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THE

RECLAMATION ERA

VOL. 26, NO. 1



JANUARY 1936



COLUMBIA BASIN PROJECT, WASHINGTON

Drillers at work above the Columbia River preparing for a blast on the western cliff at Grand Coulee Dam.

President Franklin Delano Roosevelt's Message to the National Reclamation Association

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Since my last message to the National Reclamation Association the work of forwarding the aims and policies of the Federal Reclamation Act has been steadily carried on by the Administration through the liberal allocation of emergency funds made available by Congress for allotment by the President under the Emergency Relief Act.

The past year's operation saw the completion of the highest dam in the world, Boulder Dam, and the commencement of the largest dam in the world, Grand Coulee. Each project adds to the achievements of the Bureau of Reclamation of the Department of the Interior and is another link in the chain of conservation of the West's greatest resource—water. By the wise expenditure of funds under a coordinated plan of development of national resources, we hope to help the West help itself to economic independence.

To you and your associates gathered in conference in hospitable Salt Lake City, which owes its existence to the beneficial use of water, I extend my hearty greetings and express the wish that the Administration may continue to have the counsel and advice of such organizations as yours.



Message of Hon. Harold L. Ickes, Secretary of the Interior, to the Association

I have been not only interested in reclamation since I have been in the Department of the Interior, but I have been an active protagonist in the cause. Irrigation is so inherently the life of our civilization in the West that it is of national importance. Just as other capital assets cannot be allowed to languish if a return to prosperity is to be expected, so in the case of investment in irrigated agriculture, which is rapidly translated into homes and families, the Government must continue to foster it for the national welfare. I am glad to see that this Administration has gone forward steadily in completing and developing projects which will bring happiness and prosperity to large groups of our citizens, and it has been my pleasure to share in the program. With the perfection of irrigation engineering, with the knowledge gained by a quarter of a century's intensive experimentation, and the incentive of competition I believe we can look forward to a greater water utilization in the future than in the past. Planning is as much the criterion of accomplishment as execution, and I am glad that within the last two years, as you know, there have been notable advances in this direction under Government auspices.

THE RECLAMATION ERA

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Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 26, No. 1



JANUARY 1936

National Reclamation Association Congress Held

THE National Reclamation Association, meeting at Salt Lake City November 15 and 16, elected O. S. Warden, of Helena, Mont., president, adopted a series of noteworthy resolutions, and heard a series of addresses that helped to make the convention the most important in the history of the organization.

Mr. Warden succeeded Marshall N. Dana, of Portland, who was not a candidate for reelection. Roland Harwell, of El Paso, Tex., was elected first vice president, succeeding George W. Malone, of Reno, Nev.; Lloyd Miller, of Sunnyside, Wash., was elected second vice president, succeeding Mr. Harwell; and Louis A. Campbell, of Helena, Mont., was elected secretary-treasurer, succeeding Kenneth C. Miller.

The association went on record as approving the consolidation of operation and maintenance operations within the Bureau of Reclamation in a single division, and urged that funds be made available to carry on that work chargeable to the general Reclamation Fund rather than to reimbursable accounts of the projects.

RESOLUTION ADOPTED

Other resolutions included the following:

Commendation of the Bureau of Agricultural Engineering for its work in forecasting the irrigation water supply through snow measurements and recommending continuation of the work.

Stating there is danger that water originating in the United States in international streams might be used in foreign countries, and urging that the Federal Government authorize necessary action to insure the conservation and use of such waters upon lands within the United States.

Commending the work of the Civilian Conservation Corps on Federal projects, and requesting that this work be continued and expanded to work of a similar

character on non-Federal cooperating projects.

Recommending the continuation of soil surveys with appropriation of \$2,000,000 annually for 10 years, of which 40 percent would go to State experiment stations on a cooperative basis.

Citing the necessity for long-range planning in conservation of western water resources and recommending that studies be undertaken by the Federal Government to cover ground-water conditions; stream flow and its possible utilization; precipitation trends as indicated by sustained historical records and tree-ring studies; snow surveys; readjustment of water rights to secure a more efficient use of water; adjustment of crop acreage; use of water on individual crops and lands from the standpoint of greatest returns to the district; and endorsing the Western States Engineers Conference in urging continuation of the present water resources investigation program of the United States Geological Survey.

Recognizing the necessity of providing supplemental water for small irrigation projects in the semiarid States, and authorizing its board of directors, to assist in devising a plan, in cooperation with Federal agencies, whereby water may be conserved for such projects and financial assistance obtained, and further resolving that "this association, recognizing the friendly attitude of Congress toward reclamation and conservation and of the ever-helpful attitude of the United States Bureau of Reclamation, recommends that the directors of this association closely cooperate with said bureau in devising a permanent plan for the conservation of water for small irrigation projects as hereinabove set out."

Requesting the Bureau of Reclamation to give preferential consideration to expenditures for the betterment of existing systems and to provide supplemental water supplies for such systems where needed.

Recommending and urging that an allocation to the Bureau of Reclamation "in an amount sufficient to meet the requirements" of a general investigation of water resources and the conservation and use of water.

And recommending that the Bureau of Reclamation provide for the full development of the electrical energy which may be made possible and economically feasible by the storage and use of irrigation water upon Federal reclamation projects.

DR. MEAD ABSENT

B. E. Stoutemyer, of Portland, Oreg., district counsel of the Bureau of Reclamation, substituted for Dr. Elwood Mead, Reclamation Commissioner, on the program. Dr. Mead was unable to leave Washington owing to press of important work in connection with the new program.

"By common consent", Stoutemyer said, "practically all of the arid-land States have decided that projects for the conservation and use of water in the arid region are the best and most fundamental of public works and the most permanent and desirable from the standpoint of permanent welfare of the community as well as from the standpoint of unemployment relief."

Stoutemyer outlined the present work of the Bureau of Reclamation detailing the works under the new program.

"The greatest waste that has ever occurred in this country", Stoutemyer said, in setting forth the value of permanent public works, "is the human waste which has resulted from our periodical times of depression, financial panic, and unemployment when millions, and sometimes tens of millions, of our citizens are out of work, with all that means to the millions who are vainly walking the streets."

The advantages of works like Boulder Dam, Central Valley, and Grand Coulee, to name a few, in a works program,

Stoutemyer said, were greater than all other types of unemployment relief, because through their wealth-creating and reimbursable character they do not burden the taxpayer with bonds to be met in the future.

Stoutemyer further stated that doubts that power from the great irrigation dams of the west could be marketed were ill-founded.

"They told us with great emphasis that we could not sell the power from Boulder Dam," Stoutemyer observed. "But the people, and particularly the utility companies which were most prominent and active in making that statement, were the first to scramble to buy the Boulder Dam power. The Bureau of Reclamation has never had any serious difficulty in selling the power from the various plants constructed in connection with reclamation projects, of which there are now about 20 in operation. Every one of these Government power plants has been successful and most of them very decidedly profitable."

SUCCESSFUL OPERATION

"The power plant at the Minidoka Dam in Idaho is typical. This plant has a capacity of 10,000 kilowatts, most of which is used during the irrigation season for pumping water. But the commercial power business which has been built up from this plant now pays an annual net profit of about \$100,000. It is significant that this power is all marketed on the Federal reclamation project itself and this project has been developed where a sagebrush desert existed prior to construction of the Minidoka project."

Stoutemyer said: "Each reclamation project creates new markets for the people who have been most skeptical of such development." Produce of the Middle West and manufactures of the East and Middle West, he pointed out, are shipped into every reclamation community in the arid region. Irrigation agriculture, he said, is not competitive.

"The greatest opportunity, it seems to me, for the work of the National Reclamation Association lies along the lines of educational work and the furnishing of the necessary data and information to show the people of the country as a whole the importance and desirability of these great self-liquidating projects."

EDWARD HYATT SPEAKS

Edward Hyatt, California State engineer, said inclusion of Central Valley in the reclamation program made a project "of great importance to the National Reclamation Association and the West. In size and cost, it is second only to the great Grand Coulee project. As to importance, Californians will not admit that

it is second to anything of its nature in the entire United States."

Hyatt explained the project in technical detail, as it has been explained in these columns previously, and added the project is a means of rescuing "a great agricultural civilization."

"The valley is in a desperate condition because of lack of water", Hyatt said, "and abandonment and destruction are occurring. If this is not stopped a half million acres of high-type irrigated farming land will be lost. Great losses will ensue not only to the valley, but to the State and Nation. Direct loss to the farming population has been computed. The Department of Agriculture reported in 1934 that the direct loss from lack of water to the valley was over 20 million dollars. The indirect loss as reflected in towns, cities, railways, and other commercial interests of the State and Nation would probably multiply this several times. It is estimated that 25,000 persons will have to abandon their present homes and seek new means of livelihood if the project is not built, which indicates another national interest in the way of unemployment relief. The tragedy which will occur if the project is not built will be as certain and as disastrous as flood or fire, although not as spectacular."

EXCERPTS FROM MR. DANA'S ADDRESS

Marshall N. Dana, president of the association, struck the keynote of the meeting in a stirring and masterful address, saying, "If reclamation is to be carried forward in full vigor and if projects undertaken are to be completed and thus brought to a self-liquidating status, it will be necessary that this Fourth National Reclamation Conference deal clearly and courageously with facts. It will be necessary to take these facts to the country so convincingly that reclamation may win the wide public confidence, support, and action to which its intrinsic national values entitle it."

Observing, "It is no longer sufficient to argue projects as local issues; reclamation has become one great project of numerous units," Dana said, "Far from keeping in balance with other developments, the facts are that plans now affecting the future of reclamation are not sufficiently broad to meet the requirements of the American people."

Dana said that \$85,000,000 would be needed to carry on authorized projects during the next fiscal year, adding, "It is the securing from Congress of this amount that constitutes the crux of the immediate emergency."

"But that is not the entire problem", he continued. "The people of America must be dissuaded from the mistaken impression that to irrigate western land

creates a food surplus by greedy grabs from the political pork barrel.

"Twelve million people in the West are dependent upon irrigation as a method of agriculture enforced by natural conditions, and not only is it true that western agriculture stops if reclamation ends, but these people would be compelled to move elsewhere were irrigation discontinued."

DR. EDWARD MEAD, RECLAMATION COMMISSIONER, SENDS MESSAGE

"It is a pleasure to express my appreciation for the useful and patriotic efforts of the National Reclamation Association since its organization. It has made a most valuable contribution to the policies and achievements of reclamation development. It helped to create an understanding of the fundamental necessity for conserving western water resources and was one of the factors which turned the scale in favor of a program of river development. One of its first fruits is the early completion of Boulder Dam—a triumph in engineering which has won world-wide approval. The efforts of this association helped to secure provision of adequate funds for construction and enabled Boulder Dam to be completed 2 years ahead of the contract time. As a result, Boulder Dam has already saved to the Southwest a large part of its cost. Early this year its reservoir held back a destructive flood and protected the Southwest from its action. That reservoir is now giving to Imperial Valley the water needed to save it from the loss of a ruinous drought.

"The National Reclamation Association has a membership and organization equipped to meet the problems of the future, and its zeal and earnestness is reassuring when we consider the problems to be solved in the future. Realizing how completely the growth of the arid region and the contentment and security of its people is dependent on the conservation of the waters of its great rivers, it has helped the Nation to think out and wisely plan a program to make these waters available for human use. That program begins with works to utilize the stored water of Boulder Reservoir. Parker Dam, the Gila and All-American canals are a part of this comprehensive plan and they are already under construction.

"After 10 years of intense study, in which the best engineering and economic thought of the arid region has been enlisted, the Government has entered on the conservation and development of the water resources of the Central Valley of California. It only needs this additional water to make the valley a place for homes without a superior on this planet.

"Over in the Rocky Mountain country the Government is engaged in building the Casper-Alcova project which has as its purpose the use of the North Platte River for developing the region's agricultural possibilities and making available its immensely valuable mineral resources.

"In the Northwest the Government is building the Fort Peck Dam to harness the Missouri for the service of its people. It is doing the same on the Columbia at Bonneville.

"At Grand Coulee a successful beginning has been made on what is destined to be for all time one of the greatest irrigation and power developments of the world. This project alone will provide homes, with an opportunity for a safe and comfortable living, for a half-million people within the boundaries of the project, and it will add a million people to the population of the Northwest. That addition comes to a part of the country so rich in undeveloped resources, and is so helpful in our meeting the opportunities for trade and commerce in the Pacific, that it only needs an understanding of conditions to insure carrying it to full fruition within the next decade. I have referred to the costlier developments because they require expenditures running over a series of years, but there are in each of the arid States smaller but valuable and urgent projects that are being constructed by the Bureau for conserving wasted water and making it available for the use of the people. These must be completed. Because of their smaller cost and because many of them will be completed with the funds now available they are less of a problem for the Bureau than the developments requiring expenditures running through a series of years. It is the opportunity and duty of your association to gather the facts as to the needs and opportunities of the arid region and make them known to the whole country.

"I am immensely interested in the problems you will discuss and it is a great disappointment that I am unable to be present to take part and listen. I have arranged for members of the Bureau to attend. My absence is unavoidable. The very results you have worked for are jeopardized if the program approved by the administration and for which funds have been provided is not made effective before the end of the year. The Bureau's accelerated work on studies, plans, and other work preliminary to letting contracts must not lag, and it is this work of keeping the program moving on which I am engaged. When this is understood I know my absence will be excused.

"Greetings to you and the conference. You have completed another successful

year as president. A better understanding of the aims and purposes of the Federal reclamation policy is the result. Your able leadership has helped the Bureau's operations and brought larger results."

F. E. WEYMOUTH'S ADDRESS

F. E. Weymouth, general manager and chief engineer of the Metropolitan Water District of Southern California, delivered an address on the relation of the Colorado River Aqueduct to the development of the West. He stressed the point that it was only after all the varied western interests, including the southern California municipalities, had thrown their combined support behind Boulder Dam that the development of the Colorado River was begun. The large population centers in southern California, he said, gladly had signed power contracts which guaranteed repayment of the cost of the dam with interest. "Without some additional water", he added, "the growth which will make possible use of the power cannot be had." Weymouth said the cities of the West provide markets for the irrigated farms, and in that sense the farms are dependent upon continued development of the cities. With the same reasoning he said it would be seen that the cities in their turn were dependent upon continued irrigation development in their back-country. As

Weymouth sized up the situation, the aqueduct promised continued growth to the entire West because of the interdependence of farm and city.

E. GROSVENOR PLOWMAN SPEAKS

E. Grosvenor Plowman, general manager of the Denver municipal water system, made a plea in an address for development of the water resources of the Mountain States.

"The fundamental yardstick of economic position is population," Plowman said. "Measured by that yardstick the Rocky Mountain region is poor and undeveloped."

"When residents of this vast almost uninhabited Rocky Mountain empire consider its future, we are forced to conclude that generous Federal aid, even more liberal than in the past, is our only hope", he added. "The basis for almost all our population within the Rocky Mountain area is reclamation, that is, diversion of stream and subsurface flow, coupled with adequate drainage. Every resident of these States must base his presence in the region, to some extent, upon private and public reclamation activities. It follows, therefore, that continued existence and improvement of the hundreds of irrigated oases scattered over the Rocky Mountain States is the

(Continued on p. 32)

F. A. Banks Discusses Columbia Development

FRANK A. Banks, Bureau of Reclamation construction engineer in charge of the work at Grand Coulee Dam on the Columbia River in Washington, outlined plans and hopes for the Columbia Basin project in an address at the National Reclamation Association meeting.

The address follows:

I should like to talk to you briefly, if I may, of one of this country's most valuable natural resources and some of the steps that are being taken for its development and utilization. I refer to the Columbia River in Washington and the large body of semiarid but exceedingly fertile lands of the Big Bend country adjacent thereto—together constituting the Columbia Basin project.

Rising in the Canadian Rockies and crossing the international border into the State of Washington near its northeast corner, the Columbia River, the second-largest river in this country in point of run-off, then flows for 750 miles through this State along its southern border to the Pacific Ocean, falling on its way 1,300 feet and earning for itself the distinction of being by far the largest river in this

country in point of potential power susceptible of economic development.

Adjacent to this river in central Washington is 1,200,000 acres of what has been many times referred to as the finest body of undeveloped arid land in the West. Unproductive and of little value in its present state, this land when irrigated will produce a great variety of agricultural, horticultural, livestock, dairy, and poultry products in abundance and provide homes, employment and business for a vast agrarian and urban population. The combination of these resources—water, power, and land—for the creation of the Columbia Basin project has been the goal of the people of Washington for 30 years or more. Many plans have been evolved and investigated through all these years by engineers and economists of the State of Washington, the Army, and the Bureau of Reclamation, with the result that the pumping plan as opposed to the earlier gravity plan is generally accepted as the more feasible.

The principal features of the pumping plan include the Grand Coulee Dam for raising the water surface of the Columbia River 355 feet, thereby creating a usable

storage capacity of more than 5,000,000 acre-feet; the power plant for the generation of 1,890,000 kilowatts of electrical energy for irrigation pumping and commercial use; the pumping plant for raising 16,000 cubic feet of water per second a vertical distance of 280 feet into the Grand Coulee; the Grand Coulee Reservoir, which with a usable capacity of 340,000 acre-feet, regulates the flow of irrigation water to the project and permits of the use of secondary power for pumping purposes; and the distribution system consisting of the east and west main canals, secondary pumping stations, and the laterals for conveying the water to the 1,200,000 acres of land. Although Congress by the passage of the rivers and harbors bill, approved August 20, 1935, authorized the construction, operation, and maintenance of the Grand Coulee Dam and necessary canals, structures, and other incidental works, funds have so far been made available only for surveys of the irrigable area and the construction of the foundation for the Grand Coulee Dam and power plant.

PLAN COMPREHENSIVE

The comprehensive plan for the development of the Columbia River as worked out by the Army Engineers, contemplated the construction of 10 dams to utilize 92 percent of the available fall in the river between the international boundary and the Pacific Ocean. By far the largest and most important of these is the Grand Coulee Dam—largest in that it utilizes 355 feet or 27 percent of the total available fall and includes an installation of 1,890,000-kilowatt capacity, which is larger than any existing development in the world today and most important in that it creates a storage reservoir of more than 5,000,000 acre-feet of usable capacity at the highest possible point on the river in this country and affords the most feasible and practicable means of diverting the waters of the Columbia River out of its canyon and on to any considerable area of arid land.

The Grand Coulee Dam is located in the solid granite canyon of the Columbia River just below the point where the river was once diverted from its normal channel by an advancing glacier and forced to cut a new channel, now known as the Grand Coulee, 52 miles long, from 600 to 800 feet deep, and from 2 to 5 miles wide, before it could spread out over the plains below and return to its regular channel. As the glacier receded, the Columbia returned to its normal channel and left the Grand Coulee high and dry with its bottom 600 feet above the ordinary water level of the river. Following the clue given by the forces of nature, it is now proposed to raise the water level of the river 355 feet by the

construction of the Grand Coulee Dam and then pump 16,000 second-feet, or one-seventh of the average flow of the river, 280 feet higher and utilize the Coulee once more for regulating and supplying the life-giving waters of the river to the semiarid lands of the Columbia Basin project.

GRAND COULEE THE KEY

The Grand Coulee Dam is often referred to as the "key" structure in the comprehensive plan for the development of the Columbia River and one of the principal reasons for this lies in the fact that it creates a reservoir of over 5,000,000 acre-feet of usable capacity, extending to the Canadian border, a distance of 150 miles, thereby adding a corresponding amount to the navigable inland waters of the State. Furthermore, the release of the stored waters from this reservoir during periods of low flow, not only increased the minimum navigable channel depths by 2 feet below Bonneville Dam and by 4.5 feet below Grand Coulee Dam with corresponding increases at intermediate points, but it also doubles the amount of firm power that can be developed at the six power sites on the Columbia River between Grand Coulee Dam and the point where the Snake River joins the Columbia and increases by 50 percent the firm power that can be generated at the various sites, including Bonneville, below this point. It becomes quite evident therefore why the Grand Coulee Dam is referred to as the "key" structure in the development of the comprehensive plan, and why its construction has been authorized as an initial step therein.

In order properly to visualize what follows, let us digress for a moment for a brief description of the Grand Coulee Dam and power plant. The dam will be 4,300 feet long, 550 feet high above the lowest bedrock, and 500 feet thick at the base. It will have a spillway 1,650 feet long, capable of handling a 1,000,000 second-foot flood. The volume of concrete required will be 11,000,000 cubic yards, or 2½ times that required for the Boulder Dam. The power installation symmetrically placed on each side of the spillway will amount to 1,980,000 kilowatts, of which 800,000 kilowatts will be for the generation of firm continuous power and the balance for secondary power for irrigation pumping and for stand-by service. Present contracts call for the completion of the foundation for the dam and power house to an average elevation about 50 feet above low water and involves, among other things, the excavation of 15,000,000 cubic yards of earth and rock and the placing of 3,500,000 cubic yards of concrete. The

cost of this work, including camp, railroad, highway, right-of-way, materials, etc., will be about \$63,000,000. The cost of the completed structure is estimated at \$186,000,000 and the irrigation features of the project \$208,000,000, making a total of \$394,000,000; but the maximum investment in the project is estimated at around \$260,000,000, depending upon how rapidly the irrigation features are developed and how soon the power revenues may become sufficient to take care of the cost of future construction.

POWER MARKET

An important factor in the feasibility of this project as a whole is the market that may be available for the power that is to be produced at the Grand Coulee Dam. The market area in which this power may be absorbed includes the area within a radius of 300 miles of the dam and includes all of the State of Washington, the northern part of Oregon, the northern part of Idaho, and the western part of Montana.

During the 10-year period ending with 1930 the requirements for power in the territory described as constituting the power market area increased at an average rate of 9.5 percent per year, compounded annually. The installed generating capacity of power plants serving the territory in 1930 amounted to 1,145,000 kilowatts, and during that year there was generated 4,029,000,000 kilowatt-hours by those plants. The effect of the depression has been to suspend for about 4 years the normal growth of the power market. Production fell off a little after 1920 and reached a minimum in 1933; but during 1934 returned to the 1930 maximum and during 1935 is resuming its former rate of increase with the result that there is every assurance that the production this year will substantially exceed all previous records. If we may judge the future by the past, there is every reason to believe that the rate of increase in power production for the 10-year period prior to 1930, amounting to 9.5 percent compounded annually, will continue after 1934. If we assume that the rate of increase starts off at but 8 percent compounded annually and decreases uniformly to 4 percent during the next 30 years, and if we assume further that Grand Coulee will absorb only one-half of the increase after its completion, leaving the other half to Bonneville and other new and additional developments, all of the Grand Coulee commercial power will be absorbed by the market in 15 years. If the commercial power can be sold at 2¼ mills at Grand Coulee, equivalent to 3 mills on the coast, the cost of the Grand Coulee Dam and power plant, with interest at 4 percent, can be

liquidated in 50 years with a surplus of \$144,500,000, available for the partial liquidation of the irrigation investment or other purposes, and after the fiftieth year the annual surplus would amount to \$15,000,000. The annual cost for operation and maintenance of the project, including the cost of power for pumping, is estimated at \$2.60 per acre, while the annual construction charge, if the irrigation development is deferred until the power income substantially exceeds the annual cost of power development, may not exceed \$2.50 per acre.

POWER NOW WANTED

Conditions in the power market area tributary to Grand Coulee at this time are illustrated by the fact that both Portland and western Montana are calling for power from the Washington Water Power Co., to which the company is responding to the extent of its ability, while Tacoma is feeding into Seattle all the power that its interconnecting systems will handle.

It is not contemplated, of course, that the power plant will be constructed to its full capacity in the first instance; but rather that the units will be added progressively as required to meet the demand for power. Likewise the development of the irrigation features should be made to conform to the demand for the land. Our great transportation systems, our large commercial enterprises and our extensive construction programs in the past have not been conceived today and completed tomorrow. Their history has been one of progressive development to meet the requirements of the country, and so now after 30 years of planning and consideration by engineers and economists of the State, the Army, and the Bureau of Reclamation, we are starting on a program of construction that takes its proper place in a well-considered, comprehensive plan for a long-time, progressive development of a most valuable, natural resource in land and water, constituting the Columbia Basin project.

Now what may we say of the benefits that may accrue from a project of this kind?

From the standpoint of the present, employment is given to about 4,000 men, who with their families constitute a population of about 10,000 people living at the dam site, while thousands of others are working throughout the State in cement mills, in lumber mills, in steel fabricating plants, in various factories, for the public utilities and on the farms producing, marketing, and transporting the material used in construction and the food, clothing, and other necessities for the workmen and their families, while back east of the Mississippi, where so much opposition has been expressed

toward reclamation as a national policy, practically 50 percent of the money so far spent has gone for steel sheet piling, rubber-belt conveyors, power shovels, tractors, buggies, sand and gravel plant, concrete plant, trucks, automobiles, tools, and other untold items of plant and equipment, materials and supplies, and transportation of same—money directed into the regular, established channels of industry and supplying work for thousands of persons at employment of their own choosing and at prevailing wages.

ATTRACT INDUSTRIES

For the future, low power rates should reduce the burden of the heavy users of power, particularly those engaged in pumping for irrigation and should attract new industries, particularly those requiring large blocks of power. As the irrigable lands are reclaimed, thousands of small farms should be established not for the purpose of one-crop farming to raise products of which there may already be a large surplus; but for the purpose of establishing farm homes with such surroundings that families may live there in comfort, largely from the products of their own farms under diversified farming methods that will also permit the

marketing of a sufficient amount of products to meet the running expenses.

It has been the experience in the past that for every family on an irrigated farm there is also one in the towns that are developed on the project to serve the farming districts and still another in the more distant cities and towns engaged in the manufacturing and transportation of things that the farmer must buy. Thus we begin to have some realization of the far-reaching benefits that flow from the construction of an irrigation project.

Isn't the Nation-wide employment created by the construction of this project; isn't the self-respect of those of our citizens, who have been kept off the relief rolls; isn't the additional wealth produced by the project; isn't the rehabilitation of those tillers of the soil, who move from submarginal land to the irrigated farm home, all worth to the Nation, the subsidy that it grants in the way of interest on the cost of developing the irrigation features of this project? That is the question in which we of the West are vitally interested and which we as a nation must answer affirmatively, if reclamation as a national policy is to endure.

Other Important Contributors to N.R.A. Program

In addition to those whose addresses are given in whole or in part, the following had important places on the program:

Hon. Henry H. Blood, Governor of Utah—Address of welcome;

Kenneth C. Miller, retiring secretary-treasurer—Report;

James C. Marr, Associate Engineer of the Division of Irrigation, U. S. Bureau of Agricultural Engineering, Department of Agriculture—Address;

J. N. Darling, Chief of the U. S. Biological Survey—Address "A Wild Life Trying to Save a Wild Life";

Dr. L. C. Gray, United States Resettlement Administration—Address "The Nation's Land Problem";

John W. Haw, Director, Agricultural Development, Northern Pacific Railway Company—Discussion;

E. F. Blaine, "Father" of the Columbia Basin Project;

Dr. W. L. Powers, Oregon State College, Report on Soil and Water Surveys;

George O. Sanford, General Supervisor of Operation and Maintenance, Bureau of Reclamation—Addresses "The Future of Reclamation—A review of the Haw-Schmitt Report" and "Work of the Operation and Maintenance Department, Bureau of Reclamation";

J. S. James, State Engineer from Montana—Address "The Fight to Save a State";

United States Senator James P. Pope, Member of the Senate Committee on Irrigation and Reclamation—Address "The Attitude of Congress toward Reclamation";

Hon. Compton I. White, Chairman House Committee on Irrigation and Reclamation;

H. H. Barrows, Department of Geography, University of Chicago—Address "National Resource Board as Related to Reclamation";

Judge Robert W. Sawyer—Address "Planning as it Includes Recreational Phases."

About 120 inquiries concerning settlement opportunities were received and answered during the month of November on the Riverton project. Three prospective settlers were shown over the land, 5 farm applications were received, and 2 paid the advance water rental charge for next year. One purchase of private land was reported. Thirty-three farm units are now available.

The Thomas Brannigan Memorial Library, a gift to the town of Las Cruces, N. Mex. (Rio Grande project), by Mr. Brannigan's widow, was formally opened to the public in November.



Colorado Canyons' Secrets Unlocked

"I halted at the sight of the most profound cañones, which ever onward continue." *Father Francisco Garcés, 1776.*

"No mortal has the power of describing the pleasure I felt on reaching the point where the river emerges from these horrid mountains, which so cage it up." *James Ohio Pattie, 1826.*

"The region last explored is, of course, altogether valueless. It can be approached only from the south and after entering it there is nothing to do but leave. Ours was the first and doubtless will be the last party of whites to visit this profitless locality. It seems intended by nature that the Colorado River along the greater portion of its lone and majestic way shall be forever unvisited and unmolested." *Lt. Joseph C. Ives, 1857.*

These three reactions of early explorers to the canyons of the Colorado River, one by the Spanish missionary who gave the river its name; one by a trapper, the first American to see the river; and the last by an American Army officer who was assigned to explore the Colorado from its mouth to determine the head of navigation, are as unlike as any two vistas on the river. One was reverently awed, one totally unimpressed, and one meant to convince a superior officer of the total hopelessness of the domain of America's most erratic and least known great river.

It is perhaps unfair to pick these quotations out of their texts, since in the light of what has come to pass they may appear slightly ridiculous. These men had no means of foreseeing that millions would trek to the canyon rims for inspiration nor that Boulder Dam would or could be built. Neither did Ives know that at least five parties of whites had visited the Colorado's canyons before him, three during the Spanish era then closed.

Only now are the canyons being robbed of their solitude.

With completion of Boulder Dam and creation of Boulder Lake a new era has dawned, one in which it is no longer impossible nor even difficult to explore many of the most stupendous and beautiful of the canyons that are strung like gems on a string along the Colorado River.

Still, clear water now has erased the cataracts from Boulder Dam 84 miles upstream through Boulder, Virgin, Travertine, and Iceberg Canyons and into the lower end of Grand Canyon. As months pass and Boulder Lake continues to fill more canyons and vistas will be made available. At capacity the lake will be 115 miles long and 40 miles wide.

The Colorado's canyons had been navigated less than half a dozen times, until recently, and then only by intrepid ex-

plorers who floated downstream. Until the lake came into being, no one dared attempt an upstream passage.

In November, however, a Bureau of Reclamation photographic expedition made an easy voyage in a motorboat from the dam to the headwaters of the lake in Grand Canyon. The pictures on these pages resulted. Several of them are of scenes never before photographed. All of them may be snapped thousands of times in the future by sightseers and vacationists.

The top picture at the left of page 6 is a view downstream through Boulder Canyon about 15 miles above Boulder Dam at the original site for the dam. Here less than a decade ago engineers risked life in a contest with the unregulated river making preliminary surveys. Now it is a quiet lake. The boat which carried the expedition to the headwaters and back in a leisurely 3-day trip is in the foreground.

In the center is a typical view of the lake shore at a point where the canyons do not "cage it up."

Below is a view of Grand Canyon near the headwaters of the lake, a colorful scene which heretofore has been seen by only a handful.

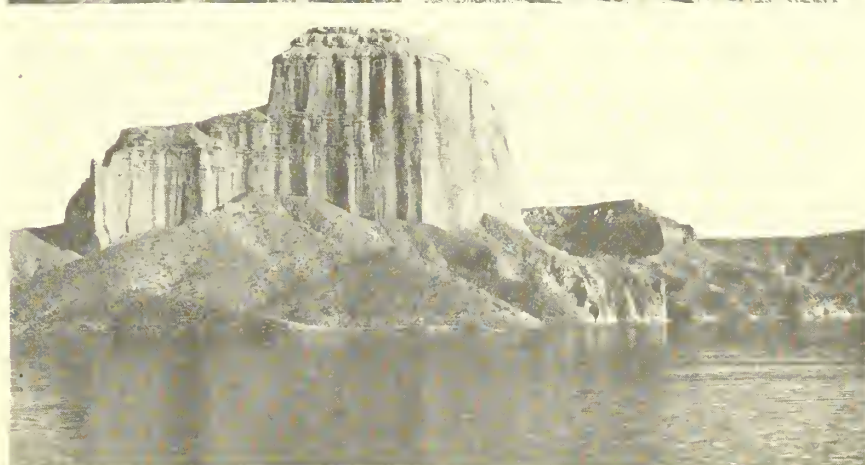
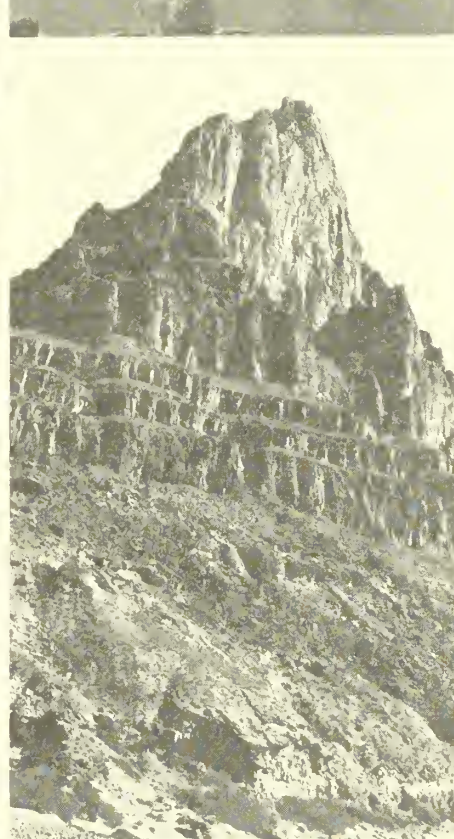
At the top of page 7 is a view of the laminated wall of Iceberg Canyon, and in the foreground can be seen a barrel cactus, typical of the desert flora surrounding the lake.

In the center are pictures of a waterfall 185 feet high, which is unnamed and which was unknown until the lake began to fill, and a picture of the Sentinel, a curious pyramidal peak marking the downstream mouth of Grand Canyon.

At the bottom is a view of the Temple, which long has been a landmark along the river. Located near the mouth of Virgin Canyon, it is a strangely beautiful remnant of an ancient plateau, carved by desert winds.

Visitors at Boulder Dam have been increasing steadily. They have averaged more than 1,000 a day this year and the 1935 total will approximate 400,000. Destined to become even more popular, it is safe to predict that the year will arrive in which half a million persons will visit this area.

The lake is being stocked with game fish. More than 200 boats are operating on its waters. Its beauties are being advertised by transcontinental railroads and by tourists bureaus. It, together with the dam, will attract hundreds of thousands of tourists to the Southwest. And within a radius of a day's motor trip of the dam live 3,000,000 people, for whom no other such vacation is offered by their locality as that at Boulder Dam and Boulder Lake.



The Reclamation Era

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JANUARY 1936

Boulder Dam Heat Problem

Heat provided the engineers in charge of construction of Boulder Dam with one of their major problems. Temperature records compiled recently covering a period of 63 months disclose exactly what this problem amounted to.

These records show that temperatures varied from a maximum of 128 degrees in July of 1931 to a minimum of 12 degrees in February of 1933.

From August 1930 to October 1935, inclusive, readings higher than 100° were recorded during 32 months. Freezing temperatures, on the other hand, were recorded during only 13 months.

The mean temperature of July 1931 was 102.2°, the maximum during the construction period. During December 1930 the mean temperature fell to 41.9°, the minimum.

The intense heat recorded during the long summers at Boulder Dam was a major problem for those responsible for the health and well-being of the 4,000 men at work. The summer set in during March and autumn came in December. Maximum temperatures during March mounted above 90° each year, and November maximums missed 90° by a

single degree only once. Temperatures ranging upward from 100° were recorded each year during the months from May to September, inclusive, with April temperatures rising above the 100 mark 3 out of 5 times and October temperatures duplicating this feat once.

While low temperatures sometimes cause discomfort among the workmen, cold weather never constituted the problem that hot weather did.

Last Call

If your subscription expired with the December issue, you will receive the January copy even though your renewal has not yet been recorded. Cancellations, however, will become effective with the February number. Please use the subscription blank below, if your renewal has not already been forwarded.

Heat fatalities were held to a minimum and, indeed, eliminated entirely after 1931 by careful supervision of working conditions. Experiments conducted in the summer of 1931, the first summer during which work proceeded on a large scale, disclosed that the human body's need for salt was increased materially while working in very hot weather. This led to the practice of placing a small amount of salt in the drinking water of the workmen. Cool water with salt added proved an excellent preventive for heat prostration. Plenty of water without the salt had proved wanting.

A total of 13 workmen died of heat prostration during the construction of the dam. All these deaths occurred during the summer of 1931, when the hottest weather recorded was being experienced and while the experiments already mentioned were in progress. The effectiveness of the simple, but there-

tofore unknown method of reducing heat casualties—the addition of common salt to the drinking water—was demonstrated by the complete lack of fatalities from heat after the discovery was made.

The excellence of the site chosen for Boulder City is demonstrated by the temperature records which show that maximum recordings at Boulder City averaged approximately 10° below those in Black Canyon. The mean temperatures at Boulder City likewise were well below those at the dam site. This was important to the health and comfort of the workmen since it insured them some relief during rest periods. Temperatures in excess of 100° were recorded in the canyon during 7 more months than at Boulder City. In addition a prevailing wind at Boulder City furnished relief which was as great as that contributed by the temperature differences.

The 5-year mean temperature of each month of the year at the project will serve to illustrate the magnitude of the heat problem. The 5-year mean temperatures are: January, 46.7°; February, 52.4°; March, 62.6°; April, 70.3°; May, 78.1°; June, 87.7°; July, 96.4°; August, 92.2°; September, 84.9°; October, 71.7°; November, 57.6°, and December, 46°.

The Orland Grange assisted in staging an exhibit at the National Grange Convention held in Sacramento during the month of November. This exhibit attracted a great deal of attention and received the highest award in competition with booths sponsored by 28 other California counties.

At the end of November the total storage in the three Government reservoirs on the Minidoka project was 491,000 acre-feet. For the corresponding date in 1934 it was 192,000 acre-feet, or an increase of nearly 300,000 acre-feet during the year.

(Cut along this line)

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Bureau of Reclamation,
Washington, D. C.

(Date).....

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First Concrete Poured at Grand Coulee Dam

The first bucket of concrete was poured in Grand Coulee Dam December 6, with Gov. Clarence D. Martin, of Washington, tripping the catch on the bucket before an important gathering.

"Before Governor Martin pulled the trip cord on the 4-yard bucket," the *Wenatchee World* reported, "a workman more than a mile away on the other side of the Columbia, started the ingenious screening plant. Here had been sent sand, gravel, and rocks, dug from a nearby pit by a 5-yard shovel. The mixture was washed, the boulders crushed

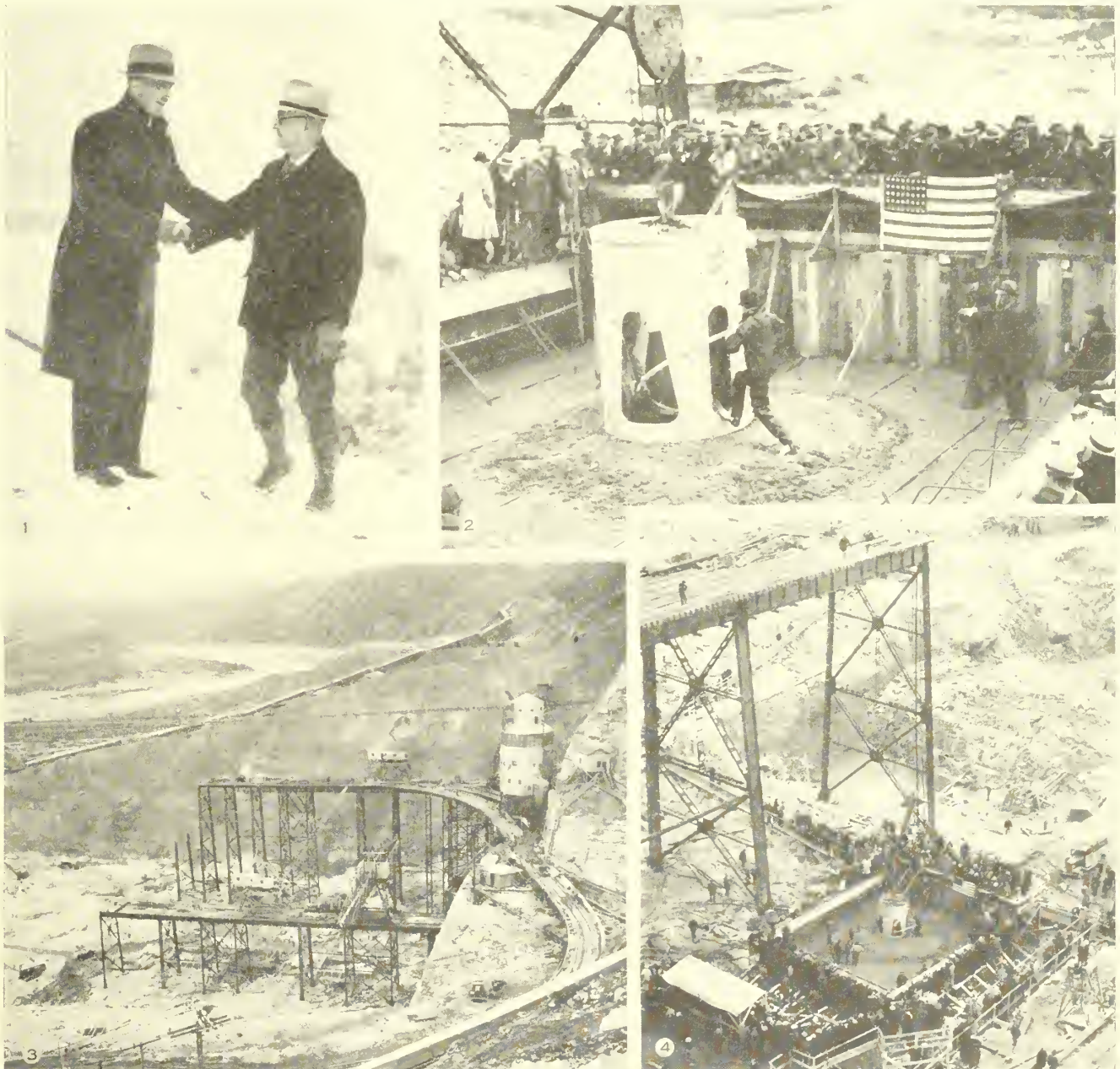
and classified and the sand screened, all in automatic operations.

"A long belt conveyed the material across the river to storage bins, near where blended cement and water also were stored. More automatic operations delivered the cement, sand, gravel, and water to the 'house of magic'—the mixing plant, where machinery operates almost as if by magic—in response to operators pressing buttons. The properly proportioned mixture was dumped into the mixing drum. It turned for exactly 2½ minutes and automatically

dumped the prepared concrete into a bucket waiting on a flatcar nearby.

"A 10-ton Diesel locomotive moved it swiftly along a trestle to the form prepared for the first pour. A huge crane picked the bucket from the flatcar, swung it through the air until it was directly over the form and lowered it several feet. Then Governor Martin pulled the cord."

Among those present at the ceremony were Marshall N. Dana, Portland, head the regional planning board; the mayors of Davenport, Wilbur, Almira, Soap Lake, Ephrata, Wenatchee, Spokane,



1, Gov. Clarence D. Martin, of Washington, greeting Construction Engineer F. A. Banks at Grand Coulee Dam; 2, Governor Martin dumping first bucket of concrete in dam, Dec. 6, 1935; 3, General view of the mixing plant and west excavation at Grand Coulee Dam; 4, Another view of the dumping ceremony showing the crane.

and Yakima; Dr. E. O. Holland, president of Washington State College, Representative Knute Hill and many, many others.

More than 17,500,000 cubic yards of earth and rock have been excavated from the dam site since the project was launched by the Public Works Administration 2 years ago. An idea of the extent of the excavation to date, with the central section untouched and the excavation on the eastern bank of the river incomplete, can be had by comparing the present total with the total of 6,480,000 cubic yards of excavation required in construction of Boulder Dam on the Colorado River.

With the first concrete actually poured, the dam itself will rise rapidly. Frank A. Banks, Bureau of Reclamation construction engineer, reported that the construction plans call for pouring 3,000 cubic yards of concrete a day during the first month of these operations, with a gradually increasing daily average until a maximum of 12,000 cubic yards is reached next spring after a second mixing plant has gone into operation.

"Concrete never has been poured that fast", Dr. Mead said, commenting upon the plans. "The average at Boulder Dam, which established all the existing records, was about 6,000 cubic yards of concrete poured each day.

"The record pour for 1 day was established at Boulder Dam at 10,642 cubic yards. To maintain an average of 12,000 cubic yards of concrete will require about 45 carloads of cement daily."

Banks reported also that 3,700 men are employed at the dam site at this time, and added that 14,500 tons of steel sheet piling were used in construction of the cofferdams which squeeze the great Columbia River into a central channel while work progresses on either side.

The present contract at Grand Coulee Dam contemplates the placement of approximately 4,200,000 cubic yards of concrete. The total yardage in Boulder Dam and appurtenant works is 4,360,000.

Commissioner Mead and Chief Engineer Walter to Serve on Important Power Committee

The executive committee of the American National Committee at its meeting in Washington on November 19, decided to appoint a special subcommittee for the purpose of assuring more effective cooperation in planning for the third power conference and the Second Congress of the International Commission on Large Dams to be held in Washington in 1936.

According to the resolution adopted, the members of the American technical committee of the International Commission on Large Dams, whose names are listed below, are to comprise this special subcommittee.

Dr. Elwood Mead, chairman, Commissioner, U. S. Bureau of Reclamation;

Hugh L. Cooper, 101 Park Avenue, New York City;

Albert S. Crane, 43 Exchange Place, New York City;

Prof. Glennon Gilboy, M. I. T., Cambridge, Mass.;

L. F. Harza, Bonneville Dam Section, Portland, Oreg.;

G. A. Orrok, 21 East Fortieth Street, New York City;

F. R. McMillan, Portland Cement Association, Chicago, Ill.;

Brig. Gen. G. B. Pillsbury, Assistant to Chief of Engineers, U. S. A., Washington, D. C.;

James W. Rickey, Aluminum Co., Pittsburgh, Pa.;

R. F. Walter, Chief Engineer, U. S. Bureau of Reclamation, Denver, Colo.

The membership of the American national committee is as follows:

Harold L. Ickes, chairman;

W. F. Durand, vice chairman;

Morris L. Cooke, chairman, executive committee;

O. C. Merrill, director;

Joel D. Wolfsohn, executive secretary.

Bureau Files Are Undamaged by Fire

Fire damaged a portion of the sixth floor of the New Post Office Department Building, the floor on which most of the offices of the Bureau of Reclamation are located, during the early morning of December 13.

The fire was confined to storerooms in which the General Accounting Office had deposited a large number of old Navy vouchers. It was reported at first that Bureau of Reclamation files were burned, but this report was in error as no files of the Bureau were burned or damaged in any way.

The damage to Bureau offices was confined to a wetting of rugs and walls and stained floors. Acrid smoke penetrated all the Bureau offices, but it caused no great discomfort to the employees, since it was cleared out by noon.

Boulder Dam of World Fame

From far away Hong Kong comes a Rotary Club publication in which Mr. M. F. Key, a member of the club who attended its international convention in Detroit in June 1934, has written a very good description of a day at Boulder Dam.

Mr. Key, an Englishman, visited the dam during its construction. That he was impressed and that he took away with him a very good understanding of the project is evident from his writings. Thus the story of Boulder Dam is carried to Asia. Numerous foreign visitors at the dam undoubtedly have spread its fame throughout the world.

A clipping from South China Morning Post sent by Mr. Key described in 700 words the dedication of the dam by the President and its accomplishments. Boulder Dam is news everywhere.

Caballo Dam on Rio Grande to Be Constructed

An allotment of an additional \$900,000 to the Bureau of Reclamation for construction of a high dam at the Caballo site on the Rio Grande in New Mexico has been announced by Public Works Administrator Harold L. Ickes. The new allotment is in addition to allotments previously made of \$100,000 to the Bureau of Reclamation and \$1,500,000 to the International Boundary Commission of the State Department.

The high dam will serve two purposes, the primary one of which is flood control in connection with the International Boundary Commission's plan for rectification of the Rio Grande in El Paso and Hudspeth Counties, Tex. It will also

provide an afterbay for the Elephant Butte Dam of the Bureau of Reclamation which stores water for the Rio Grande Federal reclamation project in New Mexico and Texas. Through provision of the afterbay, additional storage will be provided for the Rio Grande project and it will be possible to install hydroelectric generation equipment at the Elephant Butte Dam.

The high Caballo Dam will store 350,000 acre-feet of water. The dam will be constructed by the Bureau of Reclamation under agreement between the Secretary of State and the Secretary of the Interior.

Work to Start on Several Phases of Central Valley Project

SECRETARY Harold L. Ickes, announced on December 10 that the President had approved a reallocation of \$14,000,000 of work relief funds to the Bureau of Reclamation for commencement of work on the Central Valley project in California.

The reallocation of this fund followed rescission of \$14,000,000 of the original allotment of \$15,000,000 made to the Bureau for this project. The purpose of withdrawing and reallocating the money was to enable the Bureau of Reclamation to proceed with construction of the project on a more feasible plan than that originally proposed.

Dr. Elwood Mead, Commissioner of Reclamation, said work would begin on several of the principal engineering features of the project in the very near future. The Bureau has completed plans and specifications for the initial contracts and bids will be called almost immediately.

Of the original \$15,000,000 allotment, \$1,000,000 was not affected by the change. It is from this \$1,000,000 that payments are being made for preliminary work already under way.

The Central Valley project is an integrated plan for conservation and use of the waters of both the Sacramento and San Joaquin Rivers in California. The valleys of these two rivers form the Central Valley, California's principal agricultural section, in which are located the cities of Stockton, Sacramento, Modesto, Fresno, and others. The project is designed to overcome poor geographical distribution of the natural water in central California by regulating the Sacramento River, a large water producer, in order that part of its flow might be diverted into the valley of the San Joaquin River, where the water supply is deficient.

Under the terms of the original allotment, the money was to have been used in construction of Friant Dam on the San Joaquin River and the canals leading from it to areas in southern San Joaquin Valley where the underground water supply either has been or is being exhausted and where highly developed farms have been abandoned.

"Since the Central Valley project is a well-integrated conservation plan, designed at a cost of about \$1,000,000 to the State of California and the Federal Government", Dr. Mead said, "it was found to be uneconomical to break it down for the purposes of construction into component parts. The effectiveness

of the San Joaquin Valley phase of the project is dependent upon concurrent construction of the Sacramento River storage dam."

Under the provisions of the reallocation the Bureau of Reclamation is empowered to proceed in what it considers the most economical manner of constructing the project, subject only to a limitation which prohibits encumbering by contract funds in excess of the \$15,000,000 which now is available for the work.

Dr. Mead said Walker R. Young, Bureau of Reclamation construction engineer, in charge of the project, L. N. McClellan, Bureau of Reclamation electrical engineer, and J. L. Savage, chief designing engineer of the Bureau, had submitted a tentative plan for construction.

Under this plan the allocation would be spent as follows:

Excavation and preparation for building Kennett Dam on the Sacramento River, \$500,000.

Beginning relocation and reconstruction of railroad and highway to be flooded by Kennett Reservoir, \$5,000,000.

Construction of Contra Costa Conduit canal, \$2,500,000.

Purchase of water right in San Joaquin Valley, \$2,000,000.

Construction of Friant Dam on the San Joaquin River, \$3,500,000.

Beginning construction of the Madera Canal, \$500,000.

Beginning construction of the Friant-Kern canal, \$1,000,000.

"Upon further study," Dr. Mead said, "it may be found advisable to revise somewhat the amounts of the different items in the tentative plan, but at present there seems to be no better choice of features to be included in the initial construction and no necessity to change materially the amounts allotted to the various features."

The two primary purposes of redistributing the waters of the Central Valley are to prevent encroachment of salt water from San Francisco Bay upon the very rich lands of the Sacramento-San Joaquin Delta and to provide a supplementary water supply to lands in southern San Joaquin Valley. In addition a fresh-water supply will be provided the industrial cities on Suisun Bay where encroachment of salt water presents a serious threat to large developments, and hydroelectric power will be generated for the northern California market. Regulation of the Sacramento River also will assist in controlling the floods of that stream and improve navigation on the rivers.

By regulation of the Sacramento River through construction of the Kennett Dam a sufficient flow of water can be provided the year round to keep the salt water backed up in San Francisco Bay and to deepen the river along its navigable course. In addition a surplus will be created sufficient to permit diversion into the San Joaquin Valley.

The diversion of water into San Joaquin Valley will permit the use of a large part of the waters of the San Joaquin River in the sections of southern San Joaquin Valley where serious and permanent depletion of the underground water has resulted in destruction of thousands of well-developed and highly productive farms and orchards.

The Sacramento-San Joaquin Delta comprises more than 400,000 acres of some of the richest land in California. It has been reclaimed over a period of 75 years. The network of channels between the islands of the delta are the source of water for irrigation. During the summers of recent years, when the flow of the rivers has dropped, salt water has replaced the fresh water in these channels. In 1931 crop losses from this condition totaled \$1,300,000. Additional diversion without regulation of the rivers to spread their spring floods out over the dry summers would cause additional depletion of the fresh-water supply and aggravate the problem of saline encroachment. Regulation of the rivers, however, will eliminate altogether the danger of saline encroachment.

The shrinkage of the underground water supply of the southern San Joaquin Valley due to overdraft by pumping for irrigation has caused the abandonment of 40,000 acres of highly developed farm lands, most of it planted to grapes and citrus fruits. In addition to that abandoned, there is an additional 160,000 acres which must be supplied with new water in the near future or it, too, must be abandoned. These lands represent investments in excess of \$50,000,000 and an annual source of crops estimated to be worth \$20,000,000. The only source of the needed water is the San Joaquin River, and without diverting additional water into the lower San Joaquin Valley to substitute there for its natural flow no additional diversion can be made from this stream.

The roadway across Boulder Dam has been opened to the public, subject only to patrol and regulation for safety while construction at the powerhouse continues.

Color and Decoration at the Boulder Power Plant

By Allen Tupper True, Consulting Artist

IN the use of color and decoration in the power plant at Boulder Dam there is developing what may well be a pioneering innovation so far as purely industrial plants are concerned.

The employment of color and embellishment for public buildings is usually associated with courthouses, libraries, and the like, but as the machine assumes every day an increasingly prominent place in our lives, it is proper that its housing be considered from the viewpoint of orderly beautification. It no longer suffices that a hydroelectric plant which serves millions of people be encased in a mere building—its housing must express through architectural planning the new understanding of functional form and satisfy in every respect the pride and esthetic joy that man finds in his accomplishments. No longer can turbines, tunnels, galleries, cranes, generators, and control boards be assembled with the sole consideration of service and efficiency when, without in any way interfering with function or adding much to cost, these same items can be built into a magnificent and inspiring thing of beauty—beauty in a new and modern form. There is no valid reason why modern man should make a courthouse more beautiful than a powerhouse, unless he has thoughtlessly overlooked a great opportunity.

BEAUTY NEEDS EMPHASIS

As the power plant at Boulder begins to take shape the gigantic arches, buttresses, and caverns of concrete echo to the roar of riveters. Steam, smoke, and sunlight move back and forth, adding mystery and imaginative wonder to these graceful, efficient forms. It is as inspiring in its way as one of the great cathedrals. Three hundred thousand people annually visit the dam and are stirred by something akin to fervent patriotic pride in a great national accomplishment. Surely there is no sound reason why this pride should not be in the beauty of the place as well as in the size and usefulness of it.

The query may arise, "Where can any such beauty be added?" So, to be specific, consideration might be given to the machinery, all of which is given a protective coating of paint which obviously must have some sort of color. Is it not reasonable that this color should be coordinated and harmonized through planning and study? Too often the machinery fabricated in many different factories, sometimes with a high quality

of finish, is assembled and installed before consideration is given to color re-

economy obviates the possibility of much change or adjustment.

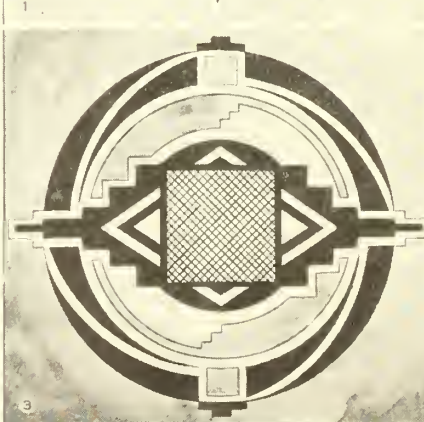
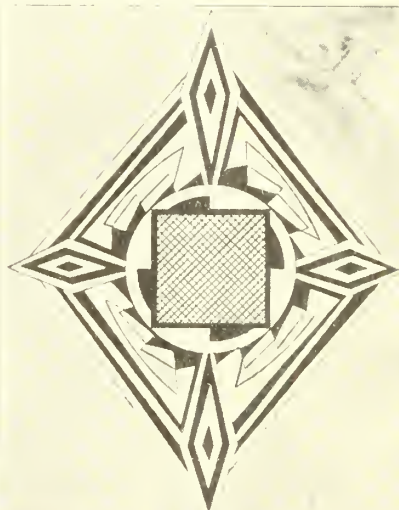
FLOORS' EFFECT IMPORTANT

The floors on which the machinery stands have a decided effect on appearance and can be studied in relation to the color ensemble and, subject to the limitations of suitable material, made to function for beauty as well as mere utility. Great wall areas of gray concrete can be relieved of their monotony by the judicious and appropriate use of color and decoration.

As a specific example at Boulder, the adits or tunnels in the dam leading from the elevator lobbies (500 feet below the top of the dam) to the power house are 323 feet long, 7 feet wide, and 8½ feet high. Engineering necessity has made them little more than mole holes a city block long, and through them more than 1,000 visitors a day will pass. Suppose they were lighted with blazing pine knots, the floors not drained, and rat

This is the first of two articles by Mr. True. In this article, the author discusses the use of color and design in industrial construction, and the novel adaptation of aboriginal Indian designs for decorations in the Boulder Dam power house. The importance of these adaptations in the field of architecture conceivably may rival the importance of comparable pioneering work done in other fields in construction of Boulder Dam. The second article, discussing the planned use of color in the power house, will appear next month.

lations one with another or with surrounding structure, and then a belated



1, to be executed in black and white on a field of red ochre terrazzo and used around floor drains in the adits leading from the elevator to the central section of the power house; 2, is derived from a Pima basket. Its use is the same as No. 6; 3, execution and use are the same as No. 1; 4, is derived from a prehistoric bowl. Its use is the same as No. 6

infested, the air foul from poor ventilation; what dreary places they would be! And yet the efficiency of the power plant itself would in no sense be lessened. Efficiency is not the only criterion in a power plant. These adits are well lighted and drained and, above all, by the use of color and decoration on walls, floors, and ceilings the oppressive monotony of the narrow passageway can be relieved if not wholly eliminated.

SURFACES IMPRESS

After all it is from surfaces and outer forms that impressions are had. We cannot see the thousands of tons of concrete which went into the fabrication of the dam, but we sense the mass and immensity of it from the locations of its surfaces. When this concrete is molded or fashioned into arches, buttresses, or other gracious forms, we sense its beauty—again from surface impressions—and if structural necessity develops a blank monotony of wall, a sterile continuity of floor, or some other interruption of the otherwise beautiful rhythm of the structure, then there is need of a decorator who by mere surface treatment can restore the offending part to its proper place in the general scheme.

In this sense decoration is being applied at Boulder Dam. With color it is being used to develop the form and structure of the building and to emphasize its inherent architectural beauty. When the Greeks polychromed their temples it was with the purpose of making the structure more "readable" and when color or decoration is applied at Boulder it is with the object of making the forms readable, coherent, and as beautiful as the dynamic new beauty of machine forms can be. It calls for new thought and the application of tested principles to modern problems.

INDIAN MOTIF USED

Probably the most significant and appropriate innovation is the selection of the decorative motifs and color scheme of our southwestern Indians as the basis of all decoration at the dam. These motifs or patterns and the distinctive color palette are eminently appropriate as well as beautifully adapted to the purpose. In the pottery designs, basketry patterns, and sand paintings of the Colorado River watershed there exists a wealth of wholly untouched and magnificent source of material which requires only discriminating adaptation to make it superior to the classic Greek, Roman, and Egyptian motifs which have been mauled to death for centuries and worn threadbare of all interest save acceptability.

With aboriginal directness these forms are derived from stepped mesas, rain,

lightning, and clouds, rather than the lotus, fasces, and garlands; from lizards, plumed serpents, and birds rather than bulls, centaurs, or scarabs; and the fertility of invention with which these native forms and abstractions are assembled seems unlimited. The bold, frank appositions of form or color and the novelty of application or use give them

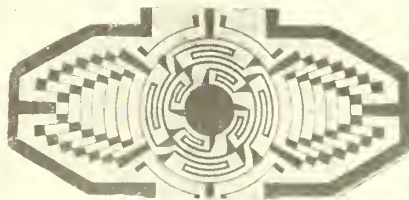


Illustration No. 5, to be executed in dull green and black terrazzo for the lobby floors of the elevator towers.

a quality all their own. For character, style, and distinction there is nothing to compare with them, and their inherent boldness makes them peculiarly adaptable for use in connection with modern architecture.

DESIGNS APPROPRIATE

As an example of their adaptability, take illustration no. 5, which shows a design to be executed in dull green and black terrazzo for the lobby floor of the elevator towers at the top of the dam. The walls of these lobbies are to be of highly polished black marble and the ceilings of the most modern anodically treated aluminum with concealed lighting. The doors are of verdigris bronze which accords with the note of green and somber shade which is dictated by the need for a cool effect when arriving in the lobbies from the blazing heat of the dam crest. The floor design itself is an adaptation of two Pima basket patterns adjusted in scale and notan to the requirements of the space and location. A little study of its central portion will reveal its striking similarity to what might be termed an engineer's basic diagram of a generator or turbine, with valves, gates, and a suggestion of centrifugal motion. What basic motif could be more appropriate or better adapted?

Apropos of fitness and adaptability the wall decoration for the control room offers

a striking example. Here is the heart of the plant. From it are manipulated the switches, valves, gates, etc., which control tremendous forces of electricity, enormous bodies of water for flood and irrigation control. The instrument boards and equipment are of bakelite, monel metal, structural glass, and aluminum. The lighting is of the most modern type, the floors of sound-deadening material varied here and there with bold "Mimbres" pottery patterns. For the walls then what could be more appropriate than the Pueblo Indian symbols for lightning, rain, clouds, and water, each with unlimited variations of treatment, all stylized into abstract geometric patterns and in no sense realistic or pictorial? It is doubtful if in the whole range of historic and classic ornament there can be found even one or two decorative themes which would compare with these which are our own and American. Some of them grace the primitive bowls and chards of ancient pueblos which are today being submerged by the waters of the Colorado as the dam backs them up the valley to the Grand Canon.

Illustrations 1 and 2 show designs for terrazzo panels to be used around floor drains in the adits leading from the dam elevators to the central portion of the power house. They are to be executed in black and white on a field of dull red ochre terrazzo and will alternate under light fixtures. The adit walls are of warm colored tile and the ceiling—a depressed arch—is of tile in which designs are embodied special designs at frequent intervals to harmonize with the floor decoration.

Other uses of such design are shown in illustrations 6, 3, and 4. These are to be used in the terrazzo floors of galleries and balconies from which the public will view the generator rooms each 600 feet, or two city blocks long. Design No. 5 is derived from an Acoma storage bowl, No. 3 from a Pima basket, and No. 4 from a prehistoric bowl. Here again we find a variation of that centrifugal movement which is essentially the story of what occurs in the power plant when the rush of water is converted into electrical energy. To a

(Continued on p. 25)



Illustration No. 6 is derived from an Acoma storage bowl and will be used in the terrazzo floors of the galleries and balconies from which the public will view the generator rooms.



ENGINEERING



Construction of Hyrum Dam

By D. J. Paul, Resident Engineer, Hyrum, Utah

THE Hyrum project is located in northern Utah about 8 miles from the city of Logan, the county seat of Cache County. The purpose of the project is to furnish a supplemental water supply to about 6,000 acres of old irrigated lands having insufficient water supply and to about 4,000 acres of dry farm lands whose cultivation of recent years has generally not been profitable due to a deficiency of rainfall during the growing season. About one-fourth of the project area lies above the Hyrum Reservoir and includes lands of the Hyrum Irrigation Co. lying upon the bench on the east side of the Little Bear River within and adjacent to the town of Hyrum. The balance of the area lies below the reservoir and comprises mostly bench lands on the west side of the river extending north and west from the reservoir and including some lands within the towns of Wellsville and Mendon. Lands of the project are generally highly productive and are fairly level and gently sloping lands, being adapted by topography to irrigation. Sugar beets, beans, peas, and other truck crops and some fruits are grown on similar lands adjacent to the project and to some extent on the project, although their cultivation on project lands has in the past been largely restricted by uncertainty as to water supply. Dairying is one of the most important industries, and small grains and alfalfa are grown on dry farm lands and to a less extent on the irrigated lands.

Construction of the project was authorized by the National Industrial Recovery Act of June 16, 1933, under which the Public Works Administration provided an appropriation of \$930,000 for the project. A contract dated October 9, 1933, was entered into between the United States and the South Cache Water Users' Association providing for construction of the project by the United States and the repayment of the cost by the association in 40 years.

Plans and specifications were prepared to permit opening of bids for construction of Hyrum Dam on December 13,

1933. The contract was awarded in January 1934, but actual construction was delayed until March, pending the execution of subscription contracts between the association and individual companies and districts. Acquisition of right-of-way was impeded because practically all lands were held in private ownership.

DAM AND RESERVOIR

The principal features of the project are the Hyrum Dam and Reservoir, and three small canals aggregating a total length of 20 miles.

The dam will create a reservoir to store about 18,000 acre-feet of run-off from Little Bear River, 14,000 acre-feet only being live storage available for the new canals. The dam is an earth and rock-fill embankment, with a maximum height of about 100 feet above foundation, and is designed to raise the water surface of the river about 80 feet above normal. The main dam is 540 feet along the crest and 600 feet from upstream to downstream toe. The principal quantities involved are: 352,229 cubic yards of earth fill in embankment; 61,653 cubic yards of rock fill; 13,082 cubic yards of riprap and gravel blanket; and 5,720 cubic yards of reinforced concrete in dam and appurtenant structures.

The upstream slopes of the earth fill are 3:1 and 3½:1 down to elevation 4610 (70 feet below the crest) to which point they will be covered with a 2-foot layer of riprap underlain by a 1-foot layer of gravel. The slope below elevation 4610 is 6:1. The downstream slope of the earth fill section is 1½:1 and the rock fill on the downstream side of the dam has a surface slope of 2:1 to elevation 4620 and a slope of 3:1 below that elevation.

CUT-OFF WALL

A concrete cut-off wall was constructed in an open-cut trench. The trench had a minimum bottom width of 25 feet, sloping sides, and a depth of 15 feet, and parallels the axis of the dam, 130 feet upstream, across the floor of the valley. Extending

up both abutments the trench converged toward the axis of the dam as it approached the crest.

The concrete cut-off wall projects 10 feet vertically above a horizontal base which is imbedded in the conglomerate or cemented gravel floor of the trench. Areas underlying or adjacent to the wall were made impervious to percolation by pressure grouting through pipe left imbedded in the concrete base.

A low dike about 850 feet long with a maximum fill of 14 feet on center line extends across a saddle located a few hundred feet northeast of the main dam. A relocated county road to replace the old road through the area of the reservoir extends from one of the Hyrum city streets across the dike and spillway, through the intervening distance between dike and dam, across the main dam, and about 500 feet along the hillside to connect with the old county road. This relocated road has a minimum width of 20 feet between guard rails and is surfaced with a 5-inch depth of gravel.

SPILLWAY

The spillway at the dam has a discharge capacity of 6,000 second-feet. The inlet is located at the west end of the dike at a point about 800 feet northeast of the dam. From this point the spillway extends in a westerly direction to the Little Bear River at a point about 2,000 feet downstream from the dam. The chute section has a bottom width of 16 feet and varies in depth from 11 to 18 feet with 1:1 side slopes. Two lines of 8-inch tile are laid beneath the floor. The stilling pool has a depth of 40 feet with a bottom width of 16 feet and 1:1 side slopes. Thickness of concrete in floor is 24 inches and weep holes at 5-foot centers are provided in floor and sides. Near the upper end of the stilling pool the steep grade of the chute floor changes to a short length of level floor at the end of which is a vertical drop of 9 feet. From this point the floor is level for a distance of 80 feet to the downstream transition where it rises on a 1½:1 slope to the outlet grade. The design of spillway was made in accord-

ance with hydraulic studies of models made by the Denver office. The inlet portion of the spillway structure is 54 feet wide and is spanned by a concrete bridge for the relocated highway. Discharge of the spillway is controlled by three 12- by 16-foot radial gates. These gates are designed to operate automatically with change in level of the reservoir surface.

OUTLET WORKS

The outlet tunnel, 593 feet from trash rack to outlet well, was constructed through the north abutment of the dam. A diversion tunnel, 117 feet in length, to divert the flow of the river during construction and empty the reservoir, branches off from the outlet tunnel at a point 138 feet upstream from the well.

Material encountered in excavating the tunnels consisted generally of irregular strata or pockets of compact clay or silt, clay, and gravel, varying widely in amount of cemented material. Liner plates were used on approximately 75 percent of the tunnel work to prevent caving in, but were omitted where a section was encountered that would stand without support.

The tunnels have heavily reinforced concrete linings with a minimum thickness of 12 inches, and are capable of withstanding fully saturated earth pressure. Holes through the lining spaced 10 feet horizontally, provided means of grouting.

Water entering the trash-rack structure is carried through a section of 8-foot diameter open tunnel to the transition section immediately upstream from the gate chamber. Two 34-inch diameter steel pressure pipes convey the water through a section of tunnel having a diameter of 10 feet 6 inches to the outlet well. Water discharged into the well will rise vertically 34 feet above the tunnel inlet to the initial grade of the canal distribution system. The amount of water entering each outlet pipe is controlled by two hydraulically-operated high-pressure slide gates. The gate chamber houses the operating equipment which is controlled automatically by the elevation of the water in the outlet flume.

CONSTRUCTION FEATURES

The contract for construction of Hyrum Dam and appurtenant structures was awarded to J. A. Terteling and Sons, of Boise, Idaho, at their bid of \$337,211. This was for labor only, the Government purchasing all materials entering into the completed structure. Work was actually started on March 26, 1934, and completed on August 10, 1935, except the parapet wall which will be built later, to allow for any settlement that may occur.



Hyrum Dam and spillway inlet at extreme right—upstream view.

Work of clearing the dam site was started on March 26, 1934, and a few days later a dragline was moved to point on the river below the dam site and began excavation of a channel to the dam as a preliminary to stripping the foundation. Excavation of the tunnel was started on March 31, 1934, and lining of the tunnel was completed to permit diversion of the river through it on October 4. During this period work was also in progress on other features including construction of the spillway, stripping of foundation, and placing of embankment.

It was necessary to strip material in the river bottom down to an average depth of about 10 feet in order to remove unstable material down to a more gravelly foundation. Only moderate stripping was generally required on the slopes of the abutments. The general plan adopted for stripping of the foundation involved diversion of the river and drainage of the river-bottom area to the greatest practical extent.

The flow of the river at the dam site during the summer of 1934 was extremely low, varying from 20 second-feet in May to 12 second-feet at the end of September. During the period of stripping and while the lower portions of the embankment were being placed the water was diverted from the natural channel at a point above the dam site and carried through the area of the dam site in a ditch along the north abutment and was flumed across the cut-off trench.

FOUNDATION DRAINAGE

In order to drain the foundation a channel was constructed from a point on the river about 1,000 feet downstream to the dam and thence through the dam-site area in the location where the greatest

depth of stripping was required to the upstream toe. A cross channel was then excavated along the line of the upstream toe. These channels, together with the cut-off trench, which was partially excavated before stripping was completed and which was kept unwatered by pumping, served to dry up the foundation area to a large extent. Stripping was done with draglines, most of the material being hauled to waste in trucks of the Linn Caterpillar type. The larger part of the stripping was leveled out immediately above the dam, although some was wasted below the dam.

PROGRESS OF WORK

Placing the earth-fill embankment began on August 25 and was completed, except for the placing of an earth blanket from stripped material against the upstream toe, on December 4, 1934. Progress of the work was delayed during the first part of September until grouting of foundation beneath the cut-off wall could be completed, and also during September and October until the river flow could be diverted through the tunnel. The location of the diversion channel along the north abutment of the dam at an elevation of several feet above the foundation permitted the placing of the earth fill to this level before water was turned through the tunnel. Work on earth fill was generally on a basis of 3 shifts of 6½ hours each, although it was cut down at times to 2 shifts. Two shovels were used in the borrow pit in excavating embankment material although three were used at times. Trucks used to haul material from borrow pit to embankment were of various makes and ranged in capacity from 5 to 13 cubic yards. On the average the equivalent of about seven

5-cubic yard trucks were required to serve each shovel. Construction progress of sprinkled and rolled earth fill in the main dam was as follows:

Month	Number of shifts by all shovels	Cubic yards in embankment
August.....	42	21,000
September.....	79	72,000
October.....	170	111,000
November.....	112	87,000
December.....	9	10,400

PLACING EMBANKMENT

The method of placing earth-fill material was similar throughout the job. A test fill was constructed at the outset of the work, and study of data obtained from this test fill indicated that about 14 passages of rolling equipment over each 8-inch layer of fill would be required to secure maximum compaction. Two other test fills were constructed later on, but the results did not alter the conclusions arrived at from the first test. Material was dumped from trucks in rows parallel to the axis of the dam. Only a small amount of spreading was accomplished as material was dumped, although some effort was made in this regard. Spreading was actually accomplished by use of a 65-horsepower Diesel caterpillar tractor with bulldozer attachment. The same outfit was used to break down the abutments along the line of contact with the fill. Rolling was generally accomplished by the use of a tractor pulling two sheep-foot rollers each weighing 4,700 pounds when filled with water. A total of 14 passages of 1 roller or 7 passages of the tractor pulling the 2 tandem rollers was required. Special measures were taken to secure effective rolling along the line of contact with the abutment by requiring extra rolling.

MOISTURE CONTROL

For sprinkling purposes two pumps were set up, one near the trash rack structure and one near the outlet of the diversion tunnel. A line of 2-inch pipe was laid along the north abutment with several connections so that it could be tapped at the most convenient point. Fire hose and nozzles were used to carry water from this pipe to the point of use. The bulk of the sprinkling was done after material had been spread and before rolling, although at times a small amount of sprinkling was done after rolling and before the new material was dumped on the rolled surface.

Tests showed optimum moisture for the embankment material to be about 14 percent. Little trouble was experienced in keeping the moisture content near this point, and embankment with this percent-

age of moisture was in good workable condition. Natural moisture in borrow-pit material was seldom less than 6 percent.

GRADING EMBANKMENT MATERIALS

The borrow pit was generally characterized by four distinct layers classified from the top as follows: First, gravelly topsoil; second, medium gravel; third, sand; fourth, fine sand, silt and clay. About 6 inches of top soil was stripped from the surface as unsuitable. Depth of cut varied from 10 to 26 feet, the effort being made to maintain the desired proportions of the different classes of material by varying the depth of cut according to the thickness of the different strata. Mixing of the different strata was accomplished by taking shallow shovel cuts up the full face of the excavation. In some of the deeper cuts the shovel was unable to reach the top, and the top gravelly material caved down falling at the base of the slope. Mixing at the base was accomplished by passing the open bucket through the material.

EARTH-FILL QUANTITIES

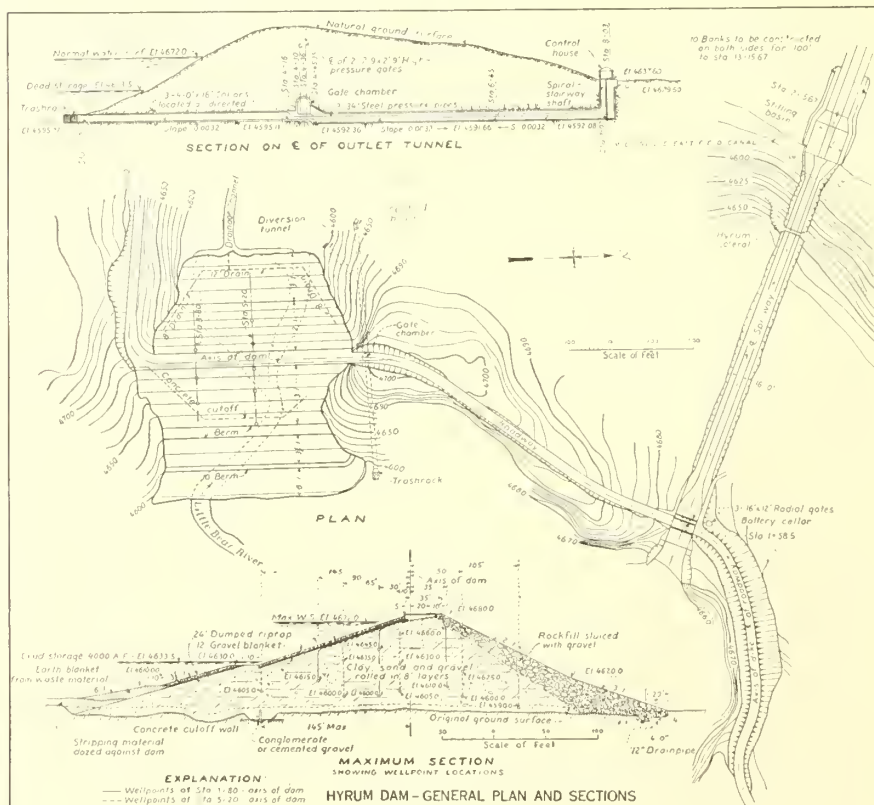
Measurement of the quantities of earth fill placed in the dam from all sources shows a total of 387,045 cubic yards as measured in embankment, while the total measurement of embankment in place is 332,310. This gives a shrinkage of 16.5 percent based on the

embankment quantity. The average density of samples taken from the embankment was 106.9 pounds per cubic foot. Dry weight density of sand in the borrow pit was about 81 pounds, and densities taken from the layer of fine sand silt and clay in the pit showed an average of about 94 pounds. Bench marks set in the top of the earth fill showed a maximum settlement of about one-half inch from December 1934 to September 1935.

ROCK FILL AND RIPRAP

Rock fill on the downstream slope of the dam was kept approximately on a level with earth fill during the months of August and September 1934. In October, work on the rock fill was discontinued and efforts were concentrated on the earth fill in order to complete that part of the work before freezing weather interfered. Rock fill was finally completed in the spring of 1935. The rock as excavated and loaded at the quarry contained a large percentage of sand and gravel. This material was hauled onto the dam by the Linn caterpillar trucks and dumped in 3-foot layers and the finer portions sluiced into the voids of the coarser material under considerable pressure.

Riprap was placed on the front face of the dam and dike during the spring of 1935. Rock was dumped in heavy rows across the face of the dam and later



moved to place by use of the dragline. Considerable hand work was required in placing. This method probably resulted in higher cost to the contractor than would have been incurred had the placing of riprap been carried on at the same time earth was being placed.

GATE INSTALLATION

Installation of the high-pressure gates in the valve chamber of the tunnel was begun in April 1935 following completion of grouting the tunnel. The plan for installing the gates was to shut all water out of the tunnel and store the flow of the river in the reservoir while the gates were being installed. Temporary gates were made and dropped into the stop-log grooves at the head of the tunnel inlet on April 1. These gates were made of 8 by 8 timbers, bolted together. The gate timbers were well oiled and the edges in contact with the groove were lined with metal. Both gates were provided with valves in order to bypass water and

equalize the pressure so that the gates could be easily removed after the installation of the permanent gates was completed. For the purpose of raising the gates a framework was constructed above the tunnel entrance and connected by trestle work to the adjacent abutment of the dam. During the period that water was shut off the high-pressure gates and control piping and a portion of the outlet pipes were installed. While the work was in progress the flow of the river increased rapidly. The increased flow of the river, together with delay in the placing of riprap, brought the water surface in the reservoir to an elevation above that of the riprap so that on April 23 it was necessary to open the outlet gates and begin the release of stored water. As the flood season was then on, it was only possible to draw down the reservoir slowly and by the time it had been drawn down to a point where work on the face of the dam and the placing of riprap could be resumed the irrigation season was well under way. All subse-

quent work in the tunnel was handicapped by the necessity of maintaining flow through the tunnel for irrigation use of old water rights below the dam and this work was not finally completed until August 10, 1935.

Water was made available for use on the lands of the Hyrum Irrigation Co. during the season of 1935 by furnishing stored water from the reservoir to old water rights below the dam in exchange for natural flow of the river. The Hyrum Irrigation Co., whose holdings include approximately one-fourth of the project area, was thus enabled to divert to their canal water which would otherwise have been required to supply earlier priorities.

The estimated total cost of the project is \$930,000, of which about \$700,000 is required by the storage system and \$230,000 by the canal system. While final costs are not available at this time it appears they will be about in line with the estimate.

Gila Valley Work Suspended

Owing to objections made by the Department of Agriculture, all work was suspended December 3 on the Gila Valley project in Arizona pending completion of a reexamination of its economic aspects.

Secretary of Agriculture Henry A. Wallace said members of his staff believed the construction of the project unjustified because of its soil, which they said was calcarous and lacking in organic matter; because of its climate, which they said would discourage settlement of the land; and because they contended grapefruit was the only crop which the soil had been shown to be adapted to.

The Bureau of Reclamation survey, completed prior to the time the project was approved, had found it feasible.

Secretary Ickes immediately appointed a board of three experts to make an independent survey and report on the project.

Those appointed were W. H. Code, member of the consulting engineering firm of Quinton, Code & Hill—Leeds & Barnard, of Los Angeles, Calif.; William Peterson, a professor at the Utah State Agricultural College, Logan, Utah; and Prof. W. L. Powers, Soil Scientist of the Oregon State Agricultural College at Corvallis, Oregon.

The suspension came the day before bids were to have been opened at Yuma, Ariz., for construction of a section of the Gravity Main Canal of the Gila Valley project. The bids were returned to prospective contractors unopened in order that a subsequent call for bids might be made without jeopardizing the one who might have been the low bidder.

Notes for Contractors

COLUMBIA Basin project, Washington.—Laclede Tube Co. and L. R. Flori Co., both of St. Louis, Mo., submitted identical low bids of \$95,958.33, f. o. b. Alton, Ill., for furnishing 3,900,000 linear feet of 1-inch black steel pipe and 8,710 bends, as called for in Invitation No. 38,141-A, opening at Denver on November 13. Other bids were as follows: James B. Clow & Sons, Chicago, Ill., \$138,170.50; Standard Sanitary Mfg. Co., Denver, Colo., \$138,169.93; Grinnell Co. of the Pacific, Seattle, Wash., \$138,170.50; Fretz-Moon Tube Co. Inc., Butler, Pa., \$135,221.12; Standard Supply Co., Portland, Oreg., \$153,418.20; Globe Steel Tubes Co., Milwaukee, Wis., \$376,770. All bids were made subject to 2 percent discount, and all except the two low were f. o. b. Odair, Wash. A drawing between Laclede and Flori resulted in Flori being successful and award of contract was approved on December 9.

The following bids were opened at Denver on November 26 for furnishing material for 11 prefabricated court-type houses (Specifications No. 745-D) for the Government camp: White Pine Sash Co., Spokane, Wash., \$21,889, discount 2 percent; Western Pine Mfg. Co., Ltd., Spokane, Wash., \$21,758, discount 2 percent; The Modelow Co., Seattle, Wash., \$21,557 f. o. b. Seattle, discount 1 percent; C. R. Collins, Seattle, Wash., \$22,464 f. o. b. Seattle; Aladdin Co., North Portland, Oreg., \$22,285.35 f. o. b.

North Portland; P. T. Ainge Co., Portland, Oreg., \$24,373 f. o. b. Portland, discount 2 percent; Long Lake Lumber Co., Spokane, Wash., \$25,577 f. o. b. Spokane; Dally Construction & Engineering Co., Seattle, Wash., \$28,484 f. o. b. Seattle; Carlton Lumber Co., Portland, Oreg., \$27,500 f. o. b. Portland; Grover C. Gorsuch, Wenatchee, Wash., \$40,260; Tacoma Millwork Supply Co., Tacoma, Wash., \$43,846. All bids not otherwise stated were f. o. b. Odair. On December 13 the Secretary approved award of contract to the White Pine Sash Co.

At Denver on December 2 bids were opened for the construction of one 5-room and eleven 4-room residences at the Government camp, as required by Specifications No. 655. The three bids received were as follows: Macdonald Building Co., Tacoma, Wash., \$57,071; Grover Gorsuch, Laurier, Wash., \$65,230; Ryberg & McCaul, Seattle, Wash., \$65,889. Macdonald was awarded the contract on December 13.

Casper-Alcova project, Wyoming.—Twenty-eight concerns bid on supplying electrical apparatus for dragline stations, Casper Canal, under Specifications No. 740-D, bids opened at Denver on November 12. Low bids were as follows: Item 1, transformers, Pennsylvania Transformer Co., Pittsburgh, Pa., \$18,774 or \$19,386 (alternate); item 2, lightning arresters 60-kilovolt, General Electric Co., Pittsfield, Mass., \$7,496.64; item 3,

lightning arresters 4-kilovolts, General Electric Co. and Westinghouse Electric & Mfg. Co., both \$68.88; items 4, 5, and 6, air-break switches and expulsion fuses, Johnson Manufacturing Co., Atlanta, Ga., \$3,300 or \$3,149 (alternate); item 7, outdoor switching and metering units, Kelman Electric & Mfg. Co., Los Angeles, Calif., \$4,575. A drawing to determine the successful bidder on item 3 resulted in General Electric being drawn. Contracts were awarded to all low bidders on December 13.

Bids under Specifications No. 630 (readvertisement) were opened at Casper, Wyo., on November 26 for construction of the Seminole Dam and power plant (schedule no. 1) highway bridge and road (schedule no. 2). The following bids were received for schedules 1 and 2, respectively: Morrison-Knudsen Co., Boise, Idaho, Utah Construction Co., Ogden, Utah, Winston Bros. Co., Minneapolis, Minn., \$2,759,804.50, \$59,655; J. C. Maguire Construction Co., Butte, Mont., \$2,784,458.50, \$65,425; W. E. Callahan Construction Co., St. Louis, Mo., Gunther & Shirley, Dallas, Tex., \$2,855,756, \$65,811. The Secretary approved award of contract to Morrison-Knudsen-Utah-Winston on December 13 for schedule no. 1 at their bid of \$2,759,804.50. All bids for schedule no. 2 were rejected.

The following bids were received at Casper on November 25, for constructing tunnels Nos. 3, 4, 5, and 6, Casper Canal (Specifications No. 649), the amounts of bids given being for schedules 1, 2, 3, and 4 respectively: W. E. Callahan Construction Co. and Gunther & Shirley, Los Angeles, Calif., \$105,656, \$157,251, \$150,791, and \$412,150; Utah Construction Co., Ogden, Utah, \$108,459.80, \$159,569.80, \$153,794.80, and \$391,287.80; Edward Peterson, Omaha, Nebr., \$106,388, \$158,885.50, \$160,163, schedule 4, no bid; Morrison-Knudsen Co., Inc., \$118,409.70, \$167,377.20, \$170,607.20, and \$430,261.20; Crook & Henno, Denver, Colo., schedules 1 and 2, no bids, \$180,953 and \$538,931; Frazier-Davis Construction Co., St. Louis, Mo., schedules 1 and 2, no bids, \$202,222 and \$521,461. The Secretary on December 6 approved award of contract to Callahan, and Gunther & Shirley for all four schedules.

Thirteen manufacturers and jobbers submitted identical bids of \$15,897.02 for supplying copper cable for temporary transmission line for dragline excavation of Casper Canal, under Invitation No. 22,209-A, bids opened at Denver November 27. All bidders except one offered freight equalization. Hendrie & Bolthoff Mfg. Co., Denver, Colo., shipping from Trenton, N. J., was the low bidder

because of stating a greater weight than other bidders, which resulted in a lower delivered cost. The Secretary approved award of contract on December 12.

Thirty manufacturers and jobbers quoted on supplying machine tools under Specifications No. 741-D, bids opened at Denver on November 18. Awards of contracts have been made as follows: Item 1, 24-inch lathe, Mine and Smelter Supply Co., Denver, Colo., \$3,246.38 f. o. b. Cincinnati, Ohio, discount 1 percent; item 2, 24-inch upright drill, Hendrie and Bolthoff Mfg. Supply Co., Denver, Colo., \$365.25 f. o. b. Rockford, Ill.; item 3, 24-inch shaper, Kemp Machine Co., Baltimore, Md., \$1,646.49 f. o. b. Holland, Mich.; item 4, 10-inch pedestal grinder, Kemp Machine Co., \$164.22 f. o. b. Cleveland, Ohio; item 5, 300-ampere arc-welding unit, Harnischfeger Sales Corporation, Milwaukee, Wis., \$590 f. o. b. Casper, Wyo.; item 6, oxy-acetylene welding and cutting set, the Alexander Milburn Co., Baltimore, Md., \$116.40 f. o. b. Casper, Wyo., discount 2 percent; item 7, power hammer, no award; item 8, metal sawing machine, no award; item 9, floor crane and hoist, H. Channon Co., Chicago, Ill., \$157.50 f. o. b. Canton, Ohio; items 10 and 11, chain blocks, Wyoming Automotive Co., Casper, Wyo., \$133.62.

The Ace Weatherstripping Co., Spokane, Wash., has been awarded the contract for furnishing and installing metal weatherstripping for 60 residences at Coulee Dam, at their bid of \$1,539 for item 2 of Specifications No. 738-D.

Robert L. Austin, Burien, Wash., was low with a bid of \$7,000 for furnishing and installing plumbing systems for 33 residences at the Government camp, Specifications No. 746-D, item 1, bids opened at Coulee Dam on November 26. Other bids were as follows: Alki Plumbing Co., Seattle, Wash., \$7,847.80, item 1; Grand Coulee Plumbing & Heating Co., Grand Coulee, Wash., \$8,492.61; Advance Plumbing & Heating Co., Tacoma, Wash., \$8,493 item 1, \$8,400 item 2; Wells and Wade, Wenatchee, Wash., \$8,707.42 item 1, \$8,278.24 item 2; Gehri Heating & Plumbing Co., Tacoma, Wash., \$13,750 item 1, \$12,975 item 2. Shipment on commercial bill of lading was provided under item 1 and on Government bill of lading under item 2.

Ogden River project, Utah.—On December 20 bids were opened at Ogden, Utah (Specifications No. 659) for the construction of earthwork, canal lining and structures, Ogden-Brigham Canal, station 587 to station 1260, and South Ogden High-line Canal, station 10 to station 335. The items of work and estimated quantities involved are as follows: 240,000 cubic yards of all classes of excavation for

canal; 20,000 cubic yards of all classes of excavation for structures; 7,700 cubic yards of all classes of excavation for drainage channels and dikes; 10,000 station cubic yards of overhaul; 9,000 cubic yards of compacted embankment; 1,500 square yards of preparing canal sections in rock for concrete lining; 115,000 square yards of trimming earth sections for concrete lining; 59,000 cubic yards of backfill about structures; 4,060 cubic yards of concrete in structures; 710 cubic yards of concrete in combination sections; 9,390 cubic yards of concrete in canal lining; 500 square yards of dry-rock paving; 220 square yards of grouted paving; 200 cubic yards of riprap; placing 1,001,000 pounds of reinforcement bars; laying 6,295 linear feet of 12- to 36-inch diameter concrete pipe; laying 410 linear feet of 12- to 36-inch diameter corrugated metal pipe; laying 1,900 linear feet of 4- to 8-inch diameter clay sewer pipe; erecting 464 linear feet of No. 120 and No. 132 metal flume; erecting 76,000 feet board measure of timber in structures; erecting 41,700 pounds of structural steel flume supports; and installing 36,000 pounds of gates and miscellaneous metal work. The work must be completed within 430 days and liquidated damages for delay will be \$100 per day for each uncompleted schedule. The Bureau will purchase reinforcement bars, concrete pipe, corrugated metal pipe, clay sewer pipe, metal flume, structural steel, gates, and metal work. Low bids of \$317,125 on schedule no. 1 and \$107,853 on schedule no. 2 were submitted by J. A. Terteling and Sons of Boise, Idaho.

The Columbian Steel Tank Co., Kansas City, Mo., was awarded the contract on December 3 for furnishing a surge tank for the Ogden River conduit (Specifications No. 748-D). Fourteen bids were received and the Columbian bid of \$1,376 f. o. b. Kansas City, discount 2 percent, was low.

Three contractors bid on construction of surge tank and division works, Specifications No. 747-D, bids opened at Ogden on November 15. The bids were: Ora Bundy, Ogden, Utah, \$11,447.50; Barnard-Curtiss Co. and Dan Teters & Co., Ogden, Utah, \$11,727.50; Doyle & Oser, San Francisco, Calif., \$11,782.50. Bundy was awarded the contract on December 3.

All-American Canal project, Ariz.-Calif.—The Jardine & Knight Plumbing & Heating Co., Colorado Springs, Colo., with a bid of \$8,877 was awarded the contract for furnishing and installing air-cooling, heating, and distributing equipment for office building and dormitory at the Government camp at Imperial Dam, as called for in Specifications No.

739-D. Bids were opened at Denver on November 22. Other bids were as follows: Bell & Carver, Phoenix, Ariz., \$9,834; Standard Engineering Sales Co., Inc., Los Angeles, Calif., \$10,506; Baker Ice Machine Co., Omaha, Nebr., \$10,777.84; Refrigerating Equipment & Supply Co., San Bernardino, Calif., \$12,495; Listenwaller & Gough, Los Angeles, Calif., \$14,557; York Ice Machine Corporation, Denver, Colo., \$14,695.

Seven contractors submitted bids, under Specifications No. 644, for construction of Imperial Dam and desilting works, bids opened at Yuma, Ariz., on November 21. The bids were as follows: Morrison-Knudsen Co., Boise, Idaho, Utah Construction Co., Ogden, Utah, and Winston Bros., Inc., Minneapolis, Minn., \$4,374,240.60; W. E. Callahan Construction Co., St. Louis, Mo., \$4,526,961.30; J. F. Shea Co., Inc., Portland, Oreg., \$4,640,058.50; Frazier-Davis Construction Co. and G. L. Tarlton, Inc., St. Louis, Mo., \$4,877,273; Walsh Construction Co., Los Angeles, Calif., and Guy F. Atkinson, San Francisco, Calif., \$4,881,250; L. E. Dixon Co., Bent Bros., Johnson, Inc., Los Angeles, Calif., \$5,596,373.20; Henry J. Kaiser Co., Oakland, Calif., \$6,370,164. On December 13 the Secretary approved award of contract to the low bidders.

The following is a result of the bidding on construction of the All-American Canal, station 50 to station 245, under Specifications No. 647, bids opened at Yuma, Ariz., November 23, the bids given for schedules 1 and 2 respectively: Geo. Pollock Co., Sacramento, Calif., \$71,407.70, \$629,580; W. E. Callahan Construction Co., and Gunther & Shirley, St. Louis, Mo., \$74,480, \$795,378; Mittry Bros. Construction Co., Los Angeles, Calif., \$148,960, \$640,650; Boyce & Igoe, Baton Rouge, La., \$78,855.70, \$685,647; Lewis Construction Co., Los Angeles, Calif., schedule 1 no bid, \$650,300; David H. Ryan, San Diego, Calif., \$74,480, \$692,303; Macco Construction Co., Clearwater, Calif., \$102,410, \$685,884; Martin Wunderlich Co., Jefferson City, Mo., \$93,100, \$732,100; Geo. W. Condon Co., Omaha, Nebr., \$107,065, \$755,328; Hardwick & Horton, St. Louis, Mo., \$69,825, \$798,542; Griffith Co., Los Angeles, Calif., \$91,703.50, \$793,478; Morrison-Knudsen Co., Boise, Idaho and Winston Bros. Co., Minneapolis, Minn., \$121,030, \$810,678; Paul J. Tyler, Oroville, Calif., \$102,410, \$832,196; V. R. Dennis Construction Co., and A. Teichert & Sons, San Diego, Calif., \$92,169, \$868,386; John A. Bressi Construction Co., Los Angeles, Calif., schedule 1 no bid, \$685,860; Rohl-Connolly Co., Los Ange-

les, Calif., schedule 1 no bid, \$693,660; Isbell Construction Co., Reno, Nov., schedule 1 no bid, \$709,190; Guy F. Atkinson Co., San Francisco, Calif., schedule 1 no bid, \$855,310; S. J. Groves & Sons Co., Minneapolis, Minn., schedule 1 no bid, \$921,780; Mark C. Walker & Sons Co., Omaha, Nebr., \$99,989.40, schedule 2 no bid. The Secretary on December 13 approved award of contract to the Geo. Pollock Co. for both schedules at their combined bid of \$700,987.70.

Seven contractors submitted bids for building wash siphon structures at 120, 424, Unnamed, and Picacho washes on the All-American Canal (Specifications No. 645) bids opened at Denver on November 25. Frazier-Davis Construction Co., St. Louis, Mo., was low with a bid of \$489,527.50 for the four schedules and was awarded the contract on December 12. Other bids for all schedules were: V. R. Dennis Construction Co., San Diego, Calif., \$524,285.50; S. J. Groves & Sons Co., Minneapolis, Minn., \$636,709.50; Morrison-Knudsen Co., Inc., Boise, Idaho, \$696,590; J. F. Shea Co., Inc., Portland, Oreg., \$771,020.50; Geo. K. Thompson, Los Angeles, Calif., \$713,589.30; Mittry Bros. Construction Co., Los Angeles, Calif., \$859,526.

Only one bid was received on November 22 under Specifications No. 648 for furnishing 300,000 barrels of modified portland cement (item no. 1) and 40,000 barrels of sulphate-resistant portland cement. The Riverside Cement Co., California Portland Cement Co., and Southwestern Portland Cement Co., all of Los Angeles, Calif., combined to bid \$1.97 per barrel f. o. b. mills on item 1 and \$2.22 per barrel on item 2, both f. o. b. Colton, Crestmore, and Victorville, Calif., and subject to sack allowance of \$0.40. Award of contract is being made to the California companies for 375,000 barrels under item 1, the schedule quantity plus 25 percent. The bid on item 2 is rejected.

Boulder Canyon project, Ariz.-Nev.—Under Invitation No. A 23178-A for furnishing 1,800 gallons of coal-tar primer, 350 tons of coal-tar enamel, and 100 gallons of coal-tar-primer thinner, bids opened at Denver on November 5, the Barrett Co. of New York City has been awarded the contract at their bid of \$16,010.50 f. o. b. St. Louis, Mo.

Nine manufacturers bid on electrical equipment called for in Specifications No. 744-D, bids opened at Denver on November 29, as follows: Item 1, one 138-kilovolt oil circuit breaker, General Electric Co., Schenectady, N. Y., \$20,400; Pacific Electric Manufacturing Co., San Francisco, Calif., \$13,932; Westinghouse Electric & Manufacturing Co., Denver, Colo.,

\$20,520; Kelman Electric & Manufacturing Co., Los Angeles, Calif., \$16,300; item 2, three 138-kilovolt disconnecting switches, General Electric Co.; Pacific Electric Manufacturing Co.; Electric Power Equipment Corporation, Philadelphia, Pa.; Delta-Star Electric Co., Chicago, Ill.; Railway & Industrial Engineering Co., Greensburg, Pa.; Electric Engineers & Equipment Co., Melrose Park, Ill.; Boure Switch Co., San Francisco, Calif., all bids \$7,135; item 3, one 138-kilovolt lightning arrester, General Electric Co., \$3,072.84; Westinghouse, \$3,333.

With 15 bids received at Denver on November 29 for furnishing pipe, fittings, and valves for the power plant (Specifications No. 743-D) Grinnell Co. of the Pacific, Los Angeles, Calif., and the Grimes Pipe and Supply Co., of Denver, Colo., submitted low bids of \$1,344.64 for item 1. The Crane-O'Fallon Co., Denver, Colo., was awarded the contract for item 2, at their bid of \$3,242 f. o. b. Boulder City, Nev., discount 2 percent.

The Pacific Car & Foundry Co., Seattle, Wash., with a bid of \$1,475 f. o. b. Renton, was low on furnishing safety doors for lower tunnels (Specifications No. 742-D) and was awarded the contract on December 7. Nine manufacturers quoted prices.

Under Specification No. 750-D, pipe and fittings for the Boulder power plant, bids opened at Denver on December 9. The Grimes Pipe & Supply Co., Denver, Colo., Midwest Piping & Supply Co., Inc., St. Louis, Mo., and the Standard Sanitary Mfg. Co., Denver, Colo. submitted identical low combination bids of \$7,585 for both items nos. 1 and 2, all f. o. b. Boulder City. Other bids were as follows: Salt Lake Hardware Co., Salt Lake City, Utah, \$9,910; The Greene-Wolf Co., Inc., Brooklyn, N. Y., \$11,000; Grinnell Co. of the Pacific, Los Angeles, Calif., \$9,480; Associated Piping & Eng. Co., Ltd., Los Angeles, Calif., \$8,877; Power Piping Co., Pittsburgh, Pa., \$8,450; Berkeley Steel Construction Co., Berkeley, Calif., \$16,970; Crane-O'Fallon Co., Denver, Colo., \$7,560; John W. Beam, Denver, Colo., \$9,910. All bids are f. o. b. Boulder City except the Berkeley Steel Construction Co., whose bid is f. o. b. Berkeley and net.

Carlsbad project, N. Mex.—Bids were opened at Carlsbad on December 21 for construction of the Alamogordo Dam (Specifications No. 660). The work is located near Fort Sumner on the Pecos River. Principal items of work and estimated quantities involved are as follows: 36,900 cubic yards of excavation in open cut, common; 184,000 cubic yards of excavation in open cut, rock; 1,490,000

cubic yards of excavation in borrow pits, common; 52,000 cubic yards of excavation in borrow pits, rock; 4,200 cubic yards of tunnel and shaft excavation; 227,000 cubic yards of stripping for dam embankment and borrow pits; 1,340,000 cubic yards of earth fill in dam; 8,000 cubic yards of back fill about structures; 290,000 cubic yards of rock fill on downstream slope; 50,000 cubic yards of rock riprap on upstream slope; 3,000 cubic yards of rock riprap about spillway; 2,960 cubic yards of concrete in tunnel, gate chamber, and shaft; 10,900 cubic yards of concrete in spillway and stilling basin; 3,580 cubic yards of concrete in other parts of dam; 12,000 cubic feet of pressure grouting; drilling 13,000 linear feet of grout holes; drilling 8,000 linear feet of holes for anchor bars; placing 1,500,000 pounds of reinforcement bars; constructing 6,460 linear feet of embankment toe drains and spillway drains; furnishing and installing 25,000 pounds of tunnel liner plates; and installing 726,600 pounds of gates, valves, and other metal work. Seven hundred days are allowed to complete the dam after date of receipt of notice to proceed. Liquidated damages for delay will be \$200 per day. The Bureau will purchase reinforcement bars, gates, valves, and other metal work. The following low bid was received: Hallett Bros. Construction Co., Crosby, Minn., \$1,132,547. Thirty bids were received.

Salt River project, Arizona.—Ten bids were received at Phoenix on November 25 for construction of spillway at Stewart Mountain Dam (Specifications No. 651) as follows: Allied Bridge & Construction Co., Central Bridge & Construction Co., Omaha, Nebr., \$150,723.50; New Mexico Construction Co., Albuquerque, N. Mex., \$153,597; Case Construction Co., Alhambra, Calif., \$164,109; N. G. Hill & Co., Phoenix, Ariz., \$165,823.50; Daley Corporation, Phoenix, Ariz., \$167,097; Phoenix-Tempe Stone Co., Phoenix, Ariz., \$170,348; W. E. Hall Co., Phoenix, Ariz., \$172,607; S. J. Groves & Sons Co., Minneapolis, Minn., \$187,797.50; Morrison-Knudsen Co., Boise, Idaho, \$189,322.50; L. E. Dixon Co., Alhambra, Calif., \$248,052. The Secretary on December 12 approved award of contract to the low bidders.

At Denver, Colo., on December 16 the following bids were opened for furnishing motors, replacement parts, and gate-position indicators for alterations to spillway radial gates and hoists at Stewart Mountain Dam (Specifications No. 751-D): Omaha Steel Works, Omaha, Nebr., \$9,675; D. J. Murray Manufacturing Co., Wausau, Wis., \$10,315; Con-

solidated Steel Corporation Ltd., Los Angeles, Calif., \$10,900; Hardie-Tynes Manufacturing Co., Birmingham, Ala., \$9,886; Long Beach Iron Works, Long Beach, Calif., \$11,660; Joshua Hendy Iron Works, San Francisco, Calif., \$10,900 f. o. b. Sunnyvale, Calif.; Provo Foundry & Machine Co., Salt Lake City, Utah, \$11,600 f. o. b. Provo; John W. Beam, Denver, Colo., \$13,000; Valley Iron Works, Yakima, Wash., \$10,200.

Burnt River project, Oregon.—Bids received at Vale, Oreg., on November 30 for construction of the Unity Dam (Specification No. 653) were as follows: J. A. Terteling & Sons, Boise, Idaho, \$273,989; Myers & Goulter, Seattle, Wash., \$290,567; Guthrie-McDougall Co., Portland, Oreg., \$313,924.75; Barnard-Curtiss Co., Minneapolis, Minn., \$328,245.95; P. L. Crooks & Co., Inc., Portland, Oreg., \$329,871.50; Utah Construction Co., Ogden, Utah, \$332,470.50; Morrison-Knudsen Co., Inc., Boise, Idaho, \$341,852; Malcom & Bell, Portland, Oreg., \$348,648.50; Megarry Bros., Bain, Minn., \$392,011.50; Orino, Berkemeier & Sarnal, Bonneville, Oreg., \$546,242.50. The contract was awarded to J. A. Terteling & Sons on December 13.

Boise project, Idaho.—On December 21 bids were opened at Boise for raising Arrowrock Dam, as called for in Specifications No. 661. The principal items of work and estimated quantities of work involved are as follows: 31,100 cubic yards of all classes of open-cut excavation; 4,350 cubic yards of excavation in tunnels; 440 cubic yards of excavation of old concrete; 37,000 square yards of chipping and roughening old concrete surfaces; 4,500 cubic yards of back fill; 12,700 cubic yards of concrete in slab on downstream face of dam; 6,450 cubic yards of concrete in other parts of the dam and spillway; 220 cubic yards of concrete in tunnels; 16,000 cubic feet of gunite; placing 675,000 pounds of reinforcement bars; placing and anchoring 52,000 pounds of gunite reinforcement fabric; removing 10,000 feet board measure of old timbering in diversion tunnel; installing 10,000 feet board measure of timbering in tunnels; drilling 42,275 linear feet of grout and drainage holes; installing 1,200 linear feet of metal joint sealing strips; manufacturing and placing 16,000 linear feet of porous concrete drain tile; installing 156,000 pounds of metal work; installing 3,500 linear feet of electrical conduit; and dismantling, altering, and installing existing gates, etc. The work must be completed within 650 calendar days. Purchases of reinforcement bars and fabric, metal work, and electrical conduit will be made by the

Denver office. T. E. Connolly, San Francisco, Calif., was low, with a bid of \$395,040.

Boise project, Payette division, Idaho.—At Ontario, Oreg., on December 2 bids were opened for the construction of Tunnels Nos. 1, 2, 3, and 4, as required by Specifications No. 654. Bids for the four schedules were as follows: J. A. Terteling & Sons, Boise, Idaho, \$65,514, \$40,758, \$101,644, \$84,499; Dan Teters & Co., Ogden, Utah, \$72,868, \$40,017.50, \$93,585.50, \$91,049; Morrison-Knudsen Co., Inc., Boise, Idaho, \$69,993.50, \$37,779.50, \$103,723.50, \$101,272.50; Utah Construction Co., Ogden, Utah, \$87,882, \$41,771, \$112,162, \$114,916; Hinman Bros. Construction Co., Denver, Colo., \$100,803.50, \$65,040.50, \$149,226, \$131,585.

Frenchtown project, Montana.—Three bids were opened at Missoula on November 30 for constructing farm bridges on the main canal, Specifications No. 1-F, as follows: Arthur Graham, Missoula, Mont., \$2,683.92; Nick Burgraff, Inc., Idaho Falls, Idaho, \$4,680; Elliott Construction Co., Missoula, Mont., \$5,590.50.

On January 3 bids were opened at Missoula for constructing the diversion works and structures, Main Canal (Specifications No. 662). The principal items of work and estimated quantities are as follows:

14,900 cubic yards of all classes of excavation and stripping;

5,700 cubic yards of compacted earth fill;

3,550 cubic yards of backfill;

4,770 cubic yards of rockfills;

1,140 cubic yards of riprap;

770 square yards of dry-rock paving;

884 cubic yards of concrete;

Placing 72,000 pounds of reinforcement bars;

Laying 993 linear feet of 18- to 36-inch concrete pipe;

Laying 926 linear feet of 12- to 24-inch corrugated metal pipe;

Erecting 42 M feet b. m. of timber in structures;

Erecting 350 linear feet of no. 144 metal flume; and

Installing 23,700 pounds of gates and miscellaneous metalwork. The Bureau will purchase reinforcement bars, pipe, metal flume, gates, and metalwork. Construction work must be completed within 135 calendar days, with liquidated damages of \$50 per day.

Gila Valley project, Arizona.—Bids received at Yuma, Ariz., on December 4 for construction of earthwork and tunnels on the Gravity Main Canal, Specifications No. 657, were returned to the bidders unopened.

Riverton project, Wyoming.—Twelve contractors bid on constructing the Bull Lake Dam, under Specifications No. 658. The bids, opened at Riverton on December 7, were as follows: S. J. Groves & Sons Co., Minneapolis, Minn., \$653,397.50; Morrison-Knudsen Co., Inc., Boise, Idaho, \$666,535; Martin Wunderlich Co., Jefferson City, Mo., \$707,230; George W. Condon Co., Omaha, Nebr., \$712,495; E. H. Hannen Construction Co., Colorado Springs, Colo., \$738,990; Mittry Bros. Construction Co., Los Angeles, Calif., \$776,802; Megarry Bros., Bain, Minn., \$779,195; Edward Peterson, J. C. Maguire Construction Co., and the Lawler Corporation, Butte, Mont., \$779,455; David H. Ryan, San Diego, Calif., \$796,895.50; Hinman Bros. Construction Co., Denver, Colo., \$808,115; Stevens Bros., St. Paul, Minn., \$927,235; Winston Bros. Co., Minneapolis, Minn., \$997,424. Groves was awarded the contract on December 19.

Yakima project, Roza division, Washington.—The following bids were opened at Yakima on December 3 for construction of Tunnels Nos. 1, 2, and 3 (Specifications No. 652). Amounts shown are for schedules 1, 2, and 3, respectively. Morrison-Knudsen Co., Boise, Idaho, \$129,955, \$129,752.50, \$744,132 (\$993,839.50 all schedules); J. F. Shea Co., Inc., Portland, Oreg., \$144,033.75, \$148,638.75, \$727,541.75; T. E. Connolly, Inc., San Francisco, Calif., \$130,653.50, \$138,608.50, \$801,966 (\$1,051,228 all three schedules); S. S. Magoffin Co., Inc., Aspen, Colo., \$149,173, \$156,503, \$895,132; Broderick & Gordon, Denver, Colo., \$177,012.50, \$182,082.50, \$870,813; Walsh Construction Co., Los Angeles, Calif., \$182,713.50, \$196,493.50, \$854,237; A. Guthrie & Co., Inc., St. Paul, Minn., and Guthrie-McDougall Co., Portland, Oreg., \$161,145, \$171,370, \$978,760.50; L. E. Dixon Co., Bent Bros., Inc., and Johnson, Inc., Los Angeles, Calif., \$191,900, \$188,815, \$943,078.50; Frazier-Davis Construction Co., St. Louis, Mo., \$204,637.50, \$209,177.50, \$1,003,278; Utah Construction Co., Ogden, Utah, \$209,462.50, \$223,141.25, \$1,017,033 (\$1,439,636.75 all schedules); West Construction Co., Monrovia, Calif., schedule No. 3, \$774,000; Winston Bros. Co., Minneapolis, Minn., schedule No. 3, \$929,429; Malcom & Bell, Portland, Oreg., schedule 1, \$166,578.75, schedule 2, \$177,078.75; Kern & Kibbe, Portland, Oreg., schedule 1, \$179,282, schedule 2, \$185,420; P. L. Crooks & Co., Inc., Portland, Oreg., schedule 1, \$184,497, schedule 2, \$203,297. The Secretary on December 19 approved award of contract to Morrison-Knudsen Co. for all these schedules at their bid of \$993,839.50.

Shoshone project, Heart Mountain division, Wyoming.—At Cody, Wyo., on December 5 bids were opened for the

construction of tunnels Nos. 1, 2, and 3 (Specifications No. 656). This is the first work to be undertaken on the Heart Mountain division. The following combination bids for all these schedules were received: Utah Construction Co., Ogden, Utah, \$614,509.50; Morrison-Knudsen Co., Boise, Idaho, \$653,342.50; W. S. Broderick and D. G. Gordon, Denver, Colo., \$670,446.40; S. S. Magoffin Co., Inc., Aspen, Colo., \$730,446.75; T. E. Connolly, Inc., San Francisco, Calif., \$792,026.70; Guthrie-McDougall Co., Portland, Oreg., \$1,025,776.75. The Utah Construction Co. was awarded the contract on December 19.

Sun River project, Montana.—Three contractors bid on Specification No. 650, covering construction of earthwork and structures, Mill Coulee wasteway and laterals. Bids were opened at Fairfield on December 2, as follows: T. G. Rowland, Salt Lake City, Utah, \$43,530.90; Rue Construction Co., Bismarek, N. Dak., \$46,095.40; Tomlinson-Arkwright Co.,

Great Falls, Mont., \$65,390.60. Rowland was awarded the contract on December 20.

Uncompahgre project, Colorado.—Eleven bids were received at Denver on December 16 for furnishing steel supports for metal flumes (Specifications No. 752-D) as follows: Midwest Steel & Iron Works Co., Denver, Colo., \$4,287 f. o. b. Montrose, Colo.; Virginia Bridge & Iron Co., Roanoke, Va., \$3,315 f. o. b. Memphis; Worden-Allen Co., Milwaukee, Wis., \$4,765 f. o. b. Montrose; Minneapolis-Moline Power Implement Co., Minneapolis, Minn., \$3,750; John W. Beam, Denver, Colo., \$3,700 f. o. b. Peotone, Ill.; Kansas City Structural Steel Co., Denver, Colo., \$3,595 f. o. b. Kansas City, Kans.; Paxton & Vierling Iron Works, Omaha, Nebr., \$4,100; Jos. T. Ryerson & Son, Inc., Chicago, Ill., \$3,052; E. Burkhardt & Sons, Denver, Colo., \$4,986; Hardesty Mfg. Co., \$6,360 f. o. b. Montrose; Pennsylvania Iron & Steel Co., Los Angeles, Calif., \$5,971 f. o. b. Montrose.

Progress of Investigations of Projects

SILT Survey, Colorado River, Ariz.-Calif.—The field work for surveys and borings along the Colorado River between Parker and Imperial dam sites, to determine the effect of desilted water released from the Parker Reservoir on the river channel was completed.

Northern transmountain diversion, Colorado.—Four planetable sheets showing topography in Estes Park and seven sheets showing power conduit lines, were completed during the month. Two sheets showing topography of the distribution system from the Big Thompson River were partially completed. Triangulation points between Bellvue and Lyons were located and checked. Reservoir sites, canal tunnel locations, and dam sites which might fit into the distribution system from Big Thompson River to the Poudre and St. Vrain Rivers, were inspected. Geological investigations were plotted on several tentative sections across the Continental Divide near the tunnel sites.

Weiser-Payette, Idaho.—A study of the Boise Valley is in progress to determine the possibility of augmenting the water supply for the Boise project. The first possibility being studied contemplates increasing the water supply for Deer Flat Reservoir by an extension of the Phyllis Canal upstream from its present headgate on the south side of Eagle Island across the island to the north side so as to include both channels of the Boise River. The canal also crosses several drains which may be diverted into the canal. A pumping lift would then be located on the Phyllis Canal in the vicinity of the reser-

voir. During the month two locations for the canal across Eagle Island were investigated. Surveys were made for gravity or pumping diversions from several drains. A contour line was run from the Deer Flat Reservoir to the approximate pump site on the Phyllis Canal.

Upper Snake River storage, Idaho.—Water supply studies to determine the waters available for transmountain diversion from Hebgen Lake, Mont., to Henrys Lake, Idaho, were initiated. Data pertaining to water rights owned by the Montana Power Co. for use at its plants along the Madison and Missouri Rivers were assembled. State officials of Idaho are conferring with those of Montana to ascertain the conditions under which water will be permitted to be diverted from Montana to Idaho. In regard to the Eagle Rock power development arrangements have been made to collect additional field data on possible power use by various irrigation districts along the Snake River.

Buffalo Rapids project, Montana.—The report has been completed and copies were distributed to interested parties from the limited edition prepared.

Gallatin Valley, Mont.—Two plane-table parties were engaged throughout the month taking topography at the lower basin dam and reservoir site on the Gallatin River. The diamond drill crew arrived at Bozeman on November 15 and commenced drilling in the center of the river at the lower basin dam site. A preliminary geological report and a tentative drilling program were prepared.

Grande Ronde, Oreg.—A progress report on these investigations was completed and distributed to interested parties from the limited edition prepared.

Deschutes project, Oregon.—A six-man transit and level party completed 31.4 miles of canal location of the north unit main canal during the month. The proposed canal follows the present location of the main canal of the central Oregon irrigation district from the dam in Bend to station 172. From there it crosses to the east of the present irrigated lands, then goes northeasterly to the east side of Redmond. Then it turns northwesterly, recrosses the irrigated lands, follows the railroad past Terrebonne, and crosses the Crooked River Canyon near the railroad bridge with a siphon and bridge. Test pits along the canal to bedrock, of 5 feet in depth, were dug at 100-foot intervals to station 184 and 200-foot intervals thereafter, and 27.6 miles of canal location were covered. A topographic map was made of the proposed Crooked River crossing. A planetable reconnaissance map was made of the canyon below the siphon site for about 5 miles for the purpose of determining the controlling elevations along the canyon rim. Soil survey auger holes were put down in the middle and the four corners of each 40-acre tract and in miscellaneous areas where special information was desirable. Soil borings were completed on the Agency Plains district involving about 25,000 acres and 13,000 acres were covered on the Culver district. Following the soil survey, a planetable irrigable area survey has covered 14,000 acres. A preliminary topographic map was made of the low diversion site on Crooked River for the proposed pumping plan for the Ochoco district. The site is about a mile south of Prineville and was abandoned when the area of improved irrigated land which would be flooded was ascertained.

Colorado River Basin, (1) Utah.—Work in Utah for October and November was located on the Green River and its tributaries in the northeastern quarter of the State. Land classification was completed on the Green River from Split Mountain to about 10 miles south of Ouray, a general valley distance of about 70 miles. Classification of lands on the Upper Blue Bench was completed in October. This completed the work in the Blue Bench region. Mapping of irrigated lands in the Uintah Basin was completed on November 13. Areas covered lie along Strawberry River, Antelope, Nine-mile, and Willow Creeks, tributaries of Green River. Ninety-eight square miles were surveyed in October, and 25 square miles in November. Land classification amounted to 38 square miles in October and 37½ square miles in November.

(Continued on p. 25)

High Dams in the United States

THERE are 66 dams in the United States, either completed or under construction, which have a maximum height above foundation of 200 feet or more. It seems proper to refer to these structures, which are listed in the following table, as "high dams." It is interesting to note that 52 are in States west of the Mississippi River, of which 25 are in California. Arizona comes next with 8, of which 2 are on the Colorado River where it forms the boundary line between States. Four of these Arizona dams—Roosevelt, Horse Mesa, Mormon Flat, and Stewart Mountain—are on the Salt River and form a continuous chain of lakes 60 miles long, storing water for the Salt River (Federal) irrigation project. Washington follows Arizona with 5 dams, then comes New York with 3, all on the New York City water supply system, and North Carolina also has 3, all power dams. Seventeen of the 66 are Bureau of Reclamation dams, shown in capitals in the table. Fort Peck, Tygart River, and Conchas are under construction by the Corps of Engineers, War Department. The 66 high dams are to be found in 18 of the 48 States. Their combined height is 3½ miles.

Boulder, on the Colorado River in Arizona-Nevada, which was dedicated by President Roosevelt on September 30, outranks all other dams with a height of 727 feet from foundation rock to the roadway on the crest. Grand Coulee Dam, now under construction on the Columbia River in Washington, will ultimately have a height of about 550 feet but is now authorized for only 177 feet. However the foundation of the present structure has been designed to support the ultimate high dam. On the Central Valley project in California, recently started with an initial allotment of \$15,000,000, the principal structure is the Kennett Dam on the Sacramento River near Redding. Preliminary plans by the State of California called for a 420-foot dam, but engineers in the Denver office are now giving consideration to a structure 520 feet high.

Salt Springs, 332 feet, a power dam on North Fork of the Mokelumne River in California, is the highest rock-fill structure. Cobble Mountain in Massachusetts, which stores water for the city of Springfield's supply, is the highest earth-fill dam with 263 feet. The Los Angeles County flood control district in southern California is now constructing San Gabriel No. 1, a composite rock-fill and rolled-earth embankment which overtops others of this type with a maximum height of 381 feet. Lake Pleasant in

Arizona, 256 feet, is the highest multiple-arch dam and Coolidge, 249 feet, in the same State the highest of multiple-dome dams. A study of the table shows that power is developed at 36 dams, 18 store water for irrigation, 19 provide storage for domestic water supply and 11 control floods. Several of the structures serve more than one of these purposes.

Among the high dams several are of special interest because of certain unusual features of construction. Boulder stands out on account of its exceptional height of 727 feet. The dam provides a maximum head of 590 feet for power development. It contains more concrete than any other concrete masonry dam. Coolidge is the first multiple-dome type dam ever constructed, and has three egg-shaped domes supported by intermediate buttresses and the walls of the canyon. Lake Pleasant is the only dam of the multiple-arch type in the United States exceeding 200 feet in height. It has 26 arches and a crest length of 2,146 feet. Fort Peck is the largest structure with its 100,000,000 cubic yards of hydraulic earth-fill, and Conchas is the longest, with a crest length of 26,000 feet, about 5 miles, which includes both main dam and wing dams. The 328-foot height of the Shoshone Dam exceeds its length of 200 feet. Salmon in the Baker River, Washington, on their way to spawning grounds, are carried over the 263-foot Shannon Dam, an elevator helping the fish in their climb. The Ariel Dam, a thin section arch, has a thickness of 19 feet at the top and 92 feet at the bottom. The Salt Springs Dam contains 3,000,000 cubic yards of rock, and has a crest thickness of 15 feet and base thickness of 900 feet. Saluda in South Carolina contains 11,000,000 cubic yards of earth placed by the semi-hydraulic method, the materials being transported to the site and then segregated, placed, and compacted by the use of water.

The Bureau of Reclamation is truly a builder of dams and a leader among Government bureaus in that line of work. Beginning with the Shoshone Dam in Wyoming, which was completed in 1910, the Bureau has now completed 71 storage and 67 diversion dams. There are at present 11 dams under construction and 22 additional dams are contemplated under the present program of work. None of the new structures will be in the 200-foot or more class with the possible exception of Deer Creek on the Provo River project in Utah. No Reclamation dam has ever failed.

TABLE

Name	State	River	Year completed	Purpose ¹	Type ²	Maximum height	Crest length	Volume	Cost
						<i>Feet</i>	<i>Feet</i>	<i>Cu. yds.</i>	
BOULDER	Arizona-Nevada	Colorado	1935	F. C., Irr., P.	Arch-gravity	727	1,282	3,250,335	\$70,600,000
GRAND COULEE ³	Washington	Columbia	(9)	F. C., Irr., P.	Gravity, straight	7550	74,200	10,500,000	113,676,000
KENNETT ⁵	California	Sacramento	(9)	Irr., P.	do.	820	2,430	3,420,000	60,600,000
OWYHEE	Oregon	Owyhee	1932	Irr.	Arch-gravity	405	840	550,000	5,378,125
Diablo	Washington	Skagit.	1931	P.	Constant radius arch, gravity wings.	389	1,150	350,000	
San Gabriel No. 1	California	San Gabriel	(9)	F. C.	Earth and rock fill	381	1,520	10,260,000	15,746,251
Pacoina	do.	Pacoina	1929	F. C.	Variable radius arch	372	640	226,140	2,514,770
Pardee	do.	Mokelumne	1929	W. S., P.	Arch-gravity	358	1,337	617,700	6,240,000
ARROWROCK	Idaho	Boise	1915	Irr.	do.	349	1,100	585,130	4,327,710
Hetch Hetchy	California	Tuolumne	1931	W. S., P.	do.	344	605	368,516	10,000,000
PARKER	Arizona-California	Colorado	(9)	W. S., P.	Constant radius arch	340	800	290,000	11 8,805,000
Salt Springs	California	N. Fork Mokelumne	1931	P.	Rock fill ¹²	332	1,300	3,000,000	6,930,000
Exchequer	do.	Merced	1926	Irr., P.	Arch-gravity	330	960	396,000	5,116,073
SHOSHONE	Wyoming	Shoshone	1910	Irr., P.	Constant radius arch	328	200	78,576	1,439,135
Morris	California	San Gabriel	1934	W. S.	Gravity, straight	325	756	480,860	5,770,000
Ariel	Washington	Lewis	1931	P.	Gravity and variable radius arch	313	1,250	307,000	
Kensico	New York	Bronx	1916	W. S.	Gravity, straight ¹⁴	307	1,843	900,000	6,735,000
ELEPHANT BUTTE	New Mexico	Rio Grande	1916	Irr.	do.	306	1,155	618,536	4,149,180
HORSE MESA	Arizona	Salt	1927	P.	Variable radius arch	305	784	147,357	15 2,873,000
New Croton	New York	Croton	1927	W. S.	Gravity, straight ¹⁶	297	17 710	855,000	7,631,185
Don Pedro	California	Tuolumne	1923	Irr.	Arch-gravity	288	1,040	296,552	3,097,419
San Gabriel No. 2	do.	San Gabriel	1935	F. C.	Rock fill ¹⁸	285	800	1,200,000	3,007,586
ROOSEVELT	Arizona	Salt	1911	Irr.	Arch-gravity	284	10 1,080	342,970	3,890,187
Cushman	Washington	N. Fork Skokomish	1926	P.	Variable radius arch	280	1,110	90,000	
Moreno	California	Cottonwood Creek	1930	W. S.	Rock fill ²⁰	278	530	324,000	1,250,000
Lake Spaulding	do.	South Yuba	1919	P.	Variable radius arch	275	800	191,772	2,353,776
Dix River	Kentucky	Dix	1925	P.	Rock fill ²¹	270	910	1,747,000	7,000,000
El Capitan	California	San Diego	1935	W. S.	Semihydraulic fill and rock fill	270	1,230	22 2,400,000	3,124,908
Norris	Tennessee	Clinch	(9)	F. C.	Gravity, straight	266	1,872	1,195,000	13,800,000
Big Tujunga No. 1	California	Big Tujunga Creek	1932	F. C.	Variable radius arch ²³	265	800	108,250	1,117,025
Cobble Mountain	Massachusetts	Little	1932	W. S. & P.	Earth fill, hydraulic	263	730	1,800,000	11 6,000,000
Shannon	Washington	Baker	1926	P.	Semigravity arch, overflow	263	450	132,000	11 8,000,000
SEMINOE	Wyoming	Platte	(9)	F. C., Irr., P.	Gravity, straight	260	600	163,000	3,750,000
Lake Pleasant	Arizona	Agua Fria	1927	Irr., P.	Multiple arch	256	28 2,146	98,400	
FRIANT ⁵	California	San Joaquin	(16)	Irr., P.	Gravity, straight	252	3,800	1,328,000	13,646,000
Olive Bridge	New York	Esopus Creek	1912	W. A.	do ²⁶	252	27 1,100	390,000	
Coolidge	Arizona	Gila	1928	Irr., P.	Multiple dome	249	932	204,000	4,500,000
Fort Peck	Montana	Missouri	(9)	F. C., P.	Hydraulic earth fill	242	25 9,000	100,000,000	86,000,000
Copco No. 1	California	Klamath	1922	P.	Variable radius arch	236	415	70,312	1,544,000
Tygart River	West Virginia	Tygart	(9)	F. C.	Gravity, straight	235	1,850	1,100,000	29 15,700,000
ALCOVA	Wyoming	Platte	(9)	Irr.	Earth and rock fill	232	900	1,500,000	3,339,000
Cheesman	Colorado	South Platte	1904	W. S.	Arch-gravity ³⁰	232	710	103,000	1,000,000
Big Santa Anita	California	Big Santa Anita Creek	1927	F. C.	Variable radius arch	230	612	76,184	1,208,000
Calderswood	Tennessee	Little Tennessee	1930	P.	Thin section arch, overflow	230		400,000	
Conchas	New Mexico	Canadian	(9)	F. C., W. S., P.	Earth fill	230	31 26,000	7,300,000	9,000,000
MORMON FLAT	Arizona	Salt	1925	P.	Variable radius arch	229	623	42,980	11 1,559,000
Bouquet Canyon	California	Bouquet Creek	1934	P.	Earth fill	228	1,950	3,421,300	3,007,586
Melones	do.	Stanislaus	1926	Irr.	Constant radius arch, overflow	222	590	92,913	1,575,000
TIETON	Washington	Tieton	1925	Irr.	Earth and rock fill, semihydraulic	222	905	1,995,000	3,756,256
Calaveras	California	Calaveras Creek	1925	W. S.	Earth fill, semihydraulic ³²	220	1,200	3,461,000	
Salmon River	Idaho	Salmon	1912	Irr.	Constant radius arch	220	490		
San Pablo	California	San Pablo Creek	1920	W. S.	Earth fill, hydraulic	220	1,250	2,200,000	
PATHFINDER	Wyoming	Boise	1922	Irr.	Constant radius arch ³³	218	432	60,210	1,755,306
YADKIN NARROWS	North Carolina	Yadkin	1919	P.	Arch-gravity, overflow	217	1,400	525,000	
Upper San Leandro	California	Upper San Leandro Creek	1926	W. S.	Earth fill, part hydraulic	215	660	1,248,000	
Barrett	do.	Cottonwood Creek	1922	W. S.	Arch-gravity	213	773	139,569	1,650,000
STEWART MOUNTAIN	Arizona	Salt	1930	P.	Variable radius arch ³⁴	212	1,260	122,000	11 2,515,000
Saluda	South Carolina	Saluda	1930	P.	Earth fill, semihydraulic ³⁵	208	7,800	11,000,000	
Wachusett	Massachusetts	Nashua	1906	W. S.	Gravity, straight ³⁶	207	971	266,663	2,378,206
Santeetlah	North Carolina	Tallasee	1927	P.	Variable radius arch ³⁷	202	340		
Davis Bridge	Vermont	Deerfield	1924	P.	Earth fill, semihydraulic	200	1,250	1,950,000	
Lake Arrowhead	California	Little Bear Creek	1922	P.	Earth fill, hydraulic	200	720	1,000,000	
Cheoh	North Carolina	Little Tennessee	1915	P.	Arch-gravity, overflow	200	700		
Mulholland	California	Weid (Canyon)	1924	W. S.	Arch-gravity	200	930	173,462	1,112,231
Glines Canyon	Washington	Elwah	1927	P.	Semigravity arch	200	555		
Bull Run	Oregon	Bull Run	1929	W. S.	Arch-gravity	200	1,000	230,000	1,480,776

¹ F. C.—Flood control; P—Power; Irr.—Irrigation; W. S.—Water supply.² All dams are constructed of concrete masonry unless otherwise noted.³ 4,400,000 including appurtenant works and power house.⁴ Not including interest during construction.⁵ Preliminary data.⁶ Under construction.⁷ Authorized for height of 177 feet. Data given are for ultimate high dam.⁸ Height of 520 feet under consideration.⁹ Now being raised 85 feet.¹⁰ Includes cost of raising.¹¹ Includes cost of power plant.¹² Upstream slope paved with 15-foot layer of placed rock surfaced with concrete slab.¹³ Arch section 313 feet, gravity section 140 feet.¹⁴ Upstream face, precast concrete blocks.¹⁵ \$4,237,000 including power plant.¹⁶ Stone masonry facing.¹⁷ Not including earth embankment 490 feet.¹⁸ Concrete facing on upstream slope.¹⁹ 1,125 feet including spillway.²⁰ Concrete core wall.²¹ Upstream slope has hand-packed rock faced with concrete.²² 1,500,000 earth, 850,000 rock, 50,000 concrete.²³ Gravity section at each end.²⁴ Includes 395,000 rock in toes and riprap.²⁵ Does not include 750-foot spillway.²⁶ Faced with concrete blocks.²⁷ 4,650 feet with earth wings.²⁸ 20,500 feet including dike on west bank.²⁹ Dam proper, \$6,249,000.³⁰ Granite in portland cement mortar.³¹ Includes wing dams.³² Lower half hydraulic fill. Upper half dry earth and rock fill.³³ Granite random rubble masonry with coarse rubble faces.³⁴ Gravity section west end, overflow section east end.³⁵ Clay puddle core.³⁶ Rubble masonry, ashlar facing downstream.³⁷ 2 gravity overflow tangents.

A DECIDED increase has occurred in the number of inquiries received and of land seekers visiting the Owyhee project. These were from three to four

times greater for the month of November than for the preceding month. Between 300 and 400 acres were sold to new settlers during the month.

ABOUT 45,000 turkeys on the Klamath project were ready for the Christmas market. The killing started about December 15.



Weed Control

By L. H. Mitchell, Field Supervisor in Charge of District No. 4

DITCH banks a garden for weeds.—Weed menace has reached a serious stage on many of the irrigated projects. When farms are abandoned, in whole or in part, on account of noxious weeds, when crop yields are materially reduced, it is time some constructive weed-control program is inaugurated.

The United States Chamber of Commerce has estimated the annual loss from weeds in the United States to be \$3,000,000,000. A recent survey in the State of Utah showed that more than 45,000 acres of the perennial noxious weeds alone were found. It is safe to assume that other arid States are suffering annually as much from this source and that our reclamation projects are participating proportionately in the damages from weeds.

Whether a reclamation project is operated by the water users or the United States there has been on nearly all the projects an attitude of indifference relative to the control of weeds. In addition to all the ways and means known to humid sections for the spread of weeds, irrigated projects have water, by far the easiest and most effective carrier of weed seeds with which to contend. Ditch banks, being semipublic property, are natural "gardens" for weeds.

On a few projects considerable effort has been made to eradicate weeds in the fields both by cultivation and by the application of chemicals. In this attempt, however, too often the canal banks are left as incubators for weeds which is comparable to treating a sufferer from a contagious disease and neglecting the quarantine restriction. The water in ditches should not be a carrier of weed seeds of any kind. To prevent irrigation water from being a "seeder", an unwelcome or unnecessary "equipment", the canal banks obviously must be free of weeds.

Any method used to maintain clean ditch banks must be practical; that is, the cost of weed control must be within the reach of the beneficiaries.

On nearly every irrigated project can be found canal banks where the owner of the adjoining land, because of pride and for other good reasons, has not allowed weeds of any kind to get a foothold. Some have accomplished this by planting pasture grasses and using the canal rights-of-way for a pasture; that is, the grass has served two purposes, a pasture and a control of weeds.

All of the canal banks on the experimental farm of the United States Department of Agriculture at Newell, S. Dak., are covered with brome grass. The banks were leveled and otherwise prepared before seeding to brome grass to allow the use of machinery in harvesting the grass for hay. The value of the hay offsets the cost of harvesting.

Photograph no. 1 shows how a farmer on one of the Bureau of Reclamation projects used the head ditch banks for shade trees and brome grass pasture.

Photograph no. 2 is a lateral with a good growth of brome grass. In this photograph the grass could be cut for hay and with an inexpensive temporary fence the canal banks would afford no small amount of pasture. This ditch was seeded to brome grass by nature, the seed having spread from the adjoining pasture.

Photograph no. 3 shows at the left the location of a small ditch which is invisible because of the mass of noxious weeds, already gone to seed and ready for deposit with the water in an irrigated field.

GIVE GRASSES CHANCE TO MAKE GOOD

Why not give grasses or clover a chance to help keep down the weeds? The preparation of canal banks by leveling, making a seed bed, and the seeding is suggested for an ideal C. C. C. project.

Brome grass is recommended on ditch banks for most projects because it has demonstrated its persistence and its resistance to drouth. It is not sensitive to cold or hot weather. On projects where the summers are hot and long,

possibly on account of brome grass being dormant during that time, some other grasses may be preferred. Brome grass, on a trial basis, however, would be inexpensive and may bring excellent results. Where it has been tried it has developed a good close sod, smothering out many less hardy grasses, and has demonstrated its value in competing with weeds. It makes excellent pasture grass and fair hay. When used for hay it should be cut just before flowering for the best nutritive value.

Strawberry clover.—Although sweet-clover is a very good competitor for and may be preferred on many ditch banks to weeds, there are places where on account of its deep, large root system, which loosens the earth material on the water side of canal banks, sloughing of banks is frequent, especially in the spring of the year. Its brushlike and rank growth is often a nuisance for the operating department. Where the canal banks are damp, and especially where there is considerable alkali, the strawberry clover has been found on two of the Bureau's projects especially adapted for making a cover crop that smothers out many of the weeds and grasses, especially saltgrass. Strawberry clover, like ladino and alsike clover, is a legume and a very good pasture. Although little is known about its resistant qualities to hard cold winters, enough is known to recommend its trial on any canal bank.

RECOMMENDATIONS

1. When practical all irrigation ditches including spoil banks and borrow pits, should be constructed and maintained to permit mowing with the regular mechanical machines.

2. Hardy varieties of grasses and clovers will grow where weeds will. Give those grasses and clovers a chance at least by properly seeding a small plot of the upper reaches of the ditches and portions of canals where the prevailing winds will help spread the seeds.



1, Brome grass on lateral banks in Whittet's pasture on the Garland division, Shoshone project, west of Powell, Wyo.; 2, brome grass growing on lateral banks on Dunton farm, Garland division; 3, weeds growing on lateral banks just across the road from Whittet's brome grass pasture.

3. After the ditch banks have a good covering of grasses or clovers they may be pastured but not overgrazed.

4. Farmers should get weed conscious. Weed control on irrigation projects is a local problem and not a job for Uncle Sam or any interest to participate in other than to conduct experiments and give constructive advice based upon conclusive and practical findings.

Other phases of this problem will be discussed in future issues.

WITH most of the mills on the Klamath project planning to operate on a 2-shift basis throughout the winter, labor conditions look more promising than they have for the past several years.

Art at Boulder Dam

(Continued from p. 13)

man from Mars such a diagram might conceivably serve as the best possible means of understanding the meaning of Boulder Dam. Meanwhile it satisfies one's aesthetic taste by being a finely ordered arrangement of line, color, and pattern.

The writer has utilized these pottery decorative elements on a penetrated barrel vault ceiling above a white marble wainscoat and the ready facility with which borders designed for circular bowls adapted themselves to arches, soffits, groins, and lunettes was a thrilling joy. The previous decoration on this classic ceiling had been of the Renaissance and Raphaelesque treatment so a comparison was possible and this newer adaptation suffered not at all. The prediction is made that when architects and decorators begin to study this aboriginal art of the Southwest a new and fertile source of inspiration will be found and a fresher, sounder output be developed.

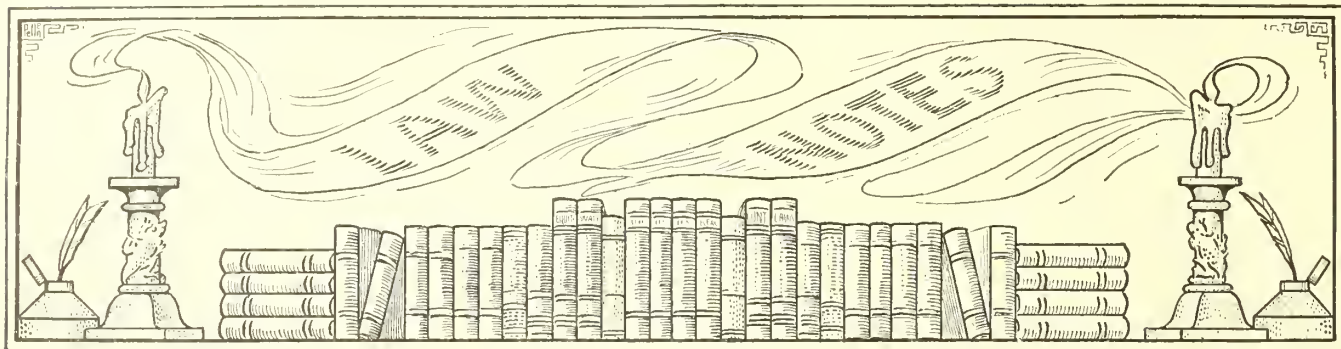
Much of the sensitive yet virile appreciation of form and color survives among the contemporary Pueblo Indians and it is planned to utilize the talents of some of the best of them when the final wall decoration is done.

Investigations

(Continued from p. 22)

(2) *Colorado*.—In Colorado the irrigated area survey was confined to lands in the valleys of the Eagle River and tributaries, the Sheephorn Valley, the Sweetwater Creek, and lands in the vicinity of Toponas and McCoy. By the end of the month the irrigated area survey had been largely completed down stream to Glenwood Canyon. A few areas inaccessible in winter remain to be completed next summer. Forty-five square miles were surveyed during the month. Land classification was confined to lands in the Big Muddy Creek Valley north of Kremmling, which was completed on November 26.

Southern Nevada.—Investigation of irrigation possibilities in the Las Vegas and Moapa Valley areas by pumping from the Boulder Canyon Reservoir are being continued. Cost estimates have been completed on all canal and tunnel work for the Las Vegas pumping project. Plans for a lateral and drainage system have been made and cost estimate completed. The report on these investigations is expected to be completed in the near future.



The legal status of water rights in the Pacific Northwest

By B. E. Stoutemyer, District Counsel

[Continued from the December issue]

THE WASHINGTON law applicable to nonnavigable streams as determined by the supreme court of that State in the *Hunter Land Co.* case may be summarized as follows:

"In the apportionment of water for irrigation between riparian owners and appropriators, riparian claimants prior in the time of their settlement are first in right and entitled to such proportion of the water as their riparian lands bear to the quantity of riparian lands on the stream capable of being irrigated therefrom, to the extent of the water necessary for such irrigation; and subsequent appropriators are entitled to the excess waters in the order of their actual appropriation and devotion of the same to a beneficial use, *Hunter Land Co. v. Laugenour*, 140 Wash. 558, 250 Pac. 41." (Rem. Rev. Stat., sec. 7351, footnote no. 13.)

It would appear, however, that in arriving at the conclusions stated in the case of *Hunter Land Co. v. Laugenour*, the Supreme Court of Washington has been misled to some extent by a misconstruction of the Federal statutes, particularly the desert-land laws, for the rule announced in the *Hunter Land Co.* case is justified by the Court on the grounds:

"Land of the United States is never without ownership, the primary title being in the United States, which owns not only the land itself but all rights attaching to it, and where land borders on a stream the ownership includes riparian rights.

"Conveyance by United States of land conveys only such portion of its riparian right as riparian land conveyed bears to whole of lands riparian to stream." (*Hunter Land Co. v. Laugenour*, 250 P. 42.)

And in the case of *Still v. Palouse Irrigation & Power Company*, 64 Wash. 606, 117 P. 466, the Washington court held that the Federal desert-land acts recognized and assented to the appropriation of water in the contravention of the

common-law right of the riparian owner only in respect to desert lands granted under the act. In this holding the Supreme Court of the United States, in the case of *California Oregon Power Co. v. Beaver Portland Cement Co.* (supra) has pointed out that the Washington court (and also the California court) was in error and that the correct view is the one adopted by the Supreme Court of Oregon in the case of *Hough v. Porter* (51 Ore. 318, 95 P. 932, 98 P. 1083, 102 P. 728), the United States Supreme Court saying:

"Only four of the desert-land States have spoken upon the matter, and their decisions are not in harmony. The Supreme Court of Oregon in *Hough v. Porter*, 51 Or. 318, 95 P. 732, 98 P. 1083, 102 P. 728, held that the legal effect of the language already quoted from the Desert Land Act was to dedicate to the public all interest, riparian or otherwise, in the waters of the public domain, and to abrogate the common-law rule in respect of riparian rights as to all lands settled upon or entered after March 3, 1877. The supplemental opinion which deals with the subject beginning at p. 382 is well reasoned and we think reaches the right conclusion. Subsequent decisions in Oregon are to the same effect, *Hedges v. Riddle*, 63 Or. 257, 259, 260, 127 P. 548; *Hill v. Ameriean Land & Livestock Co.*, 82 Or. 202, 207, 161 P. 403; *Allen v. Magill*, 96 Or. 610, 618, 619, 189 P. 986, 190 P. 726.

"This view was followed by the Supreme Court of South Dakota in *Cook v. Evans*, 45 S. D. 31, 38, 185 N. W. 262, and *Haaser v. Englebrecht*, 45 S. D. 143, 146, 186 N. W. 572.

"The Supreme Court of Washington in *Still v. Palouse Irrig. & Power Co.*, 64 Wash. 606, 612, 117 p. 466, gave a more limited construction to the Desert Land Act, holding that thereby Congress recognized and assented to the appropriation of water in contravention to the common-law right of the riparian owner only in

respect of desert lands granted under the act. See also *Bernot v. Morrison*, 81 Wash. 538, 559, 560, 143 p. 104, Ann. Cas. 1916D, 290.

"In *San Joaquin & K. River Canal & Irrig. Co. v. Worswick*, 187 Cal. 674, 690, 203 p. 999, the Supreme Court of California followed the Washington court in holding that the language of the Desert Land Act applied only to desert-land entries.

To accept the view of the Washington and California courts would in large measure, be to subvert the policy which Congress had in mind—namely, to further the disposition and settlement of the public domain. It is safe to say that by far the greater part of the public lands in the desert-land States and territories susceptible of reclamation in 1877 was remote from the natural sources of water supply. But these lands were subject to entry, not only under the Desert Land Act, but under other acts as well. Congress must have known that innumerable instances would arise where lands thereafter patented under the Desert Land Act and other lands patented under the preemption and homestead laws, would be in the same locality and would require water from the same natural source of supply. In that view, it is inconceivable that Congress intended to abrogate the common-law right of the riparian patentee for the benefit of the desert-land owner and keep it alive against the homestead or preemption claimant.

"As the owner of the public domain, the Government possessed the power to dispose of land and water thereon together, or to dispose of them separately. *Howell v. Johnson*, (C. C.) 89 F. 556, 558. The fair construction of the provision now under review is that Congress intended to establish the rule that for the future the land should be patented separately; and that all nonnavigable waters thereon should be reserved for the use of the pub-

lic under the laws of the States and Territories named. The words that the water of all sources of water supply upon the public lands and not navigable 'shall remain and be held free for the appropriation and use of the public' are not susceptible of any other construction. The only exception made is that in favor of *existing* rights; and the only rule spoken of is that of *appropriation*. It is hard to see how a more definite intention to sever the land and water could be evinced. The terms of the statute, thus construed, must be read into every patent thereafter issued, with the same force as though expressly incorporated therein, with the result that the grantee will take the legal title to the land conveyed, and such title, and only such title, to the flowing waters thereon as shall be fixed or acknowledged by the customs, laws, and judicial decision of the State of their location. If it be conceded that in the absence of Federal legislation the State would be powerless to affect the riparian rights of the United States or its grantees, still, the authority of Congress to vest such power in the State, and that it has done so by the legislation to which we have referred, cannot be doubted." (*Calif. Oregon P. Co. v. Beaver Portland C. Co.*, 79 L. ed. advance sheets 760-762.)

Insofar as the decision of the Washington court in the Hunter Land Co. case and in the case of *Still v. Palouse I. & P. Co.* is based upon the assumption that riparian rights have been preserved by the expression "subject to existing rights" set out in the first section of the water code, and that in turn is based upon at least a partial misconstruction of the Federal desert-land laws, it would seem possible that the views of the Washington court in these two cases might be modified to some extent when that court has had an opportunity to consider that part of the decision of the Supreme Court of the United States in the case of *California Oregon Power Co. v. Beaver Portland Cement Co.* (supra) which determines the correct construction to be placed upon the provisions of the Federal desert-land acts. But that may not be very material so far as the Columbia and Snake Rivers are concerned, for these are unquestionably navigable streams, at least in that portion of their courses which are in or border on the State of Washington and the Washington court has decided that in that State riparian water rights such as have been defined in the Hunter Land Co. case exist only on nonnavigable streams and that riparian water rights have never existed in Washington on navigable streams.

The Washington law with reference to water rights on navigable streams is found in the case of *State ex rel. Ham, Yearsley & Ryrie v. Superior Court of*

Grant County, 70 Wash. 442, 126 P. 945, in which it was decided:

"Under constitution, article 17, section 1, declaring that the State asserts its ownership to the beds and shores of navigable waters in the State up to and including ordinary high-water mark, an owner of upland bordering on an inland fresh-water navigable lake has, by reason of such ownership, no common-law riparian right to appropriate the water of the lake for irrigation superior to the right of appropriation possessed by owners of land not bordering on the lake under the laws of the State relating to appropriation of water for irrigation.

"The declaration of our State constitution contained in section 1, article 17, thereof, that 'the State of Washington asserts its ownership to the beds and shores of all navigable waters in the State up to and including the line of ordinary high tide in waters where the tide ebbs and flows, and up to and including the line of ordinary high water within the banks of all navigable rivers and lakes', and the decisions of this court touching the force and effect of that constitutional declaration, it seems to us fully answers in the negative the contentions of the railway company and Pettigrew insofar as their claims are rested upon their asserted common-law riparian rights. In the early case of *Eisenbach v. Hatfield*, 2 Wash. 236, 26 Pac. 539, 12 L. R. A. 632, in considering the claimed right of an upland owner to tidelands bordering upon his land, and also the claimed right of such owner to access to navigable water over such tideland as against the State's grantee thereof, the court, resting its conclusions upon this constitutional declaration of ownership in the State, insofar as the upland owner's claimed common-law right was concerned, at page 253 of 2 Wash., at page 543 of 26 Pac. (12 L. R. A. 632), said: 'The result of our investigation of the authorities leads us to the conclusion that riparian proprietors on the shore of the navigable waters of the State have no special or peculiar rights therein as an incident to their estate.'

"We are of the opinion that common-law riparian rights in navigable waters, if it can be said that the common law recognized such rights, have not existed or been recognized in this State since the adoption of our constitution; at least so far as the upland owner having any right to occupy in any way the beds or shorelands of such waters or to take from such waters, water for irrigation, as against the State, its grantees or those who have appropriated such water for purposes of irrigation in compliance with the laws of the State. This reduces our problem to one of prior appropriation as between the railway company and Pettigrew and the

relator, since both have an equal right to appropriate the water regardless of their ownership of any particular lands."

(*State v. Superior Court*, 126 Wash. 945, 947, 949.)

As the Columbia and Snake Rivers are navigable streams throughout their entire courses in the State of Washington, we may safely conclude that the Washington law applicable to these streams is the same prior-appropriation doctrine which applies in the States of Idaho, Montana, and Oregon and that the prior-appropriation doctrine as announced by the Supreme Court in the case of *Wyoming v. Colorado* applies with equal force to the Columbia and Snake Rivers and tributaries flowing into the same in the States of Idaho, Montana, and Oregon notwithstanding the continued existence of a limited form of riparian rights on non-navigable tributaries in the State of Washington.

The rule of the case of *Wyoming v. Colorado* (supra) is that the first in time in appropriating water from interstate streams is the first in right regardless of State lines, so that the rights of each appropriator depend upon the relative priority of the water appropriation just the same as if all of the appropriations were within the same State. Before such priority could be effectively enforced, however, it would be necessary to have the respective priorities and the amount of water involved in each appropriation adjudicated and determined by some form of court decree. In the case of the Columbia River the water supply is so large and the amount which could be diverted for consumptive uses in the States of Idaho and Montana is so small compared to the total run-off of the stream system that it seems doubtful whether prior appropriators on the lower reaches of the stream in Washington and Oregon will ever consider it necessary to secure the adjudication decree which would be necessary before prior rights on the lower reaches of the stream could be effectively enforced against junior rights on other portions of the stream or its tributaries in other States.

In the meantime, it is possible that in some instances junior rights on the upper reaches of the interstate stream may become superior to prior rights on the lower reaches of the same stream, by reason of adverse possession and use for the statutory period of years.

The flow of the Columbia is greater than the combined flow of all the other streams of the arid West and the opportunities for additional irrigation near the headwaters of the stream are so limited in comparison with the total water supply available that future depletion of the stream by increased consumptive use on the upper tributaries seems unlikely to

be very seriously noticed by the holders of prior rights on the main stream.

It will be understood that water rights acquired under State law by appropriation from a navigable stream such as the Columbia River and its tributaries are all subject to the paramount right of the Federal Government to control the waters of navigable streams in aid of navigation and that such paramount right of control for navigation purposes may be asserted by Congress either with or without the consent of the States whenever Congress may find that the public interest requires it as was demonstrated in the case of *Arizona v. California* (supra).

Under the Desert Land Act of March 3, 1877, it will be noticed that the grant or dedication by Congress to the public is limited to the waters of nonnavigable streams:

"If the acts of 1866 and 1870 did not constitute an entire abandonment of the common-law rule of running waters insofar as the public lands and subsequent grantees thereof were concerned, they foreshadowed the more positive declarations of the Desert Land Act of (March 3) 1877, which it is contended did bring about that result. That act allows the entry and reclamation of desert lands within the States of California, Oregon, and Nevada (to which Colorado was later added), and the then Territories of Washington, Idaho, Montana, Utah, Wyoming, Arizona, New Mexico, and Dakota, with a proviso to the effect that the right to the use of waters by the claimant shall depend upon bona fide prior appropriation, not to exceed the amount of water actually appropriated and necessarily used for the purpose of irrigation and reclamation. Then follows the clause

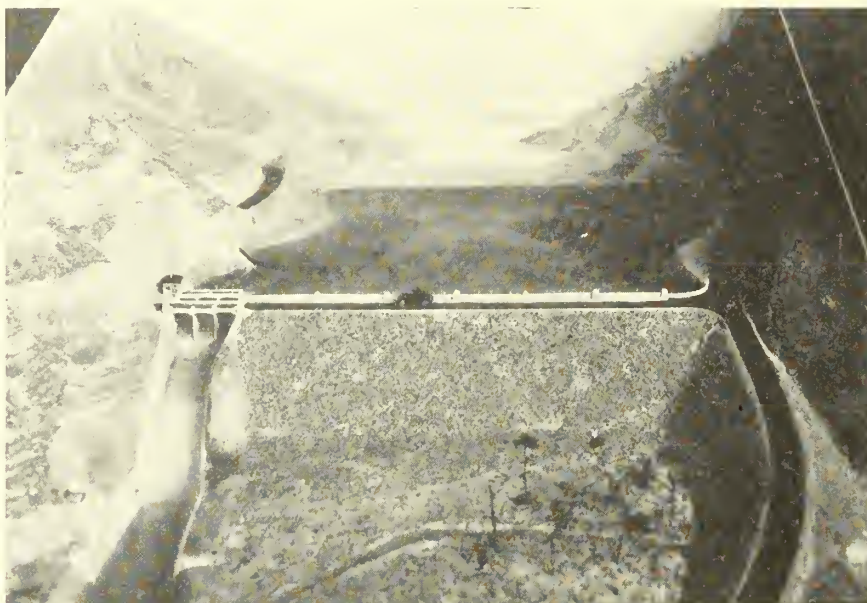
of the proviso with which we are here concerned: '* * * all surplus water over and above such actual appropriation and use, together with the water of all lakes, rivers, and other sources of water supply upon the public lands and not navigable, shall remain and be held

free for the appropriation and use of the public for irrigation, mining, and manufacturing purposes subject to existing rights.' Chap. 107, 19 Stat. at L. 377, U. S. C., title 43, sec. 321." (*Calif. Ore. P. Co. v. Beaver Portland C. Co.*, 79 L. ed. advance sheets, p. 758.)

Utah State Fair Weber County Exhibit

Weber County's exhibit at the Utah State Fair, held in Salt Lake City, September 28 to October 5, 1935, was made possible through the cooperation of the

The display was arranged near the west end of the agricultural and horticultural building. In the background was a painting of Mount Ben Lomond and adjacent

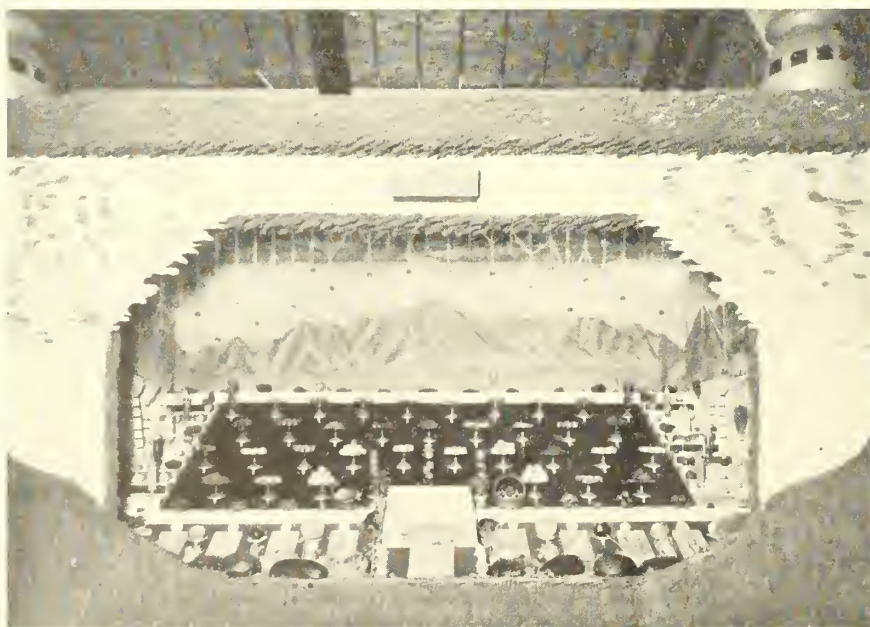


Pine View Dam, Ogden River Project, Utah.

county agent, the Farm Bureau, Weber County commissioners, Ogden Chamber of Commerce, the Utah Power & Light Co., and the Bureau of Reclamation.

hills lying north and east of Ogden. These mountains form the background for the lands to be supplied with water from the Ogden-Brigham Canal, known locally as the North Highline Canal, which is one branch of the distributing system of the Ogden River Project. Immediately in front of the picture, on a sloping field, was placed glass stands of choice fruits grown in the county. In front of this display was placed an exact replica of the Pine View Dam as it will appear, when completed with water running over the spillway. A placard giving the dimensions, capacity, and other pertinent data was placed directly in front of the miniature dam. On either side of the miniature, large melons, cantaloupes, potatoes, onions, and other vegetables were displayed. The whole display was framed with border of sugarcane and milo maize.

The following products grown in Weber County were shown in this display: Several varieties of apples, peaches, sweet cherries, pears, plums, prunes, tomatoes, and grapes, together with different grains and vegetables.



Weber County Exhibit, Ogden River Project, Utah.

Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner, accompanied by William F. Kubach, chief accountant, left Washington on December 11 for Austin, Tex., for the purpose of mapping out a program of construction for the Colorado River of Texas project. They were joined in Austin by R. F. Walter, chief engineer.

During the absence of the Commissioner from Washington, Miss Mae A. Schnurr, Assistant to the Commissioner, was Acting Commissioner.

Chief Designing Engineer J. L. Savage and Engineers Robert A. Monroe and B. W. Steele, in the Denver office, were called to Washington during December to discuss matters relating to Boulder and Grand Coulee Dams.

V. C. Nolte, president of the Northport irrigation district, North Platte project, Nebraska, and F. E. Williams, attorney for the district, were in Washington during December on matters pertaining to the district.

Edward Hyatt, State engineer of California, arrived in Washington on December 11 in connection with the Central Valley project of California.

O. S. Warden and Louis A. Campbell, of Helena, Mont., the newly elected president and secretary-treasurer, respectively, of the National Reclamation Association, arrived in Washington on December 16 and spent several days in conference relative to the business of the association.

R. K. Finney, executive secretary of the State Planning Council, called at the Yakima project office twice during the month of November for the purpose of conferring with the superintendent in regard to some of the details of the economic survey of the results of irrigation on the Yakima project and in the Yakima Valley, which the council has undertaken to make at the request of Governor Martin, who has authorized funds to be made available for the purpose. The reclamation committee of the Yakima Chamber of Commerce is acting in an advisory capacity in connection with the survey. Floyd O. Hagie, managing secretary of the Yakima Chamber

of Commerce; Guy C. Finley, chairman of the reclamation committee and president of the Washington Irrigation Institute; and the superintendent have been designated as consultants.

John Spencer, engineer for the Bureau of Fisheries, who has been stationed on the Yakima project for about 18 months in connection with the construction and operation of mechanical fish screens on the Sunnyside, Kittitas, Tieton, and Reservation Canals, closed his office about the middle of November and returned to California to accept a position with the Division of Fish and Game of the Department of Natural Resources of the State.

On November 30, while Chan Forney and Andy Johnson were driving from the top of the hill at the Seminole dam site, Casper Alcova project, to the gravel testing work along the Platte River, their

automobile rolled down the embankment, killing Mr. Forney and critically injuring Mr. Johnson.

B. E. Stoutemyer, district counsel, was a recent visitor on the Owyhee project.

Hon. Abe W. Turner, judge of the district court, Moon Lake project, Utah, spent a day during November in looking over the project works.

R. E. Rudolph, former secretary of the Kittitas reclamation district, Yakima project, Washington, has been appointed by the Colorado River Authority as personnel officer and given full authority on Colorado River appointments for the Bureau of Reclamation and for the Colorado River Authority. G. L. Sterling has been appointed to succeed Mr. Rudolph as secretary of the district, with headquarters at Ellensburg, Wash.

Articles on Irrigation and Related Subjects

Annual Report of the Secretary of the Interior for the fiscal year ending June 30, 1935:

This 440-page volume includes the report of the Bureau of Reclamation on pages 43-92, with financial and crop tables.

Boulder Canyon project:

Indian art is applied to decoration of Boulder power house, Southwest Builder and Contractor, Dec. 6, 1935, v. 86, no. 23, p. 14.

Church, J. E.:

Principles of snow surveying as applied to forecasting stream flow. Reprint from Jour. of Agrl. Research, July 15, 1935, v. 51, no. 2, pp. 97-130.

Columbia Basin:

Two 1,437-ft. suspension spans for aggregate belt at Coulce Dam, illus., Eng. News-Record, Nov. 14, 1935, v. 115, pp. 674-5.

Compton, Karl T., Chairman:

Science Advisory Board, 2d report, Sept. 1, 1934-August 31, 1935, 494 pages. Reports of programs with various departments and appendices on mapping, patents, land-grant colleges, mineral industries, Boulder Dam, etc., land planning and land of your possession by Isaiah Bowman.

Hydraulic and Excavation Tables, 1935, 7th edition, fabrikoid cover; 168 pages, 49 tables. revised. Copies may be obtained at \$1.50 each, payable in advance by check or money order drawn to the Bureau of Reclamation, and mailed to the Commissioner at Washington, D. C.

Imperial Dam:

Imperial dam to be hollow concrete weir weighted with ballast, plans, Southwest Builder & Contractor, Nov. 15, 1935, v. 86, no. 20, pp. 12-13.

Jenks, Robt. J.:

Producing aggregate for the world's largest concrete structure, illus., Pacific Builder and Engineer, Dec. 7, 1935, v. 41, pp. 26-32.

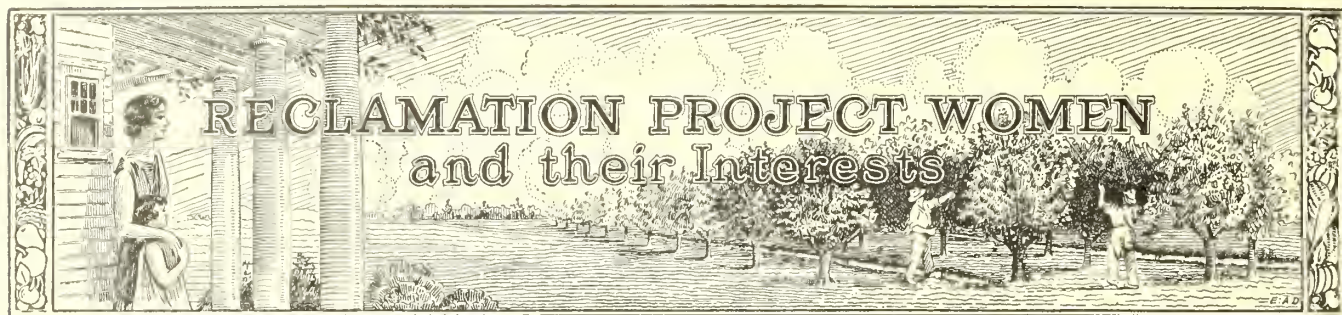
Mead, Elwood:

Mead announces plans for Central Valley, Electrical West, Nov., 1935, v. 75, no. 5, p. 52.

New American Dams; illus. and tables. The world today—Encyclopaedia Britannica, Dec., 1935 v. 3, no. 2, pp. 39-42.

Reclamation Asso., National:

National Reclamation Association considers Western irrigation problems—meeting S. L. C., Nov. 15-16, Eng. News-Record, Nov. 21, 1935, v. 115, p. 726 (Editorial p. 725—"Sound principle").



Foresight—A Story of the Klamath Project from a Woman's Viewpoint

By Mrs. Elizabeth Butler Loosley, Klamath Falls, Oreg.

A VAST stretch of country from Wood River Valley, rimmed by the Crater Lake mountains, to Tule Lake lay quiescent, somnolent—waiting. Waiting for what?

For irrigation, for development.

The Modoc War was over, the Indians confined to the Klamath Reservation and the men knowing their women and children were safe turned their thoughts to producing more hay, sheep, and cattle.

The first white settlers in the Klamath Basin, which topographically includes Tule Lake though it lies in California, located on river bottoms where gravity ditches or a water wheel could supply irrigation, or on creeks and sloughs. The later emigrant had to take to higher ground and depend on summer fallow or summer rains.

In 1878 the Ankney Canal was started as it had been proven the farmer could no longer rely on wild grasses. This system only supplied the Ankney and Henley ranches, but it made the desert entry proof on land possible and as a result, land was located on for 20 miles to the southward, and thus the population was increased. Consequently stock increased which required more acreage and it evolved that added irrigation was necessary.

Dan Van Brimmer had the foresight. He saw by making a cut in a chalk bank he could get water out of White Lake, an arm of Lower Klamath Lake. White Lake was replenished by Lower Klamath overflowing in high-water season. After his crops were in, the water would recede and Dan Van Brimmer had to watch his crops shrivel and die for want of the water that lay in the lake proper.

DETERMINATION OVERCOMES DIFFICULTIES

Looking the ground over the only thing that stood between the chance of irrigating thousands of acres was a ridge that separated White Lake from lower Klamath. Such an impediment, a mere ridge, didn't stop Dan Van Brimmer.

He took an old grey mule, Becky, a scraper, and went to work with the result that after many hardships he did make the cut and did put water on 5,000 acres. This was in 1882. Where before dry hot soil covered with sage and diminishing bunch grass had been, now an abundance of green grass followed every water trickle—restful to the eye and pocketbook alike.

Cattle seemed to come overnight, people seemed to pop up on another hundred and sixty in no time; range was scareer, hence there was more demand for hay, so 4 years later, in 1886, J. Frank Adams enlarged and deepened the Van Brimmer cut and built the Adam's canal by bringing in a dredger and digging through tule marsh. The completed system extended around the north shore of Tule Lake and put water on 10,000 acres. J. Frank Adams felt the land should produce more than one yield; he supplanted wild hay with alfalfa.

These two men, Dan Van Brimmer and J. Frank Adams, were pioneers in the field of irrigation; but they knew they could not fail, that above Lower Klamath Lake was Upper Klamath Lake, and feeding that great reservoir lay Crater Lake. They reasoned with these resources back of them they could reclaim the land. Big words—forceful, powerful—*reservoir* and *reclaim*. It took big men to take advantage of the existing conditions and so reclaim the land.

From scenes such as this, a farm abandoned for lack of water, the canal brought a transformation. Where before the soil and sage had only afforded homes for jackrabbits and badgers and droning locust it now, under irrigation, afforded homes for families where a good living could be made.

This is an article for a woman's page—perhaps you are wondering how such details concern women.

Just this: A woman was back of every man's ambitions, money to buy more land so their children might have acreage, for these pioneers were of the soil. The

women planned education, homes, machinery to till the soil. While the men labored the women grew gardens; urged their menfolk to let them have water for flowers and trees. The man recognized the value of trees for windbreaks and feeding grounds. Mrs. Van Brimmer, herself, planted the cottonwoods and poplars that still tower at their old place.

To give some idea of the conditions, the barrenness and bleakness, of the unirrigated regions: Dan Van Brimmer's daughter, Mrs. Fred Applegate, left their baby playing in front of the house. The men were in the fields or riding range. Time passed—to the busy housewife but a few seconds, but probably half an hour—and she looked out to call to the child. He was not to be seen.

She hurried through the house, around the barns, and out into the sage in which a jackrabbit whipped up and away.

She called, listened. A faint crying sound reached her.

Back to the barns to look under the mangers, into the chicken house she hastened. Out in the sage that pressed close to the buildings. And again, she heard a cry, smothered.

Into the brush further she went. The cry, deadened, dulled, was there. Searching revealed nothing, not even a footprint as the day was glowering, threatening, gray clouds hung low and a ground wind eddied the sand into swirls of dust.

This mother stopped, took herself in hand, then retraced her steps, determined to use logic, reason.

The sound came from the ground. Indian fashion she laid her ear to the earth. The sound came from there! Lying flat to listen, then to take a few steps and down again led her to the cry, and a badger hole!

She reached in. Touched nothing but earth, but the cry was coming from there, more distinctly. Carefully, methodically, so the soil would not cave in, she removed handfuls of dirt. By lying prone and reaching her arm out its stretched length she touched the baby's heels. Her nails

were broken and bleeding but still she dug. At last she could reach the child.

A fence for the boy, grass, flowers, a swing, trees—that's what this mother demanded and got. All this called for water, water to grow trees, water to make better crops to buy the fence and to erect it.

Even with limited irrigation living was losing the aspects of pioneering, and comforts such as homes, schools, and roads were gradually replacing the hazards and hardships. The herds were multiplying. More water was the cry. This taste of irrigation whetted the appetites of the farmer and the sheep and cattle man.

Determination from an earnest source always meets with results, and it seemed

as if chance played its part too. Two men, representing moneyed interests, agreed to tap Upper Klamath Lake and entered into a contract with the ranchers to supply water at a stated price.

Public meetings, in the courthouse at Klamath Falls, on street corners, in the various schoolhouses, which the women sponsored and which they turned into social affairs, afforded the farmers a chance to air their views, exchange crop reports and prices. They were all agreed that more water was needed so they signed the contracts with the Klamath Irrigation District. The tunnel was actually started.

Then in 1905 the United States Government took an option on the Klamath Irri-

gation District and 1 year later work started, and in 1908, 30,000 acres could be supplied with water. The KLAMATH PROJECT accomplished this by tapping the Upper Klamath Lake at Link River and diverging the water into a canal that winds peacefully along the Alameda in the city of Klamath Falls bringing new impetus to soil and to people.

Klamath Falls in the early 1900's was a muddy, rutted roadway with board buildings with false fronts flying a crude sign revealing a hotel, a saloon, a store, a saloon, a blacksmith shop, a saloon, a livery stable, a saloon, and so on interspersed with saloons until a dozen were there.

(Continued on p. 32)



EARLY SCENES ON THE KLAMATH PROJECT

1, Upper Klamath Lake; 2, Crater Lake; 3, land abandoned for lack of water; 4, birdseye view of Klamath Falls; 5, Klamath Falls in winter; 6, Main Street in Klamath Falls.

Excerpts from November Project Reports

Yuma.—Cotton picking has continued steadily with 1,509 bales being ginned during the month. Alfalfa hay is looking good. Harvesting of maize is nearly completed, and fair yields are reported. Harvesting of lettuce began the last day of the month. This crop appears to be in fine shape. Pecan nuts are nearly all harvested, and reports indicate the best crop, both as to quantity and quality, that has ever been produced on this project.

Orland.—The price received for butterfat showed a marked improvement, advancing from 31½ cents per pound on November 1 to 35½ cents at the end of the month. Alfalfa hay (baled) advanced from \$10 to \$14 per ton.

Minidoka.—Some very good yields of sugar beets were reported, one farm east of Rupert producing 160 tons from 8 acres or an average of 20 tons per acre. A sale of purebred Guernsey dairy cows on a farm near Rupert brought good prices, ranging from \$50 to \$102.50 per head. The Minidoka County turkey pool marketed 728 turkeys for the Thanksgiving trade. The birds weighed 6,354 pounds, the payment for which totalled \$1,397.37, or an average of nearly 17 cents per pound. The average weight was about 11.5 pounds.

Carlsbad.—Marketing the cotton crop has proceeded as rapidly as the cotton has been picked. Cottonseed is selling for \$32 per ton at the oil mill. Alfalfa hay has averaged \$12.50 per ton, baled. All hay is being reserved for use on the farms.

Klamath.—All livestock is in excellent shape. During the month a few sales of

grass-fed steers at 6½ cents and feed lot stock at 7 to 7¼ cents were reported. At the end of the month 1,625 cars of potatoes had been shipped from the project, prices ranging from \$1 to \$1.60 per hundredweight. Most of the alsike clover seed harvested in Klamath County was sold at prices ranging from 15½ to 16 cents.

Belle Fourche.—Alfalfa hay continues in fair demand at \$5 to \$6 in the stack, with liberal supplies going to various points in the Black Hills district. Beet tops were also marketed to a considerable extent, although most of this feed will be consumed on the farms by project sheep and cattle. Sheep feeding, which is a major project industry, shows prospects of good profits this year, with price levels favorable and feed relatively cheap. The price level of farm commodities, including livestock, is generally favorable and a more optimistic attitude is noticeable on the farms. Lambs purchased at about \$7 are now bringing \$9 at central markets, and with the added weight will return good profits to feeders. Butterfat and eggs gained in price during the month and are now quoted at 30 cents a pound and 30 cents a dozen, respectively, for cash sales. The wool market news reports indicate an upward price trend.

Sanpete project.—The yields of alfalfa and grain, which are the major crops of the project, are above average this season. The high yields for the area are due to the rains which occurred during the first part of the season, as the water supply for irrigation was somewhat

below normal. On the Ephraim division more than 12,000 fat lambs have already been shipped to the market. The raising of turkeys proved to be very profitable during the past year, which is well demonstrated by the fact that more than 30,000 turkeys were sold during and prior to Thanksgiving week by the Turkey Growers Association of Ephraim.

Yakima.—Apple shipments during the month were mainly Christmas loadings for domestic markets. A check of the Bartlett pear crop for the valley shows total receipts of \$1,775,233 for 65,407 tons, as compared with \$1,545,000 and 54,000 tons for 1934. A greater tonnage was placed this year with fresh-fruit dealers and canneries than a year ago. The price of butterfat maintained a steady advance during the month, ranging from 29½ cents per pound the first of the month to 38 cents at its close. Approximately 575 cars of hay were shipped out of the valley in addition to a considerable tonnage moved by truck.

Riverton.—Livestock on the project are in good condition. The market for grain has continued very good, better than was expected. The demand for potatoes has improved and most of the surplus has been sold.

Shoshone.—The sugar-beet harvest was completed early in the month. One field on the Willwood division averaged about 17 tons per acre. The stock being fed on the project appears to be in excellent condition. More sheep are being fed on the project this fall than usual by a smaller number of feeders.

Early Days At Klamath

(Continued from p. 31)

The first women's club was formed in 1904 to counteract the influence of the saloon. There were no Carrie Nation emotions; it was just a development to be met. A group of earnest women clubbed together and organized the Women's Club. They hired a hall, solicited funds, and established the Klamath Falls' first reading room (this later developed and they built a library). Later the organization became the Women's Library Club, which is still in existence, belonging to the Federation of Women's Clubs. The development of this club is a story in itself.

Irrigation brought in new settlers, the town of Klamath Falls was building, timber was being manufactured, railroads were eyeing the territory.

Canals carried water to a waiting soil, to an eager people.

No longer was the country quiescent, no longer somnolent.

It lived. Irrigation was here.

Several sales of farms on the Belle Fourche project were reported for the month of November, a few of which involved new settlers. The State Rural Credit sold a farm 3 miles west of Nisland and one just northeast of Newell. Butte County sold two places under contract to a man who was formerly a renter on the project. Demand for land has improved and the favorable trend reflects the improved agricultural conditions.

C. C. C. forces in Ontario Camp BR-42 and Nyssa Camp BR-43, Owyhee project, were employed throughout the month of November in graveling operating roads, silting reaches of the canal in gravel, placing coarse gravel riprap below lateral structures, and cleaning laterals.

N. R. A. Congress

(Continued from p. 3)

only way to maintain, much less increase, the population of the thinly settled Rocky Mountain region."

Plowman said in conclusion, "among the many suggestions that have been taking form in the Rocky Mountain region, I urge the following:

"It is hoped that the Reclamation Service, already studying the Colorado River, including one transmountain diversion project, can broaden its investigation to cover more nearly the whole problem of adequate supplementation of water supply for existing irrigation in all four upper-basin States.

"It is hoped that there can be established a Rocky Mountain regional planning body, similar to the northwest and New England planning agencies, which body will, with the aid of State water commissions or planning commissions, devote particular attention to research on improvement of land use in these upper-basin States."

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation **Elwood Mead**, Commissioner, Bureau of Reclamation
 Miss Mae A. Schnurr, Asst. to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; B. W. Steele, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. E. Smith, Chief Clerk; Harry Caden, Fiscal Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.		B. E. Stoutemyer	Portland, Oreg.
Boulder Dam	Boulder City, Nev.	Ralph Lowry	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Brunt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
All-American Canal	Yuma, Ariz.	R. B. Williams	do.	J. C. Thraikill	R. J. Coffey	Los Angeles, Calif.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Casper-Aleova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voyer	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.		R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Anstn, Tex.	H. P. Bunger	do.	William F. Sha		El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	E. A. Peek	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do.	Do.
Hyrum	Hyrum, Utah	H. J. Paul	Resident engr.	H. W. Johnson	do.	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent		B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do.	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do.	do.	do.	do.	do.	Do.
Minidoka	Burley, Idaho	E. B. Darlington	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guersey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpflig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Jakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam ²	Earl, Calif.	E. A. Moritz	do.	George H. Bolt	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Riverton	Riverton, Wyo.	H. D. Comstock	do.	C. B. Weutzel	R. J. Coffey	Los Angeles, Calif.
Salt River	Phoenix, Ariz.	E. C. Koppen	Engineer		W. J. Burke	Billings, Mont.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	W. F. Keimig	Constr. engr.	do.	do.	Do.
Stanfield	Ontario, Oreg.	R. J. Newell	do.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Lovelock, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Engineer	do.	do.	Do.
Upper Snake River Storage ²	Ashton, Idaho	H. A. Parker	Constr. engr.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do.	Do.
Yakima	Yakima, Wash.	J. S. Moore	do.	R. K. Cunningham	do.	Do.
Roza div.	do.	Chas. E. Crowmover	Constr. engr.	do.	do.	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	do.	Nobel O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non-Federal.

Island Park Dam

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Engineer-manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Fuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Palisade, Colo.	W. E. Stout	President	H. B. Smith	Palisade.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bouanza, Oreg.	Chas. A. Revell	do.	Chas. A. Revell	Bonanza.
Klamath, Horseshy	Horseshy irrigation district	do.	Jerome Smith	do.	Dorothy Eyers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Project manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Beuton	President	R. H. Clarkson	Chinook.
Do.	Fort Belknap irrigation district	do.	H. B. Bonebright	do.	L. V. Boggy	Do.
Do.	Harlem irrigation district	Harlem, Mont.	Thos. M. Everett	do.	Geo. H. Tont	Harlem.
Do.	Paradise Valley irrigation district	Zurich, Mont.	Amos Thompson	do.	J. F. Sharpless	Zurich.
Do.	Zurich irrigation district	Harlem, Mont.	C. A. Watkins	do.	H. M. Montgomery	Do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Geo. W. Lyle	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Alcorn	President	Flora K. Schroeder	Fallon.
North Platte: Interstate div	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	C. G. Klingman	Mitchell.
Do.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	Nellie Armitage	Gering.
Do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mabel J. Thompson	Torrington.
Northport div	Northport irrigation district	Northport, Nebr.	Mark Idlings	do.	Nelson D. Thop	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thop	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	J. O. Roach	do.	Geo. W. Atkins	Powell.
Do.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	Clyde Tervort	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	H. P. Wangen	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	Enos D. Martin	Hermiston.
Do.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div	Kittitas reclamation district	Ellensburg, Wash.	V. W. Russell	Manager	R. E. Rudolph	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Do.
Grand Lake-Big Thompson Transmountain Diversion	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	C. H. Howell	Engineer.
Weiser-Payette	Boise, Idaho	J. A. Keimig	Do.

SALLIE A. B. COE, *Editor.*



CASPER-ALCOVA PROJECT, WYOMING

Looking downstream into the canyon of the North Platte River in Wyoming. The shadow at the left marks the cliff against which will rest the west shoulder of the 260-foot Seminole Dam. The footbridge across the stream in the foreground marks the approximate location of the toe of the dam.

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THE

RECLAMATION ERA



VOL. 26, NO. 2

FEBRUARY 1936



DR. ELWOOD MEAD
COMMISSIONER, BUREAU OF RECLAMATION, 1924-1936

Tributes to Dr. Mead

President Roosevelt:

*Mrs. Elwood Mead,
1661 Crescent Place, Washington, D. C.*

Dear Mrs. Mead:

In the great sorrow which has come to you through the loss of your devoted husband I offer a message of sincere sympathy.

Dr. Mead was one of the country's outstanding engineers. He was a builder with vision whose loss will be keenly felt.

Very sincerely yours,

(Sgd.) Franklin D. Roosevelt.

Secretary of the Interior Harold L. Ickes.

The death of Dr. Mead is a profound shock to me personally.

His place in the official family of the Interior Department will be almost impossible to fill. He was an outstanding man, famed in his field throughout the world. All who knew him loved and respected him.

As Commissioner of the Bureau of Reclamation, Dr. Mead has left for the Nation many monuments in work well done. Perhaps no man contributed more to the planning of Boulder Dam and certainly no one had a more important part in the actual construction of it than Dr. Mead. If his place in the memory of his Nation were to rest on that accomplishment alone, it would be secure. But there were many other accomplishments in his long and exceptional career as an engineer, law-giver, teacher, and administrator in the field of irrigation.

He showed the way when he formulated the water provisions of the constitution of the State of Wyoming, which he served as its first State Engineer, where some of the knottiest problems in the arid regions of the world existed. Wyoming, at Dr. Mead's urging, discarded the riparian theory of water ownership and adopted a system under which the State retained all water rights. Development of this primary resource was retained under the jurisdiction of the State. Revolutionary in the field of water law at the time, the plan since has been adopted by other Western States and by many other nations.

The death of Dr. Mead is a distinct loss to the country, which by his life he has so enriched through original thought, and devotion to duty and ideals.

R. F. Walter, Chief Engineer of the Bureau of Reclamation:

Dr. Mead was a man of many friends. Throughout the 17 Western States comprising the arid and semi-arid region of the United States, there is scarcely a community where the results of his labors during the past 50 years have not left their mark of progress.

The Bureau of Reclamation has lost an irreplaceable leader, who due to his sympathetic and patient attitude, together with his broad engineering experience, has come to be known as one of the outstanding administrators of the Government. Under his leadership the great Boulder Dam was initiated and completed. Under him the Bureau of Reclamation constructed monumental works which now stand in nearly every Western State as evidence of the breadth of Dr. Mead's vision.

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HAROLD L. ICKES
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

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FEBRUARY 1936



Dr. Elwood Mead, Commissioner of Reclamation, Dies

THE death of Dr. Elwood Mead, for 12 years Commissioner of the Bureau of Reclamation, at his home in Washington January 26, closed the long and brilliant career of the world's outstanding authority on irrigation.

From humble beginnings, Dr. Mead made his way to the very top of his chosen profession. The boy who experimented with a homemade transit on his father's Switzerland County, Ind., farm, and worked his way through school as a rodman on a survey crew, later was to guide the Bureau of Reclamation in mapping, planning, and launching the greatest reclamation construction program in history.

The man who was to head the Bureau of Reclamation during the entire period of the construction by it of mighty Boulder Dam, began after graduating from Purdue University with a degree of bachelor of science in 1882 and a degree of master of science in 1884 as an assistant engineer in the Army on a survey of the Wabash River in his native Indiana.

As a teacher and administrator in the field of irrigation, Dr. Mead was renowned throughout the world. In his specialty, he was a pioneer and the influence of his research, innovations and ideas is reflected in laws governing irrigation practice in the arid States of western United States and in many other parts of the world.

CITED BY UNIVERSITY

The University of Michigan, in 1925, in bestowing upon Dr. Mead an honorary degree of doctor of laws, issued this statement:

"Dr. Elwood Mead, Commissioner of the Bureau of Reclamation, engineer, law-giver and administrator, whose labors will endure through ages yet to come. By framing and putting into operation the irrigation laws of the State of Wyoming, he established a precedent followed not only by the newer States of the West, but also by Canada, Australia, South

DR. ELWOOD MEAD

Dr. Elwood Mead, eminent engineer, humane administrator, who was beloved by all his associates, died at his home, 1661 Crescent Place NW., Washington, D. C., at 10 p. m., January 26, 1936.

Dr. Mead was 78 years of age. He was born January 16, 1858, at Patriot, Ind., the son of Daniel and Lucinda Davis Mead. He had served as Commissioner of Reclamation for 12 years, having been appointed by President Coolidge on April 3, 1924.

Ill about 10 days, Dr. Mead's condition became critical several hours prior to his death. His family was with him at the end.

The funeral was held at 11:30 a. m., Wednesday, January 29. The services were attended by the family and his closest associates. Burial was in Abbey Mausoleum at Arlington, Va. Pallbearers were chosen from among the employees of the Bureau of Reclamation in Washington who had served longest with Dr. Mead: George O. Sanford, William F. Kubach, Charles N. McCulloch, John C. Page, Rollin M. Patrick, L. H. Mitchell, Percy I. Taylor, and Jesse W. Myer.

Dr. Mead is survived by his widow, Mrs. Mary Lewis Mead, by three sons, Tom C. Mead, of Ogden, Utah; Arthur Mead, of Washington; and Lt. John Mead, of Plattsburg, N. Y.; by two daughters, Mrs. Lucy Marston, wife of Maj. Morrill Marston, of Fort Leavenworth, Kans., and Mrs. Sue Kaiser, wife of Edgar F. Kaiser, of Bonneville, Oreg., and by seven grandchildren.

Africa, and New Zealand. He brought order out of confusion and opened a way where none had been."

In addition to the LL. D. degree, Dr. Mead also held a civil engineering degree bestowed by the Iowa State College of Agriculture in 1883 and an honorary degree of doctor of engineering received in 1904 from Purdue, the first honorary degree given by that university.

The battles of Dr. Mead for the rights of humanity to the use of water for agriculture by irrigation can be divided roughly into five parts as follows:

1. State engineer of Wyoming, 1888-99.
2. Chief of Division of Irrigation and Drainage Investigations, Department of Agriculture, 1899-1907.
3. Chairman of State Rivers and Water Supply Commission, Victoria, Australia, 1907-14.
4. Professor of rural institutions, University of California, and chairman of the State Land Settlement Board 1914-23.
5. Commissioner of Reclamation, Department of the Interior, 1924 until his death.

After 2 years as professor of mathematics Dr. Mead in 1886 became professor of irrigation engineering at the Colorado Agriculture College, the first such chair held in an American school. In addition he served Colorado as assistant State engineer. He went to Wyoming as territorial engineer and served the State as its first State engineer from 1888 to 1898. It was during this period that he first gained prominence.

When the new State was being organized, Dr. Mead as State engineer proposed an entirely new water law for inclusion in the State constitution, one which turned its back upon the common law principle of riparian rights which had thrown into confusion the legal status of water in the arid West. Under the Mead plan the State retained title to all water, surface and underground.

Diversion from streams and all appropriations of water in Wyoming since that time have been under the control of State officials.

The success of the fight for this reform made the young Dr. Mead known throughout the entire West. His biennial reports discussed the determination of and limitations to the rights to water, their adjudication, and approval of permits to appropriate water and his later reports emphasized the importance of having the land and water under one control, and just as cities owned waterworks so he believed that irrigation communities dependent on a single large canal should own that canal. With the spread of his reputation as an authority on irrigation and water laws, the young engineer was in demand as a speaker at civic and technical associations, and delivered a very comprehensive address on The Arid Public Lands—Their Reclamation, Management, and Disposal before the recently organized American Society of Irrigation Engineers. His reputation reached the East and he wrote for the Departments of Agriculture and Interior a series of bulletins on water rights.

IN AGRICULTURE WORK

Dr. Mead served as chief of the irrigation and drainage section of the Department of Agriculture for 8 years ending in 1907, and served the University of California concurrently as professor of institutions and practice of irrigation. During this period he visited Italy and described the institutional and legal phases of irrigation in that country. He was detailed as an expert in the celebrated Kansas-Colorado case to aid in the broad policy to be laid down by the courts, and wrote papers on the influence of State boundaries on water-right controversies and water rights within the States.

In 1907 Dr. Mead went to Australia as chairman of the State Rivers and Water Supply Commission of Victoria. He inaugurated a comprehensive water conservation and reclamation plan in Victoria during his 8 years of service that is one of the models of the British Empire today. On reaching Australia, he found conditions somewhat like those in Wyoming earlier, except in this case it was the "land hog" instead of the "water hog" who was standing in the way of development. The large landowners were using the water as a sort of insurance for stock water in dry seasons paying a very small amount for the large expense incurred in bringing the water long distances to the land and preventing land settlement. Here again was the same old fight against vested interests, but by

appealing to decency, justice, and common sense, Dr. Mead won his victory as he had done in Wyoming years before.

Large estates were cut up and as a result of the controversy the Closer Settlement Act was enacted and a policy of State aid in placing settlers on the land was inaugurated. Dr. Mead assisted in settling controversies over the River Murray waters between the States of Victoria and New South Wales, suggesting a form of compact between the two States and advocating that irrigation and not navigation should have first place. Several of his addresses were published in American journals including articles entitled "Irrigation in Victoria" and "What Australia Can Teach America."

SETTLEMENT EXPERT

In 1913 Dr. Mead, then one of the leading authorities on land settlement, resigned his position in Victoria to accept the new position of professor of rural institutions at the University of California, and chairman of the State Land Settlement Board. Shortly after his return to this country in 1915 he was engaged as chairman of the Central Board of Review to aid in deciding some of the settlement problems on the Federal irrigation projects. In 1917 he acted as consulting engineer on a board in regard to the construction of the All-American Canal to Imperial Valley in California.

He later was called upon by Secretary Lane, of the Department of the Interior, for expert advice regarding settlement problems in connection with placing World War veterans on farms. A pamphlet by him on a Summary of Soldier Settlements in English Speaking Countries, was widely distributed.

In 1923, Dr. Mead was appointed by the Secretary of the Interior as a special adviser on reclamation to serve with four others on the fact-finding commission set up to investigate Federal reclamation projects. The Commission's report was the basis for reforms put in effect by Congress by the omnibus Reclamation Act of 1924.

On April 3, 1924, Dr. Mead's intimate knowledge of irrigation and land settlement was again recognized by his appointment by President Coolidge as Commissioner of Reclamation. Under his leadership Federal reclamation has been placed on a still firmer foundation of usefulness to the Nation. He was appointed by the President a special commissioner on the International Water Commission on December 27, 1924.

Dr. Mead has been loaned to foreign governments in need of expert advice on water and irrigation problems. He went to Palestine to advise the Zionists upon the problems involved in reclaiming the

arid lands of the Holy Land; he served on commissions in Cuba and Haiti, and acted as adviser to the Governments of New South Wales, Canada, Hawaii, Java, and Mexico.

NEW THE WEST

Perhaps no man knew the terrain of western United States better than Dr. Mead. He and "Buffalo Bill" Cody explored some of the more difficult rivers of Wyoming in 1888. Repeated trips in the years following gave him first-hand knowledge of virtually every creek and range of hills in the arid region. In recent years, as Commissioner of Reclamation, he had made a tour of the West each year, inspecting Federal irrigation projects, examining areas where new projects have been proposed and renewing acquaintances which were to be found in every hamlet from Denver to San Francisco and from Spokane to El Paso.

Dr. Mead's administration of the Bureau of Reclamation was businesslike and humane. He introduced several reforms, one of the most important of which was the establishment of a policy of selecting settlers for new Federal reclamation projects on the basis of their qualifications for irrigation farming. Irrigation farming, Dr. Mead believed, required a high degree of skill for success. He took great pride in the growth and development of the communities and cities on Federal projects in the West.

Dr. Mead was a member and past director of the American Society of Civil Engineers, a member and past president of the American Society of Engineers, a member of the American Society of Agricultural Engineers, and the British Institute of Civil Engineers. He was also a member of the water resources committee of the National Resources Committee and served on many other governmental committees and commissions.

He was the author of two books, used widely as texts entitled, "Helping Men Own Farms" and "Irrigation Institutions."

Dr. Mead lost his right arm in a street-car accident in Washington about 30 years ago.

Other Tributes to Dr. Mead

All work stopped for 5 minutes on Reclamation projects at 11 a. m. Wednesday, January 29 in honor of Dr. Mead. At that time in Washington the funeral was being held.

Secretary of Interior Harold L. Ickes directed that the Bureau and its employees from Calxico to Washington

take that method of paying their last respects to their Commissioner.

Miss Mae A. Schnurr, who was closely associated with Commissioner Mead during his official connection with the Bureau of Reclamation, first as his secretary and later as his assistant, in speaking for the employees of the Bureau, said:

"It is an honor to speak for those privileged to have been associates of Dr. Mead. In his death we have suffered the loss, not only of a very able Commissioner of Reclamation, but of a kindly friend and counselor who made of each associate a competent and loyal assistant. His ability inspired respect, his kindly thoughtfulness made us admiring friends. His memory will stay fresh and revered in the hearts of all of us."

John C. Page, Chief of the Engineering Division, said:

"The death of Dr. Mead means not only a tremendous loss to the Bureau of Reclamation, but it also creates a vacancy among the most eminent engineers in the world.

"Through a long and useful life, Dr. Mead exemplified the highest professional ethics and was recognized as an engineer with wide conception of the human as well as the technical side of the profession.

"Engineers throughout the world looked toward Dr. Mead for leadership in the field of reclamation. He had won his place in their esteem through sound developments and outstanding construction."

Meantime hundreds of expressions of sympathy and of regret were pouring into the Bureau's offices and to the home of the bereaved family. Noteworthy tributes were paid also by the press. This editorial from the Washington, D. C. Daily News is an example:

"In the death of Reclamation Commissioner Elwood Mead the United States loses one of its most valuable public servants. Superlatively wise, lovable, and courageous was this engineer-professor from the West. And he was one of the great builders of his time. Under his 12 years' administration 20 dams have been started or completed, including Owyhee in Oregon, Boulder in Nevada and Arizona, Grand Coulee in Washington.

"Few will forget how Dr. Mead stood like one of his own concrete dams in the long fight of the people against the power interests opposing the Swing-Johnson Act that created the vast Boulder project. The Pharaohs built their pyramids as monuments to their own vanity; Dr. Mead built these vast modern structures for the wealth of a Nation and the safety and contentment of thousands of its

families. Living in towns and farms on the Reclamation Bureau's 33 projects are 661,000 people. The reclamation settlements are oases of wealth almost literally carved out of the desert.

"Dr. Mead advanced not only reclamation, but the cause of conservation. He was an adviser in the T. V. A. project and was active in other plans looking to the salvage of soil, mineral, and other natural resources. It is to his credit and to that of Presidents Coolidge, Hoover, and Roosevelt that no one knew or cared what his politics was.

"Such administrators as Dr. Mead are all too rare in State and national affairs."

E. K. Burlew, Administrative assistant to the Secretary of the Interior, when notified of Dr. Mead's death said:

"Through 12 years of close association with Dr. Mead, I have come to esteem him as a friend and official. His professional attainments gave him an eminence that few men attain in their chosen field and his human attributes endeared him to all who had occasion to seek his kindly wisdom and straightforward honesty in the solution of their problems. He spent his life in creating homes for many thousands of people and in developing the natural resources necessary to maintain them. His passing will be mourned by a great multitude in the West who have him to thank more than any other man for their hearth and their economic independence."

House Committee Honors Dr. Mead

The following resolution was adopted at a special meeting of the Committee on Irrigation and Reclamation, House of Representatives, on January 28, 1936:

"In the passing of Dr. Elwood Mead, Commissioner of Reclamation, this Committee lost a faithful and conscientious associate in reclamation endeavors. His broad experience, good judgment, and wise counsel proved valuable to the Committee in its deliberations.

"Mindful of his long association with the problems of reclamation, and his constructive work on behalf of irrigation the members gratefully record its appreciation of him by adopting the following:

"*Be it Resolved:* That we, the members of the House Committee on Irrigation and Reclamation, attest to the inspiration and support brought to its deliberations by Commissioner Elwood Mead.

"*Be it Further Resolved:* That a copy of this resolution be recorded in the minutes of the Committee, and that a copy be sent

to Dr. Mead's family as a testimonial of our sincere appreciation of his usefulness, not only as an official of the Government, but also as a friend and adviser."

(Signed) COMPTON I. WHITE,

*Chairman Irrigation and
Reclamation Committee.*

HENRY E. STUBBS,
Chairman, Subcommittee.

WM. A. EKWALL,

JOHN J. DEMPSEY,
Executive Committee.

Attest:

EDWARD C. HALL,
Clerk.

Boulder Reservoir Officially Named Lake Mead

The world's largest artificial lake, that formed by construction of Boulder Dam on the Colorado River, on February 6, 1936, was officially named Lake Mead, honoring the late Dr. Elwood Mead, Commissioner of Reclamation.

Secretary of Interior Harold L. Ickes, in announcing the action of the Board of Geographic Names, said, "It is altogether appropriate that this great, new geographical feature of the West should bear the name of Dr. Mead. He supervised the construction of Boulder Dam, and he first envisioned the lake as a fine new playground dedicated to the benefit and pleasure of the people of the Nation. It is a fitting tribute to his large part in the development of the arid West."

The official designation by the Board of Geographic Names is as follows:

"*Lake Mead.*—An artificial lake in Mojave County, Ariz., and Clark County, Nev., formed by damming the Colorado River in Upper Black Canyon. Named in honor of Dr. Elwood Mead (born Jan. 16, 1858, died Jan. 26, 1936), Commissioner, Bureau of Reclamation, 1924-36, under whose supervision the dam that impounds the lake was built."

Lake Mead began forming February 1, 1935, when the gates of the diversion tunnels at Boulder Dam were closed. It caught the spring flood on the Colorado River last year and today contains approximately 4,000,000 acre-feet of water, being more than 82 miles long.

At capacity Lake Mead will reach 115 miles up the Colorado River, through Boulder Canyon, Virgin Canyon, Iceberg and Travertine Canyons and into the lower end of Grand Canyon. It will broaden to a maximum distance of 40 miles. It then will contain 30,500,000 acre-feet of water, or about 80,000 gallons for every person in the United States, and will cover 146,500 acres or 229 square miles.

(Continued on p. 49)

Chronological events in life of Dr. Elwood Mead

Year	Month	Event	Year	Month	Event
1858	Jan. 16	Born, Patriot, Ind.	1903	Sept.	Review, Outlook, "Irrigation Institutions."
1882	June	Graduated, Purdue University, degree, B. S.			Report, O. E. S., Bulletin No. 131, "Plans of Irrigation Structures."
	Aug.-Dec.	Assisting on Surveys, Wabash River, War Department.	1904	June	Paper, International Engineering Congress, "Irrigation in the United States."
1883	June	Iowa State College, degree, C. E.			Degree, C. E., Purdue University.
1884	do	Purdue University, degree, M. S.			Appointed Expert on Kansas-Colorado Case.
1885		Professor, Irrigation Engineering, Colorado Agricultural College.		Dec.	Paper, Independent, "Influence of State Boundaries on Water-Right Controversies."
1887		A. S. C. E. Meeting, Discussed, paper on "Irrigation."			Report, O. E. S. Bulletin No. 157, "Water Rights Within the States."
1888		Appointed "Territorial" Engineer, Wyoming.		Dec.	Paper, Year Book, Agriculture, "Relation of Irrigation to Dry-Farming."
1890		Biennial Report.	1905	May	Report, Irrigation and Drainage Investigations Bulletin, California Circular No. 20, "Reading Courses in Irrigation."
1892	Nov. 30	First Biennial Report, State Engineer, Wyoming.			Report, O. E. S. Bulletin No. 190, "Irrigation in Northern Italy" (legal phase).
				Dec.	Report, California Experiment Station Bulletin No. 188, "Lining Canals and So Forth to Prevent Seepage."
1894	Jan. 16	Address at Cheyenne Chamber of Commerce, "Reclamation of Arid Lands."	1906		Accepted position, chairman, State Rivers and Water Supply Commission, Victoria.
	Nov. 30	Second Biennial Report, State Engineer, Wyoming.			Report, State Rivers and Water Supply Commission, Victoria, Australia.
1896	do	Third Biennial Report, State Engineer, Wyoming.			Report, Bulletin No. 2, "Policy to be Followed and Irrigation Problems, Victoria."
1897	Jan.	Address, American Society of Irrigation Engineers, "Arid Public Lands."		June	Article, "Public Interest in Water Power Rights in America, Engineering News."
1898	Oct. 28	Report, U. S. G. S., W. S. Paper No. 23, "Big Horn Water Rights."		Aug.	Article, "Irrigation in Victoria," Engineering Record.
	Nov. 30	Report, Fourth State Engineer, Wyoming.	1910	Sept.	Visited the United States.
	Dec. 15	Report, O. E. S., Bulletin No. 58, Missouri River, Water Rights.		Oct.	Article, "Irrigation in Australia," Independent.
1899	Jan. 11	Report, O. E. S., Bulletin No. 60, Missouri River, Water Laws.	1911	Aug.	Article, "What Australia Can Teach America," Independent.
	Apr. 1	Appointed Chief "Irrigation and Drainage Investigation, Agricultural."	1913	Oct.	Resigns Australia, accepts position, Professor Rural Institutions, University of California, and chairman, State Land Settlement Board.
	Dec.	Paper, Year Book, Agricultural, "Rise and Future of Irrigation."			Paper, Discussed Cory's Article A. S. C. E. "Irrigation and River Control, Colorado River."
1900	Oct. 6	Paper, Outlook, "Problem of Arid Regions."			
	Oct.	Report, O. E. S., Bulletin No. 86, "Use of Water in Irrigation."	1914	Apr.	Address, "State Aid to Irrigation Farmers", Irrigation Conference, Denver, Colo. Apr. 9, 1914.
	Nov.	Paper, Trans. A. S. C. E., "Irrigation Studies."		May	Address, "Land Settlement in California", Commonwealth Club,
	Dec.	Report, O. E. S., No. 104, "Irrigation Investigation, 1900."		July	Article, "Government Aid to Irrigation in the United States and Australia", Engineering News.
1901	June	Report, O. E. S., No. 100, "Irrigation Investigations in California."		Aug.	Article, "Irrigation in America and Victoria, Lessons to be Learned", Engineering Record.
		Paper, Year Book, Agricultural "Typical Reservoirs, Rocky Mountain States."			
		Report, O. E. S., No. 119, "Irrigation Investigations, 1901."			
1902	Jan.	Paper, Forum, "Problems of Irrigation Legislation."			
	Apr.	Paper, Outlook, "Irrigation Legislation."			
	Sept.	Paper, International Quarterly "Growth of Property Rights in Water."			
	Dec.	Paper, A. S. C. E., "Should National Government Construct Irrigation Works?"			
1903	Jan. 3	Book, "Irrigation Institutions."			
		Report, O. E. S., Bulletin No. 124, "Irrigation Investigations in Utah."			

Chronological events in life of Dr. Elwood Mead—Continued

Year	Month	Event	Year	Month	Event
1914	May	Report, "Land Settlement and Irrigation Development in America", Australian Bulletin.	1918	Nov	Article, "Farms for Soldiers When They Come Back", World's Work. Report, California State Land Settlement Board.
1915		Report, "River Murray Agreement, 1915."			Address, "Planned Rural Development in the United States", Southern Land Congress, Savannah, Ga., Nov. 11, 1918.
	Nov	Address, "Rural Credit System Needed in Western Development." Conference, Marketing and Credit, Chicago, Ill.			Report, "Summary of Soldier Settlement in English Speaking Countries."
	Sept	Paper, "Distributing Water in Irrigation in Australia," International Engineering Congress September 1915. Attended meetings, Sept. 15-20, and took part.		Dec	Article, "Developing Irrigated Land with Selected Settlers", Engineering News-Record.
1916	Feb	Address, "Systematic Aid to Settlers, First Need." Governor's conference, Denver, Feb. 5, 1916. <i>Appointed</i> Central Board of Review, all projects.	1919	Jan	Article, "Placing Soldiers on Farm Colonies", Annals American Academy.
	Apr	Article, "Solution of Land Question", New Republic.		Feb	Article, "Advantages of Planned Rural Development", Reclamation Record.
	June	Article, "Needed Increase in Scope of Reclamation Service", Reclamation Record.		Mar	Article, "Farm Settlement on a New Plan", Review of Reviews.
		Address, "Government Aid and Direction of Land Settlement", Farmers Congress, Fort Collins, Colo.		Apr	Article, "Soldier Settlements—Shall there be a National Law for Homesteaders", Country Gentleman.
	Nov	Report, "Land Colonization and Rural Credits", California.	1919	June	Article "Buying a Farm in the New Way", Ladies Home Journal.
	Dec	Statement, Crosser Colonization Bill Hearings. Paper, "Land Settlement a Public Question", Conference, Markets, and Farm Credits. Reports of Central Boards of Review, on Federal Irrigation Projects.		July	Report, All-American Canal Board.
1917	Jan	Article, "What's Wrong with Legislatures?" Independent. Articles, "What our Government Ought to be and Ought to Do." Metropolitan.		Aug	Report, "A Plan for Peopling the Mesa Lands Bordering the Imperial Irrigation District", California Experiment Station Bulletin.
	Apr	Report, All-American Canal to Imperial Valley.	1920		Address, "Settlement of Public Land of Imperial Valley", League of the Southwest.
	Sept	Article, "Farming his Own", Sunset Magazine.		Aug	Report, "How California is Helping People Own Farms", California Experiment Station, Circular No. 221. <i>Book</i> , "Helping Men Own Farms."
	Dec	Address, "Government Assistance for Irrigation Development", Washington Irrigation Institute, Yakima, Wash., Dec. 4, 1917. Address, "State Aid and Direction in Land Settlement", American Economic Association, Philadelphia, Dec. 27, 1917. Report, Emergency Survey California Irrigation Resources, California Experiment Station.		June	Report, State Land Settlement Board.
1918	Mar	Paper, "Government Aid and Direction in Land Settlement", American Economic Review.		Dec	Biography, "Be Sure you are Right, Then Stick!" W. V. Woehlke, Sunset Magazine.
	Apr	Paper, "What an Agricultural Engineer Thinks of Our Farming System", Outlook.			Paper, "Silt Problem of the Zuni Reservoir" A. S. C. E.
	June-Aug	Articles, "State Aid and Direction in Land Settlement"—"Cut-over Lands."	1921	Jan	Article, "Japanese Land Problem of California" Annals American Academy. Article, "The Land Ownership Problem" California Experiment Station Bulletin.
				May	Article, "Rural Child Labor", American Child. Article, "California's Farm Colonies", Review of Reviews. Article, "Planned Rural Development" California Agricultural Monthly. Article, "Colonization and Rural Development in California." California Experiment Station Circular No. 247.
			1922	Jan	Article, "The New Forty-niners" Survey-Graphic. Address, "Advantages of Planned Rural Development", Agricultural Engineering Society.
				May	Article, "Quarter-million State Made Farms", Country Gentleman.

Chronological events in life of Dr. Elwood Mead—Continued

Year	Month	Event	Year	Month	Event
1922	Sept.	Report of California Division of Land Settlement.	1926	Apr.	Article, "Economic Development of Colorado River", Reclamation Era.
1923		Article, "Incomplete Development Prevents Success in Irrigation", Engineering News-Record.		June	Address, "National Reclamation Policy", American Society Agriculture Engineers, Lake Tahoe, Calif.
		Report on the Murrumbidgee Scheme, Australia.			"The Pressing Problem of Federal Reclamation is Settlement and Farm Development."
	Fall	Extensive trip abroad.		Aug.	Visited Haiti, as consultant on irrigation.
1924	Apr.	Report, Federal Reclamation by Irrigation—"Fact Finders Report", Senate Document.			Article, "Let the Engineer and Farmer Each Do His Share", Mod. Irrigation.
	Apr. 3.	Appointed Commissioner, Bureau of Reclamation.		Aug.	Paper, "Present policy of Bureau of Reclamation, re Land Settlement," A. S. C. E.
	June 9.	Address "Land Settlement and Irrigation Development", Western Society, C. E., Chicago.		Sept.	Article, "Federal Reclamation Policy—What it Should Include", Western Construction News.
	July	Article "Has Federal Reclamation Failed?" W. V. Woehlke, in Sunset Magazine.			Visited Cuba as consultant on hydraulic development.
		Report, Urging Secretary to adopt planned colonization policy on irrigation projects.		Nov.	Article, "What We Have Done in Haiti", New Republic.
	Nov.	Article, "Future of Reclamation", Country Gentleman.		Dec.	Report, Special Advisers on Rural Development, Elliott, Roper, and Soule.
		Report, "Agricultural Development in Palestine."	1927	Feb.	Article, "New Haiti", Review of Reviews.
	Dec.	Article, "New Palestine", Review of Reviews.		Mar.	Article, "Commissioner Mead Urges Action on Colorado River."
		Article, "Speculating in Sage Brush", Country Gentleman.		Apr.	Attended Pan-Pacific Conference, Hawaii, "Problems of Federal Reclamation."
		Article, "Irrigation Profiteers", Country Gentleman.		July	Article, "Planning the Columbia Basin Development", Reclamation Era.
		Appointed, International Water Commission, United States and Mexico.			Address, "Policies and Problems, Federal Reclamation", Pan-Pacific Conference.
1925	Feb.	Statement Favoring Swing-Johnson bill, hearings, Senate Irrigation Committee.			Paper, "Private Financing Irrigation Development", A. S. C. E.
		Article, "Community Farming", New Republic.		Aug.-Sept.	Visited Palestine, Investigation and Land Settlement.
	Mar.	Visit projects with Secretary of Interior.		Dec.	Address, "Plan for Creation of Rural Communities in the South."
	May	Degree L.L. D., University of Michigan.			Report of Experts to Palestine Survey Commission.
	July	Biography, Sunset Magazine, by T. M. Knappen.	1928	Jan.	Statement "Organized Rural Communities", Ho. Irrig. Crisp Bill.
		Report, "Columbia Basin Project", House Document No. 112, 69th Cong. 1st sess.		Feb.	Statement, "Aided and Directed Settlement", Ho. Irrig. Winter Bill.
		Paper, "Present Policy, U. S. Bureau of Reclamation, re Land Settlement", A. S. C. E.		Mar.	Visited California Consulting Eng. Board, St. Francis Dam.
		Article, "Problems of Federal Reclamation", Agricultural Engineering.		May	Article "Pygmies in the Earth—Plea for Rural South", Forum.
	Oct.	Report, Columbia Basin Sp'l. Commission, Reclamation Era.			Report, St. Francis Dam Failure, California, Reclamation Era.
		Report, Economic and Engineering Feasibility of 7 Projects.		Sept.	Report, Palestine Survey Commission, Dr. Mead, chairman.
	Dec.	Conference, Reclamation and Land Settlement.		Nov.	Article, "Economic Aspects of Federal Reclamation", Reclamation Era.
1926		Report, Survey and Adjustments, House Document No. 201, 69th Cong., 1st sess.	1929	Feb.	Address, Drainage Congress, Memphis, Tenn., "Nothing Since the Building of the Panama Canal has so Grippped the National Imagination."
	Mar.	Article, "Rural Life in America", Review of Reviews.			
		Article, "Utilization of the Colorado River", Reclamation Era.			

Chronological events in life of Dr. Elwood Mead—Continued

Year	Month	Event	Year	Month	Event
1929	May	Statement "Creation of Organized Rural Communities", Senate Irrigation Committee.	1932	Apr	Article, "Romance of Irrigation to Reclaim Arid Land", Southwest Builder and Contractor.
		Article, "Community Small Farms", Real Estate Roads.		July	Article, "Social and Economic Value of Electrical Development", Reclamation Era.
	Sept	Article, "Conquering the Colorado", Review of Reviews.			Address, Sixty-second Convention A. S. C. E., Yellowstone Park.
	Oct	Article, "Making the American Desert Bloom", Current History.		Oct	Article, "Income of Federal Reclamation Bureau", Reclamation Era.
	Nov	Article, "Federal Reclamation, Its Achievements and Needs", Reclamation Era.		Dec	Address, "Reclamation Situation", National Reclamation Association.
1930	Jan	Statement, "Organized Rural Communities", House Irrigation Hearings.			Article, "Construction Guided by Extensive Research", Engineering News-Record.
	Feb	Article, "Economic Justification for Reclamation Activities", Era.	1933	Feb	Article, "Necessity of Organized Western Support", Reclamation Era.
		Article, "Colorado River—Economic Development", Engineering News-Record.		Apr	Article, "Research Work of Bureau of Reclamation", Sci. Monthly.
	Sept	Report, International Water Commission.			Book, "Construction of Hoover Dam", Wilbur and Mead.
	Oct	Article, "Hoover Dam—Boulder Canyon project a colossal enterprise."		Aug	Article, "Modern Methods Used on Reclamation Projects", Civil Engineer.
1931	Jan	Article, "Economic Results of Federal Reclamation", Reclamation Era.		Dec	Article, "Land Settlement", Eng. Soc. Sci.
		Report, "Conservation of Public Domain", by Garfield.			Article, "A Year of Achievement at Boulder Dam", Engineering News-Record.
		Address, Associated General Contractors, San Francisco, Calif.	1934	May	Honor for an Engineer, Portrait at University of Wyoming.
	Feb	Article, "Hoover Dam, the World's Largest Irrigation Structure", Reclamation Era.		July	Conference at Denver on Colorado River use.
	May	Article, "Reason Why Federal Reclamation Should Continue", Reclamation Era.		Sept	Statement, "Drought Problems of the Arid West", Engineering News-Record.
	Aug	Article, "Ample Security for Hoover Dam", Civil Engineering.		Dec	Report, "Federal Reclamation", Haw-Schmitt Report.
		Article, "Boulder Dam", New Republic.			Address, Third Annual Conference National Reclamation Association, Salt Lake City, Utah.
		Article, "Miracles Wrought in Starting Hoover Dam", Southwest Builder and Contractor.	1935	Feb	Article, "Destruction of Land Value by Erosion", Ency. Brit.
		Article, "Hoover Dam and Influence on Southwest", Reclamation Era. A National Reclamation Policy, T. A. S. C. E.		July	Article, "Boulder Dam Lake Biggest in World", New York Times.
	Nov	Address, "Place of Federal Reclamation in a Federal Land Policy", Land Conference, Chicago.		Oct	Statement, "No Need to Worry about Silt in Boulder", Southwest Builder and Contractor.
		Article, "Policies With Respect to Reservoirs", Reclamation Era.		Nov	Statement, "Ready for December Deadline", Pacific Builder and Engineer.
	Dec	Article, "Man-made Oases in American Deserts", Scientific American.	1936	Jan. 26	Appointed Chairman, Committee to Coordinate Power and Irrigation in Nebraska.
					Died at his home in Washington, D. C.

INTEREST in settlement opportunities on the Riverton project, Wyoming, continues. During the month of December about 205 inquiries were received at the project office, 14 prospective settlers were shown over the land, 8 farm applications were received, and 1 made homestead entry. At the close of the month 30 farm units were still available.

THE new Federal courthouse in El Paso, Tex., Rio Grande project, is nearing completion. This building occupies one small block adjacent to the county courthouse and the El Paso city hall. The building is of reinforced concrete and is faced with white limestone. The contractor reports this building will be ready for occupancy by April 1.

Thomas E. Buckner, attorney for the Black Canyon irrigation district, Idaho, was in Washington during January in the interest of the district.

Porter J. Preston, senior engineer, was called to Washington early in January to discuss with the Commissioner the Gila Valley project, Arizona.

Excellent Progress Made on Bureau's Program

EXCELLENT progress was made in 1935 on the Bureau of Reclamation's construction program, and as the new year was starting, preparations were being made in 8 far Western States to turn the first earth on 11 new jobs of major proportions.

In December 1935 a total of 39 contracts having a total value of \$12,787,439.89 were awarded. Among the work covered by these awards were such projects as the Imperial Dam and desilting works on the Colorado River, a part of the All-American Canal project, California; Seminoc Dam and power plant on the North Platte River, a part of the Casper-Alcova project, Wyoming; Bull Lake Dam, a part of the Riverton project, Wyoming; tunnels on the Yakima Ridge canal, which will serve the Roza division of the Yakima project, Washington; tunnels on Shoshone Canyon conduit, which will serve the Heart Mountain division of the Shoshone project and others on the Casper canal in Wyoming.

To January 14 a total of \$21,243,710.91 worth of work had been placed under contract on those projects for which work relief money had been allotted in the fall of 1935. In addition E. R. A. money was being used to carry on the work at Grand Coulee Dam.

With the new construction starting up, the Bureau's program became a real factor in provision of employment throughout the arid region. In December the Bureau employed on its construction project approximately 10,000 men a day. This total will considerably more than double in the next few months.

STATUS IN JANUARY

In order to show exactly what progress had been made, below is given the status in mid-January of each project which has received money through Public Works Administration allotments and through work-relief allocations since the N. I. R. A. legislation was enacted in 1933.

Gila Valley project, Arizona.—P. W. A. allotment of \$75,000 for investigation. The investigation has been completed. E. R. A. allotment of \$2,000,000 for commencement of construction. The start of work was held in abeyance for a reexamination of the feasibility of the project.

Salt River project, Arizona.—E. R. A. allotment of \$3,500,000 made for construction of Bartlett Dam on the Verde River and for enlargement and completion of the spillways at existing dams. The contract was awarded in December for the spillway at Stewart Mountain

Dam; specifications were complete for the Roosevelt Dam spillway and were in preparation for the others and for Bartlett Dam.

Yuma project, Arizona.—P. W. A. allotment of \$120,000 for drains and structures, Valley division. The work was completed late in 1935.

All-American Canal project.—P. W. A. allotments of \$9,000,000 made to start the work; E. R. A. allotment of \$13,000,000 made to continue it. Contracts were let in December for Imperial Dam and desilting works, a section of the canal, and for four wash siphons. Three previous canal contracts were about one-third completed with about 25,000,000 cubic yards of excavation done. Two sections were in construction by force account.

Colorado River Indian project, Arizona-California.—P. W. A. allotment of \$25,000 for investigation. Investigation completed.

Parker Dam project, Arizona-California.—P. W. A. allotment of \$2,000,000. Contract awarded in 1933, work in progress after delays.

Boulder Canyon project.—P. W. A. allotment of \$38,000,000 for continuing work on Boulder Dam made in 1933. Congressional appropriation of \$14,000,000 made in 1935 for same purpose. Dam and powerhouse nearing completion with installation of generators.

Central Valley project, California.—E. R. A. allotment of \$15,000,000 for commencement of project. Specifications being prepared for several of the principal engineering features. Preliminary work in progress on project.

INVESTIGATION UNDERWAY

Grand Lake-Big Thompson diversion, Colorado.—P. W. A. allotment of \$150,000 for investigation. The investigation was well along toward completion.

San Luis Valley, Colo.—P. W. A. allotment of \$35,000 for investigation of drain in closed basin. Investigation completed.

Uncompahgre project, Colorado.—P. W. A. allotment of \$2,725,000 for construction of Taylor Park Dam and repairs to irrigation features. The dam was 25 percent complete and the other work in progress.

Molokai project, Hawaii.—P. W. A. allotment of \$25,000 for investigation of water diversion. Investigation was in progress.

Boise project, Idaho.—P. W. A. allotment of \$40,000 for drains. Work virtually completed.

Boise project, Idaho.—E. R. A. allotment of \$600,000 for raising Arrowrock Dam. Contract let early in January 1936.

Boise project, Payette division, Idaho.—E. R. A. allotment of \$1,000,000 for work. First contract let early in January 1936 covering four tunnels on Black Canyon canal.

Upper Snake River project, Idaho.—P. W. A. allotment of \$2,000,000 for Island Park Dam. The dam contract was let in September 1935.

Bitter Root project, Montana.—P. W. A. allotment of \$100,000 and E. R. A. allotment of \$200,000 for reconstruction of laterals and structures. Work had not started pending completion of repayment contract.

Buffalo Rapids project, Montana.—P. W. A. allotment of \$20,000 for an investigation. Investigation nearing completion.

Chain of Lakes storage project, Montana.—P. W. A. allotment of \$2,000,000. Work had not started. Repayment contract being negotiated.

Frenchtown project, Montana.—P. W. A. allotment of \$180,000 and E. R. A. allotment of \$60,000 for irrigation works for 7,500 acres. First contract let in September and second contract pending in January for canals and structures.

Milk River project, Montana.—P. W. A. allotment of \$65,000 for laterals and structures. Work completed.

Sun River project, Montana.—P. W. A. allotment of \$600,000 for drains, laterals, structures, and spillway for Gibson Dam. Work well along; E. R. A. allotment of \$715,000 for continuation of work. First contract under this allotment let in December for construction of mill Coulee wasteway.

North Platte Valley, Nebr.—P. W. A. allotment of \$50,000 for investigation. Investigation completed.

RYE PATCH HALF DONE

Humboldt project, Nevada.—P. W. A. allotment of \$2,000,000 for Rye Patch Dam. The dam was 50 percent complete.

Truckee River storage project, Nevada.—P. W. A. allotment of \$1,000,000 for Boca Dam. Work had not started. The repayment contract was being negotiated.

Caballo Dam, N. Mex.—P. W. A. allotment of \$1,000,000. Specifications about completed.

Carlsbad project, New Mexico.—E. R. A. allotment of \$1,000,000 to commence Alamogordo Dam. Award of contract for construction pending.

Rio Grande project, New Mexico-Texas.—P. W. A. allotment of \$200,000 for laterals, drains, and structures. Work virtually completed.

Burnt River project, Oregon.—E. R. A. allotment of \$500,000 for Unity Dam. Award of contract pending.

Deschutes River project, Oregon.—P. W. A. allotment of \$65,000 for investigation. Investigation nearly completed. E. R. A. allotment of \$500,000 for construction of dam. Work had not started pending completion of investigation.

Grand Ronde project, Oregon.—P. W. A. allotment of \$10,000 for investigation. Investigation completed.

Stanfield project, Oregon.—P. W. A. allotment of \$100,000 for reconstruction of canal and structures. Work completed.

Vale project, Oregon.—P. W. A. allotment of \$1,000,000 for Agency Valley Dam. Dam completed in December. E. R. A. allotment of \$340,000 for canals. Construction under way.

Klamath project, Oregon-California.—P. W. A. allotments of \$61,000 for canals and drains. Work nearly completed. E. R. A. allotment of \$135,000 for laterals. Work beginning.

Owyhee project, Oregon.—P. W. A. allotment of \$5,000,000 for continuation of work on project begun several years ago. Work largely completed under this allotment. E. R. A. allotment of \$500,000 for continuation of work. Work started.

Belle Fourche project, South Dakota.—E. R. A. allotment of \$70,000 for drains. Work in progress.

Lower Colorado River project, Texas.—E. R. A. allotment of \$5,000,000 to Bureau and \$15,000,000 as loan and grant to the Lower Colorado River Authority, of Texas, for construction of this project, which includes completion of Hamilton Dam and construction of several other dams in the vicinity of Austin. Preliminary work under way, with plans and specifications in progress on several phases of the work.

HYRUM COMPLETED

Hyrum project, Utah.—P. W. A. allotment of \$930,000. Hyrum Dam completed in December.

Moon Lake project, Utah.—P. W. A. allotment of \$1,200,000 and E. R. A. allotment of \$240,000 for Moon Lake Dam, canals, and structures. Dam was 25 percent complete.

Ogden River project, Utah.—P. W. A. allotment of \$3,000,000 and E. R. A. allotment of \$500,000 for construction of Pine View Dam and canals and waterworks. The dam was 65 percent complete and a contract was pending for construction of the canals.

Provo River project, Utah.—P. W. A. allotment of \$1,000,000; E. R. A. allotment of \$2,260,000 for construction of Deer Creek Dam, canals, structures, dikes, etc. Work had not started. Repayment contracts were being negotiated with irrigators and cities.

Sanpete project, Utah.—P. W. A. allotment of \$375,000 for Ephraim and Spring City tunnels. Ephraim tunnel under contract, work well along.

Columbia Basin project, Washington.—P. W. A. allotment of \$15,000,000; E. R. A. allotment of \$20,000,000 for construction of Grand Coulee Dam. Work ahead of schedule with first concrete poured December 6, 1935.

Columbia Basin project investigations.—E. R. A. allotment of \$250,000. Investigations in progress.

Roza division, Yakima project, Washington.—E. R. A. allotment of \$4,000,000 to commence construction. Contract for construction of three tunnels on the Yakima Ridge canal let in December.

Yakima storage project, Washington.—E. R. A. allotment of \$280,000 for spillway work on Cle Elum and Kachess Dams. Specifications in preparation.

Casper-Alcova project, Wyoming.—P. W. A. allotment of \$7,000,000 and E. R. A. allotment of \$8,000,000 for construction. Two tunnels on Casper canal completed, four others under contract; Alcova Dam under contract; Seminole Dam and power plant contract let in December.

Riverton project, Wyoming.—E. R. A. allotment of \$1,000,000 for construction of Bull Lake Dam. Contract let for construction of dam in December.

Heart Mountain division, Shoshone project, Wyoming.—E. R. A. allotment of \$1,500,000 for construction of canals. Contract let in December for construction of three tunnels on the Shoshone Canyon conduit canal.

Shoshone project, Wyoming.—P. W. A. allotment of \$50,000 for drains on the Willwood division. Work in progress.

Colorado River Basin investigations.—E. R. A. allotment of \$250,000. Investigation in progress.

Secondary investigations.—E. R. A. allotment of \$250,000. Investigations in progress.

GRADING on the new highway, Belle Fourche to Montana, has been completed, and gravel surfacing is in process. This makes a new route for transportation of products and also opens up new tourist opportunities.

GOOD farms with buildings are in demand on the Belle Fourche project, South Dakota.

Public Land Opening

Sun River Project, Montana

The Department of the Interior announced on January 10, 1936, the opening to entry on February 10 of 28 public land farm units on the Greenfields division of the Sun River project, Montana. Water for the lands included in this tract will be available beginning with the irrigation season of 1936 and thereafter. The units range in size from 50 to 148 acres.

The soil on the Greenfields division is principally a light clay loam, well adapted to the production of staple crops under irrigation. Wheat is the principal crop, but the area in alfalfa and sweetclover is increasing as is also the diversification of crops. Seed peas are a very promising crop and sugar beets probably will become an important crop. The temperature range is minus 40° to 100° and the irrigation season from May 1 to October 10.

The construction charge has not been determined, but the cost per acre will be based on the actual cost of construction divided by the irrigable area and probably will be about \$100 an acre. The lands covered by this public notice are also subject to an annual operation and maintenance charge fixed by the Greenfields irrigation district, which district is now operating the Greenfields division.

At this, as at all public land openings, ex-service men will be accorded a 90-day prior right of entry, and until May 12, 1936, the units included in the order shall be open to entry only by 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 have been honorably separated or discharged therefrom or placed in the Regular Army or Naval Reserve. At the expiration of the 90-day period any units remaining unentered will be available to other duly qualified citizens of the United States.

Each applicant must be in good health and have at least 2 years actual experience in farm work. He must also have a net worth free of liability of at least \$2,000 either in money or in livestock, farming implements, or other property deemed by the examining board to be as useful to the applicant as money.

Application blanks and descriptive matter may be obtained by addressing the Bureau of Reclamation, Washington, D. C., or Fairfield, Mont.

John Doan, of Yuma, a member of the Arizona State Colorado River Commission, died suddenly on December 1, 1935.

Important W. P. A. Project

On the Sunnyside division of the Yakima project there is a rather unusual operation and maintenance arrangement. Although the Bureau of Reclamation operates the entire gravity system, it maintains only the canals and laterals of more than 10 second-foot capacity. The smaller laterals are maintained by the water users served by each lateral. Some of the laterals are known as organized laterals, that is, under the State law a maintenance district is organized by the Sunnyside Valley irrigation district. The latter attends to the clerical and financial matters of each of its more than 100 maintenance districts and directs through local foremen, chosen by the water users on each lateral, the maintenance work necessary to their operation by the Bureau.

The news-worthy item regarding the foregoing is that the Sunnyside Valley irrigation district has been allotted a W. P. A. project which anticipates the piping of more than 5 miles of laterals in these maintenance districts. The project also includes a program of building flumes, enlarging ditches, leveling down spoil banks, and removing willows along rights-of-way. The expenditure by the W. P. A. will total \$10,000, and the maintenance districts will expend probably as much more for pipe, lumber, and other materials. The Bureau cooperates chiefly in supplying engineering and supervisory assistance. When it is known that these 100 maintenance districts are widely distributed over the division, it will be realized that the Sunnyside Valley irrigation district has undertaken a program of widespread benefit to the project.

O. and M. Conference

An operation and maintenance conference with George O. Sanford, general supervisor, was held in the Washington office of the Bureau of Reclamation beginning January 14, the purpose of which was to discuss operation and maintenance problems and prepare a comprehensive program of field activities for the season of 1936.

The field representatives attending this conference were H. S. Comstock, B. E. Hayden, H. H. Johnson, L. H. Mitchell, J. S. Moore, and R. C. E. Weber.

RESIDENTS of the town of Tulelake, Calif., Klamath project, are taking steps to incorporate the town and plan on holding an election in the near future.

Fund for Texas Project Restored

Secretary of the Interior Harold L. Ickes announced in January that the President had approved restoration of \$3,000,000 to the sum to be contributed by the Government toward construction of the lower Colorado River project of Texas.

Restoration of this sum again brings to \$5,000,000 the total allocated to the Bureau of Reclamation and representing flood control and irrigation benefits to be obtained from construction of the project.

Originally \$20,000,000 was allotted from work-relief funds to cover construction of the project, which is designed to regulate the Colorado River of Texas for flood control, power generation, and for providing a supplementary water supply for approximately 120,000 acres of land below Austin.

Of the total allotment \$10,500,000 is secured by revenue bonds of the Lower Colorado River Authority, a Texas public body which will operate the project, and \$4,500,000 was a grant to the authority representing 30 percent of the cost of labor and materials.

Under a contract between the Secretary of the Interior and the authority the Bureau of Reclamation is to supervise the construction. Originally \$5,000,000 was allotted to the Bureau, but later \$3,000,000 of this allotment was rescinded. The reallocation of the \$3,000,000 again places the project on its original basis.

The project includes completion of Hamilton Dam near Bluffton, Tex., and a unified system of new dams and reservoirs along the lower river in the general vicinity of Austin.

School Facilities at Grand Coulee

In the Government engineers' camp on the west side of the Columbia River at Grand Coulee dam site is located the four-room elementary grades school building. This school is attended by children of residents in the Government camp and the camp of the principal contractor just across the river on the east side. The contractor in turn has furnished facilities for those of secondary-school age, both in his and the Government camps.

Outside the boundaries of the Government reservation several so-called townsites have been developed on privately owned property. A school district has been created to serve these townsites, which is under State jurisdiction and is located in the town of Coulee Centre.

Western Chamber of Commerce Adopts Resolution

The western division of the United States Chamber of Commerce recently adopted a resolution recommending the continuation of Federal reclamation construction, the resolution being sponsored by J. A. Ford, managing secretary of the Spokane Chamber of Commerce.

The resolution follows:

"Reclamation by irrigation of land in the arid and semiarid portions of the United States has been shown by its results to be a sound and desirable national undertaking. When comprehensively and carefully planned, and when its anticipated benefits are clearly apparent, it represents a constructive policy of social development.

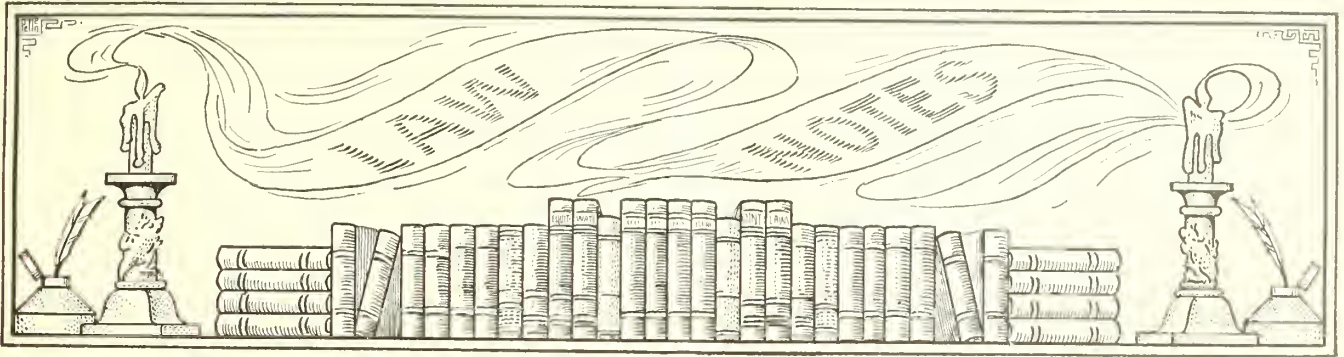
"Agriculture in reclaimed areas has little relation to the problems of surplus agricultural production. The crops produced on reclamation projects, are in the main, not those staples of which there is a recurring surplus.

"In such areas agriculture has a high degree of stability and aids in the stabilization of the country's food supply.

"Reclamation should be continued by the Federal Government as available means may permit, but under certain reasonable limitations. The successful tillage of the soil should be demonstrated by careful analysis to be feasible. The per acre cost of production should not be prohibitive. The advisability and need for each project should be previously determined by competent and qualified experts or agencies. Ready markets for the products should be available. Proper housing and living conditions for the population of such areas should be reasonably attainable."

A TOTAL of 60 men have been employed on a street project in Carlsbad under the Works Progress Administration. Two road projects and several school projects under W. P. A. were in active construction at nearby points in the county. Practically all available men capable of work are being employed on these projects. The State welfare forces are taking care of indigent unemployables.

DURING the year 1935, 350,945 persons traveling in 108,880 cars visited the Boulder Canyon project. Visitors to the project in December of that year numbered 17,500, traveling in 5,642 cars. Of these, 2,989 persons in 1,015 cars entered the reservation from Kingman via the Black Canyon ferry and across the top of Boulder Dam.



Wildlife Reservations on Reclamation Projects

Memorandum of agreement between the Secretary of the Interior and the Secretary of Agriculture respecting administration of reclamation projects which are also bird and wildlife reservations and refuges

TO THE end that the administration of reclamation projects which also constitute bird and other wildlife reservations and refuges may be adjusted in the interests of irrigators and the conservation of wildlife, the Secretary of the Interior and the Secretary of Agriculture have agreed upon the following principles to govern their respective services administering said projects, reservations, and refuges:

1. The Biological Survey of the Department of Agriculture will prepare land-use maps and specifications for each refuge located on reclamation areas and will furnish to the Bureau of Reclamation such detailed information concerning the land and water use as may best serve the objectives for which the refuge was established. Grazing and agricultural leases of land that is included in reclamation areas on which wildlife refuges have been established will be drawn insofar as possible consistent with the requirements of the irrigators to conform to the requirements for wildlife as set forth in the specifications furnished by the Biological Survey. The grazing and agricultural leases of said lands will be executed by or on behalf of the Secretary of the Interior, but before being executed drafts of such proposed leases which are at variance with the wildlife use program will be submitted to the Biological Survey and an opportunity afforded for such readjustments in the provisions of the contract as may be mutually agreed upon, but the paramount reservation for reclamation purposes and the contractual rights of persons interested therein shall be protected to the satisfaction of the Secretary of the Interior.

2. The Biological Survey may fence such areas within refuge boundaries as may be necessary to protect the nesting population and shall keep closed these areas only so long, and to the extent, as may be required to maintain an adequate nesting cover.

3. The Bureau of Reclamation, where possible, shall save a minimum supply of water in reservoirs or sumps for wildlife purposes.

4. The Biological Survey may, with the consent of the Bureau of Reclamation, make small dams on public lands in depressions adjacent to reservoirs where water levels may be maintained unaffected by irrigation activities, where such small areas to be held in permanent marsh for wildlife food-production value do not materially reduce the water supply of the reservoir.

5. The Biological Survey may institute and conduct reforestation and range recovery practices for the preservation or development of necessary cover for wildlife.

6. When an irrigation project is finally released or sold to a local water users' association or irrigation district a definite statement shall be included in any contract entered into subsequent to the date of this memorandum of agreement, or prior to said agreement if the contract holders consent, as to the extent and nature of the bird or wildlife reservation or refuge reservations attached to the lands or waters, and the Biological Survey shall be permitted to examine all such contracts before final signature.

7. In all final releases or sale of irrigation projects as to which contracts have been entered into subsequent to the date of this memorandum of agreement there shall be reserved in the contract, by and with the consent of the contracting district or association, the right of the United States to establish a bird or wildlife refuge on the lands of the said project.

8. Permits, if any, to take wildlife on refuge areas will be issued exclusively by the Biological Survey and said Survey shall have the right to control all trespass that may affect, directly or indirectly, wildlife, saving to the Bureau of Reclamation and the water users the right to remove burrowing animals menacing

levees, canal banks, or reservoirs, under the supervision of the Survey.

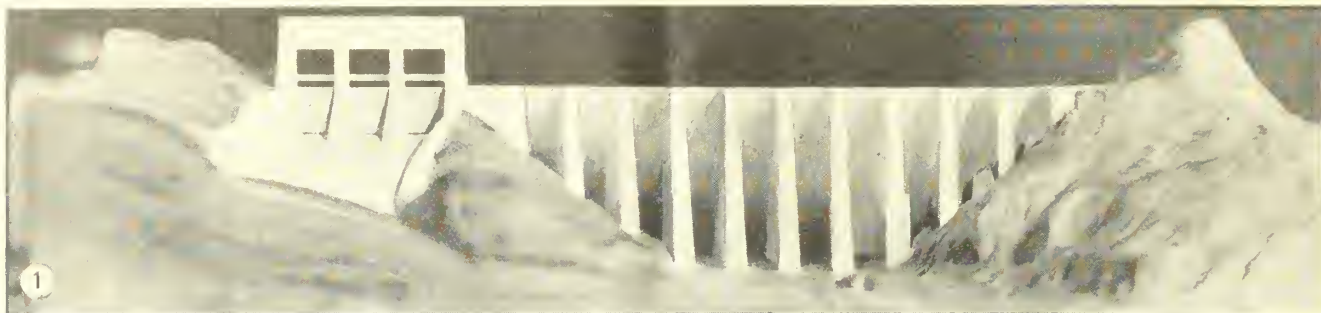
9. All waste waters from any irrigation project beyond present or future irrigation requirements of Federal irrigation needs shall, so far as permitted by law, accrue to the use of the Biological Survey for the benefit of migratory waterfowl, and in all developments and contracts for reclamation projects subsequent to the date of this memorandum of agreement, the Biological Survey shall have the right to become a party to the development or the contract and assume its proportionate liability for any water that it may desire to use for migratory waterfowl purposes.

10. All new sumps created by reclamation activities shall be held for reservation for such waterfowl refuges as may be established thereon by Executive order, upon such terms of reimbursement of the irrigation districts, so far as their interests may be involved, as shall be agreed upon by the Biological Survey and such districts.

11. The Department of Agriculture will deputize reclamation reservoir superintendents as deputy game management agents and the Bureau of Reclamation will charge their agents on any reclamation project that is also a bird or wildlife reservation or refuge with the responsibility, so far as consistent with their other duties, to protect the wildlife and to cooperate with the Biological Survey in every way feasible for the advancement of the interests of such wildlife.

Salt River Contract Ratified

SHAREHOLDERS in the Salt River Valley Water Users Association on December 17, 1935, voted 8 to 1 in favor of a repayment contract covering construction on their project of Bartlett storage dam and reservoir on the Verde River near Phoenix; enlargement and completion of spillways at existing dams;



and miscellaneous betterments to project works. Construction will be started with an allotment of \$3,500,000 of work relief funds. The total estimated project cost is \$6,844,000. The contract provides for construction of the contemplated works by the Bureau of Reclamation and the repayment by the Salt River project of the loan without interest within a 40-year period.

Lin B. Orme, president of the Salt River Valley Water Users Association, telegraphed the results of the election to

the Bureau as follows: "Shareholders express confidence in the Bureau of Reclamation and the management of the Salt River Valley Water Users Association by ratifying the contract with the Secretary of the Interior today by a vote of 8 to 1."

In the above cut is shown: No. 1, a model of Bartlett Dam, the principal construction feature involved in the Salt River program, upon which the election was held; no. 2 shows a group of prominent Arizonans at the dam site on a

recent inspection, left to right: H. J. Lawson, general superintendent and chief engineer; John H. Dobson, governor Water Users Association; R. A. Hill, consulting engineer; Lin B. Orme, president Water Users Association; E. W. Hudson, vice president, Water Users Association; United States Senator Carl Hayden; Mr. Mattison, Assistant Engineer, Bureau of Reclamation; no. 3 is a view of the first work in connection with Bartlett Dam, the construction of a road to the site. (Continued on p. 46)

Farm Census on Belle Fourche Shows Improvement

THE farm census recently compiled on the Belle Fourche project, South Dakota, shows good returns for 1935, although the total crop value of \$915,000 is 11 percent below the previous year, largely because of lower market prices for hay and grain. These lower unit values reduced the returns from \$23.56 per acre last year to \$19.87 as indicated by this census. A slight shortage of irrigation water made it necessary to ration out the supply, probably curtailing production on some farms, but in general the moisture was sufficient to bring crops through to proper maturity and favorable yields.

Sugar beets from 8,268 acres led the list with a value of \$482,000, making up more than half of the total crop returns. This includes the beet tops which had a feed value of \$30,000, but does not include payments by the Federal Government under the acreage adjustment contracts amounting to \$121,000 on the 1934 crop. The yield of 9.8 tons per acre was slightly under the average of 10 tons established for the past 8 years or since the factory came to the valley, but tonnage deficiency was more than offset by the sugar content of 17.81 percent, an exceptional record that stands out as a credit mark for this factory district. Many fields produced 12 to 14 tons per acre, the highest of 16 tons coming from the J. W. Gowan farm on the Belle Fourche River bottom.

Alfalfa hay was harvested from 11,800 acres with a production of 23,600 tons, or an average of 2 tons per acre. This crop was given an inventory value of \$5.50 per ton as compared with \$12.50 the preceding year and returns totaled \$130,000 where 1934 results showed \$262,000. The lower prices and reduced outside demand will make for wider feeding operations on the project farms, and this in turn will result in better profits on account of the spread between low feed costs and relatively high livestock prices. Twenty-six hundred acres were irrigated for alfalfa and clover pasture and provided the dairy herds and farm flocks with succulent feed through the heat and drought of July and August. The G. W. Morsman farm east of Nisland was top for alfalfa yield with 250 tons from 50 acres.

A larger acreage was given to feed grains in 1935, the combined production of barley, oats, and corn reaching 324,000 bushels as compared with 204,000 bushels in 1934. Prices averaged 25 percent lower than last year, the most pronounced decline being in oats which went from 55 to 32 cents per bushel. Corn came through with very satisfactory yields, but the small grains were adversely affected by the heat of July and rust also took its toll. Some early grains came up to expectations. A barley crop of 63 bushels per acre was reported from the John Bentz farm and the State

farm east of Vale raised 70 bushels of oats per acre. Honors for wheat go to the Heavirland farm on the Owl Creek Flats northwest of Nisland with 31 bushels per acre.

Livestock.—The livestock industry staged a good rally during the fall months, particularly with respect to sheep, which is the principal project line. The farm flocks, feeders, and lambs totaled 106,000 head on December 1, the highest ever recorded, and with the market at favorable levels and feed relatively cheap, this business should return the best profits since the depression. Tuberculosis testing of cattle was completed during the month and reactors for this county averaged 0.6 percent out of a total of 25,000 head. The district now becomes modified accredited and will be fully accredited when the disease is reduced to 0.5 percent or under.

Marketing conditions.—The lamb market made further advance during the month and shipments now bring about \$11 at Missouri River centers, indicating good profits to feeders. Grains and hay held even with wheat at \$1.07 per bushel coarse grains at \$1 per hundredweight and alfalfa at \$5 to \$5.50 in stack. Butterfat advanced 2 cents and is now quoted at 32 cents per pound, but eggs declined 7 cents and are back to 23 cents per dozen. Carload shipments from the 3 project towns consisted of 6 pickles, 2 wheat, 38 sheep, and 7 cattle.

Imperial Valley, California

NUMEROUS inquiries have been received concerning the Imperial Valley in California and its relationship to Boulder Dam. For the purpose of explaining this relationship, of which there is apparently a widespread lack of understanding, this article is presented.

The Imperial Valley is that portion of Salton Sink which has been irrigated. It lies in a sunken basin, which at one time was a portion of the Gulf of California, having been separated from it by the formation of the delta of the Colorado River. The sea that once covered this area long since has evaporated.

Irrigation of the Salton Sink first was proposed in 1857 by Oliver M. Wozencraft, who noticed that the desert on the western side of the lower Colorado River sloped away to the northwest to its bottom, which was 287 feet below the level of the sea and more than 300 feet below the bed of the Colorado River. The river ran down past this great depression on a silt ridge it had built to empty into the Gulf of California.

Wozencraft was unable to finance an irrigation project, and for many years nothing further was done toward reclaiming the land. In 1900, however, Charles R. Rockwood, an irrigation engineer, obtained financial backing for a plan to cut the bank of the Colorado River and water a portion of the Salton Sink through a gravity canal. He had been engaged in promotion of his plan for 10 years.

In 1901 water was diverted by Rockwood and his associates and settlement of a large area of desert land began. Rockwood changed the name of the irrigated section from Salton Sink to the Imperial Valley. Despite adversity originating from the erratic behavior of the Colorado River, which was the sole possible water source, the new development was settled rapidly. About 500,000 acres of very fertile land now are under irrigation in California and a varying amount, probably averaging about 200,000 acres a year, has been irrigated in Mexico from the canals Rockwood constructed.

Two principal problems faced by settlers in the Imperial Valley were the erratic nature of the Colorado River and Mexican control of their main canal, which looped through Mexican territory for a distance of more than 40 miles between its intake and principal feeder canals in California. Control of the Colorado River through construction of a great dam for its regulation and provision of an all-American water system were the only practical solutions.

The Boulder Canyon Project Act of 1928 authorized both Boulder Dam, for regulation of the Colorado River, and an All-American canal for the Imperial Valley.

That the valley had suffered at the hands of the river is history. In 1905 the river broke away from its old channel to the gulf and flowed into the Salton Sink, disrupting canals, washing away farms and parts of cities, and re-creating Salton Sea, where a salt flat formerly existed at the very bottom of the sink. The river was returned to its channel at

great cost. Each succeeding year, when the great spring floods arrived, the Colorado River threatened to break through its soft banks and again turn itself in upon the settlers. After the floods had passed, the river dwindled to a small stream so that alternately floods and droughts threatened the Imperial Valley irrigators.

Boulder Dam has overcome this through storage of the floods of the river and regulation of its flow through its lower course. The water supply of Imperial Valley and other irrigated areas along the lower river now is stabilized.

Through the construction of the All-American Canal, now under way, the Bureau also is providing the Imperial Valley with a wholly American water system.

Many have inquired whether through construction of the All-American Canal new lands will be made available for settlement. The above discussion of the Imperial Valley will show that its primary purpose is to succor the presently irrigated section from one of its primary difficulties. Lands within the present confines of the Imperial Valley are privately owned. All the lands under the present canals opened to homestead entry have been taken up.

Through construction of a branch of the All-American Canal, extending northward into Coachella Valley, which lies north of Salton Sea, water could be made available for some 300,000 acres of public lands in the desert of the eastern mesa and the southern end of the Coachella Valley. The eastern mesa lies above but adjacent to the present Eastside high-line canal of the Imperial Valley.

The Coachella branch canal was authorized under the Boulder Canyon Project Act just as was the All-American Canal, and although the All-American Canal is being constructed of a size to permit its carriage of sufficient water for the Coachella branch, no money has been made available for the branch. Consequently there are no plans at present for its construction nor for opening any new lands to homesteaders under the All-American Canal.

The situation then is that present construction is designed to serve an area known as the Imperial Valley which already has been completely settled. There are no plans for construction of the Coachella branch canal or for the opening of new lands to entry in the near future, although congressional authority has been given for these steps.

"Some of the projects that have been particularly gratifying in this way have been work done on grounds and athletic field of the Olathe High School, on the buildings of three district schools in the Olathe region, on the grounds of the school in Naturita, at the cemetery and on the city streets in Nucla. Athletic fields have been graded and seeded. Grounds of the school buildings have been landscaped, additions to school buildings have been constructed, and in every case good and lasting workmanship resulted.

"A project of another kind that proved of tangible benefit was a garden and canning project in Montrose. Only a small tract of land on a vacant lot was available, and only two or three men worked at a time on this garden, but from its products from land that would otherwise have been a weed-grown eyesore, over 6,000 cans of vegetables were canned, which are now the property of the State E. R. A. and which are being distributed to city relief clients."

Salt River Contract

(Continued from p. 44)

Salt River project officials claim for the program that it will "assure an increased supply of good river water for Salt River project lands; prevent excessive assessments and hold them down to existing levels or less; by completion of the spillways at the Salt River dams eliminate the danger of excessive damage and high repair costs, perfect the title of the Salt River project to all the water of the Verde River forever; eliminate the excessive use of pumped water; make possible refinancing of the Salt River project's bonded indebtedness by the Reconstruction Finance Corporation, whose commitment expressly requires that our dams be made safe and our water supply be increased; eliminate the danger of water shortage and thereby stabilize land values, and do all of this with less annual cost per acre in assessments."

Bartlett Dam would have a capacity of 200,000 acre-feet. Its design has been completed by the Bureau of Reclamation. The structure will cost about \$4,500,000. Twenty percent of the cost will be borne by the Indian Service and that Service will get 20 percent of the water conserved, but not to exceed 20,000 acre-feet annually. This participation by the Indian Service was stipulated by the Government. The association's obligation for Bartlett Dam and spillway completion will not exceed \$6,000,000 and should be somewhat less. Annual payments will be not to exceed \$60,000 for the first 5 years; \$120,000 a year for the next 10 years, and \$180,000 a year for the next 25 years.

Aid for the Needy on Reclamation Projects

TWO methods of providing relief to the needy in reclamation areas, which may interest readers of the RECLAMATION ERA, were outlined in reports covering Goshen County, Wyo., where relief gardens were featured, and the Uncompahgre region in Colorado, where local improvements of a permanent nature were undertaken.

C. F. Gleason, superintendent of power, on the North Platte project, said several large tracts of land were leased in Goshen County for the production of corn, potatoes, tomatoes, and cabbage. Potatoes were planted in 55 acres, sweet corn in 171, tomatoes in 49, and 4 to cabbage. The potatoes yielded 150 bushels per acre and 4,200 pounds of cabbage was obtained. The corn was delivered to the canning factory at Torrington and produced 52,368 cans. The factory was closed for lack of cans after 6,408 cans of tomatoes were run. The remainder of the tomatoes were made available immediately to needy families. Large numbers came from surrounding towns and dry land communities in other counties in addition to those from Goshen County.

In addition, Gleason said, there were 35 community gardens of about one-half acre each in the county. Miscellaneous vegetables amounting to 1,189 cans and 1,679 cans of corn were obtained from

these. Seeds and plants were also furnished to 286 relief clients and to 131 rural rehabilitation cases. These amounted to 156,100 cabbage plants, 23,685 tomato plants, and 9,978 packages of seeds.

A total of 128,403 cans of beans, corn greens, tomatoes, tomato juice, relishes, fruit, and other vegetables were canned at the Gering and Lyman canning centers in Scottsbluff County, in addition to the activity in Goshen County.

W. R. Catton, administrator of relief, reported to F. D. Helm, treasurer of the Uncompahgre Valley Water Users Association, with regard to relief activities in that region in 1935 as follows:

"Probably the Uncompahgre region has had as little unemployment during the depression as any, for which the wide diversification of industry and agriculture was responsible. But there have been a certain number of families dependent upon governmental relief.

"The policy of the relief administration has been to try to get as much useful labor as possible in return for the expenditure of relief funds. Both the community and the men on relief are much better satisfied if after it is all over there is something of permanent value that can be seen and pointed to with pride as the result.

The Reclamation Era

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Special reduced rates are given individual water-user owners or water-users organizations for mass subscriptions on Federal irrigation projects.

FEBRUARY 1936

Plenty to be Done

Observing that "there is plenty to be done", an editorial in the Yakima Washington, Daily Republic recently saw an opportunity for work in the fact that more than 500,000 tourists will visit Grand Coulee and Bonneville dams during 1936.

"The tourist travel will doubtless be all that is anticipated, and every one of those visitors will not only be open to reason on the subject which is most important to the people of this section, but each will influence others", the newspaper said in contending that the tourists will furnish "ample material upon which to work in order to overcome the eastern prejudice against Federal reclamation."

"By contacting, therefore, over half a million tourists who come right to our doors, it might be possible to swing the predominant sentiment for instead of against the development of arid areas."

The paper said merely showing the visitors Grand Coulee and Bonneville is not enough, adding, "If these tourists are to be converted, they must be shown irrigated lands; the difference in wealth between valleys such as those of Wenatchee and Yakima, for instance, before and after they are reclaimed must be demonstrated to them.

"There is no need to minimize the difficulties in the way or the problems to be met; it is sufficient to show that the same situations have been met and overcome in the past and can be in the future.

"The eastern markets created and developed from orders placed by those upon irrigated lands should be held before the eyes of those visitors. That is one of the most potent reasons why eastern people should boost reclamation, but even those directly benefited are slow to grasp the significance of those markets."

Joyful Over Canal

"Just 1 year ago today the canal was started", the heading of an editorial in the Imperial Valley Press of El Centro, Calif., said on December 16, 1935. The editorial said in part:

"On the afternoon of December 16, 1934, more than 5,000 persons saw history in the making at Potholes, near Laguna Dam in the eastern part of Imperial County. It was the day when Imperial Valley celebrated the beginning of the All-American Canal, the day when a huge dragline bit into the first piece of dirt excavation on the 80-mile line of the huge ditch.

"Today, 1 year later, Imperial County already is beginning to see the immense benefits which will come from the great ditch, every part of which is on American soil. Marvelous progress has been made in excavation and construction. Every part of the canal except a short sector near Calexico has been provided for, and all will be under construction shortly after the first of the year. Additional thousands of dollars will be spent in this county as a result. Additional men will be given work. Business and industry will feel the stimulus of the increased tempo on the All-American Canal.

"Immediate cash benefits are the least important of all to the county and its residents, however. The canal already has been instrumental in attracting nation-wide attention to Imperial Valley.

As a reclamation project it is without equal. Drawn by knowledge of the advantages here, private capital from outside sources has become increasingly interested in the valley and its opportunities

"Above all in the list of canal benefits is that of its original intention—assurance to the valley of a clear, steady water supply without fear of foreign intervention or need of international horsetrading. The additional acres which will be brought under cultivation, the greater agricultural wealth, the more abundant prosperity, all are becoming increasingly evident—only a year after work was started."

Irrigation Institute Meets

The Washington Irrigation Institute, meeting at Wenatchee recently, elected Thomas B. Hill, of Olympia, as its president, selected Coulee Dam as its meeting place in 1936, and passed a series of resolutions, including one pledging cooperation and urging upon the National Reclamation Association a "constructive educational campaign."

The group also recommended and endorsed "the completion of the Grand Coulee high dam in orderly sequence following the completion of the foundations thereof, and the gradual, orderly, and timely reclamation of the Columbia Basin lands to follow the completion of said high dam."

A resolution favoring reestablishment of the Federal-State cooperative stream gaging and Federal contribution toward snow surveys and ground water investigations also was adopted.

The meeting was well attended and enthusiastic.

ROAD work on the Hobbs and Walnut Canyon surfacing projects has been in progress on the Carlsbad project. Both potash mines and refineries have been in operation with full crews.

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

SIR: I am enclosing my check ¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name)-----

(Address)-----

(Date)-----

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

The Planned Use of Color at the Boulder Dam Power Plant

By Allen Tupper True, Consulting Artist

THE palette or scale of color of the Southwest has been spoken of as distinctive in character and to anyone having an eye for color, this is apparent. Barbaric, yes—in the sense that all barbaric color is bold, strong, and positive and lacking in any gray naunces of diffident compromise, such as stigmatize our civilized fear of real color. Take a pile of Navajo blankets and Pueblo ceremonial sashes for instance, and it has a definite color character; sour greens, decadent purples, and discords are wholly missing. The greens border on turquoise, the blues are deep, warm, and resonant, the browns dusky, and the vermilions and yellows brilliant, just the sort of restrained, virile color that would suit machinery for a power plant.

Last month the writer discussed in an article in the RECLAMATION ERA the general subject of application of color, together with adaptation of aboriginal Indian designs for use as decorations at the Boulder Dam power plant. This article, in natural sequence, is an elaboration of the subject and a description of the color plan.

TEN COLORS SELECTED

In choosing the 10 colors which are to be used throughout the plant and appurtenant works a study was first made of such colors as predominate in the so-called "industrial paints" used for machinery and the most serviceable and adaptable of these selected. With this selection as the basis of a color scale the 10 chosen were tempered to conformity with the Indian characteristics. The resultants were: Deep, warm blue and black, a brown, concrete gray and warm white, jade green bordering on turquoise, and brilliant deep red, vermillion, orange, and canary yellow. All were tempered to harmonize one with another or in various combinations. Owing to the tremendous areas of concrete gray wall and structure which had to be considered, the reds, yellows, and jade green were made as brilliant as possible and the terrazzo

floor, most generally predominating, was set in a black and white aggregate with the black dominating. It gives a satisfactory base for brilliant color and establishes a sense of solid stability in the tremendous rooms.

Whether this palette is good or bad it has at least the virtue of being a predetermined plan of color which will govern the entire plant and assure a coordinated whole. Its possible combinations have been studied relative to their application in various units such as the generator room, governor and butterfly galleries, and the range seems adequate to meet all requirements.

PLAN FACILITATES WORK

The advantages of such a plan are many. The colors are named and numbered for reference, which facilitates cor-

This is the last of two articles by Mr. True. In his first article last month, the author discussed in detail the adaptation of Indian designs for use as decorations in the Boulder Dam powerhouse. This month he expands on the general theme, discussing specifically the color scheme adopted.

respondence and the writing of specifications. It assures economy in maintenance, particularly as our paint technical laboratory has worked out a formula which makes the paint satisfactory for both indoor and outdoor use and in the future only the 10 selected colors will be required for upkeep. A paint schedule covering all items to be painted has been prepared and governs the field force. It includes areas in square feet, gallons required, specification or reference, exposure, shop coat, and remarks relative to special application or trim and striping.

One example of the application of paint is the matter of piping. Miles of pipe for various services run here and

there throughout the power-house and to have painted them in varied designating colors would have aggravated the confusion. So, with few exceptions, the pipes are to be painted the concrete gray to "tie" them to their surroundings and the color specifying the service placed on bands. Valves are the only means of access to pipes and here, too, designating colors are to be used—for example, for high-pressure water pipes, vermillion; for all compressed-air pipes, blue; for all oil pipes, yellow, or yellow combined with other colors to designate various kinds of oil.

HARMONY ESSENTIAL

Color at its best is not merely a matter of selection, but above all and of primary importance is the association of colors one with another and with the surroundings. The predominating areas, the appositions and contrasts, are what make for a pleasing harmony, and so far as the exigencies of construction make it possible, the final coats of colors will be supervised and adapted to prevailing light and other governing conditions.

Much of the metal structure at Boulder Dam, such as doors, window frames, and railings being of pure aluminum, the use of aluminum paint has been avoided almost entirely except for priming or use on surfaces which do not meet the eye and so lessen the beautiful quality of real polished metal.

The significance of color and decoration at Boulder Dam lies then in its planned development, working toward an ultimate scheme which will be coordinated and harmonious. The scale of the whole is tremendous, and without some such simplified approach to the problem no satisfying result could be obtained. All the elements involving color are considered from the standpoint of their bearing on one another, and in this respect the finished plant at Boulder Dam is expected to be a step forward in the ordered completion of our great national industrial building program.

Orland Activities

The Orland Boosters Club staged a very successful and creditable community celebration on December 13, when they held their second annual orange fiesta. A very impressive parade of floats sponsored by various organizations was held in the morning, and the afternoon was devoted to sports. The Orland Women's Improvement Club gave a very delightful and much appreciated style show, featuring women's styles from the colonial days to those of 1935. The greater part

of the costumes were authentic relics owned by those participating in the pageant. A well-arranged exhibit of oranges attracted a great deal of attention. The Central California Poultry Producers Association exhibited a showing of dressed turkeys, and substantial prizes were awarded for the best birds. This exhibit of dressed turkeys was held not only to attract attention to the industry but to serve as an educational guide to turkey growers.

WITH a registration of 1,033 of school age, the Ontario school district, Owyhee project, has been advanced from a class 2 to a class 1 district.

THE State Department of Fisheries of Washington has started construction of several rotary-type mechanical fish screens in the larger non-Federal diversions in the Yakima Valley as part of a W. P. A. program for which funds have been allotted.

Boulder Dam in Chicago

By Trent E. Sanford, Curator of Architecture, Museum of Science and Industry, Chicago, Ill.

A LARGE alcove adjacent to the main entrance court of the Museum of Science and Industry in Chicago has recently been opened with a comprehensive exhibit of the Boulder Dam project. The central feature of this exhibit is a large diorama showing the operation of the dam and appurtenant works. Built at a scale of 1 inch to 30 feet, the diorama is about 16 feet long and includes a background showing the distant mountains and the lake formed by the dam. A 4-minute cycle of opera-

tion shows the conditions at various water levels—how the water will be handled in normal times and how the spillways will operate to handle the water in times of flood. The diorama was made by engineers of the Bureau of Reclamation for Chicago's Century of Progress Exposition where it was on display in the United States Government building, during the summers of 1933 and 1934. At the close of the exposition it was loaned by the Bureau to the Museum of Science and Industry.

Accompanying the diorama is an extensive series of photographs and colored drawings showing the various stages in the construction of the dam. Beginning with a group of photographs and a map showing the site of the dam and the area which it will serve, the series continues with a panel of pictorial material illustrating some of the many preliminary jobs necessary for its construction. Another group depicts the story of the materials used, their source, and the methods of handling. Still another panel of photographs with descriptive text tells the story of the diversion tunnels. These groups are followed by a display of photographs and diagrams which illustrate some of the steps in the construction of the dam, the spillways, the intake towers, and the powerhouse. Emphasis has been placed on some of the outstanding features of construction, such as the method used in building up such a huge mass, and the cooling of the con-

crete. On the opposite wall another panel illustrates and describes the uses of the dam. Labels on either side of the diorama contain statistics and comparisons to point out the magnitude of the project. The photographs were furnished by the Bureau of Reclamation, Six Companies, Inc., general contractors, and by Ingersoll-Rand, Inc. The colored maps and diagrams were prepared by the museum staff. Literature regarding the Boulder Dam construction, including the mimeographed circular Questions and Answers, furnished by the Reclamation Bureau, is available to the visitors.

The Museum of Science and Industry in Chicago, which occupies the reconstructed Fine Arts Building of the 1893 World's Fair, was founded by Julius Rosenwald and was opened to the public in July 1933. Although only partially completed on the interior, the museum has already had more than a million visitors. New and interesting displays

are constantly being installed to show some of the outstanding and dramatic achievements in the fields of science and engineering.

The museum, which is located at Fifty-seventh Street and Lake Michigan in Jackson Park, is open to the public every day, including Sunday, from 10 a. m. to 6 p. m.

Lake Mead

(Continued from p. 35)

Lake Mead is the most important body of water in a vast territory adjacent to it on the map. It is the safety valve on the Colorado River. In it is held that stream's dangerous floods, and from it flows water stored for use by millions in Arizona and California in cities and on farms during the late summer, fall, and winter when the natural flow of the river is insufficient for their needs.

The large capacity of the lake has been allocated as follows to its various uses: 9,500,000 acre-feet for flood control; 5,000,000 to 8,000,000 acre-feet for a silt pocket; 12,000,000 to 15,000,000 acre-feet active or regulation storage.

Lake Mead will be under the joint supervision of the Bureau of Reclamation and the National Park Service. The Bureau will regulate the outflow of the water in conformity with the purposes for which Boulder Dam was built, flood control, improvement of navigation, regulation of the lower river in behalf of irrigators in the Palo Verde, Yuma, and Imperial Valleys and in behalf of domestic water users in the cities of Southern California and for generation of power. The National Park Service will have charge of the recreational facilities on the lake.

The scenic shores of Lake Mead, formed as they are by the towering cliffs of the canyons of the Colorado, are destined to prove a major tourist attraction in the Southwest. The lake will be stocked with game fish.

Dr. Mead said in advocating the development of the recreational features of the lake, that he believed as many as 500,000 people annually would eventually visit it to see the magnificent vistas and to fish and bathe in its clear waters.

L. M. Lawson and his assistant, J. L. Lytel, both former Reclamation officials, came to Washington in January on matters concerning the International Boundary Commission. They called on their former associates in the Bureau.



Photo of diorama of Boulder Dam and power plant at Museum of Science and Industry, Chicago, Ill.



ENGINEERING



Large Dams in the United States

WHEN dams are considered in terms of cubical contents or volume all other existing structures will look very small in comparison with the immense Fort Peck Dam now under construction on the Missouri River near Glasgow, Mont. It is difficult to visualize an earth embankment containing 100,000,000 cubic yards, 242 feet in maximum height, 100 feet thick at the crest, and 2,718 feet (over one-half mile) thick at the base, with a total length of 20,000 feet, or 3.8 miles. This comprises a main river section of 9,000 feet and a dike section on the west bank 11,000 feet in length. If piled on an ordinary city block, this yardage would form a solid block of dirt 4 miles high. Four dredges pump hydraulic-fill material at a rate of 3,000,000 cubic yards per month to build the embankment. The purpose of the project is to store flood waters to improve navigation, and the estimated cost is \$86,000,000.

At the present time the largest earth-fill dam in the United States (including possessions) is Gatun, in the Canal Zone, a semihydraulic fill structure 8,324 feet in length, almost as long as the main dam at Fort Peck, but only half the height, with a maximum of 115 feet. This embankment across the Chagres River contains 22,958,089 cubic yards of material, 12,229,104 cubic yards of which were dry fill. It also ranks as the largest earth-fill dam in the world at present writing. Completed in 1912, the storage permits slack-water navigation in the Panama Canal for 23 miles. In the States proper, the Saluda Dam on the Saluda River in South Carolina, with a volume of 11,000,000 cubic yards, is by far the largest. This is also a semihydraulic-fill structure and the middle third is an impervious sluiced core. Power development is the purpose of the project.

In California the San Gabriel Dam No. 1, now under construction, will be almost the size of Saluda with its 10,500,000 cubic yards of earth and rock. When completed it will be not only the largest but also the highest composite rock-fill and earth embankment in the world. Its purpose is flood control and it is being built by the Los Angeles County Flood Control District on the San Gabriel River. Salt Springs, also in California, is the largest

rock-fill dam with a volume of 3,000,000 cubic yards. Incidentally it is also the highest dam in the world of its type. The Army engineers have a second large dam under construction which is worthy of note, the Conchas on the Canadian River in New Mexico, an earth-fill embankment, which will contain 7,300,000 cubic yards. This is being built primarily for flood control.

Boulder Dam, recently completed by the Bureau of Reclamation, is outstanding among all dams in many respects, one of which is size. It far exceeds all other concrete masonry structures, having 3,250,335 cubic yards of concrete in the main structure. Next in line to Boulder is the Wilson Dam, near Florence, Ala., a straight gravity structure containing 1,400,000 cubic yards. This is a power and navigation development and was built by the Army engineers. The present structure at Grand Coulee on the Columbia River in Washington will almost equal Boulder in the quantity of concrete. When the first development is completed in 1937 at a cost of \$60,000,000 the structure, 177 feet in height, will contain 3,100,000 cubic yards of concrete. However, the size of Boulder Dam will seem insignificant when compared to the yardage in the ultimate Grand Coulee high dam, which will contain approximately 11,000,000 cubic yards. This is over three times the volume of concrete in Boulder, now the world's largest. It would build a highway, 16 feet in width, from Washington, D. C. to New Orleans to El Paso to Mexico City to Panama, a distance of 5,630 miles. The proposed Kennett Dam, on the Sacramento River, near Redding, Calif., one of the principal construction features of the Central Valley project, according to preliminary plans, will contain 3,420,000 cubic yards of concrete, which also exceeds Boulder.

The four large Ohio dams were built by the Miami Conservancy District to control floods on the Miami River and were all constructed of earth by the hydraulic-fill or semihydraulic-fill method. The Kensico Dam of the New York City water-supply system now ranks second to Boulder among the concrete masonry, nonoverflow dams with its 900,000 cubic yards and the New Croton Dam, of the same system, is nearly as large with

855,000 cubic yards of concrete. Elephant Butte on the Rio Grande with 618,536 cubic yards is the second largest concrete masonry dam completed by the Bureau of Reclamation. McKay Dam on the Umatilla irrigation project in Oregon, completed in 1926, is the largest earth fill structure the Bureau has built to date. It is a gravel embankment, one-half mile long, containing 2,304,000 cubic yards, the upstream slope being protected by a reinforced concrete slab, 8 to 12 inches in thickness.

The Tennessee Valley Authority has two noteworthy dams nearing completion, Norris on the Clinch River in Tennessee and Wheeler on the Tennessee River in Alabama. With its 1,195,000 cubic yards of concrete Norris ranks third in size among structures of this type. Both dams were designed by the Bureau of Reclamation engineers but are constructed by the Authority with day labor. A third important dam on the Tennessee River has just been started at Pickwick Landing, which will have an over-all length of 7,715 feet and a volume of over 1,000,000 cubic yards of concrete and earth. Other dams planned for early construction are Guntersville and Chickamauga on the Tennessee River and Fowler Bend on the Hiwassee in North Carolina.

The Santee-Cooper power and navigation project in South Carolina, recently authorized, includes construction of two large dams. Santee Dam, on the Santee River, will be 45 feet high, 30,000 feet long, and contain 7,305,000 cubic yards. Pinopolis Dam, on the Cooper River, will have a height of 80 feet, crest length of 7,000 feet, and will contain 2,660,000 cubic yards. The estimated cost of the project is \$37,500,000.

In the accompanying table only earth or rock-fill dams having a volume of 1,000,000 cubic yards or over, and concrete masonry dams of 500,000 cubic yards or over are listed. Of the 78 dams noted, 45 are located west of the Mississippi River. California leads other States with 19 of these large dams. Texas and New York have five, Ohio and North Carolina each have four, and Oregon, Idaho, Colorado, Massachusetts, and New Mexico have three each. Sixteen are Bureau of Reclamation dams (capitalized in the table).

TABLE 1

Name	State	River	Year completed	Purpose ¹	Type	Maximum height	Crest length	Volume	Cost
Fort Peck	Montana	Missouri	(3)	Nav., F. C., P., Irr.	Earth fill, hydraulic ⁴²	Feet 242	Feet 20,000	Cubic yards 100,000,000	\$86,000,000
Gatun	Canal Zone	Chagres	1912	R. R.	Earth fill, semihydraulic	115	8,324	22,958,089	9,626,678
Saluda	North Carolina	Saluda	1930	P.	do ⁴	208	7,800	11,000,000	6,000,000
GRAND COULEE ¹	Washington	Columbia	(2)	F. C., P., Irr.	Concrete, gravity, straight	550	4,200	11,000,000	113,676,000
San Gabriel No. 1	California	San Gabriel	(2)	F. C.	Earth and rock fill	381	1,520	10,260,000	15,746,251
Conchas	New Mexico	Canadian	(2)	F. C., Irr., W. S.	Earth fill	230	26,000	7,300,000	9,000,000
Wachusett North Dike	Massachusetts	Offstream	1905	W. S.	Earth fill, rolled, timber core	80	10,000	5,500,000	
Cajalco (Dike)	California	do	(2)	W. S.	Earth fill, rolled	97	7,574	4,169,200	8 6,500,000
Beaver Kill Dike ⁴²	New York	Beaver Kill	1912	W. S.	Earthfill	115	9,045	42 3,925,000	
Englewood	Ohio	Stillwater	1922	F. C.	Earth fill, semihydraulic ⁴	124	4,750	3,600,000	3,600,000
Calaveras	California	Calaveras Creek	1925	W. S.	do ⁴	220	1,200	3,461,000	3,888,125
Cajalco (Main Dam)	do	Offstream	(2)	W. S.	Earth fill, rolled	194	2,584	3,453,300	8 6,500,000
Bouquet Canyon	do	Bouquet Creek	1934	P.	Earth fill	228	1,950	3,421,300	3,007,586
KENNETT ³⁸	do	Sacramento	(2)	F. C., Irr., P.	Concrete, gravity, straight	420	2,430	3,420,000	60,600,000
BOULDER	Arizona-Nevada	Colorado	1935	F. C., Irr., P.	Concrete, arch-gravity	727	1,282	7 3,250,335	470,660,000
Standley Lake	Colorado	South Platte	1911	Irr.	Earth fill, puddled core, no rolling	113	6,630	3,250,000	2,800,000
Salt Springs	California	North fork of Mokelumne	1931	P.	Rock fill ¹⁰	332	1,300	3,000,000	6,930,000
Eagle Mountain	Texas	West Fork of Trinity	1933	W. S., F. C.	Earth fill, hydraulic	80	4,000	2,900,000	2,800,000
Lower San Fernando	California	Dry Wash	1920	W. S.	Earth fill, part hydraulic	130	2,000	2,577,800	1,037,432
Scituate	Rhode Island	Pawtuxet	1928	W. S.	Earth fill	180	3,200	2,500,000	3,500,000
Wyman	Maine	Upper Kennebec	1931	P.	do	115	2,250	2,500,000	
El Capitan	California	San Diego	1935	W. S.	Earth and rock fill, semihydraulic	270	1,230	12 2,400,000	3,124,905
McKAY	Oregon	McKay Creek	1926	Irr.	Gravel fill, concrete paving	160	2,600	2,304,000	1,901,000
San Pablo	California	San Pablo Creek	1920	W. S.	Earth fill, hydraulic	220	1,250	2,200,000	
Red Bluff	Texas	Pecos	(2)	Irr.	Earth fill, semihydraulic	104	9,150	2,200,000	2,600,000
Quabbin Dike	Massachusetts	Swift	(2)	W. S.	Earth fill, concrete core wall	120	1,800	2,100,000	
Garza	Texas	Elm Fork of Trinity	1926	W. S.	Earth fill, hydraulic	80	10,400	2,000,000	
TIETON	Washington	Tieton	1925	Irr.	Earth and rock fill, semihydraulic	222	905	1,995,000	3,756,256
Davis Bridge	Vermont	Deerfield	1924	P.	Earth fill, semihydraulic	200	1,250	1,900,000	
Olive Bridge (Dike)	New York	Offstream	1912	W. S.	Earthfill	70	3,650	11 1,840,000	
Catawba	North Carolina	Catawba	1919	P.	do	120	1,275	1,817,000	
Cobble Mountain	Massachusetts	Little	1931	W. S., P.	Earth fill, hydraulic	263	730	13 1,800,000	14 6,000,000
Lafayette	California	Lafayette Creek	1929	W. S.	Earth fill, rolled, puddled clay core	121	1,165	1,762,875	1,776,176
Dix River	Kentucky	Dix	1925	P.	Rock fill ¹⁵	270	1,910	1,747,000	7,000,000
ALAMOGORDO	New Mexico	Pecos	(2)	Irr.	Earth fill, rolled	135	1,550	1,660,000	3,465,000
BELLE FOURCHE	South Dakota	Owl Creek	1910	Irr.	Earth fill, rolled, timber core ¹⁶	122	6,200	1,600,000	1,230,922
ECHO	Utah	Weber	1930	Irr.	Earth fill, rolled	155	1,887	17 1,587,840	18 1,530,000
Big Meadows	California	North Fork of Feather	1927	P.	Earth fill, hydraulic	130	1,250	1,532,800	2,632,000
Wichita Falls	Texas	Big Wichita	1924	Irr.	Earth fill, part hydraulic	100	7,500	1,500,000	
ALCOVA	Wyoming	North Platte	(2)	Irr.	Earth fill, rolled, rock facing	232	900	1,500,000	3,339,000
Paddy Creek	North Carolina	Paddy Creek	1918	F. C.	Earth fill, semihydraulic	165	1,472	1,450,000	
Hardy	Michigan	Muskegon	1931	P.	do ¹⁰	120	2,800	1,410,000	
Wilson	Alabama	Tennessee	1924	Nav., P.	Concrete, gravity, straight, overflow	137	10 4,860	1,400,000	21 47,000,000
Huffman	Ohio	Mad	1922	F. C.	Earth fill, semihydraulic	73	3,600	1,396,000	1,880,000
Bridgeport	Texas	West Fork of Trinity	1931	W. S., F. C.	Earth fill, rolled	110	2,000	1,390,000	1,600,000
FRIANT ³⁵	California	San Joaquin	(2)	F. C., Irr., P.	Concrete, gravity, straight	252	3,800	1,328,000	13,646,000
Taylorville	Ohio	Miami	1922	F. C.	Earth fill, hydraulic	78	3,000	1,290,000	2,280,000
Linville	North Carolina	Linville	1919	P.	Earth fill, semihydraulic	160	1,250	1,250,000	
Upper San Leandro	California	San Leandro Creek	1926	W. S.	Earth fill, part hydraulic	215	660	1,248,000	
LOWER DEER FLAT	Idaho	Offstream	1908	Irr.	Earth fill, rolled	40	7,200	1,207,606	337,104
San Gabriel No. 2	California	San Gabriel	1935	F. C.	Rock fill ¹²	285	800	1,200,000	3,007,586
Norris	Tennessee	Clinch	(2)	F. C., P.	Concrete, gravity, straight	266	1,872	1,195,000	13 1,800,000
UPPER DEER FLAT	Idaho	Offstream	1908	Irr.	Earth fill, rolled	70	4,000	1,190,275	325,675
Oakley	do	Goose Creek	1913	Irr.	Earth fill, rolled, concrete core wall	145	1,050	1,145,200	
Wrightsville	Vermont	North Fork Winoski	1935	F. C.	Earth fill, rolled	150	1,400	1,140,000	
Santiago	California	Santiago	(2)	Irr.	Earth fill, concrete slab upstream	160	1,400	1,105,700	900,000
Tygart River	West Virginia	Tygart	1932	F. C.	Concrete, gravity, straight	235	1,850	1,100,000	31 15,700,000
Pickwick Landing	Tennessee	Tennessee	(2)	Nav., F. C., P.	Concrete, gravity, straight and earth embankments	110	36 7,715	37 1,064,000	14 40,910,143
Lake Arrowhead	California	Little Bear Creek	1922	P.	Earth fill, hydraulic	200	720	1,000,000	
Somerset	Vermont	Branch of Deerfield	1913	P.	Earth fill, semihydraulic	106	2,080	1,000,000	
Lockington	Ohio	Laramie Creek	1921	F. C.	Earth fill, hydraulic	78	6,400	1,000,000	1,280,000
TAYLOR PARK	Colorado	Taylor	(2)	Irr.	Earth fill, rolled	168	600	1,000,000	2,000,000
Cherry Creek	do	Cherry Creek	(2)	F. C.	Earth fill		3,600	1,000,000	
Kensico	New York	Bronx	1916	W. S.	Concrete, gravity, straight ²³	307	1,843	900,000	6,735,000
New Croton	do	Croton	1927	W. S.	do ²⁴	297	710	855,000	7,631,185
Conowingo	Maryland	Susquehanna	1928	P.	do	105	28 4,648	684,000	
Hetch Hetchy	California	Tuolumne	(3) ²⁴	W. S., P.	Arch-gravity	429	900	652,516	10,000,000
Wheeler	Alabama	Tennessee	(2)	Nav., F. C., P.	Concrete, gravity, straight	62	29 6,400	650,000	14 42,888,500
ELEPHANT BUTTE	New Mexico	Rio Grande	1916	Irr.	do	306	1,155	618,536	4,149,180
Pardee	California	Mokelumne	1929	W. S.	Concrete, arch-gravity	358	1,337	617,700	6,240,000
ARROWROCK	Idaho	Boise	1915	Irr.	do	29 351	1,100	602,230	4,927,710
Bonneville	Oregon-Wash	Columbia	(2)	P., Nav.	Concrete, gravity, straight	170	1,250	596,500	32 31,000,000
Bagnell	Missouri	Osage	1931	P.	do	148	27 2,543	551,000	30,000,000
OWYHEE	Oregon	Owyhee	1932	Irr.	Concrete, arch-gravity	405	840	550,000	5,378,125
Keokuk	Iowa-Illinois	Mississippi	1913	P.	Concrete, gravity, straight	53	28 4,578	550,000	
Yadkin Narrows	North Carolina	Yadkin	1919	P.	Concrete arch-gravity	217	1,400	525,000	
Madden	Canal Zone	Chagres	1934	P., F. C.	Concrete, gravity, straight	223	974	523,768	14 13,000,000
Olive Bridge	New York	Esopus Creek	1912	W. S.	do ⁴⁰	252	1,000	510,000	

¹ Includes possessions.² F. C.—Flood control, P.—Power, Irr.—Irrigation, W. S.—Water supply, R. R.—River regulation, Nav.—Navigation.³ Under construction.⁴ Puddled clay core.⁵ Puddled or rolled fill 200,000 cubic yards.⁶ Lower half, hydraulic fill; upper half, dry earth and rock fill.⁷ 4,400,000 including appurtenant works.⁸ Cost of both Cajalco Dam and Dike.⁹ Preliminary data only. 177-foot dam (3,100,000 cubic yards) costing \$60,000,000 now authorized.¹⁰ Upstream slope paved with 15-foot layer of placed rock surfaced with concrete slab.¹¹ Maximum head.¹² 1,500,000 earth, 850,000 rock, 50,000 concrete.¹³ Includes 400,000 cubic yards of rock.¹⁴ Includes cost of power plant.¹⁵ Upstream slope has hand-packed rock faced with concrete.¹⁶ Concrete blocks on upstream face.¹⁷ Concrete 9,260, rock 221,410, earth 1,357,170.¹⁸ \$228,000 additional for reservoir.¹⁹ Steel-sheeting cut-off.²⁰ Includes 900-foot powerhouse section.²¹ \$37,000,000 charged to power.²² Concrete facing on upstream slope.²³ Upstream face, precast concrete blocks.²⁴ Stone masonry facing.²⁵ Includes 2,385-foot spillway, 1,313-foot retaining section, 950-foot headworks.²⁶ Now being raised from 349 to 354 feet.²⁷ Includes 620-foot spillway, 1,512-foot retaining section, 511-foot powerhouse.²⁸ 4,288-foot spillway section and 290-foot solid gravity abutment section.²⁹ Overall length, includes nonoverflow sections, spillway 2,700 feet, powerhouse 613 feet, and lock.³⁰ 26,000 feet includes wing dams.³¹ Dam proper \$6,249,000.³² Cost of entire project.³³ Steel sheet-piling cut-off.³⁴ Now being raised 85 feet.³⁵ \$36,603,907 including power development.³⁶ Includes intakes and lock, spillway 1,156 feet, earth embankments 4,682 and 890 feet, bulkhead 266 feet.³⁷ From War Department report.³⁸ Preliminary data only.³⁹ 9,000 feet main river section, 11,000 feet dike section.⁴⁰ Faced with concrete blocks.⁴¹ 40,000 concrete, 1,800,000 earth.⁴² 175,000 concrete, 3,750,000 earth.⁴³ West and middle dikes.⁴⁴ Not including interest during construction.

The Sautet Dam—Highest Dam in France

THERE has recently been completed in France, by the French power company, Societe des Forces Motrices Bonne et Drac, a concrete arch dam, having a maximum height of 414 feet above foundation. This is 9 feet higher than Owyhee, and is outranked in height only by Boulder.

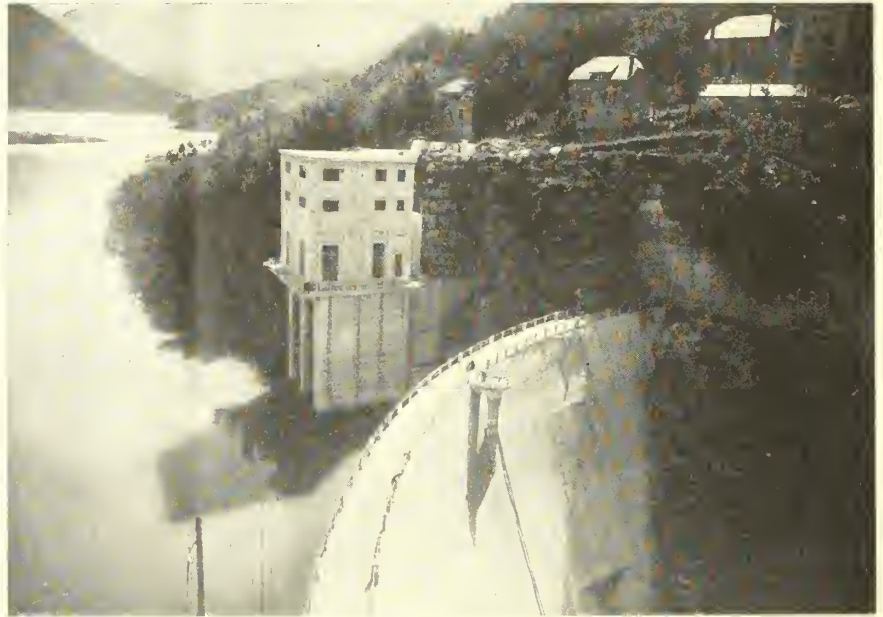
Location.—The Sautet Dam is located in the narrow canyon of the Drac River, tributary of the Rhone, French Alps, about 45 miles southeast of Grenoble. The canyon is only 25 to 50 feet wide, but spreads out above the midheight of the dam, resulting in a crest length of 262 feet. The walls of the canyon are of a sound compact limestone formation without faults or other imperfections.

Designs.—The peculiar topography and geology of the site necessitated considerable grouting and suggested the following design for the dam: (1) An effective so-called "active" arch, varying in thickness from 10 feet at the crest to 56 feet at the base, constructed of vibrated concrete containing from 368 to 460 pounds of portland cement per cubic yard; (2) a massive block concrete containing less cement, most of it containing only 300 pounds of portland cement per cubic yard, which backs the "active" arch and is bracketed within the canyon walls. With this block the over-all thickness of the dam varies from 246 feet at the base (which is 5 to 10 times the lower length of the dam) to a 10-foot thickness at the crest.

Quantities.—The total volume of concrete in the dam is 130,400 cubic yards; the excavation amounted to 30,700 cubic yards. The concrete was of unusually dense and dry mix and had to be deposited with 2½-yard buckets, in layers about 1 foot thick, subsequently vibrated where necessary, with compressed air "vibroplis", weighing 175 to 220 pounds, which operated at a pressure of 70 to 85 pounds per square inch. The concrete is good for over 2,800 pounds per square inch, while the average stress in the "active" arch is only 285 pounds per square inch.

Expansion joints.—Two expansion joints, about 32 inches wide, commence at the crest and end about 150 feet lower. The lateral surfaces of the gaps made by these joints are corrugated.

Strain testing instruments.—Many types of mechanical and electrical testing apparatus have been installed in the dam, most of them in a special chamber just back of the "active" arch near its midheight; included is a Coyne deformer, which utilizes the variation in the musical pitch of a metallic string vibrated



by an electromagnet to measure strains. Altogether there were 66 devices for measuring strain, temperature, and deflection.

Spillway.—The Drac at Sautet drains an area of 382 square miles, which has been known to yield a maximum of 74 cubic feet per second per square mile. The spillway of the reservoir was designed for an actual capacity of 56,500 cubic feet per second, or 148 cubic feet per second per square mile—which is twice the maximum flood observed.

Outlet works.—At a level of 302 feet below its crest the "active" dam is traversed by two circular outlets, 5.4 feet in diameter, having a capacity of 2,825 cubic feet per second, which discharge into a much larger culvert located in the body of the backing block of the dam.

The wasteways consist of 2 concrete-lined tunnels, 409 to 947 square feet in cross section, nearly 1,000 feet long, discharging into the canyon at a height of 230 feet above the river bed.

Another outlet is afforded by a concrete-lined tunnel, 19.7 feet in diameter, 1,250 feet long, which was used to divert the Drac during construction. Its capacity is 11,650 cubic feet per second, which permits the reservoir to be entirely drained in 9 to 13 days, depending on the flow of the river. At about 500 feet from its inlet this outlet is controlled by a system of sluices and valves, where the flow may be diverted into heavily reinforced pressure conduits that may act as scouring outlets.

Reservoir capacity.—The total capacity of the Sautet reservoir is 106,000 acre-

feet, of which only 82,000 acre-feet are counted on for generation of power. The lower 24,000 acre-feet of the volume of the reservoir is expected to silt up in the course of a hundred years or so.

Powerhouse.—The powerhouse is located 230 feet downstream from the dam and straddles the river gorge by means of a concrete arch foundation having a clear span of 120 feet. Admission to the powerhouse is by a vertical shaft 13.1 feet in diameter, 426 feet deep. Two high-speed elevators are operated in this shaft. The powerhouse contains six double-runner Francis turbine or generator units, each of 13,250 kilovolt-amperes, running at 500 revolutions per minute under a head that varies from 174 to 305 feet, depending on the lake level.

Correction

The following changes should be made in the table of "High Dams in the United States", published in the January ERA.

Calderwood Dam has a crest length of 897 feet and the volume is 280,000 cubic yards. Santeetlah Dam, completed in 1928, on the Cheoah River, is 200 feet in height, 1,150 feet long, and has a volume of 214,000 cubic yards. Cheoah Dam, completed in 1919, is 230 feet high, 770 feet long and the volume is 200,000 cubic yards.

Olive Bridge Dam has a crest length of 1,000 feet and volume of 510,000 cubic yards. Yadkin Narrows should not be capitalized.

Progress at Casper-Alcova

By H. W. Bashore, Construction Engineer

WORK now is underway on all the major engineering features of the Casper-Alcova project, which was started with a \$7,000,000 Public Works allotment and for which later an additional \$8,000,000 was made available from work relief funds.

The project is located in Carbon and Natrona Counties, Wyo. The portions of the project in Carbon County are the Seminole Dam, power plant, reservoir, and many miles of telephone and transmission lines extending north to the Natrona County line and south to the Union Pacific Railroad and towns lying east and west of that railroad.

The portions of the project lying in Natrona County are the Alcova diversion dam, the Casper main canal, the lateral distribution system, and transmission and telephone lines.

The project is to be constructed in two units covering 35,000 and 31,000 acres, respectively. The lands in the first unit lie west of the North Platte River and extend from Alcova to Middle Casper Creek. The most westerly irrigated area at the northern boundary of the first unit will be about $1\frac{1}{2}$ miles east of Bucknum, or about 13 miles west and 11 miles north of Casper. The second unit embraces several thousand acres lying east of the North Platte River between Bates Creek and Alcova, and those lands lying west and north of Casper, extending from Middle Casper Creek to a line about 3 miles east of Casper and at a maximum distance of about 8 miles north of Casper.

PRINCIPAL FEATURES

Seminole Dam and power plant are to be constructed across the North Platte River at a point about 26 miles north and 12 miles east of Parco, Wyo. The dam will be a concrete arch about 250 feet in height above the foundation and will create a reservoir capacity of 1,020,000 acre-feet. This reservoir will supply storage water for the lands to be irrigated and, with a power plant having an installed capacity of 37,500 kilowatts, will incidentally permit an annual power output of 140,000,000 kilowatt-hours.

The estimated cost of the dam, power plant, substation, and transmission lines is about \$8,500,000. Work has been in progress since the fall of 1933 in connection with this feature on miscellaneous items such as building roads and trails, foundation drillings, clearing reservoir, gravel pit explorations, camp construction, and telephone and electric line construction. The direct expenditures for labor on this work to November 1,

1935 amounted to \$200,932, the total number of man-hours of employment to 303,300, and the average wage 66 cents an hour. Bids were opened in the Casper office November 26, 1935, for construction of the dam and power plant. The contract was awarded in December to the Morrison Knudsen Co., of Boise, Idaho, the Utah Construction Co., of Ogden, Utah, and the Winston Brothers Co., of Minneapolis, Minn., on their joint bid of \$2,759,804.50, which was low among those submitted. The contractor will have 1,150 days in which to complete this work. It is estimated that the direct employment to be provided on this work, exclusive of the work now completed, will amount to 4,050,000 man-hours and the peak number of men to be employed will be about 400.

Alcova Dam is located about 30 miles southwest of Casper. The dam will be an earth, gravel, and rockfill embankment 235 feet in height above the foundation and will raise the river 169 feet, to provide diversion into the Casper Canal. It is estimated to cost \$3,500,000. The first contract in connection with this work was awarded late in 1933 and under its provisions the diversion tunnel was completed. The contract for the construction of the dam proper and all appurtenances was awarded several months ago to the W. E. Callahan Construction Co. and Gunther & Shirley, of Los Angeles, and work is now underway on the foundation. The contractor is now employing 250 men. The direct expenditure for labor on this work to November 1, 1935, amounted to \$274,032; the total number of man-hours to 424,660, and the average wage to 64½ cents per hour. It is estimated that the construction of the Alcova diversion dam, exclusive of work then completed, will provide about 3,700,000 man-hours of direct labor and will require a peak employment of about 350 men.

Casper Canal system, which is the main canal of the distribution system, will extend, for the first unit, from Alcova to Middle Casper Creek, a distance of 62 miles. This canal at the head is 34 feet wide on the bottom with a water depth of 10 feet. This canal traverses very rough topography and numerous reinforced concrete structures such as siphons and culverts will be necessary. Throughout its length there will be a total of six tunnels. Two of these occur in the first $3\frac{1}{2}$ miles leaving Alcova, and have been completed along with this portion of the canal. The direct expenditure for labor on this work to November 1, 1935, amounted to \$351,816;

the total number of man-hours to 534,397 and the average wage to 66 cents per hour.

Bids were opened at Casper on November 25, 1935, for construction of the four remaining tunnels. The contract was awarded in December to Callahan, Gunther & Shirley on a bid of \$794,948, which was the low proposal submitted. The contractor has 750 days to complete this work. This job will require about 445,000 man-hours of labor and will employ a maximum of about 300 men.

The excavation of the open section of the Casper Canal, the construction of the lateral distributaries with appurtenant structures and the excavation and construction of all drainage ditches and necessary structures will be performed by Government forces. Two Government-owned draglines were shipped in from Montana and two more were trucked in from Riverton, Wyo., for this work. These machines are electrically operated and additional transmission lines were constructed from the existing main line to the machines. The entire canal and drainage system is estimated to cost about \$8,000,000. On the canal, lateral, and drainage systems, exclusive of work already completed and the work contracted for on the four tunnels, there will be about 3,134,000 man-hours of labor and about 300 men will be employed for a period of 4 years.

The direct employment on the Casper-Alcova project to November 1, 1935, was 1,262,000 man-hours. The potential employment in the features to be completed amounts to 11,329,000 man-hours.

Notes for Contractors

Casper-Alcova project, Wyoming.—Lincoln Steel Works, of Lincoln, Nebr., was the successful bidder on furnishing 953,929 pounds of reinforcing steel bars, under Invitation No. 22,231-A, opened at Denver on December 11. The low bid was \$28,633.92 f. o. b. Casper, Wyo., shipping from Minnequa, Colo. The next low bid of \$28,694.10 was submitted by B-D-R-Materials, Inc., Kansas City, Mo. The following companies submitted identical bids of \$29,683.25: Republic Steel Corporation, Youngstown, Ohio; Soule Steel Co., San Francisco, Calif.; Joseph T. Ryerson & Son, Inc., Chicago, Ill.; Laclede Steel Co., St. Louis, Mo.; Judson Steel Corporation, Oakland, Calif.; Concrete Steel Co., Chicago, Ill.; Jones & Laughlin Steel Corporation, Pittsburgh, Pa.; Columbia Steel Co., San Francisco, Calif.; Sheffield

Steel Corporation, Kansas City, Mo.; The Youngstown Sheet & Tube Co., Youngstown, Ohio; Inland Steel Co., Chicago, Ill.; Missouri Rolling Mill Corporation, St. Louis, Mo.; Pacific Coast Steel Corporation, San Francisco, Calif.; Concrete Engineering Co., Inc., Omaha, Nebr.; Carnegie-Illinois Steel Corporation, Denver, Colo.; Colorado Fuel & Iron Products Co., Denver, Colo. All bidders agreed to equalize freight rates and allowed discount of one-half of 1 percent discount on basing point values.

Seventeen bids were received at Denver on December 5, under Specifications No. 749-D, for furnishing dragline excavators and power shovels. The following contracts have been awarded: Schedule no. 1, item 1, $\frac{3}{4}$ -yard dragline excavator, The General Excavator Co., Marion, Ohio, \$7,476.55; schedule no. 2, item 2, $\frac{1}{2}$ -yard dragline excavator, Bay City Shovels, Inc., Bay City, Mich., \$5,450; schedule no. 3, item 4, $\frac{3}{8}$ -yard power shovel, and schedule no. 4, item 6, $\frac{3}{8}$ -yard power shovel, Harnischfeger Sales Corporation, Milwaukee, Wis., \$9,890.

Boulder Canyon project, Arizona-Nevada.—Bids were opened at Denver on January 2 for furnishing ventilating ducts and exhaust fans for tunnel plug outlet works and penstock tunnels at Boulder Dam, under Specifications No. 755-D. The following bids were received for items 1 and 2 calling for two and four systems ventilating duct, respectively: Andel & Co., Chicago, Ill., \$2,990 and \$37,845; Electric Ventilating & Engineering Co., Inc., New York, N. Y., \$2,280 and \$20,647, combination \$22,400; Paper, Calmenson & Co., St. Paul, Minn., \$3,369 and \$53,724, combination \$55,593; J. Herman Co., Los Angeles, Calif., \$1,210 and \$27,700; Consolidated Steel Corporation, Ltd., Los Angeles, Calif., \$1,687 and \$32,625; Rees Blow Pipe Manufacturing Co., Inc., Los Angeles, Calif., \$1,500 and \$21,995, combination \$23,395. Bids for items 3 and 4 calling for two and four exhaust fans, respectively, were as follows: American Blower Corporation, Detroit, Mich., \$395 and \$2,474, combination \$2,869, all f. o. b. Boulder City; Electric Ventilating & Engineering Co., Inc., \$522 and \$3,694 f. o. b. Boulder City; Hendrie & Bolthoff Manufacturing & Supply Co., item 4, \$2,560 f. o. b. Boulder City; Consolidated Steel Corporation, Ltd., Los Angeles, Calif., \$825 and \$3,989; Rees Blow Pipe Manufacturing Co., Inc., Los Angeles, Calif., item 3, \$768 f. o. b. Berkeley, Calif., item 4, \$2,668 f. o. b. Boulder City; B. F. Sturtevant Co., Inc., Kansas City, Mo., item 4, \$2,450 f. o. b. Boulder City; Clarage Fan Co., Kalamazoo, Mich., item 4, \$2,805 f. o. b. Boulder City. The Rees Co. also submitted combination bids

of \$25,895 for items 1, 2, and 4, f. o. b. Berkeley, Calif., and \$26,645 for all four items, f. o. b. Boulder City. Contracts have been awarded as follows: J. Heeman Co., item 1, \$1,210; American Blower Corporation, items 3 and 4, \$2,869.

Only two manufacturers submitted bids on supplying 30-inch motor-operated gate valves for station service penstocks at Boulder Dam (Specifications No. 754-D), bids opened at Denver on December 30. Chapman Valve Manufacturing Co., Indian Orchard, Mass., bid \$9,114 on schedule 1, item 1 (three valves for emergency operation) and \$17,688 on schedule 1, item 2 (six valves for emergency operation), both bids f. o. b. Boulder City. The bids under schedule 2 for item 3 (three valves for balanced pressure) and item 4 (six valves for balanced pressure) were as follows: Chapman Valve Manufacturing Co., \$8,574 and \$16,808 f. o. b., Boulder City; Crane-O'Fallon Co., Denver, Colo., \$8,580 or \$9,240, and \$15,900 or \$17,220, all f. o. b., Boulder City.

Salt River project, Arizona.—The Valley Iron Works, Yakima, Wash., submitted low bid on supplying motors, replacement parts, and gate position indicators for alterations to spillway radial gates and hoists at Stewart Mountain Dam (Specifications No. 751-D). Their bid was \$10,200 f. o. b. Yakima.

On February 5 bids were opened at Phoenix, under Specifications No. 663, for alterations to the spillway at Roosevelt Dam. The principal items of work and estimated quantities involved are as follows: 70 cubic yards of excavation for spillway aprons; 610 cubic yards of excavation of old concrete and stone masonry; 2,300 square yards of chipping and roughening surfaces of old concrete; 850 cubic yards of concrete; 2,160 square yards of gunite; drilling holes for and installing 3,900 anchor bolts of reinforcement bars; placing 96,000 pounds of reinforcement bars; drilling 1,700 linear feet of holes for anchor bars; installing 46,000 pounds of radial gate hoists; installing 570 pounds of pipe handrails; dismantling, altering, reinstalling, and painting radial gates; dismantling old radial gate hoists; and installing electrical circuits and apparatus. The work must be completed within 200 days after date of receipt of notice to proceed.

Frenchtown project, Montana.—Three contractors submitted bids for construction of diversion works and structures, main canal, under Specifications No. 662, bids opened at Missoula on January 3. The bids were as follows: Bates & Hale, Missoula, Mont., \$48,329.50; Barnard-Curtis Co., Minneapolis, Minn., \$51,598.30; Nick Burggraf, Inc. and J. W. Brennan, Idaho Falls, Idaho, \$62,499.20.

Carlsbad project, New Mexico.—Bids received at Carlsbad on December 21 for construction of the Alamogordo Dam, under Specifications No. 660, were as follows: Hallett Construction Co., Crosby, Minn., \$1,132,547; Mittry Bros. Construction Co., Los Angeles, Calif., \$1,144,000; Macco Construction Co., Clearwater, Calif., \$1,231,849.50; Martin Wonderlich Co., Jefferson City, Mo., \$1,243,380; S. J. Groves & Sons Co., Minneapolis, Minn., \$1,252,310; Hinman Bros. Construction Co., Denver, Colo., \$1,293,880; Hardwich & Co., St. Louis, Mo., \$1,340,890; W. E. Callahan Construction Co., Dallas, Tex., \$1,345,675; Ed H. Honnen Construction Co., Colorado Springs, Colo., \$1,368,355; Utah Construction Co., Ogden, Utah, \$1,498,400; Three Companies, Denver, Colo., \$1,518,294; Geo. W. Condon Construction Co., Omaha, Nebr., \$1,637,065; Frazier-Davis Construction Co., St. Louis, Mo., \$1,777,212.50.

Boise project, Idaho.—Four bids were opened at Boise, Idaho, on December 21, under Specifications No. 661, for raising the Arrowrock Dam, as follows: T. E. Connolly, Inc., San Francisco, Calif., \$395,040; Utah Construction Co., Ogden, Utah, and Morrison-Knudsen Co., Inc., Boise, Idaho, \$519,352.50; Case Construction Co., Inc., Alhambra, Calif., \$542,738.40; Colonial Construction Co., Spokane, Wash., \$576,022.50. The Secretary on January 8 approved award of contract to T. E. Connolly.

Owyhee project, Oregon-Idaho.—Bids were opened at Ontario, Oreg., on February 4 for the construction of earthwork, concrete lining and structures, Locket Gulch wasteway channel, Mitchell Butte division (Specifications No. 760-D). The principal items of work and estimated quantities of work involved are as follows: 29,000 cubic yards of all classes of excavation for wasteway channel; 260 cubic yards of all classes of excavation for structures; 1,000 cubic yards of backfill about structures; 6,400 square yards of trimming wasteway channel for concrete lining; 400 cubic yards of concrete in structures; 800 cubic yards of concrete in wasteway channel lining; 175 square yards of dry-rock paving; placing 126,000 pounds of reinforcement bars; constructing 2,570 linear feet of clay sewer pipe underdrains; and erecting 4,000 feet board measure of timber in structures. The work must be completed within 150 days from date of receipt of notice to proceed.

Colorado River project, Texas.—On February 3 bids were opened at Austin, Tex., for clearing 15,800 acres in the Hamilton reservoir site (Specifications No. 667). The work must be completed within 550 days from the date of receipt

(Continued on p. 55)

Progress of Investigations of Projects

Silt Survey—Colorado River, Ariz.-Calif.—Surveys and borings along the Colorado River between the Parker and Imperial Dam sites to determine the effect of desilted water released from the Parker reservoir on the river channel have been completed. The maps and profiles have been prepared and forwarded to the Denver office.

Weiser-Payette, Idaho.—The canal and pump site location surveys to carry water from the Phyllis canal to Deer Flat reservoir were completed. Surveys were made to ascertain the possibility of pumping water from Snake River. One line to Deer Flat reservoir involved 4 miles of canal, a mile of tunnel, and two pumping lifts. An additional pumping lift was located which would permit water to be pumped into the Mora canal. Another line to pump water from Snake River into the Mora canal at a point near Bowmont involves three lifts totaling 435 feet and 11.5 miles of canal. A 60-foot contour was run on the proposed reservoir site above Twin Springs.

Gallatin Valley, Mont.—Investigations were continued of dam sites along the Gallatin River for use in furnishing a supplemental supply to develop lands in the Gallatin Valley. Hole No. 1, at the lower basin dam site, is being drilled at an angle of 39° with the horizontal. It reached a depth of 195 feet in the Madison limestone formation by the end of the month. At 135 feet leakage was unusual and coloring placed in the hole came out in one of the several springs by the river, indicating that the water was following a bedding plane at that point. A test pit crew of seven men started on December 12, to uncover rock on the west side of the canyon. The topographic survey of the reservoir site was continued throughout the month.

Madison River Diversion, Mont.-Idaho.—Investigation is being made to determine the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henrys Lake, Idaho. Field surveys on these investigations have been completed. Water supply studies to determine the amount of water available for diversion will be completed upon the receipt of data from the Montana State officials stating the conditions under which transmountain diversions will be permitted.

North Unit Deschutes, Oreg.—The survey party which located 31.4 miles of north unit main canal last month completed 20.8 miles in December, of which 3.9 miles were alternate location. From the point near the railroad bridge the line runs on a flat gradient near the rim of Crooked Creek Canyon. It crosses

Osborn Canyon in an 1,100-foot siphon. It passes around the head of the next two canyons. The next construction of note is a 40-foot cut. The line crosses the railroad approximately on grade. It contours easterly along the north side of Juniper Butte. At one point it drops into a ravine and comes out with a very crooked line for which alternate locations have been run in the hope of saving rock cuts. Beyond this the canal drops into another rocky ravine and follows this natural rock channel to its mouth. This is mile 51.3 of the line. Canal test pits were continued at 200-foot intervals to mile 37.4 and at 400-foot intervals beyond. In some of the deeper cuts, holes were drilled in the bottom of the pits to ascertain the presence of hardpan and rock. Total length of canal thus explored was 21.7 miles, making 49.6 miles to date. The soil auger party completed its work December 31. Holes were put down in the middle and at the four corners of each 40 acres to a depth of 3½ feet or to hardpan. A total of 36,480 acres was covered in December, making a total of 74,838 acres to date. A plane table party is following the soil survey and mapping the boundaries of irrigable and interior nonirrigable areas. A total of 25,310 acres was mapped in December, making a total of 39,260 acres to date.

Rapid City, S. Dak.—Work on these investigations has not been started.

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California: The 1936 Agricultural outlook for California, Circular No. 94, California Agricultural Extension Service, College of Agriculture, University of California, December 1935, 74 pages, charts.

Columbia Basin Project: Preparing millions of yards of aggregate for Grand Coulee Dam, illus., Western Construction News, Nov. 1935, v. X, no. 11, pp. 310-315.

Department of Agriculture, Farmers Bulletin No. 1749, Modernizing Farm Houses, by Wallace Ashby and Walter H. Nash, Bureau of Agricultural Engineering, 61 pp., November 1935. For sale by Superintendent of Documents, Washington, D. C. Price 5 cents.

Grand Coulee Concrete Number. Pacific Builder and Engineer, illus., Jan. 4, 1936, v. 42, no. 1, pp. 30-36. Manufacture 4,500,000 cubic yards of concrete for Coulee Dam, pp. 32-34. Westmix—The House of Magic, pp. 32-34. Pouring the first forms for the base of Grand Coulee, pp. 35-36.

Hovey, Otis E: Steel Dams, illus., O. E. Hovey, American Steel Institute, N. Y., 1935, 122 pages with index. (Describes: Ash Fork, Redridge, Kent's Falls, Lower Olay, Sevier River, Skagway, Penrose-Rosemont, and El Vado, Chieopee, Bonnet Carré, Fort Peck, and Iselta Dams.)

Kirman, Richard, Governor, Chairman: Report of the Colorado River Commission of Nevada, Jan. 1, 1927, to Sept. 1, 1935, 179 pages with maps. Collaboration aided by John A. Fulton, Robert A. Allen, and Jay A. Carpenter.

Lane, E. W.: Recent studies on flow conditions in steep chutes, illustrated, Engineering News-Record, Jan. 2, 1936, v. 116, pp. 5-7.

Mair, Walter E.: World's greatest dam (Grand Coulee), to create an electrified paradise, illus., Popular Science, Feb. 1936, v. 128, no. 2, pp. 11-13, 100.

National Resources Board: Report on State Planning, June 1935, 310 pages, Chapter on Reclamation, pp. 151-161.

Nelson, Wesley R.: Construction of the Boulder Dam—How the \$35,000,000 power plant will appear when completely equipped, illus. Compressed Air Magazine, Nov. 1935, v. 40, no. 11, pp. 4881-4888. (21st of a series of articles on the Boulder Canyon project.)

Siltometer: A siltometer for studying size distribution of silts and sands, Amar Nath Puri, Research Publication No. 7, vol. II, Nov. 1934, Punjab Irrigation Research Institute, Lahore, India, 6 pages and 4 charts.

Victoria, Australia: Thirtieth annual report, State Rivers and Water Supply Commission, Victoria, Australia, 1934-1935, R. H. Horsfield, Chairman, 42 pages, chart, and maps.

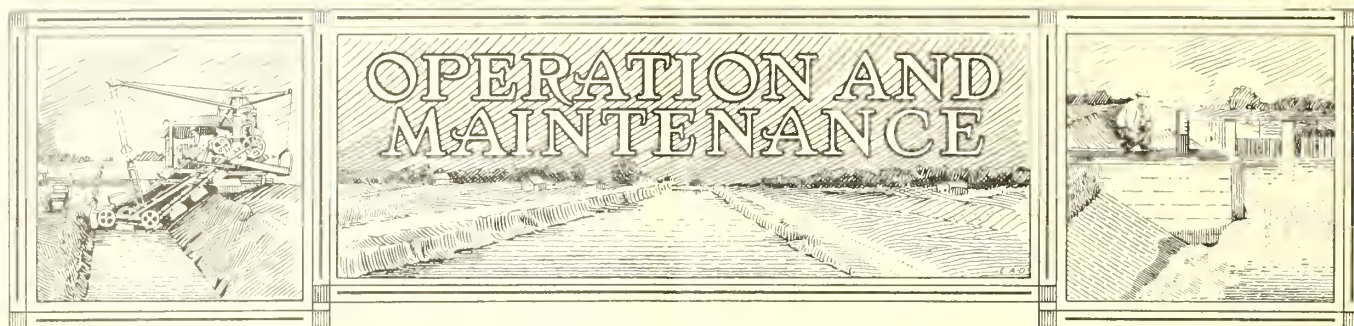
Young, Walker R.: Boulder Dam, past construction and work yet to be done, illus., Engineering News-Record, Dec. 26, 1935, v. 115, pp. 878-883.

Notes for Contractors

(Continued from p. 54)

of notice to proceed. This is the first construction job on this project to be advertised for bids.

All-American Canal project, California.—Bids were opened at Yuma, Ariz., on February 6 for the construction of earth lining, station 419 to station 601 and station 803 to station 1245. The principal items of work and estimated quantities involved are as follows: 225,000 cubic yards of compacted earth lining; and 81,000 cubic yards of uncompacted earth lining. The clearing is required to be completed within 450 days from date of receipt of notice to proceed.



Know Your Weeds

(Continued from January issue)

By L. H. Mitchell, Field Supervisor, District No. 4

SIMULTANEOUSLY with the work of controlling weeds on ditch banks, highways, vacant farms, and other gardens for their growth, farmers should be eradicating, or at least controlling, the weeds in their fields. As different methods are required to kill various weeds, obviously farmers should familiarize themselves with the many varieties and the habits of at least the most noxious and dangerous weeds. This is not a difficult task if given only a little attention.

The field supervisors of operation and maintenance, the project managers, and, if available, agricultural extension agents, should be the leaders or contact men working cooperatively in any educational campaign or school, teaching the farmers how to distinguish and extinguish the noxious weeds, especially the perennials.

DEFINITION OF A WEED

Dictionaries define a weed as any harmful or useless plant; a wild plant which hinders the growth of cultivated ones; anything useless or troublesome.

Alfalfa, brome grass, and the various clovers in a beet field, are harmful, useless, and troublesome, and therefore may be classed as weeds. However, as these

are not wild plants, farmers should encourage the growth of such plants on ditch banks, highways, and other uncultivated places. Although perhaps not harmful, and in some instances being used as a green manure crop in maintaining the fertility of the soil, wild plants (weeds) in an orchard should give way to the tame plants, sweetclover, for example, that will serve the same purposes, because the wild ones can easily be spread to adjoining farm lands not in orchards and cause a great amount of damage. On one of the Bureau's projects in Colorado many orchards during the summer of 1935 were gardens for weeds of many kinds and descriptions. These weeds after having matured were plowed and otherwise worked into the soil to give ventilation, to increase organic matter and nitrogen, and to do other things that would benefit the conditions of the soil. And this project in Colorado was not alone in its method of using weeds for a cover crop in orchards. But what about the farmers below such orchards who are general farmers and who are suffering the loss of crops and livestock on account of the continuous appearance of weeds? This is just another example of how our farmers

could and should be weed conscious and work cooperatively for the good of the community. Our southern projects seed pastures and lawns to Bermuda grass. On the Orland project this grass is a pest.

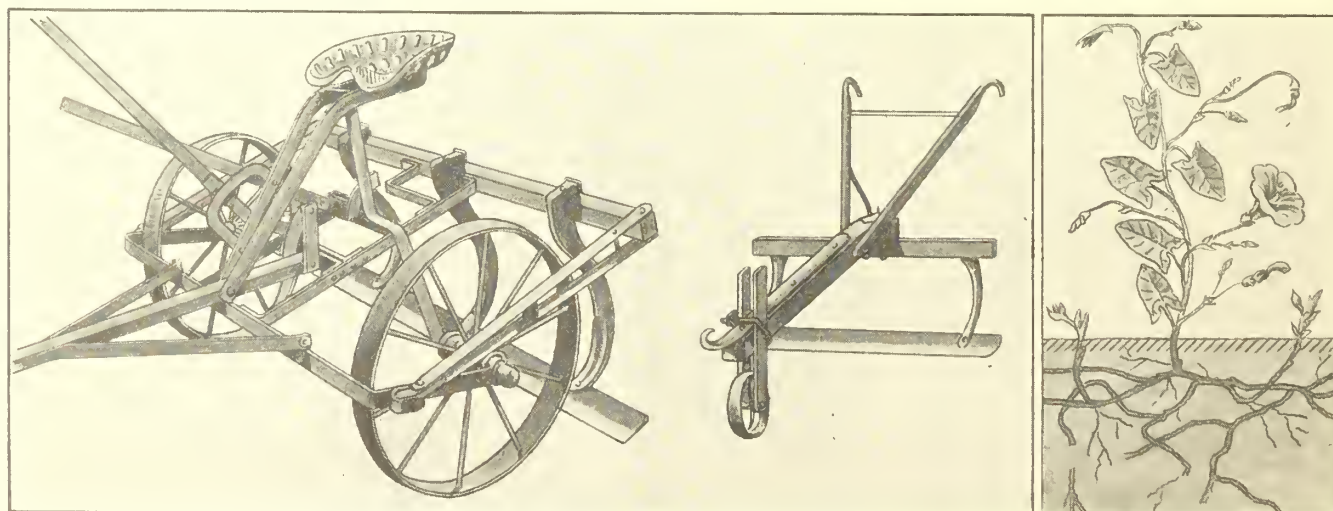
DESCRIPTION OF WEEDS

Annual.—A plant that lives only 1 year and depends upon seeds for reproduction. Examples: sunflower, wild oats, puncture vine, and Russian thistle.

Biennial.—A plant that requires two seasons to complete its growth, using the first year in storing up food and the second in completing its work of maturing seeds. Examples: Wild parsnips and burdock.

As annuals and biennials are rather easily controlled by timely cultivations, further description of these and discussion on how to eradicate them is not necessary.

Perennial.—A plant that lives 3 or more years and reproduces by both seeds and roots. Examples: Wild morning glory, Russian knapweed, Johnson grass, whorled milkweed, Canada thistle, white top, dandelion, plantain, silver-leaf poverty-weed, and many others.



Illus. no. 1.—Equipment used in eradicating perennial weeds by the starvation method.

Wild morning glory.

The wild morning glory (bind weed) is probably the most prevalent and persistent, and harder to control or eradicate than any other weed. Its roots, in addition to spreading horizontally, go deep in the subsoil, thus consuming large amounts of both moisture and plant food. Under favorable soil and moisture conditions its roots are known to extend 20 feet below the ground surface (see illustration no. 1).

HOW TO CONTROL AND ERADICATE WEEDS

The killing of annual weeds can be accomplished by clean cultivation but it does not follow that all such weeds can be eradicated in one season's operation. Weed seeds like wild oats, puncture vine, and many others may remain in the soil several years before germinating, and the eradication of perennials requires at least 1 to 3 years. Therefore any program of weed control should cover at least a 3-year period.

When a contagious disease breaks out in a community, it requires a little time for those in authority to get control of the malady. Likewise, it takes time to control an outbreak of weeds. Some weeds, like diseases, are much more persistent and difficult to control than others and a farmer can live with some weeds for several years and in the interim he can produce fairly satisfactory crops. Living with weeds can be termed "getting by." Many farmers, by plowing and cultivating at the proper time and by raising crops especially adapted to combating certain weeds, have been able to control some very noxious varieties of weeds. This is far more desirable than giving up, and where there is no cooperative community program which has eradication of weeds for its goal, living with weeds is a practical procedure.

Starvation method of killing weeds.—Starvation is a term used rather extensively in Utah. In some parts of the



Illus. no. 3.—Inspecting a field where starvation method of killing wild morning glory was successful.

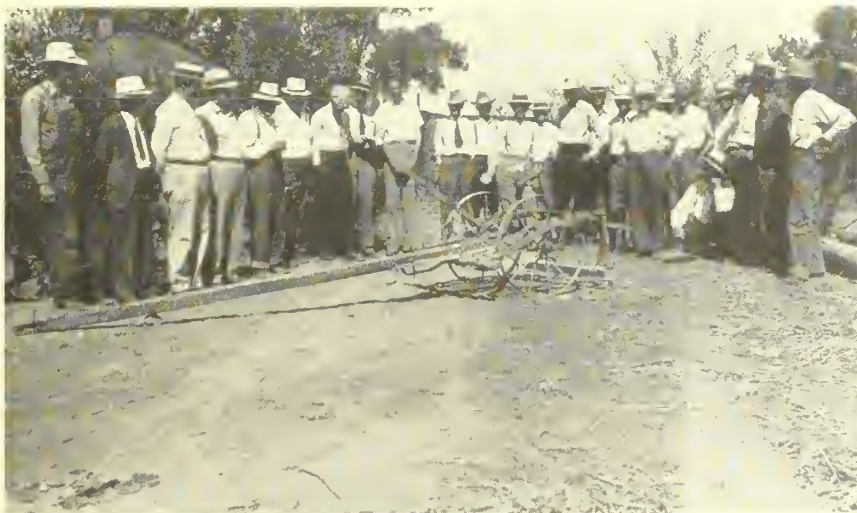
West, clean cultivation is the term used, and in one locality it is called scraping. After carefully observing the type of equipment generally used and understanding the theory of the procedure, it is my opinion starvation is the most applicable term.

Illustration no. 1, which shows types of equipment that can be built by most any blacksmith by working over or adding to some farm tool generally found on a farm is recommended for use in the eradication of perennial weeds. The length of the cutting blade, which must be sharp, depends upon the power to be used. A 30-inch blade can be handled easily in most soils by two mules. The size of a field to be tilled, the kind of power available, whether tractor or mules, and the nature of the soil, whether clay or sandy, are factors which determine the type of equipment to be used. In Utah where small farms are the rule,

there can be found the old-fashioned 1-horse cultivators, with an 18-inch blade attachment, that have been used for years and they are still very practical equipment for killing perennial weeds.

When using the term "scraping", the moving of dirt like using a scraper to level ground can be imagined. Although the starvation methods require cultivation, it is a special method where the surface of the ground after being plowed is left intact. The starvation system means fallow or no crop during the time of its operations. The same is true when chemicals are used.

Procedure under starvation method.—A farmer on one of the Bureau projects in Colorado carried out the following program of eradicating a healthy growth of wild morning-glory from a 10-acre field: In the spring of 1934 he cleaned the ground of the previous year's growth of vines, plowed, and did the other work generally required to prepare a seedbed. On a certain day each week thereafter until fall, the 10-acre field was tilled with a home-made device consisting of a blade attached to a bean puller (see illustration no. 2). When tilling the soil, the blade of the machine was kept at about 4 or 5 inches under the surface of the ground to prevent any of the soil being overturned. The object of this timed procedure is to prevent any new sprouts, leaves, or food-manufacturing parts of the weed from reaching daylight. The root system by this process is prevented from storing up food, hence the term "starvation process." Considerable expense could have been saved by this farmer had he, in place of tilling once a week, or by some fixed schedule, examined the progress of underground growth



Illus. no. 2—A weed tour gathering. Home-made cultivator in foreground.

(Continued on p. 59)



Profits

By Elizabeth Butler Loosley, Klamath Falls, Oreg.

A MOTHER of a family living in the Tule Lake reclaimed area said to me in reply to my remark, "—— you're looking so well."

"Why shouldn't I? This is the first time in 4 years that we could see daylight. Our potato crop did it—that and irrigation."

"That's the best thing I've heard in a long time. How many acres did you have planted?"

"Thirty-five acres and we got 10,000 sacks. While we had to sell at a lower price than potatoes are bringing now—we had to sell early in order to be financed—still we did very well. I'm thinking seriously of giving up my newspaper work and thus make room for someone who needs the work more than I."

That's one of the encouraging things we hear from women of the Klamath project, women who can step into journalism and who can still help run a farm.

There is another proud person, a mother; she is Mrs. Sam Dehlinger, the mother of five sons.

This year Clyde Dehlinger grew 3 acres of potatoes for his 4-H project

under the direction of Clifford Jenkins, club leader of Klamath County. That meant going to work 1 year ago in November to prepare the soil. Then in May, using certified seed, he planted his potatoes with the help of one hired man. This meant still more work had to be given to the soil, roughing it to rid it of disease. Hot days when the earth called for water, and the fact the water was there, for the Dehlinger ranch is under the Klamath project, meant Clyde's success.

Of course he had to put labor, thought, and time into his work; he had to keep a set of books. Evidently he did all these as he has to his credit 442 sacks of potatoes per acre that can bring him \$1,500, or a net of \$1,200 (for his cost of producing as shown by his cost sheet is \$246.23 for the 3 acres); a cash prize of \$50 offered by the Klamath Falls Herald-News; honors at the Pacific International Livestock Exposition at Portland, Oreg.; first place at the National Land Products Show in Chicago.

Two other boys, T. Haley and Norman Jacobs, both belonging to the 4-H potato

club, placed second and third, respectively, at this national show. These boys also grew their crops under irrigation on the Klamath project.

Asked what he intended to do with his potato fund, Clyde replied, "Why, I don't know for sure. I may raise more potatoes next year or may put it aside for a college fund."

Driving to the Dehlinger farm one saw sumptuous limousines, rattletrap trucks, de luxe house trailers and others made from odd pieces of tin and packing cases that still carried a sign, stripped cars and so-so cars, of the 3,000 potato pickers that flock in to harvest the Klamath potato crop.

Inasmuch as Mother Nature, in her attempt to fill the reservoirs so that there would be water for next year's crops, sent a cold snow and freezing temperature, no control of prices was necessary; they mounted overnight.

One sees new furniture, shrubbery, a new range, the news item that John and Mary are at college, someone is going abroad, all as a result of the excellent crops grown under the Klamath project that has water plenty.

THE Vale-Owyhee Land Settlement Board reports continuing increases in inquiries and of land seekers visiting the Owyhee project. Between 600 and 800 acres were sold to new settlers during December.

ONE Ontario (Owyhee project) salesman of automobiles in the higher price class, i. e., above the three in the low-price class, reports the sale of 231 cars in the 6-month period ending December 31.

ON THE Vale project, Oregon, several sales and resales of land have been made on the west and east benches, and several sales have been reported on the Willow Creek unit.



COURTESY C. JENKINS, LEADER
4-H CLUB, KLAMATH COUNTY

Clyde Dehlinger on his three acres that have brought him a college fund.

The Kingman Kolony Book Club

By Mrs. Mary Brumbach, Nyssa, Oreg.

ABOUT 3 or more decades ago, 12 men from Middle Western States, with visions of establishing homes, heard of the productiveness of the sage brush country of eastern Oregon and, after investigating its resourcefulness, moved West and bought land in the section lying between Nyssa and the Idaho State line.

The part of the lives of these particular men that we are interested in is the fact that all were married to educated, cultured women, who also had visions of happy homes, child welfare, and the betterment of social and intellectual conditions of their communities.

It was destined that this particular group of women should meet in parent-teacher work and, after becoming better acquainted, the idea of forming a club was originated.

A meeting was called and a pleasant afternoon was spent in laying plans. Every detail was so thoroughly understood that after more than a decade the original 12 members are as enthusiastic as they were at the first meeting. Such

was the origin of the Kingman Kolony Book Club, which differs from others as there are no officers and no dues. One meeting is held each month, thus each lady entertains once a year.

The object of this club is study and discussion.

The duty of each member is to hold a meeting in her home, choose one or more of the other members to give a review of some good book or magazine article of her choice, and furnish a light lunch.

The interesting part is the lack of formality at the meetings. The reviewer may be stopped at any time, when questions are asked and the subject debated. While there are many different opinions expressed, there never has been a quarrel, nor feelings hurt over any discussion.

Each hostess has the privilege of inviting guests when she entertains and it is a standing rule, if outside company is being entertained, they are always welcome.

A picnic during the summer is enjoyed by the 12 families and a number of mutual friends.

A special program is provided, and the dinner is all that can be imagined, as each contributes.

In December, the Christmas luncheon is an outstanding event. This is followed by the review and an exchange of gifts.

Each member is a heroine in the Book of Life, as all have had their share of trials, hard work, sickness, and death, yet each one has found the true spirit of living and is glad to share with others.

The county librarian has been of great assistance in advising and selecting books on travel, biography, nature studies, poetry, art, plays, best fiction, psychology, philosophy, politics, and other subjects of interest.

The greatest contrast is in the dispositions of this group—there are the studious, the witty, the solemn, and the dignified matrons—yet all can be described in the words of an unknown poet: There is a lady sweet and kind—

Was never face so pleased my mind.
Her gestures, motions, and her smiles,
Her wit, her voice, my heart beguiles.

Know Your Weeds

(Continued from p. 57)

and let the near surface appearance of new growth be the time to cultivate. Obviously, in the spring and fall, when the ground is cool, plant growth is much slower than during the hot days of summer. The ground was given one irrigation to hasten plant growth and to germinate any seeds. In the spring of 1935 until time to seed the 10 acres to beans, the same system of tillage was followed. At the time of a farm weed tour on August 13, 1935 (see illustration no. 3, showing wild morning-glory and other weeds in foreground), the 10 acres had one of the best crops of beans on the project. Only occasional small unhealthy wild morning-glory plants could be found on the entire 10 acres, and they may have come from seed or roots brought onto the field with the irrigation water. This experiment was well worth the effort to the owner, who advised that the per-acre cost of his labors was about \$16.

From information gathered in other irrigated sections, it is the consensus of opinion of those having had actual experience with the starvation method that it takes at least 1 to 3 years to kill the wild morning-glory, the controlling factor being the depth of the root system and the amount of stored-up food.

It is not unusual to contact farmers on reclamation projects who have endeavored to control the growth of the wild morning-glory by plowing once or twice

during the season. Such a system of tillage tends to increase the vigor and thicken the stand. Frequently, with improper cultivation practices, perennial weeds are spread to other parts of a field.

Eradication of other perennial weeds.—The method described for controlling the wild morning-glory is applicable to nearly all perennials, the principal exception being in the control of whorled milkweed, a plant poisonous to livestock in the Rocky Mountain territory. Further studies are necessary to determine if means of controlling this weed by tillage are possible and practicable.

The next article, which will appear in the March issue, will deal with poisonous weeds.

Cattle-Raising Business

Grow but don't go into the dairy or stock-raising business. The true worth of this maxim is appreciated by many farmers starting out to develop a home on a Federal reclamation project.

It is not unusual for a new farmer with a little capital and good credit to start out on a large scale as a dairyman or stockman. And even though prescribed instructions from reliable sources are followed, if one has not had actual experience in the game and if he does not have business ability, he is practically certain of failure.

(Continued on p. 60)



Reclamation Organization Activities and Project Visitors

Dr. Elwood Mead, Commissioner of Reclamation, died at his home, 1661 Crescent Place, Washington, D. C., January 26, 1936.

R. F. Walter, Chief Engineer, Bureau of Reclamation, Denver, Colo., arrived in Washington January 27 to serve as Acting Commissioner pending the appointment of a successor to Commissioner Mead.

Ralph Lowry, construction engineer, Boulder Canyon project, was in Washington a few days the first week in February on matters concerning the operations of the contractors on the project.

Dr. William F. Durand, one of the consulting engineers on Boulder dam, was a visitor in the Washington office early in February.

J. L. Savage, Chief Designing Engineer, Walker R. Young, construction engineer on the Central Valley project, Resident Engineer R. M. Snell of Kennett Dam, together with the members of the consulting board for the Central Valley project, paid a short visit to the Orland project office the latter part of December.

Walker R. Young, construction engineer of the Central Valley project, was welcomed to his new headquarters at Sacramento by a dinner given in his honor by the Sacramento Chamber of Commerce at the Sutter Club.

Gov. Frank F. Merriam and other prominent Californians were present, including Representative Albert Carter, of Oakland; Charles G. Johnson, State treasurer; Edward J. Neron, deputy director of public works; Edward Hyatt, State engineer; A. M. Barton, chief

engineer of the State reclamation board; State Senators John B. McColl, of Redding, D. J. Metzger, of Red Bluff, W. P. Rich, of Marysville, Charles H. Deuel, of Chico, Bradford S. Crittenden, of Stockton, Will R. Sharkey, of Martinez, Frank W. Mixer, of Exeter; and many others.

Harold J. McCurry, president of the chamber of commerce, presided.

Patrick W. Tierney, electrician helper at Boulder Dam, fell to his death from the intake tower into the reservoir, a drop of 325 feet. It is assumed that Mr. Tierney lost his footing while stepping from a ladder on which he was going down from the dome of the tower. The body was found in the lake at a depth of approximately 15 feet and was recovered.

Maj. Gen. John Biddle, 1859-1936

Maj. Gen. John Biddle, United States Army, retired, died January 18 at Fort Sam Houston, San Antonio, Tex., at the age of 77 years, and was buried at West Point, N. Y., on January 23. General Biddle served in the Spanish-American War and in the Philippines, and was Engineer Commissioner of the District of Columbia from 1901 to 1907. In 1914 he went to Europe as an official observer with the Austro-Hungarian Army, and later became Superintendent of the Military Academy at West Point. In 1918 and 1919 he served as Assistant

Chief of Staff in France during the World War.

In 1910 President Taft appointed General Biddle as President of the Board of Army Engineers on Reclamation Projects, detailed to inspect the various reclamation projects. After visiting all of the projects the Board on November 28, 1910, made a comprehensive report to the Secretary of the Interior, entitled "Funds for the Reclamation of Arid Lands," which was printed as House Document 1262, Sixty-first Congress, third session, dated January 6, 1911.

Excerpts from December Project Reports

Minidoka.—Numerous reports have been received of large yields of potatoes last fall, ranging from 175 to 250 sacks per acre. T. C. Gunnerson, a prominent South Side farmer, produced 28,000 bags, with an average yield of 200 bags per acre. Other growers did equally well. The Cassia County Swine Pool marketed 2,381 head of hogs during the past year, at an average net price of \$40,000. The Cassia County Sheep and Wool Pool sold more than \$19,000 worth of lambs and \$13,000 worth of wool in 1935. There were 2,595 head of sheep and more than 75,000 pounds of wool marketed by the pool.

North Platte.—Beets showed the highest tonnage per acre and the highest sugar content for several years.

Owyhee.—Livestock prices continue strong. Hog prices after a considerable decline are coming up again. The indications are that the strong turkey market for this year will encourage expansion in 1936.

Klamath.—As a whole, the year 1935 was a successful year, livestock prices averaging much higher than in 1934. Livestock is in excellent shape and prices are satisfactory.

Belle Fourche.—The farm census recently compiled shows good returns for 1935. Sugar beets from 8,268 acres led the list with a value of \$482,000, making up more than half of the total crop re-

turns. Alfalfa hay was harvested from 11,800 acres with a production of 23,600 tons, or an average of 2 tons per acre. A barley crop of 63 bushels per acre was reported from the John Bentz farm, and the State farm east of Vale raised 70 bushels of oats per acre. Honors for wheat go to the Heavirland farm on the Owl Creek flats northwest of Nisland with 31 bushels per acre. The livestock industry staged a good rally during the fall months, particularly with respect to sheep, which is the principal project line. The farm flocks, feeders, and lambs totaled 106,000 head on December 1, the highest ever recorded, and with the market at favorable levels and feed relatively cheap this business should return the best profits since the depression.

Sanpete.—Several thousand head of fat lambs and some beef cattle were shipped to the markets during the month, which stock was in excellent condition. More than the usual number of sheep were retained on the project for winter feeding because of the fact that the hay crop was better than it has been for the past 8 or 10 years. It is estimated that at least 15,000 turkeys were sold during the Christmas holidays. The marketing conditions for lambs, beef cattle, turkeys, and dairy products were exceptionally good. There was an increase in price of butterfat, which is helping the dairy farmers.

Cattle Business

(Continued from p. 59)

A good example of growing into the cattle-raising business is found on the Willwood division of the Shoshone project. In 1929, soon after making homestead entry, F. H. Menuey started with a single cow (the one in the right foreground of the photograph accompanying this article). Last September this cow was the mother, grandmother, or great-grandmother of 26 cattle, 21 of which were still on the Menuey homestead. Most of them can be seen in the photograph. Five of the twenty-six were bull calves butchered for home consumption.

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Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation; **R. F. Walter**, Acting Commissioner, Bureau of Reclamation; Miss Mae A. Schnurr, Asst. to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

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Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
Belle Fourche.....	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise.....	Ontario, Oreg.	R. J. Newell	Constr. engr.	.....	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam.....	Boulder City, Nev.	Ralph Lowry	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Burnt River.....	Vale, Oreg.	Clyde H. Spencer	do	.....	B. E. Stoutemyer	Portland, Oreg.
All-American Canal.....	Yuma, Ariz.	R. B. Williams	do	J. C. Thraillkill	R. J. Coffey	Los Angeles, Calif.
Carlsbad.....	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Casper-Alcoya.....	Casper, Wyo.	W. W. Bashore	Constr. engr.	C. M. Voyer	W. J. Burke	Billings, Mont.
Central Valley.....	Sacramento, Calif.	W. R. Young	do	.....	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas.....	Austin, Tex.	H. P. Bunker	do	William F. Sha	.....	El Paso, Tex.
Columbia Basin, Grand Coulee Dam.....	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown.....	Missoula, Mont.	J. W. Taylor	Resident engr.	.....	W. J. Burke	Billings, Mont.
Gila Valley.....	Yuma, Ariz.	R. B. Williams	Constr. engr.	.....	R. J. Coffey	Los Angeles, Calif.
Grand Valley.....	Grand Junction, Colo.	W. J. Chiesman	Superintendent	E. A. Peck	J. R. Alexander	Salt Lake City, Utah.
Humboldt.....	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do	Do.
Hyrum.....	Hyrum, Utah	D. J. Paul	Resident engr.	H. W. Johnson	do	Do.
Klamath.....	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	.....	B. E. Stoutemyer	Portland, Oreg.
Milk River.....	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage.....	do	do	do	do	do	Do.
Minidoka.....	Burley, Idaho.	E. B. Darlington	do	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake.....	Duchesne, Utah.	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte.....	Guersey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpflig	W. J. Burke	Billings, Mont.
Ogden River.....	Ogden, Utah.	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland.....	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee.....	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam ²	Parker Dam, Calif.	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River.....	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Rio Grande.....	El Paso, Tex.	H. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Riverton.....	Riverton, Wyo.	H. D. Comstock	do	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River.....	Phoenix, Ariz.	E. C. Koppau	Engineer	Geo. H. Boit	R. J. Coffey	Los Angeles, Calif.
Sanpete.....	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone.....	Powell, Wyo.	L. J. Windle ¹	Superintendent	L. J. Windle ¹	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Stanfield.....	Ontario, Oreg.	R. J. Newell	do	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent	.....	W. J. Burke	Billings, Mont.
Truckee River Storage.....	Lovelock, Nev.	L. J. Foster	Constr. engr.	.....	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam).....	Pendleton, Oreg.	C. L. Tice	Reservoir supt.	.....	B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park.....	Gunnison, Colo.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals.....	Montrose, Colo.	C. B. Elliott	Engineer	do	do	Do.
Upper Snake River Storage ³	Ashton, Idaho.	H. A. Parker	Constr. engr.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale.....	Vale, Oreg.	C. C. Ketchum	Superintendent	do	do	Do.
Yakima.....	Yakima, Wash.	J. S. Moore	do	R. K. Cunningham	do	Do.
Roza div.....	do	Chas. E. Crownover	Constr. engr.	do	do	Do.
Yuma.....	Yuma, Ariz.	R. C. E. Weher	do	Nobel O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non-Federal.

³ Island Park Dam

Projects or divisions of projects of Bureau of Reclamation operated by water users

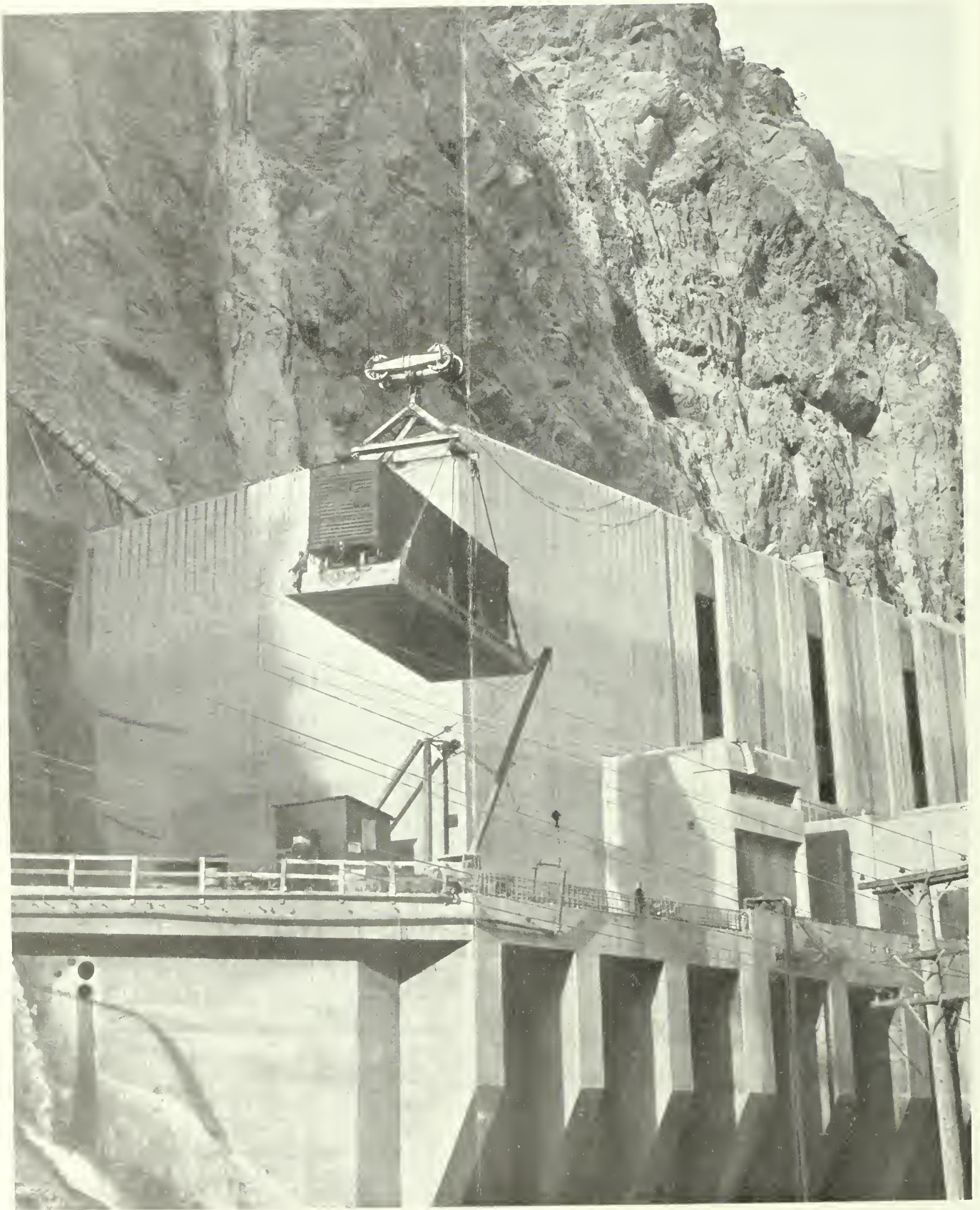
Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division).....	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root.....	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Engineer-manager	Elsie H. Wagner	Hamilton.
Boise.....	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa.....	Orchard Mesa irrigation district.	Pallade, Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley.....	Huntley irrigation district.	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley.....	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do	Chas. A. Revell	Bonanza.
Klamath, Horseshoe.....	Horseshoe irrigation district.	do	Jerome Smith	do	Dorothy Evers	do.
Lower Yellowstone.....	Board of Control	Sidney, Mont.	Axel Person	Project manager	O. B. Patterson	Sidney.
Milk River: Chinook div.....	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Do.....	Fort Belknap irrigation district	do	H. B. Bonbright	do	L. V. Bogy	do.
Do.....	Harlem irrigation district	Harlem, Mont.	Thos. M. Everett	do	Geo. H. Tout	Harlem.
Do.....	Paradise Valley irrigation district	Zurich, Mont.	Amos Thompson	do	J. F. Sharpless	Zurich.
Do.....	Zurich irrigation district.	Harlem, Mont.	C. A. Watkins	do	H. M. Montgomery	do.
Minidoka: Gravity.....	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	W. C. Trathew	Rupert.
Pumping.....	Burley irrigation district.	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley.
Gooding.....	Amer. Falls Reserv. Dist. No. 2.	Gooding, Idaho.	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands.....	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Alcorn	President	Flora K. Schroeder	Fallon.
North Platte: Interstate div.....	Pathfinder irrigation district.	Mitchell, Nebr.	T. W. Parry	Manager	C. G. Klugman	Mitchell.
Fort Laramie div.....	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	Nelle Armitage	Gering.
Do.....	Goshen irrigation district.	Torrington, Wyo.	Bert L. Adams	do	Mabel J. Thompson	Torrington.
Northport div.....	Northport irrigation district.	Northport, Nebr.	Mark Iddings	do	Nelson D. Thorp	Northport.
Okanogan.....	Okanogan irrigation district.	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.).....	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D. Harris	Ogden.
Salt River.....	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.....	Shoshone irrigation district.	Powell, Wyo.	J. O. Roach	do	Geo. W. Atkins	Powell.
Frannie div.....	Deaver irrigation district.	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley.....	Strawberry Water Users' Assn.	Payson, Utah	Clyde Tervort	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.....	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div.....	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East div.....	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West div.....	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre.....	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.....	Kittitas reclamation district.	Ellensburg, Wash.	V. W. Russell	Manager	R. E. Rudolph	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15.....	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey.....	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Deschutes.....	Bend, Oreg.	C. C. Fisher	Engineer.
Gallatin Valley.....	Bozeman, Mont.	R. R. Robertson	do.
Grand Lake-Big Thompson Transmountain Diversion.....	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai.....	Honolulu, Hawaii.	Hugh Howell	Engineer.
Weiser-Payette.....	Boise, Idaho.	J. A. Keimig	do.

SALLIE A. B. COE, Editor.

U.S. GOVERNMENT PRINTING OFFICE



STEEL BOX CAR LOADED WITH POWER MACHINERY DESCENDING 800 FEET TO THE NEVADA POWER HOUSE ON THE GOVERNMENT CABLEWAY AT BOULDER DAM. THE CABLEWAY IS A PART OF THE PERMANENT TRANSPORTATION SYSTEM TO THE POWER HOUSE.

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THE RECLAMATION ERA

VOL. 26, NO. 3



MARCH 1936



YAKIMA VALLEY, WASHINGTON

This air view shows a sharp contrast between the irrigated checkerboard of the Yakima project in Washington and the unwatered sagebrush of the original desert.



STEAM HEATING THE MOST RECENT POURS OF CONCRETE AT GRAND COULEE DAM
DURING A COLD SNAP IN JANUARY

THE RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.
Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

ELWOOD MEAD
Commissioner, Bureau of Reclamation

Vol. 26, No. 3

MARCH 1936



Tributes to Dr. Mead

THROUGHOUT the West memorial services were held for the late Dr. Elwood Mead, Commissioner of Reclamation, whose death at his home in Washington January 26 removed from service of his Government a world authority on irrigation.

The week beginning February 17 was set aside in memory of Dr. Mead by proclamation by Gov. B. B. Moeur, of Arizona, who said, "The entire citizenship of Arizona mourns the loss of Dr. Elwood Mead. We have lost one of our most constructive friends."

Gov. Clarence D. Martin of Washington also by proclamation declared this week "Elwood Mead Week" in his State.

Memorial services, sponsored by civic organizations, service clubs, irrigation district boards, and chambers of commerce, were held in many communities in each of the States of the arid and semiarid West.

Likewise, the honor paid to Dr. Mead through naming the lake formed by Boulder Dam "Lake Mead" was hailed as an appropriate tribute throughout. Typical comments were:

"A well-merited tribute was paid to the memory of Elwood Mead and to the value of his long labors in western development by the action of the Board of Geographic Names in designating the inland sea formed by Boulder Dam 'Lake Mead'."—*Engineering News-Record*.

"No more appropriate honor could have been paid to Dr. Elwood Mead, the late great Commissioner of Reclamation, than that bestowed by giving his name to the lake formed by construction of Boulder Dam. * * * I am sure the people of the arid and semiarid regions of the West will join with me in acclaiming the action of the Board of Geographic Names of the Interior Department on the thoughtfulness of the tribute to Dr. Mead."—*Honorable Henry E. Stubbs, of California, in the House of Representatives*.

The Press throughout the Nation spontaneously joined in deploring the loss of

Dr. Mead, and uniformly glowing were the many tributes paid to his memory and his service. In the West scores of communities felt his death was a personal loss, because "Dr. Mead was not only a conscientious administrator, a foremost expert on irrigation, and a pioneer in reclamation", as the *Washington (D. C.) Post* said, "but also a very human and lovable character."

"In the death of Reclamation Commissioner Elwood Mead the United States loses one of its most valuable public servants", said the *Washington (D. C.) News*, "Superlatively wise, lovable, and courageous was this engineer-professor from the West. And he was one of the great builders of his time."

"While, as Kipling said, 'The east is east and the west is west, and never the twain shall meet', Dr. Elwood Mead devoted the best years of a valuable life to make the people and legislators of the industrial region east of the Mississippi River recognize the value of the neglected area of an intermountain empire with its waters running to waste and its fertile valleys lying idle for lack of Federal assistance", observed the *Salt Lake City (Utah) Tribune*. "He introduced eastern capital to western possibilities."

"Dr. Mead had been in charge of the reclamation program of the Government for many years", said the *Albuquerque (N. Mex.) Journal*, "and was a real champion of the interest of the West. He understood the irrigation needs of the Western States as no other man in the Federal service and was an exponent of orderly development of western agricultural areas."

"Dr. Elwood Mead's passing is a grievous loss to the Nation, to the West and to the administration at Washington", said the *Spokane (Wash.) Spokesman-Review*. "With a fullness of knowledge garnered in more than half a century of active, practical service to western reclamation, it can be said without exaggeration that he knew the West

better than any other American. His duties carried him again and again into every far-western valley. Better than any other American he knew the resources of the enriching streams and their falling waters."

"The Central Valleys project has lost a valued friend and the engineering profession an able member", said the *Sacramento (Calif.) Bee*. "California and the Nation lost an efficient and faithful public servant in Dr. Mead's passing."

"The West lost one of the most loyal and effective friends it ever had in Washington when Dr. Elwood Mead passed on", said the *Yakima (Wash.) Daily Republic*.

"The passing of Dr. Mead is an unfortunate blow to the West", the *Wenatchee (Wash.) Daily World* said.

"A special niche must be reserved for Dr. Elwood Mead in the history of Wyoming and the West", said the *Sheridan (Wyo.) Press*. "In a semiarid land where water is the lifeblood Dr. Mead was responsible, perhaps more than any other one man, in charting the early development of reclamation."

"The Southwest lost one of its best friends in the death of Dr. Elwood Mead", said the *Carlsbad (N. Mex.) Current-Argus*.

"Dr. Mead was an authority on water problems, and leaves behind a record of real accomplishment for the reclamation of arid regions of the country", said the *Burley (Idaho) Bulletin*.

"In the passing of Dr. Mead", said the *Fallon (Nev.) Standard*, "the Far West, the farmers thereof particularly, have lost one of the staunchest friends ever to have been at their service."

"Here in the Kittitas Valley", said the *Ellensburg (Wash.) Evening Record*, "Dr. Mead was regarded as a real friend and as a foresighted developer of western resources. He will be greatly missed."

"Not only Imperial Valley, but all of the West loses a friend at court with the passing of Dr. Elwood Mead", the *El Centro (Calif.) Morning Post* said.

Romance Under the Water

By Frank T. Bell, United States Commissioner of Fisheries

A STORY about stairways for fish, and elevators designed to raise a carload of finny passengers a height of 72 feet, may sound like a chapter out of "Alice in Wonderland." On the contrary, these seemingly fantastic devices are being recorded in the history of our own United States in the year 1935. They represent a serious and carefully planned effort on the part of those charged with the preservation of our natural resources. They are an attempt to save from destruction an industry which yields an annual income of \$10,000,000. For the famous Columbia River salmon run is threatened with extinction.

The preservation of the industry depends upon the ability of the fish, migrating from the depths of the ocean, to reach the headwaters of the river to spawn. The salmon is a fighter in every ounce of his graceful body. He can force his way through any rapids and over any falls nature ever placed in his way up a thousand miles of the Columbia. But against the gargantuan barriers of steel and concrete which man is erecting at Bonneville, at Rock Island, and at the Grand Coulee, he is helpless.

Denied an opportunity to reach their natural spawning grounds, the migrating salmon would die without producing the next generation, and the most famous run of salmon in the world would be destroyed. Now, above the tumult and roar of the machinery which is erecting these giants of civilization, is heard the question: "How shall we save the salmon?"

Picture for a moment the setting in which is being waged this dramatic battle to reconcile nature and civilization. From its source among the glacier-fed streams of British Columbia, the mighty river makes its way southward and westward 1,400 miles to the sea. In the shallow upper tributaries of the Columbia, spreading out over three States, are the principal spawning grounds of the Chinook salmon.

Every spring and summer the adult fish leave the ocean and fight their way up to these gravel-bedded streams. The parent fish never make the return journey, but die after spawning. The young fish, however, after spending from several months to a year in fresh waters, return to the ocean.

"Rivers are moving roads" and to the young Chinook salmon, the Columbia is a mighty road which leads him down to his feeding grounds in the sea. After several years in the ocean, where he

reaches a weight of 20 or 30 pounds, he, like his parents, will make the journey up the Columbia, returning to the very tributary where he was hatched.

In the days before the white man invaded the Northwest, immense numbers of salmon made up the annual run. Only the predatory animals along the shore, and the Indians with their fishing spears, took a small and insignificant toll. With the advent of the white man's civilization, destructive forces have multiplied with telling rapidity.

By far the most serious menace to the salmon is the construction of titanic dams for power and irrigation projects. A way must be found to pass upstream migrants over the dams, and to insure the safe return of their offspring to the sea. Biologists of the Bureau of Fisheries, working in cooperation with the conservation authorities of Washington and Oregon and with Army engineers, have been at work on the problem for the past 2 years. Their solution is: Stairways and elevators for the migrating fish.

It should be understood at the outset that there are no precedents to serve as guides in the solution of the problem, for never before has there been a serious attempt to pass large numbers of migrating fish over obstructions of this size.

The first obstacle the salmon will meet as they ascend the river will be the 72-foot dam at Bonneville. In designating the so-called collecting system at each end of the main dam, fishery experts and engineers have taken into consideration the instinct of the salmon to prefer the swifter currents of water. A stream flowing at the rate of 1,000 cubic feet a second will issue from the entrances of the collecting systems, and it is hoped that this volume of water will induce the fish to enter. Once inside, the salmon may choose their method of ascending to the top of the dam. To one side they will find a fish ladder. This is a series of 16-foot pools, each 1 foot higher than the pool below. Fish ascend the ladder by making the short jump from one pool to the next.

Those which do not choose to climb the ladders will have an opportunity to try the most modern development in fish transportation—the fish locks. These are, in effect, large elevators, 20 by 30 feet. Entrance gates 10 feet square will discharge 200 cubic feet of water per second, as an inducement to the fish to enter the locks. Once the fish are inside, the entrance gates will close, and water will be admitted through the floor of the

lock chamber to raise the water level to that of the top of the dam. The "elevator" itself rises with the mounting water, and when the exit level is reached the gates are opened and the fish speeded on their way by the device of tipping the floor and spilling them out into the river above the dam. Two fish locks will be in operation at the same time. While one lock is ascending the other will be receiving fish below.

Young salmon on their seaward journey are expected to use the fish ladders for the downward passage. Many fingerlings, however, will probably fail to find the passes provided for them. These may actually pass through the power wheels without injury, due to the large size of the openings.

There is good reason to believe that the proposed system of fishways will fulfill its purpose. Engineers are confident that the fish will be prevented from approaching the spillway by the terrific volume of water issuing from the gates. These currents, it is thought, will also sweep them toward the entrance of the collecting system.

About 150 miles from the Canadian border, in the high, arid plateaus of eastern Washington, the salmon will come to the end of their journey. Not its natural end, for many of them first knew life in some shallow tributary far above this point, and to their original home some instinct bids them return. But at the Grand Coulee, man is erecting an insurmountable barrier which will eventually tower nearly 500 feet. There is no practicable means of transporting fish over or around a structure of such gigantic proportions.

The only alternative is to build a collecting trap across the river below the dam. The fish that reach this point will be caught and taken to holding pools which are to be built in the nearby canyon. When spawning time arrives, the eggs will be hatched artificially in special troughs and the young fry returned to the river below the dam. It may even be possible to transplant the fertilized eggs to tributaries that are now used by the salmon, and so to re-establish runs in these streams.

Such is the challenge which the development of the Columbia River for power and irrigation has presented to conservationists. As always when man changes the face of nature, a serious problem of protecting the wildlife is created. In this case, we have tried to foresee the

(Continued on p. 63)

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MARCH 1936

Is It Foolishness?

There is nothing inherently foolish in constructing reclamation projects at a time when submarginal acres are being removed from cultivation. Federal reclamation is practiced only in the arid and semiarid West, which includes the Rocky Mountain region and the area between that and the Pacific Ocean. In this vast district, which represents one-third of the area of the United States, there is no intensive agriculture that is not irrigated.

In this region are such cities as Denver, Phoenix, Los Angeles, San Diego, Spokane, Salt Lake City, Albuquerque, Santa Fe, and many another that is dependent upon irrigation for its food supplies. Almost everyone would recognize that it might be economic to construct a new theater in Los Angeles, if the demand were there, while at the same time another theater was being wrecked in Philadelphia where there were too many. It is good economics to irrigate new land in the West, where growth of populations makes new production areas necessary, while submarginal and unprofitable land is being retired in the East and South.

Regarding the impression that many have obtained from some source that projects now under construction by the Bureau of Reclamation will irrigate "millions of acres of new lands," the best that can be said of it is that it is mistaken. If all the irrigation projects now under construction by the Federal Government could be completed tomorrow, less than 500,000 acres of new land would be brought into cultivation immediately. Instead, the completion dates are several years in the future, anywhere from 2 to 10, and these new projects will irrigate less than 30,000 acres in 1936. This acreage is included in the Owyhee project which was started in 1928 and is now being completed.

Projects like Boulder Dam are important because they conserve water, the West's principal natural resource, and because of their flood control, navigational, power, and other features. Boulder Dam is completed, and not a single acre of new land is being irrigated, nor is a single new acre going to be irrigated in the near future. Before the dam was started there were about 1,000,000 acres in irrigation below its site. These areas are still in irrigation as they have been for more than 30 years. They have been benefited through provision of a regulated water supply and through removal of danger of flood and drought. Subject to irrigation from Boulder Dam are 1,000,000 acres of land now desert. None of the work being done, or now contemplated, will carry water to these lands this year. The Gila valley project in Arizona, now under construction, in 4 or 5 years will irrigate 150,000 acres of new land.

The majority of the new projects undertaken by the Bureau since 1932 are in the same category as Boulder Dam. They are conservation projects to provide supplemental water and other benefits to existing improved areas. There are, however, a few projects which will irrigate new acreages. These are scattered throughout the West and the areas to be

irrigated are small and are in localities where there is a demand for more land.

THE Burley sugar factory on the Minidoka project closed its season's campaign on January 2, after a very successful run. There were 99,634 tons cut at this factory, which were grown on 7,207 acres, or an average yield of 13.62 tons per acre. The sugar content averaged 16.19 percent.

CLYDE Dehlinger, 15 years of age, recently won a competition among 4-H club boys, sponsored by the Klamath Falls Herald-News by producing 442.2 sacks of potatoes, including 340½ sacks of U. S. No. 1's, on an acre. He is a member of the Henley 4-H Club.

The Riverton project, Wyoming, reports that during the month of January three homestead entries were made and two private farms, involving 283 acres, were sold. At the close of the month 30 farm units were still available.

Romance

(Continued from p. 62)

difficulties and avert their destructive effects. We believe that the problem has been solved successfully, and that the famed Columbia River salmon will be saved.

COLUMBIA Basin, economic surveys, Washington.—Headquarters have been established at Ephrata with a force of 48 men, and 7 parties are continuing the section-line-retracement work, having run a total of 191 miles during the month in Quincy Flats area of Grant County. During the month a level party has run 104 miles of levels, connecting all the important benchmarks in the area.

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

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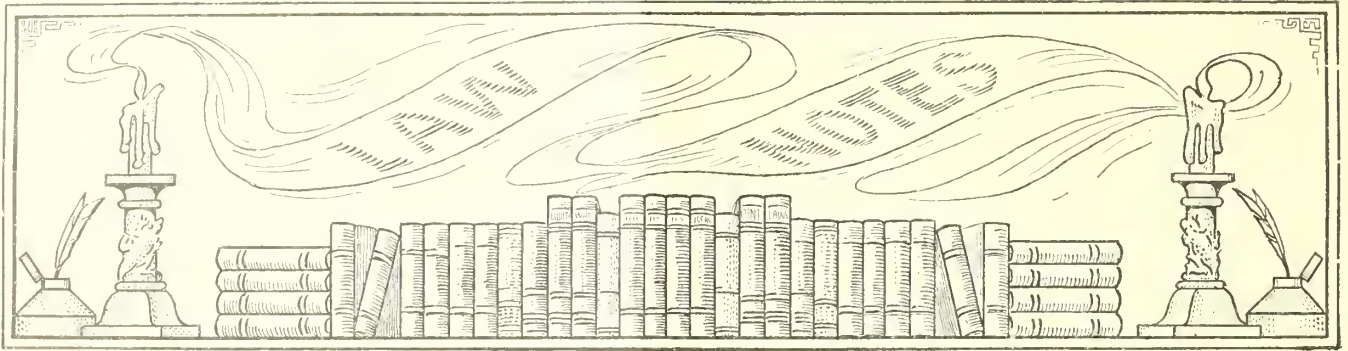
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The Federal Government's Power of Eminent Domain

By S. Rothbard, Counsel, Bureau of Reclamation

IN CONNECTION with the construction of reclamation projects the Government has found it necessary to acquire lands through purchase and, in some cases where negotiations have failed, through condemnation.

The method employed by the Government with respect to the acquisition of needed lands demonstrates the fairness with which the Government deals with landowners. After determining the particular areas required, a board of appraisers is appointed for the purpose of determining the value of the lands and the improvements situated thereon. In the selection of appraisers care is taken to select those who are thoroughly honest, capable, and sufficiently experienced in land values in the particular area involved. Offers to landowners are based on appraisal valuations, and where acceptable to the landowners, contracts are executed and payment made. Only in comparatively few cases, however, has it been necessary to exercise the Federal Government's power of eminent domain.

It may be well to reflect for a moment on the meaning of the phrase, "eminent domain." Historically, the phrase originated in the writings of an eminent publicist, Grotius, in 1625, who says: "The property of subjects is under the eminent domain of the state, so that the state, or he who acts for it, may use and even alienate and destroy such property, not only in case of extreme necessity, in which even private persons have a right over the property of others, but for ends of public utility, to which ends those who founded civil society must be supposed to have intended that private ends should give way." *Grotius De Jure Belli et Pacis, Lib., 3, C. 20.*

Eminent domain has been defined by statute as the right of the people or Government to take private property for public use. *Shasta Power Co. v. Walker*, 149 Fed. 568.

Another definition of eminent domain is the right of the Nation or the State or of those to whom the power has been lawfully delegated, to condemn private property for public use, and to appropriate the ownership and possession of such property for such use upon paying the owner a due compensation to be ascertained according to law. 20 Corpus Juris 513.

Under the fifth amendment to the Constitution of the United States it is provided that private property shall not be taken for public use without just compensation. In determining the value of the property, consideration is given to the fair market value of the property at the time of its taking. The fair market value as construed by the courts is the price that the seller is willing but not obliged to take and the price that the buyer is willing but not compelled to pay. In other words, in determining the fair market value consideration is given to the sum that would reasonably be agreed upon between a willing seller who was under no necessity to sell and a willing buyer who was under no necessity to purchase.

The courts recognize that notwithstanding there is no constitutional provision expressly authorizing the Federal Government to exercise the power of eminent domain, such power belongs to it as an attribute of its sovereignty.

That the United States may exercise the right of eminent domain within the several States has been long established. This right may be exercised so far as is necessary to the enjoyment of the powers conferred upon the United States by the Constitution.

The reason for the above rule is well noted in the case of *Kohl v. U. S.* (91 U. S. 367, 23 L. ed. 449) in which it was stated as follows:

"It has not been seriously contended during the argument that the United States Government is without power to

appropriate lands or other property within the States for its own uses, and to enable it to perform its proper functions. Such an authority is essential to its independent existence and perpetuity. These cannot be preserved if the obstinacy of a private person, or if any other authority, can prevent the acquisition of the means of instruments by which alone governmental functions can be performed. The powers vested by the Constitution in the general government demand for their exercise the acquisition of land in all the States. These are needed for forts, armories, and arsenals, for navy-yards and lighthouses, for customhouses, post-offices, and court-houses, and for other public uses. If the right to acquire property for such uses may be made a barren right by the unwillingness of property-holders to sell, or by the action of a State prohibiting a sale to the Federal Government, the constitutional grants of power may be rendered nugatory, and the Government is dependent for its practical existence upon the will of a State, or even upon that of a private citizen. This cannot be. No one doubts the existence in the State governments of the right of eminent domain—a right distinct from and paramount to the right of ultimate ownership. It grows out of the necessities of their being, not out of the tenure by which lands are held. It may be exercised, though the lands are not held by grant from the Government, either mediately or immediately, and independent of the consideration whether they would escheat to the Government in case of a failure of heirs. The right is the offspring of political necessity; and it is inseparable from sovereignty, unless denied to it by its fundamental law * * *. But it is no more necessary for the exercise of powers of a State government than it is for the exercise of the conceded powers of the Federal Government. That government is as

sovereign within its sphere as the States are within theirs. True, its sphere is limited. Certain subjects only are committed to it; but its power over those subjects is as full and complete as is the power of the States over the subjects to which their sovereignty extends. The power is not changed by its transfer to another holder."

The Federal Government may obtain immediate possession of the lands condemned. This is permitted under section 258-A, title 40, United States Code, in which it is provided that—

"In any proceeding in any court of the United States which has been or may be instituted by and in the name of and under the authority of the United States for the acquisition of any land or easement or right-of-way in land for the public use, the petitioner may file in the cause, with the petition or at any time before judgment, a declaration of taking, signed by the authority empowered by law to acquire the lands described in the petition, declaring that said lands are thereby taken for the use of the United States. * * * Upon the filing of said declaration of taking and of the deposit in the court, to the use of the persons entitled thereto, of the amount of the estimated compensation stated in said declaration, title to the said lands in fee simple absolute, or such less estate or interest therein as is specified in said declaration, shall vest in the United States of America, and said lands shall be deemed to be condemned and taken for the use of the United States, and the right to just compensation for the same shall vest in the persons entitled thereto; * * *."

In other words, the Federal Government is not compelled to await the final outcome of a suit but may at the very outset obtain possession of and title to the lands in advance of final judgment.

Agreement Reached on Grand Coulee Contract

Secretary of the Interior Harold L. Ickes on January 30 announced that final approval had been given to an adjustment of contract made necessary by the order issued June 5, 1935, for a change in the design of the Grand Coulee Dam, which is being built by the Bureau of Reclamation on the Columbia River in eastern Washington.

The adjustment was based on an agreement which was reached recently by the contractor (the MWAK company) and the Bureau of Reclamation, upon probable cost and the new work involved in the alterations.

Park Service to Assist at Lake Mead

A general plan has been adopted under which the National Park Service and the Bureau of Reclamation will cooperate in control of Lake Mead for recreational purposes, Secretary of the Interior Harold L. Ickes announced recently.

Lake Mead, formed by storing the waters of the Colorado River behind the great Boulder Dam, is the world's largest artificial lake and one of its most scenic stretches of water.

The Bureau of Reclamation will have complete charge of the dam, power-house, and outlet works, since the dam must be operated in conformity with the needs for flood control, river regulation, and power generation. The Bureau also will retain control of Boulder City, the permanent camp it constructed near the dam site to serve as homes for the many employees who will be working at the power-house.

The National Park Service, chosen because of its eminent position as an administrator of recreational areas, will have charge of the development of the lake itself for recreational purposes. It will provide facilities for tourists and sightseers, through concessions or otherwise, and enforce safety regulations. It will also enforce the regulations of the Bureau of Fisheries and the Biological Survey that are applicable to the lake.

The Bureau of Reclamation will be responsible for tourist facilities at the dam itself and in the power-house. It will make its regulations conform, as nearly as safety and efficiency of operation

will permit, with those of the National Park Service.

Many details remain to be worked out, but the Bureau of Reclamation and the National Park Service have agreed upon the general plan.

Efforts will be made to increase the facilities at the lake for entertainment of its visitors as soon as possible. Because of its mild climate, Lake Mead is an attractive winter resort.

During 1935 approximately 365,000 persons visited the dam and the lake. It is probable that the number will increase this year.

New attractions will be afforded during the year. After the spring flood, which is due in late May or early June on the Colorado River, Lake Mead will be much larger. Already it extends 85 miles upstream, and contains more than 4,000,000 acre-feet of water. In the late spring, also, generation of power is expected to begin at the Nevada power house.

The highway between Las Vegas, Nev., and Kingman, Ariz., which crosses the crest of Boulder Dam, now is opened to the public for through traffic for several hours each day. Soon it will be open continuously. The road affords easy approach to the dam and lake from either the overland or southern transcontinental highways.

The National Park Service has two C. C. C. camps now at work in the Boulder Dam area developing its recreational facilities.

The change order altered the shape of the foundation of the dam, resulting in increases in various classifications of work involved.

The adjustment of contract contemplates expenditure of \$60,000,000 instead of the \$63,000,000 originally estimated under the contract. The saving results from elimination of the immediate construction of a power-house. The agreement estimates an increase in payment to the contractor of approximately \$7,000,000, of which \$6,700,000 represents the cost of additions to the estimated quantities of common excavation and of concrete poured in the dam.

The original quantity of 11,000,000 cubic yards of common excavation is now increased to 14,400,000 largely through the action of slides encountered during the excavation for the foundation. A total of 1,100,000 cubic yards of concrete was added to permit completion of the structure to an elevation where no further work in controlling the river will be required, approximately 177 feet above bedrock.

Increases in these items of work are to be paid for at the unit price established in the original contract. A few new items were introduced. Unit prices were established for them on the basis of bid prices for comparable work in the original contract.

Grand Coulee Film

Release is announced of a two-reel 35 millimeter film explaining the Columbia Basin project, Washington, its conservation purposes and structural features. In it the Columbia River is traced from its fountainhead in the mountains of the Continental Divide; Grand Coulee Dam is seen under construction; the irrigable lands are shown; and the results of irrigation in similar nearby areas are disclosed.

There is no charge for the loan of this film. The only expense is transportation fees both ways.

Orchard Irrigation Experiments Disprove Old Theories

By William E. Warne, Public Relations Division

FOR 15 years in California two university men have been conducting experiments in irrigation and cultivation of fruit trees which are at present revolutionizing orchard practices in that State.

This work has gone forward with such evident success that a brief review of it here may be beneficial to irrigation farmers throughout the West. The University of California estimates that the new practices introduced as a result of these experiments now are saving California farmers \$4,000,000 a year in orchard irrigation and cultivation costs. It estimates that when the new methods have been adopted throughout the State the saving will amount to \$10,000,000 a year.

"I should say that the experiments have led to very substantial savings in water, and that in the long run this will result not only in lessening the total expenditure for water, but will materially increase the area that can be irrigated", Prof. Frank Adams, head of the division of irrigation investigations and practice in the University of California College of Agriculture, a recognized authority, has said.

WATER SAVING GREAT

Professor Adams estimated that increasing the efficiency of present irrigation practice in California by only 10 percent would make water available for an additional 500,000 acres of land.

The experiments have been conducted by Associate Prof. F. J. Veihmeyer and Dr. A. H. Hendrickson, pomologist. They were begun in orchards in the Santa Clara Valley and have been continued in the orchards at the university farm at Davis where laboratory conditions can be maintained.

These two scientists have shown that many of the old and commonly accepted theories of orchard culture were fallacious. For instance, they have demonstrated that cultivating an orchard does not assist in preserving soil moisture; that cover crops use far more water than they protect in the soil, and thus that the planting of cover crops in an orchard for the purpose of preserving soil moisture is false irrigation economy; that root distribution is not affected by irrigation during the growing season, but that naturally deep-rooted trees will send their roots down into the lower soil if it is properly moistened regardless of the wet or dry condition of the upper soil; that either under or over irrigation will damage trees, and that many orchardists irrigate more often than

necessary since a surplus of water in the soil above the permanent wilting point will not increase growth nor production.

They discovered that capillary attraction is the source of a very much smaller loss of soil moisture than it was supposed. The amount was considered by them as negligible. Consequently cultivation of orchard soils to break up the surface for the purpose of retarding moisture loss through capillary attraction is useless. They found that cover crops were competitors with the trees for the available moisture in the soil and that their transpiration did not raise the humidity of the orchard sufficiently to affect materially the transpiration of the trees.

The growth of cover for fertilizing purposes and cultivation for destruction of noxious weeds, or for smoothing the surface for diking or for harvesting, Veihmeyer and Hendrickson found, is all that is necessary.

DISPROVE OLD THEORIES

"Some of the commonly accepted ideas are that root distribution may be affected by irrigation during the growing season, that by withholding irrigation, trees may be made to send their roots deeply into the soil, that light irrigation tends to encourage shallow rooting, and that irrigation on one side of the tree only will result in confining the roots to that side", these scientists said. "Observations indicate that if soils are wet only to a certain depth, either by rainfall or by irrigation, and if the soil below this depth is at the permanent wilting percentage, the roots will be confined within the wetted areas; on the other hand, plants which normally are deep-rooted cannot be made to keep their roots in the upper layers of soil if those at lower depths have a readily available supply of moisture and if no other adverse condition for root development is present below. If the soil is wet to the full depth to which the roots of the trees would normally go at the beginning of the growing season, then subsequent applications of water during the summer, unless they be frequent enough to produce unfavorable oxygen conditions or the detrimental effects which have been observed to follow certain practices in citrus irrigation, will have no influence on the extent of the distribution of the roots. Water logging the soil, however, may injure the roots of some trees."

Veihmeyer and Hendrickson found that each soil has a field capacity, which is the amount of water retained by the soil after drainage has taken place. Of

this field capacity only a certain percentage is readily available to plants because a certain amount is held so tightly by the soil particles as to prevent the roots of the plants from absorbing it rapidly enough to keep them from wilting.

When the percentage of moisture is reduced below that which is readily available the permanent wilting percentage is reached. At this point, plants are unable to obtain sufficient water and wilt. The normal activities of the tree or plant are affected.

Each soil has a different field capacity and a different percentage of readily available moisture, and consequently the permanent wilting percentage is different on each type of soil.

"There is no simpler way, so far as we know, of determining the amount of readily available moisture in the soil than by growing a plant on the soil and finding the permanent wilting percentage", Veihmeyer and Hendrickson said. "While the field capacity of clay soils is generally greater than that of sandy soils, we have found some sandy soils that actually contain more readily available moisture than some clays."

The belief that there is an "optimum" or best soil-moisture content for plant growth, these scientists have disproved. They found that the plant functioned both in growth and fruit production exactly as well so long as the soil moisture remained anywhere between the field capacity and the permanent wilting percentage. The discovery that there is a fairly wide range of soil-moisture conditions through which the tree operates at maximum efficiency has made it possible for California irrigation orchardists to reduce the number of their irrigations and save both water and money.

"The apparent moisture condition of a soil", these scientists pointed out, "is not a safe criterion by which to judge whether a soil contains readily available moisture. It may be possible to have a soil which appears moist but from which a plant cannot secure enough moisture to prevent its wilting, and, in this sense, will be dry. The old expedient of compressing the soil in the hand, and judging if it contains sufficient water for plant growth by the way in which the particles stick together, is not always dependable."

A few broadleaf weeds, such as the sunflower, weeds that have deep roots comparable to those of fruit trees, can be left growing in the orchard at various places. The experimenters said it was difficult sometimes to determine when permanent wilting had set in in fruit trees. The

permanent wilting percentages, however, affect alike all plants of similar root structure. Broadleaved weeds make good indices, because they quickly droop unmistakably when the permanent wilting percentage is reached.

WILTING TO BE AVOIDED

Veihmeyer and Hendrickson advised irrigating an orchard just before the permanent wilting percentage is reached. Difficulties in anticipating this time can be overcome by watching the broadleaved weeds.

"Experiments with peaches in California show that the growth of the fruit is retarded and the leaves droop when the soil containing most of the roots has been reduced to about the permanent wilting percentage. The degree of injury is influenced by the length of time the soil remains in this condition. If the soil is at the permanent wilting percentage for only a few days the effects are scarcely noticeable. No difference in the quality and size of peaches was observed between trees which were irrigated before the readily available moisture was exhausted and those which had just reached the permanent wilting percentage even though the trees were watered shortly before the fruit was picked. These results substantiate those obtained with prune trees and grapevines, and lead to the conclusion that the growth of plants or fruit cannot be influenced by irrigation when the moisture is still above the permanent wilting percentage provided the soil is not kept saturated long enough to produce adverse conditions. The only result of adding

water to soil which already contains readily available moisture is to replenish the supply before it is exhausted."

As an illustration of their work, the California scientists gave the following:

"Assuming a mature orchard with the trees 24 feet apart on the square system, and with the majority of the roots in the upper 5 feet of soil, there are 2,880 cubic feet of soil from which each tree may obtain water. This volume of soil is essentially a reservoir that contains, when filled to its field capacity, a definite amount of readily available moisture. As an example taken from actual measurements, a peach orchard in one of the largest peach-growing sections on clay-loam soil with a field capacity of 25 percent, two-thirds of which is readily available, contains approximately 260,000 pounds of dry soil in the 2,880 cubic feet. A 25-percent moisture content of this soil is 65,000 pounds of water, or 1,040 cubic feet. Two-thirds of this, or about 700 cubic feet of water, is readily available to the trees, and this quantity is equivalent to a depth of about 15 inches of water. In other words, when the permanent wilting percentage is reached an application of water 3 inches deep would be required to wet each foot of such soil. Of course, if the entire 5 feet of soil is not reduced to the permanent wilting percentage, 15 inches will not be needed. While an application of 15 acre-inches to the acre may seem too great when ordinary irrigations are considered, it must be remembered that ordinarily water is applied before all of the readily available moisture is exhausted, or the soil is not wet to 5

feet. Another experiment with clay-loam soil showed it to have a field capacity of about 25 percent, half of which was readily available. Only about 500 cubic feet of water could be used readily by the trees and it would require approximately 10½ inches of water to replenish the supply."

The number of times the trees will reduce the soil moisture from its field capacity to the permanent wilting point during a season, they said, depends on the size of the trees, the climatic conditions, and the kind and depth of soil.

"The total amount of water that comparable trees will use will not be greater on a clay soil than it is on a sandy soil if both are fertile and are supplied with readily available moisture at all times", they added.

SOIL TYPES GOVERN

Experiments with mature peach trees in the Sacramento and San Joaquin Valleys showed that the interval between depletions of the readily available moisture in the upper 5 feet in the summer varied from 3 weeks in a sandy soil to 6 weeks in a clay loam soil. On loam soils mature prune trees in the Santa Clara Valley exhausted the readily available soil moisture in from 4 to 6 weeks during the hottest part of the season.

"Ordinarily, there are more roots in the upper layers, excluding the cultivated surface, than in the lower", Veihmeyer and Hendrickson said. "In the experiments with peach trees, previously referred to, the readily available moisture was exhausted more rapidly in the upper layers than in the lower. Furthermore, when the readily available moisture was exhausted in the top 2 or 3 feet of soil, the peach trees wilted, even though there was wet soil below. The trees were using moisture from below this depth, but could not secure it rapidly enough to keep them from wilting. Likewise when the readily available moisture in the upper 3 feet in prune orchards was exhausted the trees wilted.

"Both the leaves and the fruit are affected when the soil moisture is reduced to about the permanent wilting percentage. Fruit on trees on dry soil grows more slowly than that on trees having readily available moisture. It is exceedingly important, therefore, to see that the soil-moisture content does not remain at or below the permanent wilting percentage for more than a few days. The trees will not be affected, however, if water is applied to the soil when it already contains readily available water. If the trees wilt when the upper 2 or 3 feet are dry, it will be necessary to wet them even though readily



The Malheur River siphon of the Owyhee project, Oregon, the largest of its type on the continent, carries the main canal through the Malheur River Valley and over a low range of hills 4½ miles away. The siphon is being constructed of 80-inch pipe. It is approaching completion.

available water is present below. If possible, the soil should be wetted at each irrigation to the depth in which most of the roots occur even though the lower layers still contain some readily available water, since it would be less expensive to wet this depth at this time than later. In the fall, when early rains may be anticipated, it is not necessary to wet the deeper layers. Wetting

the soil to a depth of 5 or 6 feet will usually be sufficient with most deciduous fruit trees, and to a shallower depth with citrus trees. If there is an impervious layer within the depth mentioned, just enough water should be applied to wet the soil above this layer. The term 'overirrigation' is often used to mean frequent irrigation which results in the maintenance of the readily available

moisture at a high level. In fact, however, overirrigation is accomplished only when enough water is applied to deep soils to cause percolation below the roots, or the waterlogging of shallow soils, and when the applications are frequent enough to affect the oxygen supply of the soil. Of course, leaching may take place if applications of irrigation water are too frequent or too great in amount."



THE BEAUTIFUL BULL LAKE COUNTRY, WYOMING, WHERE THE NEW RIVERTON PROJECT DAM WILL BE LOCATED

1, Trout water on upper Bull Lake Creek; 2, a gnarled sentinel; 3, Bull Lake shoreline; 4, the dam site on Bull Lake Creek; 5, another view of the lake shoreline; 6, upper falls on Bull Lake Creek above the reservoir high water line.



ENGINEERING



Six Companies' Boulder Dam Contract Completed

BOULDER Dam and power-house was accepted by Secretary of Interior Harold L. Ickes on behalf of the United States from the contractor March 1, thus terminating the contract and marking the end of actual construction of the project in 11 days less than 5 years.

More than a year prior to the date on which the project became the property of the Government, Boulder Dam was put to work at its task of controlling the floods and conserving the waters of the Colorado River. The gates of the diversion tunnels were closed February 1, 1935, and a dangerous flood of a few months later was caught and stored.

While work continued on the project, Lake Mead, which was formed by the dam, filled to one-seventh of its capacity and grew to be the largest existing artificial body of water. In addition to catching a threatening flood, Lake Mead and Boulder Dam prevented a drought in the irrigated valleys along the lower Colorado River, where crop losses totaled \$10,000,000 in 1934, by making it possible to release from storage a larger volume of water than the river was carrying during the summer and fall of 1935.

In construction of Boulder Dam and power-house, the Bureau of Reclamation estimated that a total of 604,800 man-months was provided of all classes of employment.

The Bureau of Reclamation took over the plant and equipment of the contractor for use without charge until October 1 in the installation of power-house equipment and in putting certain finishing touches on the structures.

Under the contract entered by the Bureau with Six Companies, Inc., on March 11, 1931, the contractor's gross earnings will amount to approximately \$54,700,000. The work now being completed originally was expected to require 2,565 days and the contractor was given until April 28, 1938, to finish the job. Thus the work was completed 2 years, 1 month, and 28 days ahead of schedule.

Six Companies, Inc., the contractor, and the Bureau of Reclamation entered a final agreement on payments, penalties, and settlement of claims prior to fixing

the date for termination of the contract. The contract was a unit-price contract, as contrasted with a lump-sum contract, and under it payments were made on the basis of the yardage of excavation done, concrete poured, etc. Disagreements between the contractor and the Bureau of Reclamation with regard to amounts of work done; disputes over the unit price at which certain classifications of work were to be paid and assessment of penalties by the Bureau against the contractor for violation of the law against overtime work all were adjusted in the final agreement, in which the contractor resigned any further claim against the Government.

When bids were called on construction of Boulder Dam and power-house the Bureau of Reclamation estimated that on the basis of the specifications it had prepared the job would cost \$48,866,254. Six Companies, in the successful bid, estimated the cost under the unit prices submitted at \$48,890,995.50. The gross earnings now are estimated at \$54,700,000. With deductions made by the Bureau of Reclamation for various services, such as provision of electric power to the contractor and rental at Boulder City, the actual cash payment to the contractor approximated \$51,950,000.

After the contract was let, a change was made in the design of the power-house to increase its size. This increased the cost of the power-house by more than \$2,000,000 over the estimate. This was the most important of several alterations in plans and design. The penstock tunnels, however, were increased from 30 feet in diameter to a size which would permit the installation in them of steel pipe of 30-foot diameter. This increased the cost of these tunnels by about \$1,000,000 over the estimate.

Up to January 1, 1936, Six Companies had excavated 5,965,972 cubic yards of all classes of materials on which it earned \$27,433,627. It had poured 4,364,903 cubic yards of concrete in the dam and power-house, and thus earned \$19,305,198. This amount of concrete would build a standard highway across the continent. In almost 100 dams it had built up to

1933, the Bureau of Reclamation had poured a total of 3,690,000 cubic yards of concrete. These figures will be increased by work done in January and February, but not appreciably.

The amount of concrete actually poured in Boulder Dam itself, without considering the appurtenant works such as spillways, intake towers, and power-house, was 3,240,871 cubic yards, for which the contractor was paid \$8,750,351.70. The most costly single item in the construction program was the drilling of the four 50-foot diameter diversion tunnels at \$12,914,874.

These tunnels carried the Colorado River around the site of the work until February 1, 1935, when the dam was sufficiently near completion to permit the start of storage of water. Two tunnels were drilled on either side of the river, each being about 4,000 feet in length. They will be used permanently for the greater part of their length, the outer two as a part of the spillway system and the inner pair as penstock tunnels.

Only one important item in the Six Companies' contract was not completed when the contract was terminated. It was the plugging of one of these tunnels. The Bureau found it necessary to delay completion of this plug because of the necessity to bypass water for irrigation through the tunnel until the power-house is placed in operation. The Bureau will place the plug by force account when the time arrives.

ALTHOUGH there is some unemployed labor at Klamath Falls, Oreg., Klamath project, all mills are operating and conditions are considerably improved over those of a year ago.

THE new Federal courthouse in El Paso, Tex., Rio Grande project, is nearing completion. This building occupies one small block adjacent to the county courthouse and the El Paso city hall. The building is of reinforced concrete and is faced with white limestone. The contractor reports this building will be ready for occupancy by April 1.

Notes for Contractors

BOULDER Canyon project, Arizona-Nevada.—Twenty-six manufacturers and jobbers submitted bids on furnishing insulated cable for Boulder power plant under Specifications No. 759-D, bids opened at Denver on January 31. A preliminary abstract of bids gives the following information. Under schedule no. 1, 5,000-volt varnished-cambric-insulated cable, the low bid was \$5,318.70, submitted by the Associated Wholesale Electric Co., Los Angeles. The following submitted identical bids of \$111,208.75 and guaranteed weights of 621,804 pounds, on schedule no. 2, 5,000-volt, 1,000-volt and 600-volt rubber-insulated cable: Anaconda Wire & Cable Co., Westinghouse Electric Supply Co., Mine & Smelter Supply Co., General Cable Corporation, Graybar Electric Co., American Automatic Electric Sales Co., General Electric Co., General Electric Supply Corporation, Electric Sales Co., Okonite Co., Hazard Wire Rope Co., B. & R. Electric Supply Co., Triangle Conduit & Cable Co., Inc., New England Electric Co., E. B. Latham & Co., Phelps-Dodge Copper Products Corporation, M. B. Austin Co., Simplex Wire & Cable Co., American Steel & Wire Co., and the United States Rubber Products, Inc. On schedule no. 3 calling for inclined cable the Triangle Conduit & Cable Co. Inc., Lavenson & Savasta, and the M. B. Austin Co. submitted identical low bids of \$3,499.65. On schedule no. 4, rubber and asbestos insulated cable, the same concerns that bid on schedule no. 2, with the exception of the United States Rubber Products Inc., and with the addition of Lavenson & Savasta, and Rockbestos Products Corporation offered identical bids of \$4,422.30. Two concerns were low with bids of \$8,720.70, on a combination of schedules nos. 1 and 3, Lavenson & Savasta and M. B. Austin Co. All bids were f. o. b. Boulder City with discount of one-half of 1 percent. The successful bidders have not yet been determined.

Two bids were received at Denver on January 30 for furnishing granite for elevator and utility towers (Specifications No. 761-D) as follows: V. D. Coleman & Co., Colorado Springs, Colo., \$1,669; the Colorado Wholesale Granite Co., Denver, Colo., \$1,969. The low bidder was awarded the contract on February 7.

Ogden River project, Utah.—The following bids were received at Ogden, Utah, on February 4 for furnishing sand and gravel (Specifications No. 762-D): Item 1, 20,000 tons of sand, Ora Bundy, Ogden, Utah, \$11,600 f. o. b. Brigham; Wheelwright Construction Co., Ogden, Utah, \$22,000 f. o. b. Ogden; Utah Sand and

Gravel Products Corporation, Salt Lake City, Utah, \$13,500 f. o. b. Salt Lake City. On item 2, 8,500 tons of gravel $\frac{3}{8}$ inch to $1\frac{1}{2}$ inch, the same concerns bid \$5,100, \$9,350, and \$5,525, respectively. On item 3, 16,500 tons of gravel $\frac{3}{8}$ inch to 1 inch, the bids were \$9,900, \$18,150, and \$10,725, respectively. The secretary approved award of contract to Ora Bundy on February 17.

Under Invitation No. 39105-A, bids opened at Denver on January 24, the Portland Cement Co. of Utah, Salt Lake City, has been awarded a contract for 20,000 barrels of portland cement, at their bid of \$2.44 per barrel f. o. b. Ogden, less \$0.50 sacks returned and discount. The Union Portland Cement Co., Devils Slide, Utah, will furnish 30,000 barrels, at their bid of \$2.25 f. o. b. Devils Slide, with sack allowance and discount of \$0.50.

Bids for construction of earthwork, concrete lining and structures, Locket Gulch wasteway channel, Mitchell Butte division (Specifications No. 760-D) opened at Ontario, Oreg., on February 4, were as follows: John Klug, Nyssa, Oreg., \$20,521.40; Henry L. Horn, Nyssa, Oreg., \$22,466.40; Geo. B. Henly, Nyssa, Oreg., \$25,775; Herber & Sheldon, Tacoma, Wash., \$25,404.60; J. A. Terteling & Sons, Boise, Idaho, \$25,798.50; H. J. Adler Co., Tacoma, Wash., \$26,532.50; Dan Teters & Co., Ogden, Utah, \$27,189; Brent Sturgill Co. Inc., College Place, Wash., \$27,256.50; Morrison-Knudsen Co. Inc., Boise, Idaho, \$27,615. The low bidder, John Klug, has been awarded the contract.

Salt River project, Arizona.—On February 3 the Tinius Olsen Testing Machine Co., Philadelphia, Pa., was awarded the contract for furnishing five hydraulic testing machines under specifications no. 758-D, their bid being \$7,365 f. o. b. Philadelphia. Other bids were Baldwin-Southwark Corporation, Philadelphia, Pa. \$7,550 f. o. b. Eddystone; and American Machine & Metals Corporation, East Moline, Ill., \$9,250 f. o. b., East Moline. The machines are to be shipped, one each to the Salt River, Colorado River, and Carlsbad projects, and two to Central Valley.

Six contractors submitted bids under specifications no. 663 for alterations to spillway at Roosevelt Dam, bids opened at Phoenix on February 5. The bids were as follows: Dan Teters & Co., Garnet, Calif., \$53,930; Vinson & Pringle, Phoenix, Ariz., \$69,609.50; Pleasant-Hasler Construction Co., Phoenix, Ariz., \$78,225; Case Construction Co., Alhambra, Calif., \$87,336; Bent Bros. Inc., Los Angeles, Calif., \$91,870; Allied Bridge & Construction Co. and Central Bridge &

Construction Co., Omaha, Nebr., \$92,690.50.

Bids are being received at Denver until March 16 and then opened (specifications no. 671) for furnishing and delivering one vertical-shaft, 11,500-horsepower, 214 r. p. m., hydraulic turbine or a new plate-steel scroll case, speed ring, and draft-tube liner for the 11,500-horsepower S. Morgan Smith Co. vertical-shaft hydraulic turbine now installed in the power plant; and one 102-inch diameter butterfly valve with operating mechanism for installation in the Mormon Flat power plant. All of the apparatus will be installed by the Government.

Gila Valley project, Arizona.—On February 27 bids were opened at Yuma, Ariz., under specifications no. 657 (re-advertisement) for the construction of earthwork and tunnels, station 30 to station 931, Gravity Main Canal. Estimated quantities involved are as follows: 3,443,000 cubic yards of all classes of canal excavation, 120,000 cubic yards of excavation for drainage channels and dikes, 92,500 cubic yards of excavation in tunnels, 580 cubic yards of concrete in tunnel portal structures and transitions, 19,400 cubic yards of concrete in tunnels, placing 64,000 pounds of reinforcement bars, furnishing and installing 486,000 pounds of permanent steel tunnel supports, and furnishing and erecting 155 M feet board measure of permanent timbering tunnels. The work must be completed within 800 days.

Moon Lake project, Utah.—At Denver on February 7 bids were opened for furnishing high-pressure gates for outlet works at Moon Lake, Taylor Park, and Island Park dams (Specifications No. 666). Item 1 calls for two 3-foot 3-inch by 3-foot 3-inch gates; item 2 for one 4-foot by 5-foot gate, and one 5-foot by 6-foot gate; and item 3 for two 5-foot by 6-foot gates. Bids received for the respective items were as follows: Hardie-Tynes Manufacturing Co., Birmingham, Ala., \$9,500, \$17,274, and \$24,460; Timken-Detroit Axle Co., Michigan Valve and Foundry Division, Detroit, Mich., \$15,743, \$30,000, and \$37,548, items 2 and 3, \$65,000; Joshua Hendy Iron Works, San Francisco, Calif., \$7,707, \$18,092, and \$25,440, items 2 and 3, \$43,315, items 1, 2, and 3, \$51,025; Bartlett-Hayward Co., Baltimore, Md., \$6,500, \$13,800, and \$18,000, items 1, 2, and 3, \$35,800; Steacy-Schmidt Manufacturing Co., York, Pa., \$8,200, \$18,850, and \$27,600, items 1, 2, and 3, \$52,350; International Engineering Co., Dayton, Ohio, item 1, \$6,350; Long Beach Iron Works, Long Beach, Calif., item 1, \$7,243; Commercial Iron Works, Portland, Oreg.,

item 1, \$6,445; Rosedale Foundry & Machine Co., Pittsburgh, Pa., item 1, \$7,980, item 2, \$18,820.

All-American Canal project, Arizona-California.—Bids opened at Yuma, Ariz., on February 6, under Specifications No. 668, for earth lining station 419 to station 601, and station 803 to station 1245, were as follows for schedule 1 and 2 respectively: David H. Ryan, \$55,980 and \$43,170; George J. Bock Co., \$77,060 and \$52,000; V. R. Dennis Construction Co., \$101,150 and \$68,500; George Pollock Co., \$112,520 and \$91,500; C. G. Willis and Sons, Inc., and Charles G. Willis \$96,050 (schedule 2 only).

Colorado River project, Texas.—The first construction job advertised for bids on the Colorado River project attracted twelve bids, opened at Austin on February 3. The specifications (No. 667) called for clearing Hamilton reservoir site—Schedule 1, 9,700 acres and schedule 2, 6,100 acres. Bids received for each schedule were as follows: Brown & Root, Inc., Austin, Tex., \$189,150 and \$134,200; T. L. James & Co., Inc., Ruston, La., \$203,700 and \$164,700; Atlas Construction Co., Dallas, Tex., \$290,030 and \$182,390; Morrison-Knudsen Co., Boise, Idaho, \$289,545 and \$242,780; S. E. McCullough, Dallas, Tex., \$349,200 and

\$219,600; J. De Puy, San Antonio, Tex., \$353,080 and \$241,560; The Driver Co., Memphis, Tenn., \$363,750 and \$228,750; Al Johnson Construction Co., Minneapolis, Minn., \$411,280 and \$262,300; Cage Bros. & Ruby, Bishop, Tex., \$383,150 and \$305,000; W. E. Callahan Construction Co., Dallas, Tex., \$582,000 and \$366,000; Nevada Construction Co., Nevada, Mo., \$344,835 (Schedule 1 only). The low bid of \$323,350 for both schedules was submitted by Brown & Root, Inc.

THERE is practically no unemployment on the Carlsbad project.

Progress of Investigations of Projects

Silt survey, Colorado River, Arizona-California.—Surveys and borings along the Colorado River between the Parker and Imperial dam sites to determine the effect of desilted water released from the Parker Reservoir on the river channel consisting of 18 cross-sections, have been completed. The maps and profiles have been prepared and forwarded to the Denver office for review.

Wciser-Payette, Idaho.—Field work during the month was hampered by cold and stormy weather. A level traverse was run in the vicinity of the Twin Springs dam site to ascertain the equation between the datum of the United States Geological Survey survey of the reservoir site and an earlier survey by the Bureau of Reclamation of the dam site. Cross-sections were taken at various intervals for a distance of about 8 miles along the Phyllis Canal to determine its capacity. Water-supply studies were carried forward in the field office to determine the irrigation needs of the Boise project and the past shortages. Studies were undertaken to estimate the quantities of water available for rediversion from the various drains and subsequently pumped into the Deer Flat Reservoir. A report on the Boise River investigations is now in preparation.

Gallatin Valley, Mont.—Assistant Geologist F. M. Murphy made a preliminary geological examination of the Spanish Creek dam site, located about 22 miles downstream from the Lower Basin dam site. An inspection was also made of two alternative dam sites for the Lower Basin reservoir site. Drill hole no. 1 at the Lower Basin dam site was completed from a depth of 195 feet to 358 feet. Hole no. 2 was drilled to a depth of 80 feet by the end of the month. The holes encountered limestone which exhibited some leakage, mainly along fissures. Drilling progress has been slow because of the necessity of grouting the rock

seams and reaming the casing down to secure accurate data on percolation tests and cold weather which caused freezing of the pipe lines. The results of the testing to date were reviewed by Associate Geologist F. A. Nickell and plans formulated for additional explorations to be conducted at this site. Two plane table parties were engaged throughout the month in completing the reservoir topography for the Lower Basin reservoir site and taking topography in the canyon downstream from the dam site to obtain data on highway relocation. A profile survey was also made for an alternative dam site (no. 2) for the Lower Basin reservoir. The test pit crew has uncovered the rock on the west abutment along the 6,200 foot contour for a distance of 300 feet upstream and 500 feet downstream from the dam axis. This crew is now engaged in uncovering the rock on the east abutment of the dam site.

Madison River diversion, Montana-Idaho.—Investigation is being made to determine the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henrys Lake, Idaho. Field surveys on these investigations have been completed. Water supply studies to determine the amount of water available for diversion will be completed upon the receipt of data from the Montana State officials stating the conditions under which transmountain diversions will be permitted.

North Unit Deschutes project, Oregon.—The location survey for the North Unit main canal was completed from mile 51.3 to its terminus at mile 65.0 on the Agency plains about 5 miles beyond the northerly rim of Willow Creek. From mile 51.3 to 54.6 the canal line contours northwesterly at an approximate elevation of 2,650. From mile 54.6 to 57.5 the line chutes down the point of the ridge to elevation 2,480. From mile 57.5 to 59.2 the line contours along the easterly side of the

railroad to the south rim of Willow Creek Canyon. From mile 59.2 to 59.5 the canal crosses Willow Creek Canyon in an inverted siphon having a maximum head of about 260 feet. From mile 59.5 to 65.0 the line follows a flat grade across the Agency plains. An alternative canal location was also surveyed from mile 48 to 49.6. A location survey was started for the Mud Springs lateral which diverts from the main canal near the Madras railroad station. A total of 6 miles (including 1.8 miles of alternative line) were surveyed during the month. Cross-sections were surveyed for the main canal at 100-foot intervals with numerous pluses from the site of the diversion dam to mile 3.26. Test pits at 400-foot intervals along the main canal were excavated from mile 48.5 to 59.2, and on alternative locations between miles 34.4 and 35.3 and 45.9 and 49.6. This phase of the work was completed on January 13 and the test pit party disbanded. A planetable party has continued the irrigable area survey. Thirty thousand three hundred and thirty-six acres were covered during January making a total to January 31, 1936, of 69,596 acres. It is contemplated that the irrigable area survey will be completed about the middle of February. In the field office the main canal alignment and profile were computed and platted to mile 65; preliminary canal sections were computed, the bottom grades platted and excavation quantities computed from mile 3.3 to 38.7; canal cross-sections were platted from the diversion dam to mile 3.3.

Crooked River, Oreg.—Data were secured from the Pacific Power & Light Co. pertaining to the present set-up of their Cove and Bend power plants and transmission lines and an estimate of the additional requirements to provide power from the Cove plant for pumping onto the Ochoco lands near Prineville.

Report on these investigations is in course of preparation.

Rapid City, S. Dak.—The engineer in charge arrived at Rapid City, S. Dak., on January 27 and has been engaged during the remainder of the month in the collection of data and reports available in local offices. The chamber of commerce submitted available data on the Deerfield Dam site on Castle Creek near Rapid City. The city's interest in this reservoir appears to be in trading a small amount of storage water during the late summer for the waters from three large springs on the bank of Rapid Creek which are now used by the fish hatchery and various irrigators along Rapid Creek.

Salt Lake Basin, Utah.—Field work on the Currant Creek and the Ouray project investigations are completed. It is planned to complete the reports on these investigations in the near future. In December 1935 a number of gaging stations on the Virgin River were installed to determine the surplus waters available for diversion near Hurricane, Utah, for the development of lands south of the Virgin River between Hurricane and St. George. The hydraulic investigations, including arrangements made for the collecting of silt samples to determine the quality and quantity of silt at various places along the Virgin River were initiated during December and carried forward throughout December 1935 and January 1936. An inspection of the Dixie project investigations was made on January 24, 25, and 26, and a reconnaissance was also made of the irrigable lands proposed for inclusion in the Dixie project.

Canal to Skirt Calxico

Secretary of Interior Harold L. Ickes announced February 4 that final approval had been given to the routing of the All-American Canal around Calxico, Calif.

The route of the canal in the vicinity of Calxico had been the subject of controversy for several months. Some citizens of the city, which lies directly on the international boundary, wanted the canal routed through the city.

The All-American Canal consulting engineering board had recommended against routing the canal through the city because of danger of severe damages in case of a break. Subsequently a special board appointed to rehear the case, recommended final approval of the R line, which passes the city on the north.

Secretary Ickes said the canal would be beautified in the vicinity of Calxico, "provided funds can be used for that purpose."

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Sutherland Dam: Modified soil control proposed for rolled-fill dam construction, illus., *Eng. News-Record*, Jan. 30, 1936, V. 116, pp. 158-159.

Book Review

Water Rights for Irrigation, Principles and Procedure for Engineers: By S. T. Harding, Prof. of Irrigation, University of California.

This book, based on 25 years of experience in engineering practice and teaching engineering students of a western university, includes the elements of law, engineering, and public policy in relation to this most important natural resource of the Western States. It is divided into 10 chapters discussing: The history of water rights, from early use to present procedures, general classification of waters appropriation rights, principles of riparian

rights, conflict of riparian and appropriation rights, loss of water rights, underground waters, rights on international and interstate streams, rights-of-way, and water-right legislation, including acquirement of new rights, adjudication of old rights, and administration of water rights.

The book is issued in photolith form, 5½ by 8½ inches, 176 pages, price \$2.25, Stanford University Press, California.

THE Poultry Producers Association of Central California has installed cold storage facilities at Orland for holding birds prior to shipping. This improvement was a long-felt need.

All-American Canal Program Sponsored by A. S. C. E.

The January meeting of the Los Angeles section of the American Society of Civil Engineers consisted of an All-American Canal Program. The meeting which was held in the evening at the University Club, was attended by about 200 members of the Los Angeles section of the society.

M. J. Dowd, chief engineer and general manager of the Imperial irrigation district, spoke on the early history of Imperial Valley. W. E. Callahan, president

of the W. E. Callahan Construction Co., described the equipment being used by his company in excavating the canal, illustrating his talk with lantern slides and motion pictures. R. B. Williams, construction engineer in charge of the All-American Canal project, gave a talk illustrated with lantern slides on features connected with design and construction of the canal and Imperial Dam and desilting works.

with its 9,000,000 gallons of water, another 25,000 gallons was required to replace the volume lost by compression of the air in the water contained in the pipe and the expansion of the steel pipe as pressure was applied."

The penstock system tested was the upper Nevada penstock, the first of the four to be completed. The remaining penstocks are approaching completion, with all the pipe fabricated and most of it placed.

The first of the 82,500-kilovolt-ampere generators, more than twice as large as any previously installed in this country, was being installed in the Nevada powerhouse where it will be served by this penstock. Fifteen of these giant generators and two 40,000-kilovolt-ampere generators will be installed in the Boulder Dam powerhouses.

This generator will serve the city of Los Angeles. Seven such generators are expected to be installed this year.

Power generation will be started later this spring, probably in May.

Penstock Tested as Generator is Installed

THE first of the four huge penstock systems at Boulder Dam had successfully passed its test on December 26, 1935, under a hydraulic head of one and one-half times the maximum it will be required to withstand under operating conditions.

"All parts of the system", Ralph Lowry, Bureau of Reclamation construction engineer in charge, said, "successfully withstood the pressure; only a few and extremely small leaks were apparent during the test and these will be readily tightened by additional caulking."

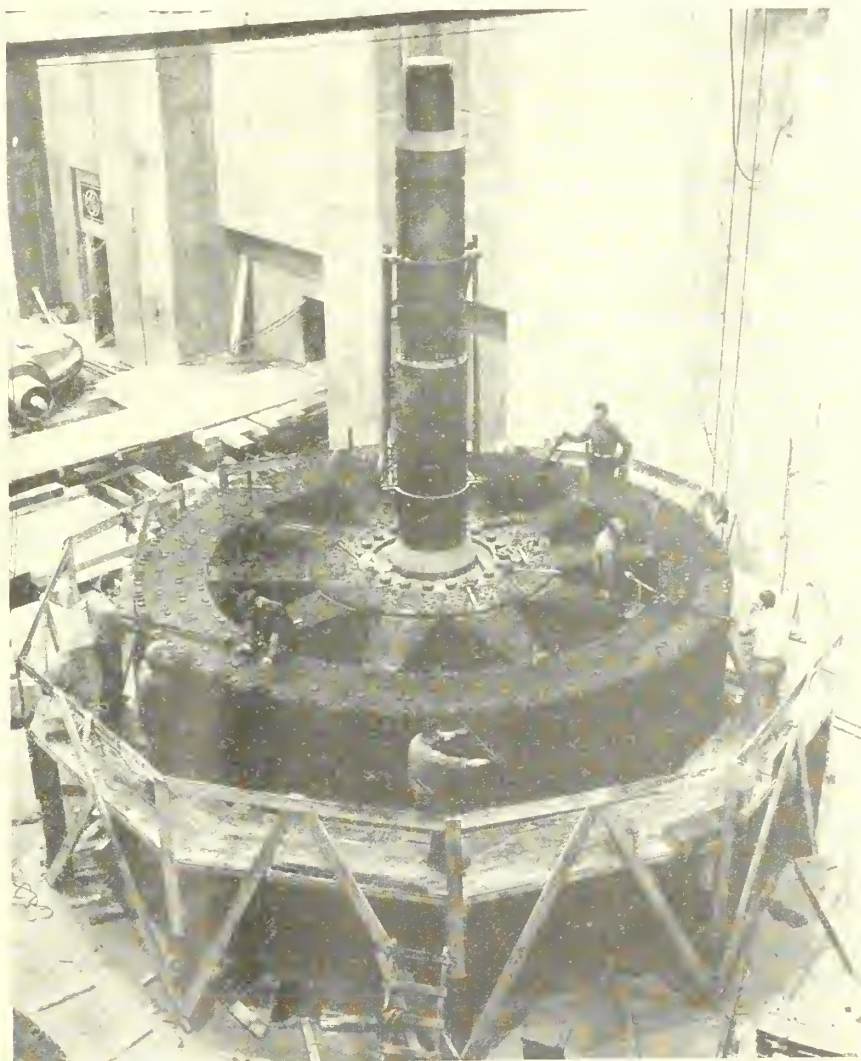
This penstock system will feed a battery of four 82,500-kilovolt-ampere generators in the Nevada powerhouse at the foot of Boulder Dam. It consists of a 30-foot diameter supply header which receives water from the reservoir through gates in an intake tower, four 13-foot diameter connecting lines to powerhouse turbines, and six 8½-foot diameter conduits leading to 84-inch needle valves in the canyon wall outlet works. All the pipe sections are fabricated of plate steel of a maximum thickness of 2 inches. The joints were electrically welded. The field joints were connected by heating and shrinking, inserting cold pressure pins of 2½ inches maximum diameter, and caulking the ends of the outer or encircling pipe.

The penstock drops 253 feet from the intake tower openings to the turbines.

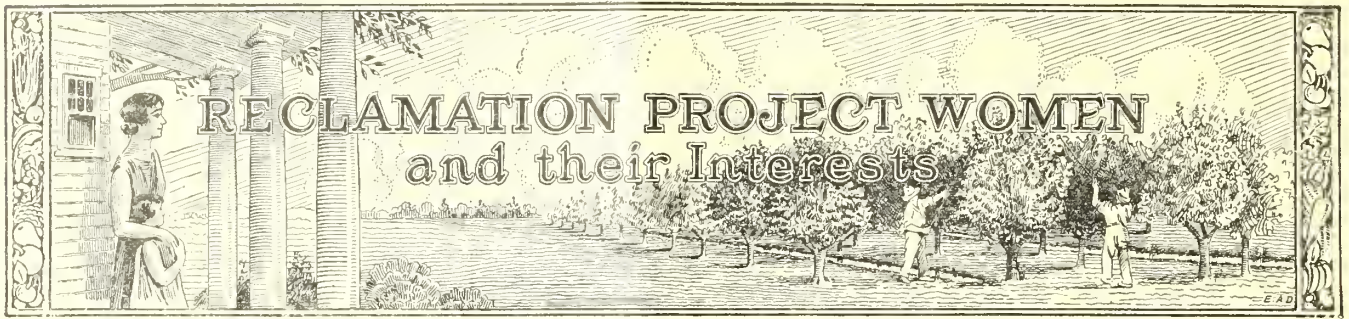
For the hydraulic test, the pipe openings at the intake tower and powerhouse were closed by steel bulkheads, and the canyon wall outlet conduits were sealed by needle valves. The system then was filled with water by pumps from sumps in the river bed below the dam. It took 3 days to pump 9,000,000 gallons into the penstock system and fill it. After the penstock system was filled additional head was applied by filling a standpipe to an elevation 648 feet above the center line of the header and 831 feet above the penstock outlets at the powerhouse. Thus a pressure of approximately 280 pounds per square inch was applied to

the 30-foot diameter header pipe and 360 pounds per square inch to the 13-foot pipe leading to the turbines. The maximum operating pressure on these same 13-foot pipes when the reservoir is at capacity will be 248 pounds per square inch.

Lowry said, "It is interesting to note that after the penstock system was filled



The first of the world's largest generators being installed at Boulder Dam in the Nevada powerhouse. This giant will have a capacity of 82,500 kv-a.



The Helping Hand Society of Malin, Oreg.

By Mrs. Almo H. Newton, Merrill, Oreg.

AN UNUSUAL club which has had a long and interesting history in Klamath County is The Helping Hand Society, of Malin, Oreg. It is just this year "coming of age" as it will celebrate its twenty-first birthday in June 1936.

"We will never, at any time, say anything detrimental to anyone at our meetings", read one of the early bylaws of the society, and contrary to the usual rule, the members have upheld this law staunchly through the years. The husbands of these first few members laughed when they heard of the passing of this bylaw, for they believed it would never be upheld. Gradually, however, they realized that the society had a serious purpose, and it was not long before they were only too willing to aid in any way they could.

This club was formed by a few scattered homesteaders' wives in a sagebrush land, in a time when conveniences were few, transportation was hard and uncertain, and money was scarce indeed.

Of the seven charter members, four are

still active in the society. Of these, Mrs. Clara Daniel is serving again this year as president; Mrs. Dilla Bailey has served 7 consecutive years as secretary-treasurer; Mrs. Lyda Kirkpatrick and her sister, Mrs. Emma Wilson, have at various times filled the different offices.

At their first meeting, when the seven courageous women first came together, \$1.75 was collected in dues. This seems a small sum, but it was to prove the nucleus of a fund which has served the community many times. Shortly after that the seven members bought gingham, made it into aprons, and sold them to each other at a slight profit.

The glow of achievement fired their ambition, so they looked for more extensive fields for their endeavor. They assumed the task of threshing some Sudan grass for the husband of one of the members, he having grown a small amount as an experiment. They tried every method their ingenuity could devise, from pounding it with sticks to sacking and rubbing it on the washboard,

and after 2 days' hard work were rewarded with the whole sum of one dollar!

The farmers owned no automobiles in that hard-pressed time, so these members drove their teams from 1 to 15 miles to the home of the hostess, holding an all-day session. The hostess furnished a hot noon meal, thereby setting a precedent which obtains to the present time. Since the club now comprises 30 to 40 members, it is quite a pleasant meal and the fact that the hostess is fined if she provides any but simple food precludes a burdensome service by the hostess.

PRACTICAL ASSISTANCE

The ladies soon found many deserving causes to which they could render aid. Among the first was the Shasta View schoolhouse, to which they supplied a much-needed piano. Taking advantage of election year, they gave an entertainment to the candidates for county office. The members invested their meager funds in materials, from which they made 50 boxes and filled them with delicious home-cooked food. These boxes were auctioned at the meeting, and to the club members' intense satisfaction, they realized \$85 from this venture.

This was the feat which impressed the husband, who had predicted the society would disband within the year. The men even allowed their wives the use of the farm horses in the busiest season of the year and offered time and tools for many projects.

The society was soon called upon to assist in Red Cross work and its members responded by meeting each week to sew, knit, or do anything that was required. Their first entertainment for this work netted them \$200, quite an amount to be raised by a membership of only 12!

Since that time the society has helped purchase a piano for the high school, one for the community hall, and nearly furnished the hall kitchen, and has helped to pay numerous other bills incurred during its construction.



W. W. Bailey home in 1911

The society holds a bazaar each year which usually nets \$125 to \$160 which is used in the community in many ways, such as aid to the sick in the form of fruit and flowers, helping the high school purchase athletic equipment, and so on.

A reception is given each year by the society for parents and teachers of both grade and high schools, and a delicious "feed" is served to both the boys' and girls' winning athletic teams. The society has furnished and maintains a rest room for the use of teachers and pupils who are taken ill at school, has taken an active part in a health program in connection with the county health association, and for the past 2 years has actively supported the President's Ball, the purpose of which is to raise money to combat infantile paralysis.

During the passing years, sagebrush has given way to fertile fields, automobiles have become a necessity, and good roads are here to stay. Homes have been wonderfully improved and many other blessings have come in the wake of irrigation which has brought its life-giving water.

Malheur County Library,

*By Mrs. Mildred E. Oleson,
County Librarian*

A visitor to the Malheur County Library stood looking at the map of the county. "This isn't a county!" he exclaimed. "It's a State!"

The very size of the county offers a challenge to the library. People in remote sections, cut off not only from villages but from neighbors, need books. It is not necessary to stimulate an interest in books and reading. The problem is to supply the demand.

The Malheur County Library was organized as a county library in May



A modern home, showing the miraculous changes which have taken place on the Klamath project during the past 2 or 3 decades

1920. The Ontario Public Library, housed in a Carnegie building, is the central library of the system. The two branches are located in Vale and Nyssa. The branches are supported locally and own some of their books but the main collection is supplied by the county library. Special requests are sent to the central library. If the county library cannot fulfill the request the order is referred to the State library. Eighteen stations are scattered over the county, housed in post offices, stores, garages, and private homes. There are 46 school stations.

And so, we see the main lines of the library's activities—to the branches, the stations, the schools, and the individuals. Any resident of the county has the privilege of writing directly to the library for books. No person in the county need be without reading material.

There are endless ramifications to the work done by the library. Reference questions come by telephone and mail. "What is the Indian name for the board to which the papoose is strapped?" "Where can I find a good account of the manufacture of pretzels?" "How do you measure hay in the stack?" "Where can I learn about the diseases of the gold-fish?"

Club leaders and grange lecturers appeal for help with their programs. The library is glad to collect material for the study clubs, and books are reserved for a reasonable period so that those participating in the programs may have access to the best available information.

Close cooperation with the schools has lead to courses in library instruction, work with the parent-teacher groups, and advice to parents in the choice of reading for their children.

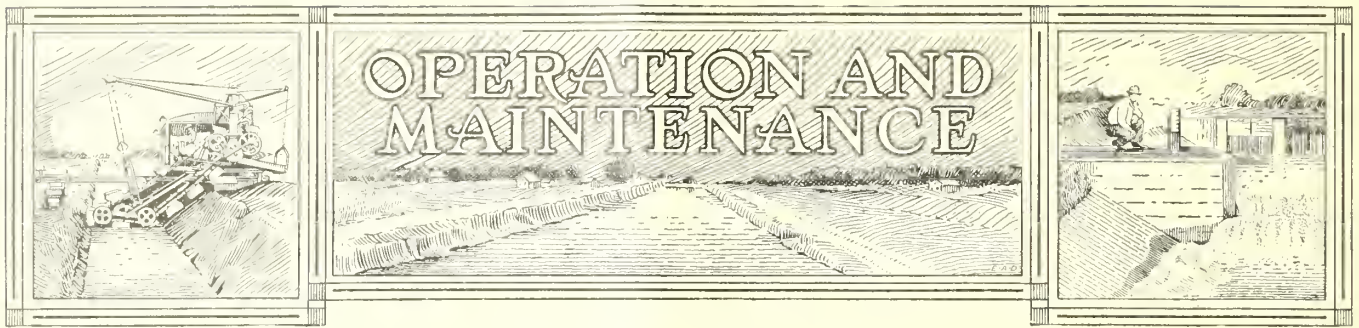
Like most libraries, the Malheur County Library has had to keep a sharp watch for economies. Last year the S. E. R. A. and this year the W. P. A. have furnished the library with a group of women to mend and repair books. Three young people, under the auspices of the National Youth Movement, have worked in the library shelving and checking books and wrapping packages to be mailed.

Last year 79,390 books traveled from the central library to the various agencies and individuals.



Public Library, Ontario, Oreg.

SNOWFALL on the North Platte project has been quite heavy in the mountains and prospects are good for an ample water supply for the coming season.



Poisonous Weeds

By L. H. Mitchell, Field Supervisor in Charge of District No. 4

FREQUENTLY on irrigated projects, because of the mass of other weeds, poisonous plants cannot be readily distinguished and it is a common occurrence for a farmer to be unaware of the presence of poisonous weeds on his property or on waste places near his home. An irrigation farmer's lack of knowledge about these disastrous weeds very often can be traced to the fact that he has no livestock feeding in his pastures and consequently has not yet had the experience of losing some valuable animal which has eaten such weeds. Yet few irrigated sections are free from poisonous weeds. Only scattered localities of the irrigated West have escaped losing either human lives or livestock from eating poisonous plants.

It is not unusual when conversing with farmers on this subject to find some who

have lost valuable livestock, and upon further investigation circumstantial evidence has pointed to poisonous weeds as the cause. They were not informed on the subject and did not think of investigating the cause. The old saying, "Don't lock a door after property is stolen" applies here. Many farmers do not look for poisonous weeds until livestock or, in some instances, even members of their families have become their victims.

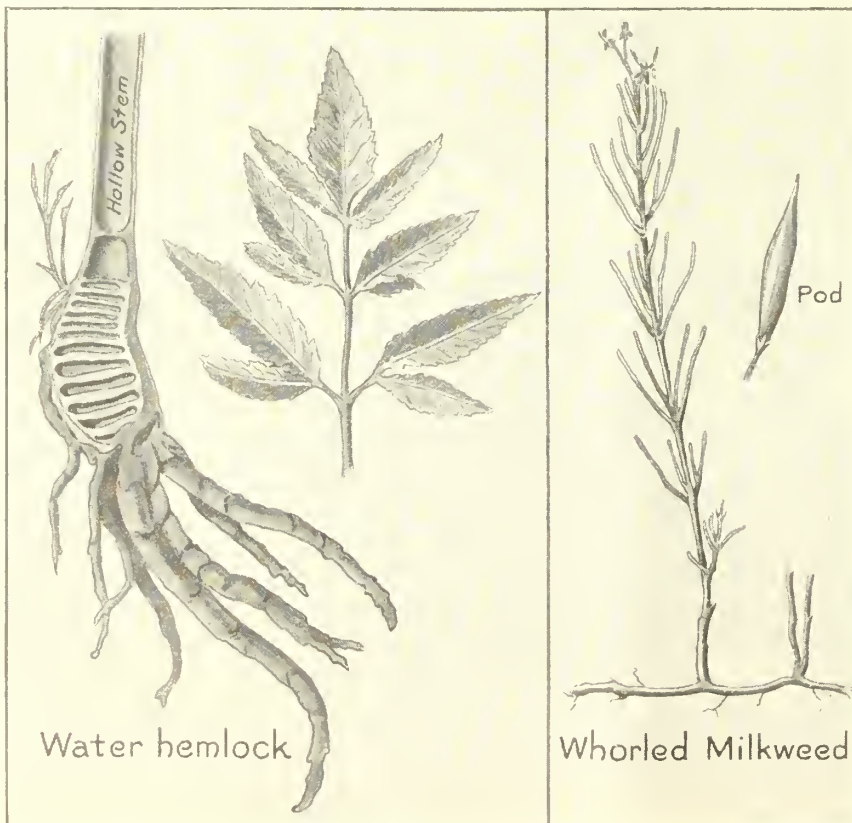
The purpose of this article is to acquaint our settlers with the whorled milkweed and water hemlock—two very poisonous weeds found on many of the Government projects—which, among the many other poisonous weeds are the most prevalent and dangerous.

Whorled milkweed.—This weed is easily recognized by its leaves which grow in

whorles around the stem. It grows either in clumps or a single stem. Its height depends upon growing conditions. On vacant farms and on the prairie it rarely grows higher than 18 inches. Where moisture and soil conditions are favorable—on irrigation ditches for example—it will grow twice this height. When mature, the seed pod is 2 to 3 inches long and is in about the proportion shown in the illustration. On a few of our projects large losses of livestock occur each season from this weed. It is also a perennial that is hard to control. On a few reclamation projects the loss of range stock has been so heavy and frequent from feeding hay containing whorled milkweed and from pasturing stock in the fall or early winter on the farmers' ditch banks and other waste places where this weed may be found, that stockmen make surveys and keep records of the farms where this and other poisonous weeds are permitted to grow. The result has been that many farms infested with this weed have had no buyers for either hay or pasture.

Project settlers should always be on the watch for this weed, and when discovered, use effective methods to eradicate it.

Water hemlock.—This weed, although new to some projects and most of the settlers, is perhaps one of the oldest known poisonous plants in the world. In order to impress the readers of this article with the dangers of the weed, and to add weight to what was heard and observed in the field during the summer of 1935, the following is quoted from Compton's Encyclopedia: "The water hemlock (*Cicuta maculata*) is probably the most deadly of poisonous plants, and in fact is the most poisonous of all our native plants. It is especially dangerous because the fleshy carrot-like root, in which the poison is most concentrated, is sometimes eaten by children. Even water in marshes where these roots have been crushed by trampling is poisonous to cattle." The Rural Life, Knowledge and Inspiration, A Guide to the Best in



Modern Living, has this to say about water hemlock: "This is without doubt the most poisonous plant in northern United States and Canada. There are several species, all closely resembling. It is found in moist places. It grows from a rootstock to which are attached roots which may be rather thick and tubelike. If the rootstock is cut lengthwise, it will be found to have a number of transverse chambers. The plant grows luxuriantly along irrigation ditches, growing clear to the edge of the water and even reaching out into the water with its roots."

The illustration accompanying this article shows how this weed may be identified. Another, and probably the best means of identification is by breaking one of its fresh roots. When this is done a yellowish sap, an oily material, appears. Water hemlock can easily be confused with the wild parsnip until they are examined together, when a difference from the roots to the seeds can be easily observed. Regarding the wild parsnip the Rural Life states: "The true wild parsnip is not poisonous. However, it harbours fungus that is very destructive to celery." Therefore, my suggestion is, when eradicating poisonous weeds, play safe and include the wild parsnip.

In order to acquaint our project settlers with a few of the many water hemlock poisoning cases called to my attention in 1935 when visiting projects to give aid and direction to settlers, the following impressive cases are recited:

(1) A fruit grower on a small acreage near Provo, Utah, owned a cow that was obtaining its feed by grazing on an irrigation ditch passing in front of the farm home. The cow, much to the farmer's surprise, one morning was found dead. He did not know the cause of its sudden death but upon examining the water's edge of the ditch the writer found considerable water hemlock. Circumstantial evidence points to this weed as the cause of the cow's death.

(2) On a project in Wyoming when cleaning a ditch with a dragline, the material which was not known to contain water hemlock was placed where livestock were accustomed to browse when going from pasture to corral. Soon after the completion of this work 11 of a dairy herd of 26 died in a few hours' time. A veterinarian was called who, after investigating, diagnosed the cause as poisoning from eating water hemlock.

(3) In a rural school district in Colorado, several of the children who were playing with the hollow stems of water hemlock during recess evidently got some of the poisonous roots in their mouths, for soon after many of the pupils were sick

and the teacher dismissed school. Later in the day two of the children died.

Some of the irrigated projects in Colorado, Idaho, Oregon, Utah, and Wyoming appeared to be more infested with this very poisonous weed than the projects in other States. A few of the projects appear to be free from this weed.

Eradication of water hemlock.—Water hemlock is eradicated either by pulling out or grubbing all of the plant before seeds form. As it always grows in wet places, the removal of the entire plant can be accomplished easily. All of the plant, including roots, should be placed in a cloth sack, its contents labeled "Poison", and the sack put where neither livestock nor children can get it. The sack and all its contents should be burned at the earliest possible date.

It has been reported that a farmer on an irrigated project, realizing the danger connected with this weed, gathered, as outlined above, all of the water hemlock on his ditch banks. He hung the sack in his barn for the contents to dry out. When he took the sack down a few months afterward, he discovered that mice had been sampling some of the roots of the water hemlock. This discovery answered his frequent inquiry as to what could be killing the mice. This is not a suggestion to be tried for eradicating mice, but it does show how poisonous the roots of the water hemlock are and how imperative it is to burn the weed as soon as practical.

IF

If this article, with the two previous ones relating to weeds, makes our reclamation farmers weed conscious, its purpose has been accomplished.

If the farmers on irrigated projects work consistently, conscientiously, and cooperatively (C. C. C.) to eradicate weeds, they can do it.

If any damages from weeds are lessened by having clean ditch banks and farms the individual, the project, and the community are the winners.

WEED TOURS OR FIELD DAYS

No better way is known to acquaint farmers with the various types of weeds and their control or eradication than to have well-arranged and planned weed tours. To that end farmers on many reclamation projects are cooperating with the Bureau in the plan of controlling weeds by carrying out the suggestions previously outlined and it is anticipated much good will follow.

RECOMMENDATIONS

A great deal is being written and said about the handling of various crops, timely irrigating and cultivating, main-

tenance of soil fertility through rotation and manuring, soil conservation, and erosion control. Project settlers, do not lose sight of the most important agricultural problem on our projects, namely, weed control. Watch your local newspapers for weed tour notices and join the caravans. Have the study of weeds a major project in 4-H and vocational agricultural work and encourage the boys, the farmers of tomorrow, in this important educational undertaking.

Magazine Recognizes Value of Bromegrass

The following is taken from November 1935 Successful Farming magazine, page 5:

"BROMEGRASS.—The increased interest in this grass comes as a result of the killing out of Kentucky bluegrass during the drought of 1934. It is a new crop but in the Missouri River area and eastward it has recently proved its great value. Nebraska farmers report that it grazes about twice the livestock per acre that bluegrass will carry. The Nebraska State Highway Department has used it extensively for seeding along the shoulders of pavement to prevent soil washing and weed growth. It is recommended that this crop be seeded with sweetclover and timothy which come on rapidly and make pasture while brome is getting established.

"At the Kansas station brome demonstrated its great value during the drought. Chief objection is its tendency to become sod bound, which is merely a condition of nitrogen deficiency, according to A. E. Aldons, pasture authority. Adding fertilizer or manure will correct the deficiency, and it is recommended that legumes be planted with the brome."

THE Holly Sugar Corporation of Colorado has purchased the beet-sugar factory located at Hamilton City, 10 miles east of Orland, and has started the work of modernizing and rebuilding. The plant has been idle for more than 20 years.

THE Grand Valley project report for January states that the first instalment of operation and maintenance, \$9,500, was paid in full by the Grand Valley Water Users Association; the Mesa County Irrigation District paid \$1,000 on water rental. About \$4,200 miscellaneous, chiefly from sale of materials to E. C. W. camps, made up the balance of the month's collections.

Sugar-Beet Seed Growing on the Rio Grande Irrigation Project

SUGAR-BEET seed grown on the Rio Grande irrigation project for planting in sugar-producing areas elsewhere, has come to be one of the project's most important and valuable cash crops, although no beets are grown on the project for sugar production. An advantage which has promoted the development of the enterprise has been the fact that seed planted about the first of September produces a heavy seed crop about the first of the following July without any transplanting.

First experiments in the growing of sugar-beet seed on the Rio Grande project were conducted in the early fall of 1922 as a cooperative venture between the United States Department of Agriculture and the New Mexico Agricultural Experiment Station. Beet-sugar companies have taken an active interest in and given encouragement to the development as a domestic source of seed supply for sugar-beet growing districts.

Plantings were made twice each month beginning in September 1922, and continuing until July 1923. It was found that beets planted in September and early October had attained sufficient size before the onset of freezing weather to resist any appreciable amount of winter kill. The winter cold checked the growth of the plants temporarily, but with the advent of warm weather in the spring an active growth was resumed, with seed stalks developing rapidly during May and June and producing a heavy crop of seed ready for harvest by the first of July.

Further experiments continued from 1923 through the year of 1931 determined the following facts:

(a) That the best yields could be expected from those plots planted between August 15 and September 15.

(b) That the heaviest yield combined with the greatest viability could be obtained by planting in 22-inch rows, using a planting rate of 18 pounds of seed per acre and leaving the plants unthinned;

(c) That frequency of irrigation plays a highly important part in increasing the amount of seed, it being particularly necessary that from the beginning of the blooming period until harvest time (4 to 5 weeks) the plants be irrigated once a week.

(d) That a medium to heavy loam type of soil heavily manured and well leveled, which permits of ready penetration by the irrigation water and on which there is good drainage to ground water below, is best adapted to the cultivation of sugar-beet seed.

FIRST COMMERCIAL PLANTINGS

The first commercial plantings were made on the Rio Grande project in the fall of 1927 with rather widely varying results as to yield and viability because of lack of information as to proper methods of procedure in this new field. From 1928 to 1932 the acreage contracted commercially for the planting of sugar-beet seed was gradually increased and as methods of cultivation became more standardized, both yield and viability in the project became more uniform. In 1932, 158 acres were planted with a yield of 426,000 pounds and a gross return of \$29,750. In 1933 the crop was increased to 446 acres with a yield of 930,000 pounds of seed and a gross return of \$70,680. In 1934, 822 acres were planted with a yield of 840,000 pounds and a gross return of \$58,806. In December 1935, 1,800 acres of sugar beet seed were under cultivation in the

Mesilla Valley, with some acreage in the El Paso Valley.

Enemies of the sugar-beet seed crop encountered so far in the Rio Grande project are the beet leafhopper and the grasshopper. Ordinarily the leafhopper, which is directly responsible for the transmission of the virus causing curly-top, has disappeared in the fall before the young sugar-beet plants emerge from the soil, and in the spring does not begin his migration to this valley until after the plants have attained such growth that there is little danger of serious crop loss through his activities. However, during the early spring of the year 1935, supposedly because of unusual weather conditions and a lack of feed in his winter habitat, this insect invaded the sugar-beet seed planting on the project earlier than usual, causing a loss of approximately 50 percent to the yield harvested during July and August of that year. Methods of combating this menace are directed chiefly toward developing a resistant type of sugar-beet plant, of which U. S. No. 1 and Accession No. 23 are to date seemingly the most successful. The grasshoppers, when numerous in the fall of the year, are best combated by destroying weedy patches and borders and other such cover in the immediate vicinity of the beet fields and by direct poisoning methods.

Pollen arising from undesirable sources such as other sugar-beet types, garden beets, mangel-wurzels, chard, or volunteer beets, must be prevented from reaching the field during the flowering season, or off types, mixtures, and worthless hybrids will be produced in place of the desired strain.

The type at present considered best adapted for propagation in this valley is U. S. No. 1. Requirements specified by commercial sugar-beet companies for sugar-beet seed grown in southern New Mexico are based on the Magdeburg standard as amended to New Mexico conditions for larger seed-ball size, this seed to be delivered in good condition, properly cleaned, but not sorted for seed-ball size except by the screens used for cleaning purposes. The seed crop is contracted for by sugar companies in advance of planting and the mother seed to be used is stipulated by the companies or sold to the seed grower by them.

PROSPECTS FOR INDUSTRY BRIGHT

Future prospects for the sugar-beet-seed industry in the Rio Grande project are, on the whole, very bright. In considering, however, the relative economic importance of this project to the valley it must be borne in mind that (1) before planting, a contract must be entered into



Beets planted for sugar beet seed crop, Rio Grande project, New Mexico-Texas

between the producer and one of the commercial sugar-beet companies for disposal of the crop, otherwise the possibility of finding a market is very slight; (2) owing to the necessity for heavy fertilization, frequent irrigation, and special beet machinery, a greater outlay in money is necessary than for most crops; (3) the sugar-beet-seed industry on this project is still to a certain degree in the experimental stage and the extent to which cross-pollination and insect pests can be controlled has not yet been fully determined.

On the basis of past experience and conclusions reached, the Rio Grande project in New Mexico, with a fall planting of 1,800 acres for the year 1935, may well look forward to the harvesting of 3,500,000 pounds of cleaned sugar-beet seed by August of 1936. This would mean about 25 percent of the total required for planting the annual sugar-beet crop in the United States, with a gross return to our local producers in the neighborhood of a quarter of a million dollars.

ON November 30, the first annual meeting of the farmers' unions of western Colorado was held in Grand Junction. Nearly every city in western Colorado was represented. It is estimated that 2,000 attended this meeting.

Organization Formed in Western North Dakota

Western North Dakota marshaled its forces at Mandan January 24 to join with the Greater North Dakota Association in an attempt to bring insured crops and a stable farm revenue to dry acres in the State.

Men from all sections of the Missouri Slope met with Greater North Dakota Association officials to form the Western North Dakota Reclamation and Conservation Association which will affiliate with the national association.

The new organization is pledged to campaign for furtherance of conservation and irrigation projects in the western part of the State, to seek dam and river and flood-control measures and Federal aid for their construction.

Heading the new association is Jacob Krier of Gladstone as president, with M. O. Ryan, secretary of the Greater North Dakota Association, and the State planning board, as secretary. Directors include Krier, J. D. Beakey, Williston; W. C. Krebsbach, Reeder; R. E. Tousdale, Mott; S. W. Corwin, Bismarek; E. W. Jones, Killdeer; W. P. Whitney, Dickinson; Michael Tschida, Glen Ullin, and Martin Holtan, Washburn.

Nearly a score of reclamation projects were reviewed before J. E. Davis of Bismarek, chairman, turned the session into an open conservation discussion.

Gov. Walter Welford sounded the keynote, calling on all North Dakotans to aid in water and soil conservation.

"The time has come when North Dakota must rebuild", he declared.

(Continued on p. 80)

Fire at Parker Dam

Fire swept a dormitory at the Six Companies' camp at Parker Dam early in the morning of February 3, causing seven deaths. The blaze also razed the mess hall and store.

E. A. Moritz, construction engineer reported: "The best available information is that the fire started near the center of the dormitory at about 2:30 in the morning. The intense heat generated by this fire and its proximity to the mess

hall made it impossible to protect the latter, although there was practically no wind. It seemed to me quite miraculous that the other dormitory was saved. All efforts were concentrated on this building after the other two were hopelessly gone."

San Bernardino County, Calif., officials took charge of the bodies of the victims, several of whom were recent arrivals in camp.

Relative order of importance by value—Crops for 1934 on 25 Federal irrigation projects

1. SIX CROPS ON EACH PROJECT OF HIGHEST VALUE

State	Project	First	Second	Third	Fourth	Fifth	Sixth
Arizona	Salt River	Alfalfa	Cotton	Truck	Citrus fruit	Other hay	Wheat
Arizona-California	Yuma	Truck	Alfalfa seed	Alfalfa	Citrus fruit	Citrus fruit	Do.
California	Orland	Alfalfa	Corn	Small fruit	Citrus fruit	Prunes	Peaches
Colorado	Grand Valley	Beans	Potatoes, white	Potatoes, white	Corn	Sugar beets	Wheat
	Uncompahgre	Alfalfa	Wheat	Potatoes, white	Do.	Onions	Sugar beets
Idaho	Boise	Do.	Potatoes, white	Wheat	Barley	Clover seed	Onions
Montana	Minidoka	Do.	Potatoes, white	Wheat	Clover seed	Beans	Sugar beets
	Bitter Root	Do.	Apples	Sugar beets	Wheat	Do.	Truck
	Huntley	Sugar beets	Do.	Beans	Do.	Oats	Do.
	Milk River	Do.	Do.	Potatoes, white	Oats	Wheat	Do.
	Sun River	Alfalfa	Wheat	Beans	Do.	Potatoes, white	Barley
Montana-North Dakota	Lower Yellowstone	Sugar beets	Alfalfa	Oats	Corn fodder	Wheat	Do.
Nebraska-Wyoming	North Platte	Do.	Potatoes, white	Alfalfa	Barley	Corn	Oats
Nevada	Newlands	Alfalfa	Wheat	Pasture	Do.	Truck	Small fruit
New Mexico	Carlsbad	Cotton	Alfalfa	Alfalfa seed	Other hay	Oats	Wheat
New Mexico-Texas	Rio Grande	Do.	Do.	Truck	Corn	Potatoes, sweet	Apples
Oregon	Umatilla	Alfalfa	Truck	Pasture	Do.	Potatoes white	Other hay
	Vale	Do.	Potatoes, white	Wheat	Onions	Clover seed	Barley
Oregon-California	Klamath	Potatoes, white	Alfalfa	Do.	Barley	Oats	Truck
South Dakota	Belle Fourche	Sugar beets	Do.	Corn fodder	Do.	Do.	Wheat
Utah	Strawberry	Alfalfa	Wheat	Truck	Do.	Sugar beets	Peaches
Washington	Okanogan	Apples	Truck	Pears	Small fruit	Potatoes, white	Alfalfa
	Yakima	Do.	Alfalfa	Do.	Potatoes, white	Small fruit	Peaches
Wyoming	Riverton	Oats	Do.	Pasture	Truck	Wheat	Alfalfa seed
	Shoshone	Beans	Do.	Potatoes, white	Wheat	Oats	Pasture

2. FREQUENCY OF RELATIVE IMPORTANCE

Crops	First	Second	Third	Fourth	Fifth	Sixth	Total	Crops	First	Second	Third	Fourth	Fifth	Sixth	Total
Alfalfa	11	11	1	1		1	25	Other hay				1	1	1	3
Alfalfa seed			2			1	3	Pasture			3			1	4
Apples	2	1				1	4	Peaches						3	3
Barley				6		3	9	Pears			2		1		3
Beans	2		2		2		6	Potatoes	1	4	4	1	3		13
Citrus fruit				2	1		3	Small fruit			1	1	1	1	4
Clover seed			1	2			3	Sugar beets	5		1			2	10
Corn		1		4	1		6	Sweet potatoes					1		1
Corn fodder			1	1			2	Truck	1	2	3	1	1	4	12
Cotton	2	2					4	Wheat		4	4	3	3	5	19
Oats	1		1	2	5	1	10								
Onions				1	1	1	3	Total	25	25	25	25	25	25	150

Organization Activities and Project Visitors

Since the death of Commissioner Elwood Mead on January 26, R. F. Walter, chief engineer from Denver, has been in Washington serving as Acting Commissioner of Reclamation.

R. F. Walter, left Washington, March 1, for a trip to Texas and in his absence designated John C. Page, Chief of the Engineering Division, Acting Commissioner.

S. O. Harper, assistant chief engineer, attended a recent meeting of the All-American Canal Board at Yuma, later going to the Central Valley project, California, to inspect the Kennett and Friant Dams and location of the various canals.

George O. Sanford, general supervisor of operation and maintenance, delivered an illustrated lecture on Boulder Dam before the Royal Canadian Institute in Toronto on February 15.

Paul M. Guyer, associate engineer in the Denver office, has been transferred to the Central Valley project, Redding, Calif.

H. Beal Atkinson and Harold A. Wallace, assistant engineers in the Denver office, have been transferred to the Boulder Canyon project.

W. H. Code, of Los Angeles, Professor Peterson, of the Utah Agricultural College, and Dr. W. I. Powers, of the Oregon State College, were recently appointed by the Secretary of the Interior as a consulting board to report on the proposed Gila Valley project, to give particular emphasis on the suitability of the soil. The board met in Yuma on January 4 and continued in session until the 10th. In addition to the members of the board, those present at the meeting included Porter J. Preston, W. W. Johnston, R. S. Hawkins, H. V. Smith, A. F. Kinnison, Dr. H. L. Shantz, P. S. Burgess, and P. H. Ross, a board representing the State of Arizona, which had met at Yuma to investigate various features of the Gila Valley project.

C. A. Lyman, field representative, spent several days on the Carlsbad project, during which period he audited the books of the Carlsbad irrigation district.

R. K. Cunningham, 1872-1936

Robert K. Cunningham, born at Westford, Pa., October 7, 1872, died from an attack of apoplexy on February 17, 1936. Mr. Cunningham had been with the Bureau of Reclamation since May 20, 1907, serving in a clerical capacity on the Yakima project, where he was promoted to the position of Chief Clerk July 1, 1924.

As the clerical work under his supervision expanded his responsibility increased from year to year. He was unsparing of his health in his endeavor to carry on as head of the clerical organization.

J. S. Moore, Superintendent, in reporting Mr. Cunningham's death, said:

"It is needless to say that Mr. Cunningham's death came as a terrible shock to me and the entire project organization. His knowledge of the Yakima project, reclamation law and regulations, and his ability to function in his capacity as Chief Clerk has been of inestimable value to myself as Superintendent, as well as to my predecessors. His integrity was



unquestioned and his personality such that a host of friends will miss his sharp wit, ready smile, and hearty laugh."

Organization formed

(Continued from p. 79)

"Experiences in recent years have proven that water and soil conservation are among the most important building activities for the State. Early pioneers took the best the State had to offer as do all pioneers, but pioneer days are on the way out. The time has come for new pioneers."

Ryan outlined the necessity for affiliating with the National Reclamation Association and reviewed the accomplishments of 13 other States forming the association. He said the State planning board has asked the National Resources Committee to make detailed studies in this State.—*The Bismarck (N. Dak.) Tribune.*

Gila Work Resumed

Secretary of the Interior Harold L. Ickes on February 3 authorized the Bureau of Reclamation to resume its work on the Gila Valley project, Arizona, as a result of the withdrawal by the Department of Agriculture of its objections to the construction.

R. F. Walter, Acting Commissioner of Reclamation, immediately telegraphed R. B. Williams, construction engineer in charge of the project at Yuma, Ariz., to again put his survey parties in the field. He also telegraphed the Denver, Colo., engineering office to proceed with readvertisement of the excavation of the gravity main canal.

Work was halted on the project December 3, and 15 bids for construction of the canal, then in the hands of Bureau of Reclamation officials at Yuma, were returned to bidders unopened the following day.

The Department of Agriculture objected to the project saying it was unjustified because of allegedly poor soil and hot climate. The Bureau of Reclamation previously had found the project feasible. Secretary Ickes appointed an independent commission of experts, W. H. Code, consulting engineer of Los Angeles, William Peterson, a professor at the Utah State Agricultural College, and W. L. Powers, soil scientist of Oregon State College, to make an investigation and report.

The commission recently made a preliminary report which was favorable to the project and promised its full and complete report on February 15. Resumption of work will not halt the preparation of this report.

The Gila Valley project contemplates irrigation of about 150,000 acres of desert land near Yuma. An allotment of \$2,000,000 of work-relief funds was made for commencement of the work, which will require several years for completion.

THE Greenfields Development Association on the Sun River project has been organized to further the development of the Greenfields division. Considerable interest is being developed in electrification, roads, schools, and industries.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation R. F. Walter, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Asst. to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk
Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; B. W. Steele, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.		B. E. Stoutemyer	Portland, Oreg.
Boulder Dam	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird ¹	R. J. Coffey	Los Angeles, Calif.
Burnt River	Vale, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
All-American Canal	Yuma, Ariz.	R. B. Williams	do	J. C. Thraillkill	R. J. Coffey	Los Angeles, Calif.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Casper-Alcova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voven	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	E. A. Peek	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do	Do.
Hyrum	Hyrum, Utah	D. J. Paul	Resident engr.	H. W. Johnson	do	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do	do	do	do	do	Do.
Minidoka	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Gurnsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Jakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam ²	Parker Dam, Calif.	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Riverton	Riverton, Wyo.	H. D. Comstock	do	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Engineer	Geo. H. Bolt	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle ¹	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Stanfield	Ontario, Oreg.	R. J. Newell	do	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Lovelock, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Engineer	do	do	Do.
Upper Snake River Storage ³	Ashton, Idaho	H. A. Parker	Constr. engr.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do		do	Do.
Koza div.	do	Chas. E. Crowmover	Constr. engr.		do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	do	Noel O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non-Federal.

³ Island Park Dam

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Engineer-manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Palisade, Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do	Chas. A. Revell	Bonanza.
Klamath, Horsedly	Horsedly irrigation district	do	Jerome Smith	do	Dorothy Evers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Project manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do	Fort 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.
do	Paradise Valley irrigation district	Zurich, Mont.	Amos Thompson	do	J. F. Sharpless	Zurich.
do	Zurich irrigation district	Harlem, Mont.	C. A. Watkins	do	H. M. Montgomery	Do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Alcorn	President		Fallon.
North Platte: Interstate div.	Pathfinder Irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder	Mitchell.
Fort Laramie div.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Nelle Armitage	Torrington.
Northport div.	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	J. O. Roach	do	Geo. W. Atkins	Powell.
Frannie div.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	Clyde Tervort	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West div.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Thompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	V. W. Russell	Manager	R. E. Rudolph	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	do.
Grand Lake-Big Thompson Transmountain Diversion	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Weiser-Payette	Boise, Idaho	J. A. Keinig	do.

SALLIE A. B. COE, Editor.



BOULDER CANYON PROJECT. ARIZONA-NEVADA

The new Kingman, Arizona, and Las Vegas, Nevada, highway winds down Black Canyon to the crest of Boulder Dam, which is its bridge across the chasm of the Colorado River. In this picture can be seen the four-lane highway on the crest of the dam. The Arizona spillway can be seen in the background.

21.5:1936

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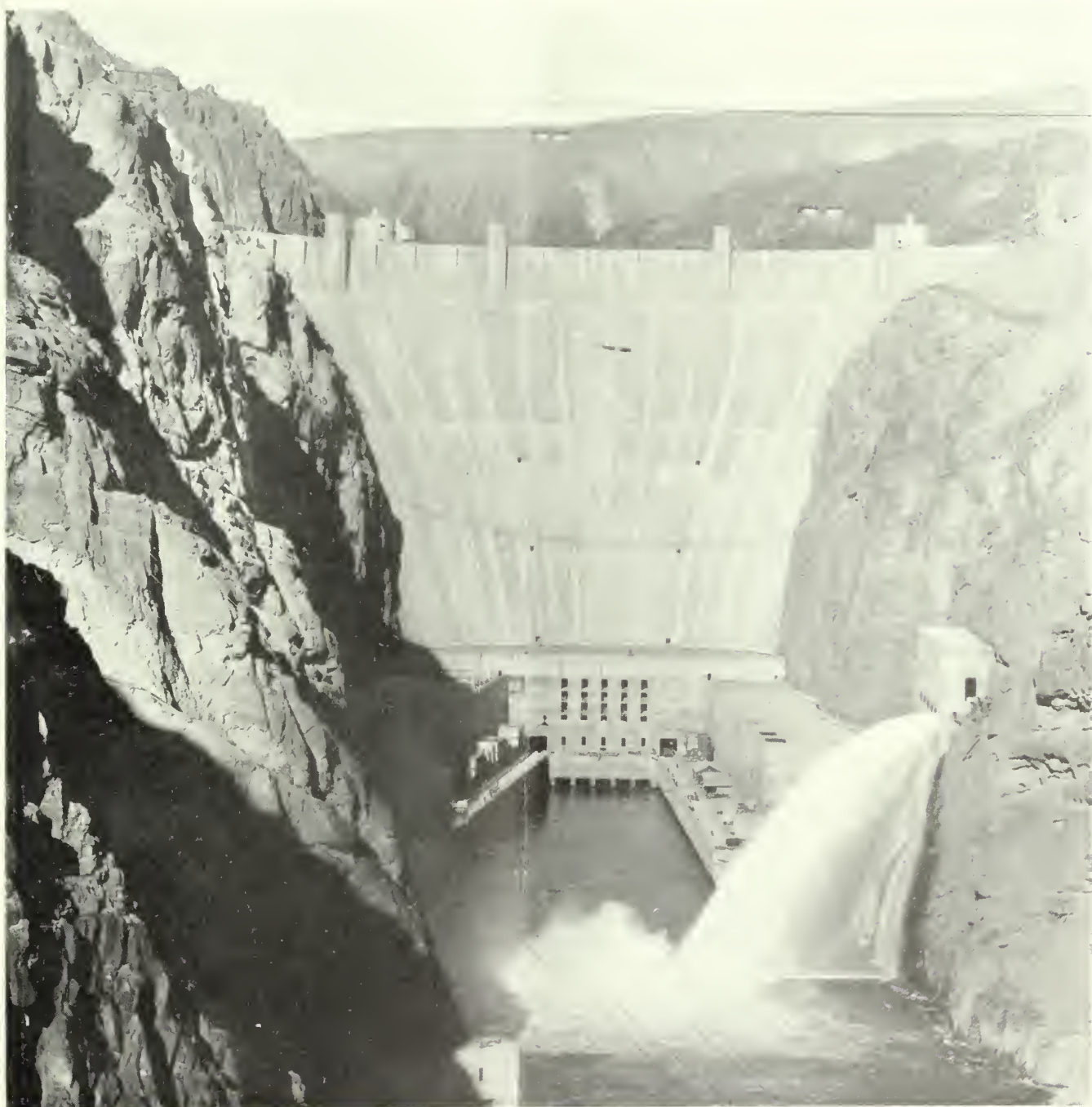
THE

RECLAMATION ERA



VOL. 26, NO. 4

APRIL 1936



BOULDER DAM, BOULDER CANYON PROJECT

FIRST WATER TO GO THROUGH PENSTOCKS AND ARIZONA OUTLET, FEBRUARY 1936

Another Milestone Has Been Passed

Where only towering cliffs marked the Colorado River's course through Black Canyon 5 years ago, today the world's highest dam stands complete, braced in the narrow gorge, one shoulder against the Arizona wall and the other against the Nevada wall, forever controlling the riotous stream.

The contractor has completed his job; the Bureau of Reclamation has accepted Boulder Dam. The transfer March 1 was marked by a total lack of fanfare. The contractor's representative shook hands with the Bureau's construction engineer and the status of the dam had changed.

Upon being notified that Boulder Dam had been accepted from the contractor, Secretary of the Interior Harold L. Ickes said:

"Another milestone has been passed in the history of the West. With final completion of Boulder Dam, man has asserted his mastery over a great and dangerous river, the Colorado, one which endangered tens of thousands while it was unregulated, but which will be an active benefit to millions now that it is harnessed. The people of southern California, Arizona, and Nevada are to be congratulated today, for the security of their futures has been vastly increased. Regulated water supplies have been guaranteed for their farms and cities. A source of a tremendous amount of cheap power has been provided for use in increasing their comforts and developing their industries."

THE RECLAMATION ERA

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Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 4

APRIL 1936



The Repayment Policy of the Bureau of Reclamation

THE INTEGRITY of the Federal Reclamation Policy, and the future existence of the Bureau of Reclamation as an agency active in the development of the West are dependent upon repayment by those benefited of the cost of construction of their projects.

The repayment principle was laid down in the Reclamation Act of 1902. While the plan under which repayment is made has been altered several times in intervening years, the principle remains unchanged. It is the main pillar of support for the entire Federal policy of constructing irrigation projects in the arid West with funds collected from western sources. In the past it has stemmed floods of unreasoning criticism directed against the policy, and in the future it must uphold the whole reclamation program before a critical world.

The theory behind the Government's entrance into the field of reclamation 34 years ago was that the West should be helped to help itself. In order to do this a revolving fund was created, with receipts from the public domain in western States. Reclamation projects were to be built with this fund and the water users were to return to it the cost of their projects, so that the money might be used again. The public-land States, which were also the arid and semiarid land States of the West, were contributing to the United States Treasury quite a considerable sum each year during the early days of the reclamation policy, the money coming from the sale of public lands under the homestead laws. It was this money that was used to start the reclamation fund. The western people believed they had a just right to use this money. The Congress agreed with them.

PROVISIONS OF RECLAMATION ACT

The Reclamation Act of 1902 provided that the Government should build irriga-

tion projects and assess their cost for repayment against the land benefited, the cost to be repaid without interest in 10 years.

The method and the terms under which the money is to be repaid have been altered several times since 1902. In 1914 Congress extended the repayment period 20 years. In 1924 Congress offered the project people the option of making their repayments on the basis of 5 percent of their gross crop revenues. Fifteen water users groups adopted this plan prior to its repeal in 1926 when a 40-year repayment plan was substituted.

It is easily seen that the tendency has been to give a longer and longer time in which to repay the charges. This was influenced by two factors, one the need for bringing charges into line with ability to pay and the other the higher initial cost per acre of the later costlier projects.

The original 10-year period, had it been held to, would have made it impossible to undertake many desirable developments which were built later, built at per acre costs sufficiently high to have made repayment of them in a single decade a ridiculous attempt.

The 20-year repayment plan proved satisfactory in some cases. In others it, too, was found too short. Some relief was needed.

Theoretically the repayment of the construction charges by taking a fixed percentage of the gross revenue of the land is, perhaps, the most just method. When the percentage was fixed at 5 percent, this plan, offered by Congress in 1924, was adopted pretty generally by those projects where to do so would act to extend the repayment period; or in other words, where the annual payments made on the basis of 5 percent of the gross crop revenue were less than those required under the 20-year repayment plan.

Difficulty in administering such a contract was its chief drawback. The difference of opinion over what was and what was not 5 percent of the gross of the irri-

gators was unending. Some farmers wanted to subtract water charges to find the gross. Some wanted to deduct other expenses.

Bureau of Reclamation officials were anxious to find some other equitable plan with the merits of the fixed crop percentage plan and with less room for controversy.

The 40-year plan, then came as a welcome substitute. While it did not withdraw the crop percentage contracts already completed, it prevented issuance of more of them.

The act of 1926, which established the 40-year plan, attempted to meet the need for an equitable arrangement by authorizing the Secretary of the Interior to determine the number and amounts of annual installments in which the construction charges were to be repaid, limiting him only to a maximum of 40 years from the date of public notice.

New contracts being made to cover expenditures under the present program of construction generally are being written to cover the full 40 years.

As a result of these various stages in the development of a policy, which now can best be described as repayment in a reasonable time based on ability to pay, the operating projects of the Bureau are divided into three general groups so far as repayment methods are concerned, the 20-year, the crop percentage, and the 40-year groups. The Okanogan project in Washington and the Rio Grande project in New Mexico and Texas, however, are covered by special legislation in this regard.

The table on the following page will illustrate this point.

By and large, although Congress has written off certain noncollectible charges, Federal reclamation projects had made a remarkable record in their repayments up to the time of the depression, when Congress granted a moratorium on construction repayments and extended it to cover 5 years so that it expired only with the year 1935.

¹ Paper presented by E. O. Larson, engineer in charge of Utah projects, at meeting in Salt Lake City, Mar. 11-13, 1936, of the Institute of Irrigation Agriculture of the American Farm Bureau Federation.

The Bureau of Reclamation does not believe that construction repayments should be levied against the project people without regard to their ability to pay. It does believe strongly, however, that a just repayment contract should be honored.

DANGERS OF MORATORIA

A moratorium on repayment charges, when badly needed, should not be opposed for individual projects. We could never see the justification for granting blanket moratoria. Some projects which have been granted moratoria for 5 years would have had no difficulty in meeting their payments in full or in part even during these trying years. These payments must be resumed as soon as possible, because every year of postponement brings nearer the danger of repudiation and the downfall of Federal reclamation as a continuing policy.

It can be argued that development of new areas in these arid States of ours through reclamation is worthy of additional support by the Federal Government. It is true that irrigation of desert lands in other countries is encouraged by governmental subsidies that far overreach the one governmental contribution made in the United States, the extension of credit without interest in the construction of new projects. We are not arguing for such subsidies. There are many arguments against them. Extension of credit without interest is a means of making very material savings to the water users. And, quite aside from the question of whether a subsidy is in order or is not in order, the repayment contracts now in force should be respected until such time in the future as the repayment policy may be altered by Congress.

The reclamation fund, which built our finest projects, is still revolving, although it has been brought almost to a standstill by the repeated moratoria, and by diminishing returns from such sources as the sale of public lands, and royalties on oil produced on the public domain. All public domain has been withdrawn temporarily from homestead entry for classification in connection with administration of the Taylor grazing law. In any case the day is gone when a large revenue will be received from homesteaders, because the land suitable for homesteading is near exhaustion. Present policies affecting exploitation of oil have reduced the amount paid in royalties to the Government. This source of revenue to the reclamation fund, however, is not diminished, but simply conserved. Despite diminishing revenues from these sources,

Project	Division	Present repayment plan	Years remaining to pay balance of construction charge after 1934	Average construction charge per acre yet to be repaid
Salt River, Ariz.		35-year+S. C.	21	\$17
Yuma, Ariz.-Calif.	Reservation	20-year+S. C.	6	15
Orland, Calif.	Valley	30-year	21	43
Grand Valley, Colo.		20-year+S. C.	22	81
	Gravity	40-year	37	73
	Orchard Mesa	do	37	94
Uncompahgre, Colo.		35-year+S. C.	37	48
Boise, Idaho	Arrowrock	Crop	40	52
	Notus	do	50	69
	Emmett	40-year	35	30
Minidoka, Idaho	Gravity	20-year	4	6
	South Side	Crop	24	38
	Gooding	20-year	20	44
	Do	40-year	40	94
Huntley, Mont.	Pryor	40-year+S. C.	28	38
	Eastern and Fly Creek	40-year	33	52
Milk River, Mont.	Malta and Glasgow	do	40	57
Sun River, Mont.	Fort Shaw	Crop	25	20
	Greenfields	do	75	103
Lower Yellowstone, Mont.-N. Dak.		do	45	68
North Platte, Nebr.-Wyo.	Interstate	do	44	60
	Northport	do	67	64
	Fort Laramie	do	55	84
Newlands, Nev.		40-year	26	45
Carlsbad, N. Mex.		Special	9	9
Rio Grande, N. Mex.-Tex.		do	19	70
Umatilla, Oreg.		Crop	51	77
Vale, Oreg.		39-year	39	166
Klamath, Oreg.-Calif.	Main	30-year+S. C.	26	32
	Tule Lake	40-year	40	88
Owyhee, Oreg.-Idaho		39-year	39	146
Belle Fourche, S. Dak.		40-year+S. C.	57	69
Strawberry Valley, Utah		20, 40 and crop	34	50
Okanogan, Wash.		31-year	29	78
Yakima, Wash.	Sunnyside	20-year	5	14
	Tieton	40-year	27	34
	Kititas	Crop	83	166
Riverton, Wyo.		40-year	40	88
Shoshone, Wyo.	Garland	Crop	60	76
	Frannie	do	96	96

NOTE.—S. C. denotes supplemental construction.

the reclamation fund would contain \$25,000,000 today had no moratorium been granted and had collections averaged up to expectations during the past 5 years. When payments are resumed it again will be an important source of revenue for future developments in these States.

RECLAMATION LAW UNCHANGED

Although the present large construction program is being financed from emergency funds, all these projects are being constructed under the reclamation law. This means that the cost of the projects must be repaid by those benefiting. Repayment contracts are being negotiated just as though the money came from the reclamation fund.

A distinction has been drawn here between repayment by water users and repayment by those benefiting. We believe that in certain cases other than the water users have an interest in the project. All those benefiting should contribute to repayment of the cost of a project.

If hydroelectric power is a part of the development, it should be used in the repayment plan to defray the cost of the

project properly chargeable to power. If construction of a project dam improves navigation or assists in the control of floods, these benefits should be taken into consideration in the negotiation of contracts with water users, and suitable discounts made in the amount to be repaid. In this day, when very large structures to control entire river systems are being built, it is important that something be done toward establishing the machinery by which the cost of such projects shall be allocated to the various purposes which they serve proportionately to the benefits derived. It is unfair to squeeze a disproportionate share of the cost from the water users, because they may be faced with an emergency as they are in the case of one new project I have in mind, and for that reason may be willing to assume the burden.

This problem can be worked out so that all are treated fairly. It cannot be solved by repudiation of repayment contracts now existing, however, and it is feared that such will be the result of continuing the moratoria beyond the period of critical need.

It is difficult sometimes to explain to people in other sections of the country

the importance of irrigation to the West. They are not acquainted with the conditions out here. They do not always understand that in semiarid and arid localities irrigation is necessary to any development beyond the pastoral stage. Water does not control their civilization as it does ours in the West. For the reason that the purposes of reclamation are not always appreciated elsewhere, those in the West who do understand should be doubly careful to keep the faith.

If I were asked the most effective argument in favor of reclamation, when it is brought up for discussion in a national conclave, I would say it always has been this:

"The West wants reclamation and is willing to pay for it."

However, there are more profound reasons for western reclamation. The fact that no additional development can come in these States without further developments of their water resources, and the fact that growth here enriches the entire Nation are important.

If you were to draw a jury from all the various sections of the country to which to put the case of Federal reclamation, you would find the jury most impressed by the testimony: "The West wants reclamation and is willing to pay for it."

If the time ever comes when this statement must be trimmed to a simple, "The West wants reclamation", neither this nor any other argument in favor of reclamation will longer prevail.

Elwood Mead Memorial Week

Early in February Governor Clarence D. Martin, of Washington, proclaimed the week of February 16-22 as Elwood Mead Memorial Week, calling for "remembrance of his contributions to our commonwealth" in reference to the Yakima project and Columbia Basin development. In observance of the Governor's proclamation, the Yakima Chamber of Commerce had a special program at its regular weekly luncheon on February 17, at which time Dr. John W. Summers, of Walla Walla, former Congressman from Washington, spoke on the subject "The Life and Services of Dr. Elwood Mead." Other commercial and civic organizations sponsored similar programs during the week in the towns throughout the project. The finest tribute to Dr. Mead which has come to the attention of the Yakima office is found in an editorial under the heading "A Great Example," by Col. W. W. Robertson, editor of the local paper, which is quoted in full as follows:

"Great men die and for the moment their fellows pause and pay tribute to their memories, but for the moment only. For an outstanding national figure the period of respect for the departed is somewhat extended, but when has such period been lengthened to a month?"

"The passing of Dr. Elwood Mead has

been marked by a remarkable showing of appreciation on the part of the people who knew him best. A week of tribute not merely as an honor to his memory, for he has passed beyond the need of such appreciation, but as a time in which the study of what the man did and what lessons can be learned from his achievement, is altogether fitting and proper. With such a thought in mind, all may well join in the united effort to honor the memory of the greatest leader in irrigation of all time.

"As E. F. Blaine said at Grandview, Dr. Mead built his own monument of concrete, earth dams and fertile fields. The duty laid upon those who survive him is to see that the work fostered and advanced by him shall not be permitted to lag, that the program laid out by him and carried to a successful conclusion as to various separate units, shall be carried forward until it reaches a well-rounded whole.

"Honor to the reclamation commissioner, tribute to the memory of one who planned widely and executed efficiently, recognition of the work done by a great builder of communities—all those are timely and appropriate, and above all there should be a determination to profit by his example, to be worthy of being called his followers."

Operation of Boulder Dam

Now that construction of Boulder Dam is complete, attention is turning to operation of the project. This, the new phase, is divided into four divisions.

1. Operation of the dam itself, including the outlet works which feed the turbines in the powerhouse and which empty directly into the river below the dam.

2. Operation of the powerhouse, where the turbines and generators are installed.

3. Operation of Boulder City, the permanent camp, a community of 5,000 or 6,000, with water works, etc.

4. Operation of Lake Mead (principally for recreational purposes).

The Federal Government retains title to all features of the project, the dam, the powerhouse and equipment, the city, and the lake. However, it will not operate all departments.

The Bureau of Reclamation will operate the dam and the outlet works, in order to insure proper regulation of the storage reservoir, which is Lake Mead, and proper regulation of the flow of water to the irrigators and cities below the dam. Thus the responsibility for



A handshake marks acceptance by the Government of Boulder Dam. Frank T. Crowe (left), General Superintendent of Six Companies, Inc., delivers the dam to Ralph Lowry, Bureau of Reclamation construction engineer, on March 1, 1936

the safety of the dam remains upon the Bureau which built it. The operator of the dam will have to gage the water level in the lake to insure a factor of safety to meet such emergencies as a sudden rise in the river or a major flood during the flood season—the spring.

The powerhouse will be operated by the city of Los Angeles and the Southern California Edison Co., two of the contractors for hydroelectric energy. The city will operate units of the powerhouse generating electricity for itself, for other municipalities, for the States of Arizona and Nevada and for the metropolitan water district; while the Southern California Edison Co. will operate the units generating for itself and for other utility companies. These power contractors purchase the energy in terms of falling water measured in power at transmission voltage. While the powerhouse and equipment belongs to the Federal Government, the contractors, then, will be responsible for its maintenance.

The Bureau of Reclamation will continue to operate Boulder City, which will be occupied by those employed at the dam and powerhouse and by private businessmen. It also is likely to become a major tourist center.

Operation of Lake Mead, this being differentiated from operation of the dam, will consist of general supervision of use of the lake as contrasted with actual use of the water in the lake. This will involve supervision of pleasure and freight boats upon the lake, supervision of bathing, fishing, and other sports at the lake, and general supervision of the uses which will attract tourists and sportsmen. A general agreement has been reached under which the National Park Service of the Interior Department will supervise this work. The details have not as yet been worked out by the Park Service and the Bureau of Reclamation.

United States v. Orr Water Ditch Co.

The Attorney General has approved the proposed decree which will finally determine the water rights on the Truckee River in Nevada and terminate litigation begun in 1913 in the case of the *United States v. Orr Water Ditch Co.*

The form of contract between the various water users on the river also was approved.

The decree and contract now will be submitted to the Truckee-Carson irrigation district and the Washoe County Water Conservation District for approval and presentation to the Federal District Court of Nevada for final action.

Important Dates in the History of Boulder Dam

Dec. 21, 1928.....	Boulder Canyon Project Act, authorizing Boulder Dam, approved by President Coolidge.
June 25, 1929.....	Proclamation declaring Boulder Canyon Project Act effective issued by President Hoover after six States had ratified the Colorado River compact.
Apr. 1, 1930.....	Contracts for sale of power from Boulder Dam power-house for sufficient revenue to repay the cost of the project with 4 percent interest in 50 years were executed with the Metropolitan Water District of Southern California, the City of Los Angeles, and the Southern California Edison Co.
May 19, 1930.....	Walker R. Young, Bureau of Reclamation engineer in charge of the Kittitas division of the Yakima (Wash.) project, was appointed construction engineer of Boulder Dam.
July 3, 1930.....	Second deficiency bill carrying the first appropriation, \$10,660,000, for construction of Boulder Dam was enacted.
July 5, 1930.....	The construction engineer was instructed to proceed with preliminary work.
Sept. 17, 1930.....	First spike in the 22-mile construction railroad was driven at Las Vegas, Nev.
Mar. 4, 1931.....	Bids were opened for construction of the dam at the Denver, Colo., engineering offices of the Bureau of Reclamation. Three bids submitted.
Mar. 11, 1931.....	Contract for construction of Boulder Dam and power-house was let to Six Companies, Inc., of San Francisco.
Sept. 17, 1931.....	Construction of the diversion tunnels begun.
Oct. 3, 1931.....	Boulder City, permanent Government camp, was occupied.
May 23, 1932.....	Excavation of diversion tunnels completed.
Apr. 23, 1933.....	The Colorado River was diverted at the dam site.
June 5, 1933.....	Excavation for the dam was completed.
June 6, 1933.....	The first bucket of concrete was poured in the dam.
Jan. 7, 1934.....	The 1,000,000th cubic yard of concrete was placed in dam.
Mar. 20, 1934.....	Set all-time record by pouring 10,642 yards of concrete in a single day.
June 6, 1934.....	The 2,000,000th cubic yard of concrete was poured in dam.
July 20, 1934.....	Peak employment reached, 5,251 men working.
Dec. 5, 1934.....	The 3,000,000th cubic yard of concrete was poured in dam.
Feb. 1, 1935.....	Gates of the diversion tunnels were closed and Lake Mead began to form.
May 29, 1935.....	The final bucket of concrete, a total of 3,240,871 cubic yards, was poured in Boulder Dam itself.
Sept. 30, 1935.....	President Franklin D. Roosevelt dedicated Boulder Dam.
Dec. 26, 1935.....	The first penstock was tested successfully.
Feb. 4, 1936.....	Tailrace of dam filled with water for first time.
Mar. 1, 1936.....	The United States accepts Boulder Dam and power-house from the contractor, marking completion of actual construction 2 years 1 month and 28 days ahead of schedule. A total of approximately 4,400,000 cubic yards of concrete was poured in the dam and power-house.

Generation of power will start later this year, probably in June or July. Turbines and generators now are being installed.

The decree and contract were worked out by attorneys for the various water users' organizations, the Indian Service, and the Bureau of Reclamation.

Settlement of the water rights disputes on the river is necessary before the Bureau of Reclamation can negotiate a repayment contract with the Truckee-Carson irrigation district and undertake construction of Boca Dam on the Little Truckee River, for which the Public Works Administration allotted \$1,000,000.

It will be necessary for the two irrigation districts involved to hold elections

upon approval of the decree and contract.

"There would appear to be no major obstacles remaining in the way of final settlement of this long-drawn-out controversy in a manner satisfactory to everybody", John C. Page, acting commissioner of reclamation, said. "The Bureau's engineering office is proceeding with the necessary preliminary steps and will be ready to begin construction of the dam within a few weeks, anticipating favorable action upon the decree and contract by the Nevada water users."

Schools in the Grand Coulee Dam Area

By F. J. Sharkey, Engineer

WITHIN the short span of 2 years, the area around the site of the Grand Coulee Dam has changed from an arid district of widely scattered farm houses to a great construction project surrounded by several small towns, and a population of approximately 9,000 directly and indirectly connected with the project.

As was to be expected in a sudden metamorphosis of such magnitude, the functions of organized society lagged far behind the requirements which arose for them. One of the most important of these functions, and one which is still being hard pressed to keep pace with its necessary development, is the schools.

GOVERNMENT CAMP AND MASON CITY

In line with a decision of the Comptroller of the Treasury in 1917 to the effect that funds of the Bureau of Reclamation could be used for the construction of schools on projects where it would be in the interest of the Government to do so, an excellent modern school building has been erected in the Government camp. The building is a single-story frame structure of pleasing architectural design. The floor plan includes four classrooms, a library, a superintendent's office, and toilet rooms for boys and girls. These surround on three sides a recreation room 45 feet by 75 feet in floor area. A partial basement provides a fireproof boiler room for the oil-burning low-pressure steam furnace, also a shower room and a locker room.

In addition to its value as a lunch and play room for younger pupils, the recreation room is used regularly for practice and for games by the high and grade school basketball teams with teams from other schools. The ladies' and men's basketball teams of the Bureau, the teams formed from the contractor's organization, and a team from C. C. C. Camp BR-48 have also taken advantage of the floor for practice and games. In addition, the room is used for school theatricals and parties, and for dancing and card parties given several times during the fall and winter by the Community Club of the Bureau and by the Officers' Reserve Corps. Church is also held twice each week in the room. Plans are now in progress for the installation of volleyball and handball courts. In short, the value of the recreation room as a center for social, community, and athletic activities can not be overestimated, as is attested by the fact that 13 organizations have been using the room an average of 14 hours per day.

In Mason City, built by the Mason-Walsh-Atkinson-Kier Co., on the east side of the Columbia River opposite the Government camp, the contractor has provided two 3-room school buildings. These buildings are of substantial wood frame construction, and are electrically heated.

The school facilities on the two sides of the river have been so organized as to avoid duplication and lessen expense. Grades 1 and 2 are housed in one of the Mason City buildings, grades 3 to 8 in the Government school building, and the high school in the other building in Mason City. The principal of the high school is also superintendent of education and has charge of all three schools. The schools are now completely departmentalized above the second grade, with an excellent staff of 10 teachers and are probably the equal of any schools of their size in the State. The enrollment in grade and high schools totals about 250. The expense of operating the schools both in the Government camp and Mason City is borne by the Mason-Walsh-Atkinson-Kier Co.

At the head of the Grand Coulee, about 2 miles southwest of the Government camp, three rival communities of characteristic mushroom-like growth have recently incorporated into the city of Grand Coulee, with a population of approximately 6,000. In the fall of 1934 an eight-room school, for the accommodation of the children of these communities, was completed with the aid of P. W. A. funds. It now has a staff of 17 teachers, with an enrollment of 630 pupils and is so crowded that classes are divided into two shifts, the first class opening at 7:30 in the morning and the second class closing at 5:15 in the evening. A recent W. P. A. grant will add four more rooms to the school, and permit the schedule to be returned to the usual hours.

At points about 2 and 3 miles down the Grand Coulee from the city at its head are, respectively, the small communities of Electric City and Osborne. About 180 pupils from the two communities are being taught in the two-room school at Osborne, which, with a staff of four

(Continued on p. 104)

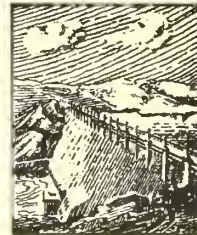


Upper: Government school at Grand Coulee Dam

Lower: Thanksgiving in the recreation room of the Government school



ENGINEERING



Agency Valley Dam

By Henry L. Lumpee, Assistant Clerk, Vale Project

LOCATED in a place of unusual historical interest approximately 70 miles west of Vale, Oreg., Agency Valley Dam was recently completed on the North Fork of the Malheur River by Hinman Brothers Construction Co. of Denver. (See back cover page.)

The character of the country is barren and rough, nearly mountainous, with rocky peaks rising above scattered juniper trees growing on the bold slopes of the hills. Forests of pine and fir are only a few miles away to the north.

The 1,700-foot-long crest of the earth-fill type dam rises to a height of 90 feet above a valley that in former years was the scene of barbaric pagantry, for the area was once an Indian agency. With the removal of the Indians to another reservation after some years, it became a unit in the far-flung cattle kingdom of the great Miller & Lux outfit, and was known as the Agency ranch. The cattle empire era in the United States declined, and the valley passed to other owners, from which the Government secured the necessary right-of-way for the reservoir.

Now the major part of the valley, its lower outlet obstructed by the mass of Agency Valley Dam, approximately 639,000 cubic yards of earth, rock, and concrete, is to become of greater value than ever before as a reservoir storing 60,000 acre-feet of water to supplement the irrigation of the Vale project's 30,000 acres of fertile land. The volume of the material composing the structure across the North Fork may be somewhat imagined from the following: If placed upon an area 300 feet square the top would tower slightly in excess of 191½ feet above the base.

During the irrigation season waters of the reservoir will be released as needed through an outlet tunnel, described hereinafter, under the west abutment of the dam. Flowing in the North Fork channel 17 miles they will enter the Malheur River at Juntura, Oreg., will travel with that stream several miles farther east to Namorf, Oreg., and there be diverted into the Vale main canal for ultimate delivery to the project farms.

The damsite was selected in 1930; at that time H. W. Bashore was construction engineer of the Vale project. The late Dr. F. L. Ransome was the consulting geologist. Agency Valley Dam, built under the supervision of C. C. Ketchum, superintendent of the Vale project, and C. H. Spencer, engineer resident at the site, may be considered as having three main physical features, as follows: The outlet tunnel, the dam (or embankment) itself, and the spillway.

Construction of the structure was begun by Hinman Brothers on March 30, 1934, on the site of the post office of Beulah and a county highway bridge crossing the North Fork. Both of these edifices were removed, a temporary diversion dam constructed, and 117,431 cubic yards of earth and rock stripped away to expose the projected dam's foundations.

The 520-foot tunnel to divert the river flow during construction and also act, upon the completion of the dam, as an outlet for the reservoir water, was worked through basalt and soft shale. This geologic formation was unfortunate, in that blasting the basalt caused considerable overbreakage in the shale. However, cave-ins were prevented by the use of steel liner plates and permanent timbering, and the horseshoe-shaped bore, 10 feet in diameter when concrete-lined, was successfully holed through.

For the first 300 feet of the tunnel the water flows free, then is diverted into two 42-inch diameter steel pipes to be carried the remaining 220 feet to the outlet portal. At the point of transition to the pipes an ample emergency gate chamber has been hollowed from the rock and provided with hydraulic machinery for operating two 3-foot, 3-inch slide gates, which will regulate the flow of water through the tunnel.

Two thousand nine hundred cubic yards of all classes of materials were excavated from the tunnel, and 975 cubic yards of concrete went into its lining. The metal rack placed at the inlet to prevent trash from entering weighs 10 tons; the steel pipes, emergency gate machinery, and other equipment in the tunnel have

a weight of more than 60 tons. The discharge capacity is 600 second-feet.

The volume of the dam itself, exclusive of low concrete cut-off walls, amounts to 637,000 cubic yards of earth and rock, secured from borrow pits adjacent to the dam site. Hauled to the dam in trucks, the earth was dumped, spread into layers, moistened, and compacted by means of rollers that passed over each layer 11 times. Thus 603,000 cubic yards of earth as excavated from the borrow pits became 525,000 cubic yards when compacted into the dam.

To determine the suitability of the material intended for use in the embankment a laboratory was established at the site and operated throughout its construction. In connection with this control, experimental earth fills were built.

Above a 20-foot berm near the base of the dam the upstream face, rising on a 3:1 slope to its 90-foot vertical height, was covered to a depth of 3 feet with 26,000 cubic yards of dumped riprap as a protection against expected wave action from the reservoir. The downstream side of the embankment was similarly protected against erosive elements, and made stable, by a thick rock fill.

While excavating for the rock in a side hill borrow pit a power shovel dug into a shallow, unmarked grave and exposed a human skeleton. It was reported that the county sheriff and coroner, summoned to the scene, pronounced the bones to be apparently those of a child. As far as is known they were never identified, and were reinterred elsewhere.

The placing of the rock fill completed the major features of the embankment.

On the west abutment of Agency Valley Dam the down-curved spillway inclines steeply from the dam's crest to a stilling pool below. It is approximately 400 feet long, 13 feet deep, and 24 feet wide at its base, containing, together with the stilling basin into which the outlet tunnel also empties, some 3,800 cubic yards of concrete from 24 inches to 8 inches thick. It was necessary to excavate 86,000 cubic yards of material in order that the spillway and tunnel portals might be built.

To control the flow of water through this precipitous channel a bank of three balanced radial steel gates, each 17 by 18 feet and weighing, together with appropriate electrical operating machinery, 47½ tons, were installed at the spillway crest.

The dam has its own electric generator powered by a gasoline engine, situated in the needle-valve house at the tunnel's outlet. Plans of the needle-valve house are so arranged that in the future a turbine-driven generator may be installed.

DAM COMPLETED

Hinman Brothers completed their contract December 13, 1935. The specifications originally called for a concrete parapet at the crest of the dam, but it was decided to omit this construction until settlement of the embankment, if any, had subsided. The needle-valves in the outlet tunnel were not placed, and it is expected that this work will be accomplished by Government forces during the summer of 1936. Grouting in the tunnel, after the contractor had completed his work there, was performed by Government forces under the supervision of J. B. Hays, engineer from the Denver office. Forty-three holes totalling 1,193 linear feet were drilled, and grouted with 2,884 sacks of cement.

In order that Agency Valley Dam might be constructed it was necessary for the Government to relocate a county highway existing within the reservoir. A new road, 4½ miles long and with an 18-foot crown, was built under contract by Morrison-Knudsen Co. of Boise, Idaho, along the east side of the reservoir. Construction was begun May 24, 1934,

and completed July 28, 1934. The road was inspected and accepted by the Malheur County court on behalf of the county August 3, 1934. Maintenance thereof will be performed by the county.

The Government camp erected at the damsite for reclamation employees consisted of one permanent and six temporary cottages, a bunkhouse and office, garage for official cars, and the laboratory. The buildings were equipped with modern plumbing and secured electricity from Hinman Brothers. Since the dam is completed they will be removed, with the exception of the permanent cottage, which will be the residence of the reservoir's caretaker.

For the purpose of facilitating communication to the damsite a telephone line 17 miles in length was constructed by Government forces in the winter of 1933-31 from the reclamation camp to Juntura, and there connected with the lines of the Central Oregon Telephone Co.

CONSTRUCTION COSTS

The construction of Agency Valley Dam, purchase of the reservoir right-of-way, building of the relocated county road, the telephone line, Government camp, etc., involved the use of three funds. Approximately \$81,000 from the reclamation fund was expended for preliminary surveys and testings and partial purchase of the right-of-way. In 1933, \$1,000,000 was appropriated for the dam by the Public Works Administration under the National Industrial Recovery Act. More than \$125,000 of this latter amount, however, was sub-

sequently diverted for other construction on the Vale project, and it was necessary to complete the dam contract with an appropriation made available by the Emergency Relief Act.

The ultimate cost, from all funds, for Agency Valley storage (including the dam, right-of-way, relocated county road, telephone line, Government camp, etc.) is expected to amount to approximately \$1,060,000.

The gates of the dam were closed December 21, 1935, and storage begun. With good run-off conditions prevailing it is not improbable that the reservoir will fill to the point permitted this first year (1936). The ground is being cleared of brush and trees in advance of the rising water by C. C. C. Camp SCS03, Beulah, Oreg., under the direction of the Department of Agriculture.

Agency Valley Reservoir will have uses other than that of the reclamation of land. Spreading over an area 3½ miles long by ¾ of a mile wide, it will provide the people of this section with excellent recreational facilities in the form of fishing, boating, swimming, etc. Trees are to be planted along the shores of the lake, further enhancing its fitness for a pleasure resort. It is contemplated that the 2,000 acres reserved for reservoir purposes will, in the future, be made into a fish and game preserve.

Thus, though it is to be submerged, the fate of the old Agency Valley cannot be considered an unhappy one, for through the rising waters of its reservoir it is to become both economically and socially more important than it ever was, even in the best days of its historic past.

Grand Coulee Rings Cash Registers

CASH registers in 36 States are jingling with money from the Grand Coulee project, where expenditures are going forward at the rate of \$35 a minute.

On New Year's Day the ledger sheet should show that approximately \$27,200,000 had been spent in the promotion, preliminary engineering, and actual construction of the project by the State and Federal Governments.

By January 1, 1936, the Reclamation Bureau, represented on the project by Frank A. Banks, construction engineer, had paid \$21,866,041.11 to contractors and for materials and equipment.

Larger payments by the Bureau include earnings to contractors (with 10 percent retained until the contract is accepted) \$14,704,557.81; salaries to Reclamation Bureau engineers, \$617,750.06; material and supplies, \$1,430,886.75; freight charges, \$317,828.35; passenger fares,

\$2,532.27; purchase of right-of-way, \$303,879.02, and miscellaneous, \$6,518.93.

The pay roll on the project to that date was about \$4,000,000, while material and equipment totaled about \$11,647,654.

After President Roosevelt allocated \$63,000,000 from his Public Works fund for the project it was necessary for Washington to spend additional money in engineering studies, and to maintain the Columbia basin commission. This additional work has resulted in another \$1,200,000 expenditure for engineering, highway construction, and maintenance.

The project is helping industry throughout the United States, James O'Sullivan of the basin commission said today, "That is the thought that everybody in the northwest should be getting across to their friends and business associates in the east."

States and the extent to which they have benefited so far follow: Wisconsin, \$123,048.18; Washington, D. C., \$2,600; Utah, \$2,410.54; Tennessee, \$201.71; Pennsylvania, \$744,201.22; Ohio, \$654,139.33; New York, \$1,151,894.45; New Jersey, \$535,049.55; Montana, \$51,498.24; Missouri, \$55,598.50; Minnesota, \$129,727.21; Michigan, \$53,539.85; Iowa, \$76,359.92; Kansas, \$10.73; Kentucky, \$3,960.70; Maine, \$3,166.64; Maryland, \$42,771.23; Massachusetts, \$99,391.06; Oregon, \$170,719.13; Rhode Island, \$2,651.06; Texas, \$68; Virginia, \$792.10; West Virginia, \$5,451.36; Washington, \$2,659,531.60; Alabama, \$1,000; Arkansas, \$456.38; California, \$632,240.89; Colorado, \$40,257.88; Illinois, \$1,296,718.94; Connecticut, \$60,371.29; Delaware, \$33,370.95; Florida, \$252.73; Georgia, \$2,008.02; Idaho, \$3,289.45, and Indiana, \$1,861.83.—*Spokane, Wash., Chronicle.*

Large Reservoirs in the United States

WHEN the Elephant Butte Reservoir on the Rio Grande in New Mexico was completed by the Bureau of Reclamation in 1916, to provide storage for the irrigation of lands on the Rio Grande project, it was not only the largest artificial irrigation reservoir in this country, but also in the world. It is still the largest of reservoirs in this country built entirely for irrigation storage, but outside of the United States it is now outranked by Assuan in Egypt which stores 4,040,000 acre-feet. The reservoir is located about 130 miles north and west of El Paso, and extends from near the town of Hot Springs to San Marcial, a distance of 40 miles. In addition to impounding water for irrigation of project lands, 25,000 acres in the Juarez Valley, Old Mexico, are also served in accordance with a treaty between the United States and the Republic of Mexico. Waters from this reservoir, therefore, not only irrigate lands in the two States of New Mexico and Texas but also in two countries. It receives its name from an ancient volcanic crater, known as Elephant Butte, because of a striking resemblance to an elephant's head. Located about a half mile above the dam it is an outstanding landmark, rising 500 feet above the river and forming the most conspicuous of the many islands in the reservoir.

After 20 years of operation, a silt survey of the reservoir in 1935 showed that 365,186 acre-feet of silt have been deposited, reducing its original capacity from 2,638,860 to 2,273,674 acre-feet. The results of all surveys show a continued decrease in the amount of silt deposited each year, the amount being 17,989 acre-feet in 1935. It would take 147 years to fill the reservoir if the average rate of silting for the past 20 years were maintained. However, the construction of upstream reservoirs and the retardation of soil erosion are expected to materially lessen future silt deposits.

LAKE MEAD—RESERVOIR FORMED BY BOULDER DAM

The reservoir behind Boulder Dam on the Colorado River in Arizona-Nevada, is now holding approximately 4,000,000 acre-feet, storage having started in February 1935. When Lake Mead, as the reservoir has been officially named, in honor of the late Dr. Mead, Commissioner of Reclamation, is full to elevation 1,229, the high-water line, it will contain 30,500,000 acre-feet or 10,000,000,000 gallons. This would supply 5,000 gallons to every inhabitant on

earth. It will store the entire average flow of the river for 2 years. The reservoir will cover 146,500 acres or 229 square miles, and some idea of its vast area may be had from the fact that the estimated annual evaporation alone on the reservoir is 600,000 acre-feet, or more than twice the capacity of the reservoir behind the Wilson Dam in Alabama. In terms of capacity this reservoir far outranks all others. Its purposes are six in number—flood control, river regulation, irrigation, silt control, power development, and domestic water supply.

The Colorado being a silt-bearing stream, 5,000,000 to 8,000,000 acre-feet of the reservoir capacity are reserved for a silt pocket. It is estimated that in 50 years the total silt deposits will not exceed 3,000,000 acre-feet. Reservoirs to be constructed above will hold back a considerable amount of silt now entering Lake Mead. Studies show that 30 percent of the silt reaching the reservoir comes from the San Juan. At the dam there will be a maximum water depth of 590 feet. The maximum water pressure at the base of the dam is 45,000 pounds per square foot. Lake Mead offers the pleasure seeker opportunities for boating, bathing, and fishing. Its waters, now cleared of sediment, have been stocked with bass and other game fish. A trip through the canyons on one of the numerous pleasure boats is very interesting. At the present time the lake is about 85 miles long, but when the water level reaches 1,229, the water will reach to Bridge Canyon, a distance of 115 miles from the dam. During 1935 the dam and reservoir attracted 347,517 visitors, close to 1,000 a day, with a maximum of 39,884 during the month of February.

FORT PECK, GRAND COULEE, AND GATUN RESERVOIRS

The huge Fort Peck flood control reservoir now under construction by Army engineers on the Missouri River in Montana, will outrank Boulder in area and length, but will have less capacity. Back of this largest of earth dams there will be formed a lake 140 miles in length with an area of 245,000 acres, and a storage capacity of 19,500,000 acre-feet. Its shore line will measure 1,600 miles. The ultimate Grand Coulee Reservoir on the Columbia River in Washington will be even longer, as it will extend from the dam to the Canadian border, a distance of 151 miles. Including both the United States and possessions the Gatun Reservoir on the Chagres River in Canal

Zone, completed in 1912, still overtops all other completed man-made reservoirs with its capacity of 4,413,000 acre-feet. Its purpose is to improve navigation on the Panama Canal, by regulation of the river waters.

"LAKE OF THE OZARKS", NORRIS AND QUABBIN RESERVOIRS

Near Bagnell, Mo., on the Osage River is the Lake of the Ozarks formed by the Bagnell power dam. This is one of the largest reservoirs, with a length of 129 miles and a shore line of 1,300 miles. Removal of 42 cemeteries in the flooded area was necessary. Its capacity of 2,300,000 acre-feet exactly equals that of Lake Murray behind the Saluda power dam in North Carolina. The Norris Reservoir on Clinch River in Tennessee, now nearing completion, has the largest storage capacity of the several reservoirs now under construction or planned for the Tennessee Valley. Among reservoirs constructed for domestic water supply the largest is that formed by the Quabbin dam and dike of the Metropolitan Water District in Massachusetts.

SIX T. V. A. RESERVOIRS

Six notable reservoirs are included in the program of the Tennessee Valley Authority for development of the Tennessee River Valley. The river basin includes portions of seven States, Virginia, North Carolina, Georgia, Tennessee, Alabama, Mississippi, and Kentucky. It is interesting to note that there are seven States, the same number that are in the Colorado River Basin. The reservoir formed by the Norris Dam on the Clinch River, 20 miles north of Knoxville, is the largest, and when completed in 1936 will be exceeded in capacity only by Gatun. It will store 3,400,000 acre-feet of water for the twofold purpose of flood control and power development, and will extend 72 miles up Clinch River and 63 miles up Powell River. Gates were closed and storage of water was begun on March 4. The Wilson Dam, power plant, and reservoir on the Tennessee River at Florence, Ala., were constructed by the Army engineers but were turned over to the Authority for operation and maintenance. The Wheeler Dam, also on the Tennessee River, near the head of Wilson Lake, forms a reservoir of 1,260,000 acre-feet capacity. A third project was authorized in November 1934, which comprises a dam and reservoir on the Tennessee River at Pickwick Landing, Tenn. Storage of 1,032,000 acre-feet will be provided and the lake will back

up 53 miles to Wilson Dam. Two additional projects, Gunterville and Chickamauga, have recently been authorized for construction, both on the main river. An additional project, the Fowler Bend Dam and Reservoir, planned to store 475,000 acre-feet, and located on the Hiwassee River about 60 miles east of Chattanooga, is now under investigation.

IMPORTANT RECREATIONAL FEATURES

Eleven of the reservoirs listed in the table (capitalized) are Bureau of Reclamation projects. On 26 Federal irrigation projects there are 63 storage reservoirs completed or under construction. Their total area is approximately 770,000 acres, which is 20 percent larger than the area of Lake Erie. They have a combined capacity of approximately 52,000,000 acre-feet, enough water to cover the

State of Kansas 1 foot deep, or supply New York City with water for 3½ years. Lake Mead and adjacent area has been designated as a wildlife refuge, and also the Elephant Butte Reservoir. Pathfinder and Roosevelt Reservoirs are both bird reservations and Owyhee will soon be so designated. The recreational features of these lakes have always been of importance to the adjacent communities, aside from their primary uses for storage of water for irrigation, flood control, and power development. They have attracted a large and growing tourist traffic from all parts of the country. Swimming, boating, and fishing are very popular. Arrowrock Reservoir extends into the mountains of the Boise National Forest, and attracts many camping parties. Jackson Lake is the largest of several beautiful bodies of water lying along the

eastern slope of the Teton Mountains, south of Yellowstone Park, and is one of the most alluring of the Nation's playgrounds. Pathfinder was named after the well-known explorer John C. Fremont, who was called "The Pathfinder."

RESERVOIRS UNDER CONSTRUCTION

Reservoirs now under construction by the Bureau include Grand Coulee in Washington; Parker in Arizona-California; Island Park in Idaho; Alcova, Seminole, and Bull Lake in Wyoming; Rye Patch in Nevada; Taylor Park in Colorado; Pine View and Moon Lake in Utah; Alamogordo in New Mexico; Hamilton in Texas; and Unity in Oregon. Work on Caballo in New Mexico, Bartlett in Arizona, and Arnold in Texas will be started immediately.

TABLE 1

Name	State	River	Year completed	Purpose of storage ¹	Capacity	Area	Length	Average width	Shore line
					<i>Acre-feet</i>	<i>Acres</i>	<i>Miles</i>	<i>Miles</i>	<i>Miles</i>
Boulder.....	Arizona-Nevada.....	Colorado.....	1935	F. C., Irr., P.....	30,500,000	146,500	115	(³)	550
Fort Peck.....	Montana.....	Missouri.....	(⁴)	F. C., N.....	18,500,000	245,000	140	16	1,600
Grand Coulee.....	Washington.....	Columbia.....	(⁴)	F. C., Irr., P.....	9,610,000	77,000	151	0.8	-----
Gatun.....	Canal Zone.....	Chagres.....	1912	R. R.....	4,413,000	107,200	29	2	-----
Norris.....	Tennessee.....	Clinch.....	(⁴)	F. C., P.....	3,400,000	49,500	72	-----	705
Kennett.....	California.....	Sacramento.....	(⁴)	F. C., Irr., P.....	2,940,000	23,000	32	1	-----
Elephant Butte.....	New Mexico.....	Rio Grande.....	1916	Irr.....	* 2,638,860	40,080	40	1.5	166
Saluda.....	North Carolina.....	Saluda.....	1930	P.....	2,300,000	50,000	42	(⁵)	520
Bagnell.....	Missouri.....	Mississippi.....	1931	P.....	2,300,000	61,000	129	-----	1,300
American Falls.....	Idaho.....	Snake.....	1927	Irr.....	1,700,000	58,055	25	4	100
Roosevelt.....	Arizona.....	Salt.....	1911	Irr., P.....	1,637,300	18,300	23	2	80
Martin.....	Alabama.....	Tallapoosa.....	1926	P.....	1,376,000	39,400	31	0.8	700
Big Meadows.....	California.....	North Fork, Feather.....	1927	P.....	1,308,000	28,257	12	3.7	55
Quabbin Lake.....	Massachusetts.....	Off stream.....	(⁴)	W. S.....	1,273,000	24,960	18	10 3.5	11 175
Wheeler.....	Alabama.....	Tennessee.....	(⁴)	N., F. C., P.....	1,260,000	76,000	87	1.2	814
Coolidge.....	Arizona.....	Gila.....	1923	Irr., P.....	1,200,000	22,000	18	2	-----
Owyhee.....	Oregon.....	Owyhee.....	1932	Irr.....	1,120,000	13,000	27	1	82
Pathfinder.....	Wyoming.....	North Platte.....	1922	Irr.....	1,070,000	22,700	23	2	75
Pickwick.....	Tennessee.....	Tennessee.....	(⁴)	N., F. C., P.....	1,032,000	48,500	53	1.2	550
Seminole.....	Wyoming.....	North Platte.....	(⁴)	Irr., P.....	1,020,000	18,400	25	0.7	85
Hamilton.....	Texas.....	Colorado.....	(⁴)	P.....	1,000,000	20,173	22	1.7	96
Gunterville.....	Alabama.....	Tennessee.....	(⁴)	N., F. C., P.....	951,000	12 63,300	82	1.2	-----
Bridgeport.....	Texas.....	West Fork, Trinity.....	1931	W. S., F. C.....	13 870,000	11,381	12	1.6	75
Jackson Lake.....	Wyoming.....	Snake.....	1919	Irr.....	847,000	25,540	10	4	45
Cobble Mountain.....	Massachusetts.....	Little.....	1932	W. S., P.....	812,000	1,134	5	0.4	19
Conklingville.....	New York.....	Sacandaga.....	1930	P.....	805,000	27,000	27	(¹⁴)	125
Conchas.....	New Mexico.....	South Canadian.....	(⁴)	F. C.....	800,000	16,000	15	-----	-----
Chickamauga.....	Tennessee.....	Tennessee.....	(⁴)	N., F. C., P.....	15 736,000	12 38,000	76	1	491
Eagle Mountain.....	Texas.....	West Fork, Trinity.....	1933	W. S., F. C.....	16 630,000	9,848	13	1.3	65
Madden.....	Canal Zone.....	Chagres.....	1934	P., F. C.....	506,000	14,080	13	1	-----
Wilson.....	Alabama.....	Tennessee.....	1924	P., N.....	500,000	14,500	15	1.3	-----

¹ Includes possessions.

² F. C.—Flood control; Irr.—Irrigation; P.—Power; R. R.—River regulation;

N.—Navigation; W. S.—Water supply.

³ Varies from several hundred feet in the canyons to a maximum of 8 miles

⁴ Under construction.

⁵ Data is for ultimate Columbia Basin project.

⁶ Preliminary data only.

⁷ Preliminary work prior to construction.

⁸ Original capacity.

⁹ Varies from stream width to maximum of 12 miles.

¹⁰ Maximum width of main branch.

¹¹ Includes 100 islands.

¹² Area at normal level.

¹³ 290,000 at spillway and 580,000 above spillway for flood water detention.

¹⁴ Varies from 0.6 to 5.3 miles.

¹⁵ Additional 755,000 uncontrolled flood capacity.

¹⁶ 210,000 at spillway and 420,000 above spillway for flood-water detention.

Specifications to schools

Hundreds of surplus copies of specifications of dams, canals, tunnels, and other irrigation structures designed by the Bureau of Reclamation were distributed in February to the Nation's engineering colleges

These specifications originally were issued by the Bureau in calling for bids on the work involved. Once each year unused copies are offered to the engineer-

ing schools for their libraries, where they can be used by students in studying design.

There was an unusual demand this year for specifications of many of the dams advertised for contract in past months. Copies of these specifications went to schools in every section of the country. Generally, only a single copy of a specification can be furnished to a school, because of the limitation of the supply and the demand.

THE Montana State Highway Commission has awarded contract for the completion of State Highway No. 14, south from Sidney, approximately 4 miles, as well as connecting up with the Yellowstone Bridge located about 3 miles south and east of Sidney. When this road is completed there will be an oiled highway throughout the length of the project. This is a much-needed improvement for the project.

The Reclamation Era

Issued monthly by the Bureau of Reclamation,
Department of the Interior.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users organizations for mass subscriptions on Federal irrigation projects.

APRIL 1936

Conservation

Conservationists are known widely for their breadth of outlook. It is a general characteristic common to all conservation enthusiasts. They must see the possibilities of the future or they would not be conservationists, for conservation is a process of weighing the present against the future. They must recognize no sectional boundaries where public welfare is concerned or they could not be conservationists. Selfishness would prevent it.

Conservation, according to the dictionary, is the preservation of natural resources for economical use. If water in the arid and semiarid West is a natural resource, then its preservation for irrigation by the Bureau of Reclamation must be a conservation function.

Nothing is more obvious than that water is a natural resource of this area. Indeed, it is the primary, the controlling resource, the one which gives value to all other resources, the one without which that area would be useless.

It is equally true that any area, humid, semiarid, or arid, would be useless without water, but the mind refuses to take seriously the idea that a humid region could be deprived of water. Such an area might have less water or more water,

but the mind declines to accept the suggestion, except in theory, that it might become a desert. The mind therefore fails to recognize water as a natural resource when water is plentiful and is not concerned with its conservation.

Water flowing in channels is recognized as a natural resource, for it can be navigated; water plunging down falls is recognized as a natural resource, because it is a thing of beauty and a source of electric energy; a stream full of clear, pure water is recognized as a natural resource because it can be used to quench a city's thirst; water gathered in shallow ponds can be recognized as a natural resource because wild water fowl can nest and rest there. But just plain water, without any qualifying advantages surrounding its presence, becomes a natural resource, apparently, only when it is not plentiful, when the supply of it is deficient and uncertain, and, consequently, when there is least likelihood of the condition of its occurrence making it valuable.

Many sincere conservationists have never understood that water is a natural resource. They subscribe to the principle that all natural resources are heaven-sent gifts to be cherished, used wisely without waste, and protected for the benefit of future generations, but they have not seen that water is eligible in every way to join that select brotherhood for which conservationists labor the world over; the forests, rivers and harbors, wildlife, fish and game, natural beauty, and the like.

Just as soil was taken for granted, with the belief that it never would diminish and never could be exhausted, so water is being taken for granted by many millions of our population. Suddenly conservationists everywhere awoke to the fact that soil was a natural resource in need of their protection and that already careless erosion had wasted many millions of fertile acres.

Such an awakening on a similar inter-sectional basis is impossible in the case of water. Its presence in sufficient or deficient quantities is a geographical matter on this continent. Occasional

droughts may occur in humid sections, but not through carelessness or greedy exploitation on the part of the users of the natural rainfall. The boundaries of the arid region, where drought is perpetual, are permanently fixed. This should not, of itself, make it impossible to obtain general support from conservationists for a program to conserve water in the arid West. Sectionalism has no part in the make-up of our true conservationists, who will fight for preservation of a trout stream in Idaho although he is certain never to see it or a trout from it.

Therefore it puzzles the West, where water never is and never can be taken for granted, that so few outside the arid region realize the importance of water conservation. It is illogical that the conservationist of Pennsylvania, Georgia, or Iowa should fail to join his fellows in the West in their stand for preservation of the scant water supply of that area for economical use. It can be explained only when it is ascribed to lack of understanding.

It is useless to hope that all can ever agree upon details of any program for conservation of western waters, but there should be no insuperable obstacle in the way of agreement among all conservationists upon the broad principles involved.

It is one thing to ask the unified support of conservationists for the principle of reclamation and quite another to ask for agreement among them upon the methods of putting that principle into practice in each individual locality where a project is undertaken. There probably is some room for honest differences of opinion in the latter case, but none can be admitted in the matter of the principle.

THE moving-picture theater at Powell, Shoshone project, Wyoming, has been remodeled and the town now has one of the most modern small theaters in the Rocky Mountain area.

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date) _____

SIR: I am enclosing my check ¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) _____

(Address) _____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Notes for Contractors

YAKIMA storage project, Washington.—Bids received for construction of a spillway at Kachess Dam (Specifications No. 669) opened at Yakima on February 24, were as follows: John Klug, Nyssa, Oreg., \$48,778; Fred G. Redmon, Yakima, Wash., \$51,095.75; Barnard-Curtiss Co., Minneapolis, Minn., \$69,301; Queen City Construction Co., Seattle, Wash., \$73,578.75; Guthrie-McDougall Co., Portland, Oreg., \$80,948.75; Butler Construction Co., Seattle, Wash., \$85,520.50; Myers & Goulter, Seattle, Wash., \$90,753.50; Sound Construction & Engineering Co., Seattle, Wash., \$100,044.25; L. Romano Engineering Corporation, Seattle, Wash., was \$135,816. John Klug was awarded the contract on March 20.

The next work to be undertaken will be the construction of earthwork, tunnels, and structures on the Yakima Ridge Canal, station 315 to station 576+81.5. Specification no. is 675 and bids will be opened at Yakima on April 13.

Colorado River project, Texas.—Opening of bids under Specifications No. 673 for construction of the Arnold Dam and power plant and the processing of sand and crushed rock for the Arnold and Hamilton Dams, scheduled for March 31 at Austin, Tex., was postponed. The work will be located west of Austin and near Burnet and Kingsland.

The specifications provide for alternative bids on two different types of construction, one a concrete gravity dam and the other concrete slab and buttress dam. The contractor under either schedule shall construct and maintain at his own expense a road between the end of the railroad at the Hamilton and Arnold Dams. The principal items of work and the advance estimated quantities involved in the two alternative types, which are covered by schedules nos. 1 and 2 of the specifications, are as follows: Schedule no. 1 (concrete gravity dam), 20,000 cubic yards of common excavation in open cut; 25,000 cubic yards of rock excavation in open cut; 136,000 cubic yards of concrete in dam and spillway bucket; 7,200 cubic yards of concrete in appurtenances to dam and in power-house; 11,000 cubic feet of pressure grouting; drilling 15,000 linear feet of grout and drainage holes; placing 500,000 pounds of reinforcement bars; installing 135,000 pounds of standard steel, brass, and cast-iron pipe, fittings, and valves; erecting 285,000 pounds of structural steel in power-house and switchyard; installing 415,000 pounds of gates, gate hoists, control mechanism, power pen-

stock, cranes and crane rails, metal pier noses, hand railing, trash rack, and other metalwork. Schedule no. 2 (reinforced concrete slab and buttress dam)—26,000 cubic yards of common excavation in open cut; 15,000 cubic yards of rock excavation in open cut; 34,800 cubic yards of concrete in buttresses and face slabs; 8,600 cubic yards of concrete in footings and spillway bucket; 13,000 cubic yards in mass sections of dam; 7,200 cubic yards in appurtenances to dam and in power-house; 7,700 cubic feet of pressure grouting; drilling 7,700 linear feet of grout holes; placing 3,800,000 pounds of reinforcement bars; installing 60,000 pounds of standard steel, brass, and cast-iron pipe, fittings, and valves; erecting 285,000 pounds of structural steel in power-house and switchyard; and installing 485,000 pounds of gates, gate hoists, control mechanism, power penstocks, cranes and crane rails, metal pier noses, hand railing, trash rack, and other metalwork. Schedules nos. 3 to 6, inclusive, of the specifications provide for alternative bids on producing sand and crushed rock, including washing, if necessary, for concrete aggregates for the completion of the Hamilton Dam and for the construction of the Arnold Dam and power-plant. Estimated quantities are as follows: Schedule no. 3 (processing sand for Hamilton Dam and Arnold gravity-type dam)—200,000 tons. Schedule no. 4 (processing sand for Hamilton Dam and Arnold slab-and-buttress-type dam)—160,000 tons. Schedule no. 5 (processing crushed rock for Hamilton Dam and Arnold gravity-type dam)—16,000 cubic yards stripping rock quarry; 135,000 tons $\frac{3}{16}$ - to $\frac{3}{4}$ -inch size; 110,000 tons $\frac{3}{4}$ - to 1 $\frac{1}{2}$ -inch size; 85,000 tons 1 $\frac{1}{2}$ - to 3-inch size; 100,000 tons 3- to 6-inch size. Schedule No. 6 (processing crushed rock for Hamilton Dam and Arnold slab-and-buttress-type dam)—12,000 cubic yards stripping rock quarry; 115,000 tons $\frac{3}{16}$ - to $\frac{3}{4}$ -inch size; 95,000 tons $\frac{3}{4}$ - to 1 $\frac{1}{2}$ -inch size; 65,000 tons 1 $\frac{1}{2}$ - to 3-inch size; 45,000 tons 3- to 6-inch size.

The work contemplated in schedules nos. 1 and 2 shall be completed within 600 calendar days from the date of receipt of notice to proceed.

Liquidated damages for delay will be \$200 per day.

The Bureau, through its Denver office, will purchase cement, reinforcing bars; pipe, fittings and valves; structural steel, gates, gate hoists, control mechanism, power penstocks, cranes and crane rails, metal pier noses, hand railings, trash rack, and other metalwork.

Four bids were received for furnishing 365,000 barrels of Portland Cement for the Hamilton and Arnold Dams under Specifications No. 766-D. Identical bids of \$2.353 per barrel (bulk) and \$2.803 (sacks) f. o. b. Beverly, were submitted by the following companies: Republic Portland Cement Co., Longhorn, Tex.; Trinity Portland Cement Co., Fort Worth, Tex.; Universal Atlas Cement Co., Atco, Tex.; Lone Star Cement Co., Dallas or Houston. The bids have been taken under advisement.

Salt River project, Arizona.—Twenty-five manufacturers bid on furnishing radial gate hoists, handrails, and miscellaneous materials for alterations to radial gates in spillways at Roosevelt Dam as called for in Specifications No. 767-D, bids opened at Denver on February 27. Bids for item 1, radial gate hoists, ranged from \$21,710 f. o. b. Portland, Oreg., to \$41,000 f. o. b. Kenton, Ohio; item 2, position indicators, \$385 f. o. b. Kenton to \$1,300 f. o. b. Denver; item 3, radial gate alterations, \$4,300 f. o. b. Peotone, Ill. to \$9,600 f. o. b. York, Pa.; item 4, handrails, \$585 York to \$1,235 f. o. b. Tacoma.

Dan Teters & Co., Ogden, Utah, with a bid of \$53,930, has been awarded the contract for alterations to spillways at Roosevelt Dam (Specifications No. 663).

On April 7 bids were opened at Phoenix, Ariz., for construction of the Bartlett Dam (Specifications No. 674). The successful bidder will be allowed 800 days to complete the work. The Bureau, through its Denver office, will purchase 5,500,000 pounds of reinforcing bars, 3,000 linear feet of drain pipe, and 3,191,300 pounds of gates, valves, and other metalwork. Robert F. Herdman is resident engineer in charge of construction.

Bids were opened at Denver on February 27 for furnishing radial gate hoists, gate-position indicators and miscellaneous materials for alterations to radial gates in spillways at Roosevelt Dam (Specifications No. 767-D). The following bids were received for item 1, 19 radial gate hoists: Commercial Iron Works, Portland, Oreg., \$21,710; Phillips & Davies, Inc., Kenton, Ohio, \$41,000; John W. Beam, Denver, Colo., \$26,780 f. o. b. Peotone, Ill.; Valley Iron Works, Yakima, Wash., \$22,915, discount 5 percent; Darbyshire-Harvie Iron & Machine Co., El Paso, Tex., \$29,961; Steacy-Schmidt Manufacturing Co., York, Pa., \$28,150; Consolidated Steel Corporation Ltd., Los Angeles, Calif., \$26,950; Hardie-Tynes Manufacturing Co., Birmingham,

Ala., \$32,780; Lakeside Bridge & Steel Co., Milwaukee, Wis., \$29,925, discount $\frac{1}{2}$ percent; Madsen Iron Works, Ltd., Huntington Park, Calif., \$24,524 f. o. b. Los Angeles; Foote Bros. Gear & Machine Co., Chicago, Ill., \$29,800; S. Morgan Smith Co., York, Pa., \$22,998; Long Beach Iron Works, Long Beach, Calif., \$23,596; Pacific Iron & Steel Works, Tacoma, Wash., \$25,210, discount $\frac{1}{2}$ percent; Omaha Steel Works, Omaha, Nebr., \$27,000; Los Angeles, Calif., \$25,653.25; Caravel Industries Corp., New York, N. Y., \$24,892, discount 2 percent, f. o. b. Springfield, Mass.; Minneapolis-Moline Power Implement Co., Minneapolis, Minn., \$29,870; Clyde Sales Co., Duluth, Minn., \$30,282.53; Ogden Iron Works Co., Ogden, Utah, \$26,665.50. Sixteen bids were received for item 2, gate-position indicators, and Phillips & Davies, Inc., Kenton, Ohio, were awarded the contract on their low bid of \$385, discount 1 percent. John W. Beam, Denver, Colo., was the lowest of 13 bidders on item 3, new parts for alterations to radial gates, with a bid of \$4,300, discount $\frac{1}{2}$ percent, f. o. b. Peotone, Ill., and was awarded the contract. There were also 13 bidders on item 3, pipe hand-rails and accessories, Crane-O'Fallon Co., Denver, Colo., being awarded the contract, at their bid of \$742, discount 2 percent, f. o. b. Mesa, Ariz.

Moon Lake project, Utah.—The following contracts have been awarded for furnishing needle valves for outlet works at Moon Lake, Taylor Park, Agency Valley, Seminole, and Alcovia Dams (Specifications No. 664): Joshua Hendy Iron Works, San Francisco, Calif., \$16,034, items 1 and 2; Hardie-Tynes Manufacturing Co., \$61,252, items 3, 8, and 9.

Bartlett-Hayward Co. of Baltimore, Md., with a bid of \$35,800 for items 1, 2, and 3, was awarded the contract for furnishing high-pressure gates for the Moon Lake, Taylor Park, and Island Park Dams as called for in Specifications No. 666.

Parker Dam project, Arizona-California.—The Monolith Portland Cement Co. of Los Angeles, Calif., has been awarded the contract under Invitation No. 44,080-A for furnishing 35,000 barrels of portland cement, at their bid of \$1.43 f. o. b. mill, Monolith, Calif. Five companies submitted bids.

Rio Grande project, New Mexico-Texas.—Bids were opened at El Paso, Tex., on April 2 for the construction of the Caballo Dam on the Rio Grande near Hatch (Specifications No. 672). The successful bidder will be allowed 700 days to complete and liquidated damages will be \$200 for each calendar day of delay. The Denver office will purchase cement, 1,580,000 pounds of reinforcement bars,

600,000 pounds of steel-sheet piling, 8,310 linear feet of drain pipe, and 825,000 pounds of miscellaneous metalwork.

Columbia Basin project, Washington.—Bids were opened at Denver on February 27, for furnishing under Invitation No. 38,220-A, 500,200 linear feet of 1-inch, 370,200 linear feet of 1½-inch, and 33,400 linear feet of 2-inch, plain and thin wall steel tubing. The following bids were received: Graybar Electric Co., Inc., Denver, Colo., \$43,929.83 f. o. b. Brooklyn, N. Y.; Steel & Tubes Inc., Cleveland, Ohio, \$43,960.99 f. o. b. Brooklyn; Triangle Conduit & Cable Co., Inc., Brooklyn, N. Y., \$54,350.25 f. o. b. Coulee City, Wash.; The M. B. Austin Co., Chicago, Ill., \$54,350.25 f. o. b. Coulee City. Graybar was awarded the contract on March 18.

Four bids were received at Denver on February 26 for furnishing galvanized fittings for plain and thin wall steel tubing (Invitation No. 38,221-A) as follows: Graybar Electric Co., Inc., Denver, Colo., f. o. b. Elizabeth, N. J., or Brooklyn, N. Y., \$35,309.71; The Mine and Smelter Supply Co., Denver, Colo., \$37,174.87 f. o. b. Chicago; B. & R. Electrical Supply Co., Denver, Colo., \$37,174.87 f. o. b. Chicago; Hendrie & Bolthoff Mfg. and Supply Co., Denver, Colo., \$37,174.87 f. o. b. Chicago. Graybar was awarded the contract on March 18.

Gila Valley project, Arizona.—Twenty-one contractors submitted bids under Specifications No. 657 (readvertisement), bids opened at Yuma, Ariz., on February 27, for the construction of earthwork and tunnels, gravity main canal, station 30 to station 931. Bids received for schedules 1, 2, 3, and 4 were as follows: Boyce and Igo, Baton Rouge, La., \$73,200 (schedule 1), \$200,400 (schedule 4); Mittry Bros. Construction Co., Los Angeles, Calif., \$76,700, \$210,830, \$470,745, and \$236,225; V. R. Dennis Construction Co., San Diego, Calif., \$239,285 (schedule 2), \$503,205 (schedule 3); Morrison-Knudsen Co., Boise, Idaho, \$90,510 (schedule 1), \$247,795 (schedule 4); J. F. Shea Co., Inc., Portland, Oreg., \$243,535 (schedule 2), \$505,075 (schedule 3); W. E. Callahan Construction Co., St. Louis, Mo., and J. P. Shirley, Dallas, Tex., \$90,600, \$247,840, \$541,170, and \$270,500; Griffith Co., Los Angeles, Calif., \$131,850, \$264,260, \$542,560, and \$355,700; West Construction Co., Monrovia, Calif., \$256,105 (schedule 2), \$545,270 (schedule 3); J. A. Terteling & Sons, Boise, Idaho, \$73,540 (schedule 1), \$425,645 (schedule 4); Walsh Construction Co., Los Angeles, Calif., \$267,074 (schedule 2), \$556,374 (schedule 3); David H. Ryan, San Diego, Calif., \$91,210 (schedule 1); Mark C. Walker &

Son Co., Omaha, Nebr., \$345,595 (schedule 4); Maceo Construction Co., Clearwater, Calif., \$354,975 (schedule 4); Utah Construction Co., Ogden, Utah, \$297,860 (schedule 2), \$667,945 (schedule 3); Jahn & Bressi, Los Angeles, Calif., \$121,450, \$261,130, \$556,480, and \$420,850; L. E. Dixon Co., Bent Bros. Inc., and Johnson Inc., \$333,160 (schedule 2), \$681,500 (schedule 3); Winston Bros. Co., Minneapolis, Minn., \$304,617 (schedule 2), \$679,670 (schedule 3); Geo. J. Bock Co., Los Angeles, Calif., \$94,625 (schedule 1); Lewis Construction Co., Los Angeles, Calif., \$237,850 (schedule 1); Isbell Construction Co., Reno, Nev., \$665,400 (schedule 4); D. McDonald, Sacramento, Calif., \$539,825 (schedule 4).

All-American Canal project, California.—Bids were opened at Yuma, Ariz., on March 30 for road-mix surface treatment of the construction highway from Laguna Dam to Imperial Dam and of streets and parking areas in the Government camp at the Imperial Dam (Specifications No. 773-D). The principal items of work and estimated quantities are: Distributing 535 tons of asphaltic oil; preparing, treating, mixing, and shaping 69,200 square yards of highway, streets, and parking areas; and hauling, placing, and spreading 300 cubic yards of pea gravel or sand. The successful bidder will be allowed 60 days to complete the work.

Boulder Canyon project, Arizona-Nevada.—The Lakeside Bridge & Steel Co., Milwaukee, Wis., on March 3 was awarded a contract for furnishing miscellaneous metalwork for the Boulder power plant (Specifications No. 763-D) at their bid of \$8,277 f. o. b. Boulder City, Nev. Other bids were: E. M. Weymer Co., Chicago, Ill., \$8,300 f. o. b. Chicago; Consolidated Steel Corporation, Los Angeles, Calif., \$9,533 f. o. b. Los Angeles; John W. Beam, Denver, Colo., \$10,400 f. o. b. Peotone, Ill.

Humboldt project, Nevada.—The successful bidders under Specifications No. 764-D were as follows: Item 1, dragline excavator, General Excavator Co., Marion, Ohio, \$7,626.55 f. o. b. Marion; item 2, buckets, Isaacs Iron Works, Seattle, Wash., \$550 f. o. b. Seattle. Other bids were: Harnischfeger Sales Corporation, Milwaukee, Wis., \$8,495 and \$565 f. o. b. Milwaukee; Marion Steam Shovel Co., Marion, Ohio, \$9,700 and \$775 f. o. b. Marion; Northwest Engineering Co., Chicago, Ill., \$8,223 f. o. b. Green Bay, Wis. (item 1); Byers Machine Co., Ravenna, Ohio, \$8,590 and \$725 f. o. b. Ravenna; Bay City Shovels, Inc., Bay City, Mich., \$8,270 f. o. b. Bay City, and \$645 f. o. b. Omaha, Nebr., or Cleveland, Ohio; General Excavator Co., Marion, Ohio, \$590 (item 2) f. o. b.

Marion; Lima Locomotive Works, Lima, Ohio, \$9,795 and \$775 f. o. b. Lima; Osgood Co., Marion, Ohio, \$7,500 and \$661.50 or \$825 f. o. b. Marion; Koehring Co., Milwaukee, Wis., \$10,522 and \$860 f. o. b. Milwaukee; Browning Crane & Shovel Co., Cleveland, Ohio, \$10,685 f. o. b. Cleveland and \$750 f. o. b. Chicago; Page Engineering Co., Chicago, Ill., \$555 (item 2) f. o. b. Chicago.

Owyhee project, Oregon-Idaho.—Bids opened at Ontario, Oreg., on March 5 for building structures on north canal laterals (Specifications No. 530-0) resulted as follows: Henry L. Horn, Nyssa, Oreg., \$8,818.50; Fife & Co., Nyssa, Oreg., \$9,309; John Klug, Nyssa, Oreg., \$9,463.50; David A. Richardson, Nyssa, Oreg., \$9,494; H. J. Adler Co., Tacoma, Wash., \$10,058.50.

Henry L. Horn, Nyssa, Oreg. submitted the low bid of \$7,977 for construction of north lateral structures (Specifications No. 529-0), opening at Ontario, Oreg., on February 27. Other bids were: David A. Richardson, Nyssa, Oreg., \$8,204; John Klug, Nyssa, Oreg., \$9,902.50.

Boulder City Settles Down to Permanency

With the sale of about 600 small houses by Six Companies, Inc., reports arose that Boulder city's boom days were done and that it was about to slip into the limbo and join some of its neighbors in the Southwest as a "ghost" town.

Of course, Boulder city is a permanent city. The contractor's camp was a temporary camp, largely, but Boulder city will have a permanent population of several thousand.

The first number of the Boulder Dam Challenge, which calls itself "Voice From Rim of New Desert Lake That Joins Boulder Dam, Grand Canyon", expresses a lusty kick on the part of Boulder city to being assigned to a place among the back numbers. It also sets forth interestingly the many reasons why the city will remain.

Columbia Basin Engineers Play Basketball

During the 1935-36 season, the U. S. B. R. Engineers' basketball team played 19 games with the leading teams from Wenatchee, Spokane, Washington State College, Coulee City, Bridgeport, Mason City C. C. C. Camp BR-48, Wilbur, Creston, and the Colville Indians from Nespelem.

Excerpts From February Project Reports

Yuma.—More alfalfa was cut than usual, with hay of excellent quality. Packing of the fall lettuce crop was completed and harvesting of the spring crop was begun. An average yield of 135 crates per acre was reported for the fall crop. Considerable land was being re-leveled in the interest of more efficient use of irrigation water. Seven carloads of livestock were received on the project for fattening and 30 carloads were shipped to market by rail, in addition to which an equivalent of 22.8 carloads were shipped out by truck.

Packing of the season's grapefruit crop on the Yuma auxiliary project continued throughout the month. At the end of February approximately 52 percent of the crop had been harvested. The grade and quality of the fruit this season are excellent. The demand during the month was good and conditions in the orchards were slightly better than January. Indications are very favorable for the coming year's crop. First-grade fruit marketed during the month brought \$1.50 to \$2.10 per packed box, and second-grade fruit was priced at \$1.25 to \$1.85 per box.

Orland.—The price of alfalfa hay continued high, \$18 per ton being asked for baled hay. A few plantings of oranges and almonds are contemplated by land-owners.

Minidoka.—The annual report of the Minidoka County Wool and Lamb Growers Association shows that in 1935, 23 cars of lambs were shipped to market in eight pools. The shipments included 5,670 fat lambs, besides 654 feeder lambs, ewes, and wethers. The receipts from these lambs were \$35,116. In addition, the sum of \$31,537 was received from wool shipments, or a total of \$66,653 from the sale of both lambs and wool.

Frenchtown.—The livestock industry is in good condition. Satisfactory prices are being received for livestock, hay, grain, and potatoes.

Humboldt.—All of the surplus hay produced during the 1935 season has been sold and there is no unsold or uncontracted hay on the project. All cattle are in fine condition, and 39 carloads of feeder cattle were shipped to market during the month from the feeding lots.

Klamath.—About 500 cars of potatoes were shipped during February, bringing total shipments to date to about 2,700 cars. It is estimated that there are about 1,000 cars remaining in storage on the project. All livestock is in excellent shape. Lambing among farm flocks was just starting at the close of the month.

Provo River.—The marketing conditions for livestock, poultry, and dairy products and for hay and grain remained excellent.

Riverton.—In 1935, for the first time, a considerable acreage of seed beans was contracted in the vicinity of Riverton, none of the acreage being on the Riverton project. In spite of the fact that 1935 proved to be an unfavorable year for beans, most of the men who raised seed beans did very well with them. As a result a much larger acreage is being contracted for 1936, including a considerable amount on the project. The livestock on the project are in good condition.

Shoshone.—The price of alfalfa hay increased from \$5 to \$5.50 per ton in the stack, with a good local demand by stockmen. The price for Great Northern beans advanced from \$2.35 to \$2.50 per hundredweight. Potatoes showed a 5 cent per hundredweight increase and were bringing 80 cents per hundredweight.

In winning most of the games played, the U. S. B. R. Engineers scored a season's total of 721 points against a total of 668 for their opponents.

The U. S. B. R. "Engineerettes" played seven games with teams from Coulee City, Mason City, and the Nantues Club of Colville Indian Women from Nespelem. The Reclamation Women scored a total of 136 points while the visiting ladies were scoring a total of 94 points.

From a season-tickets' sale and paid admissions, the U. S. B. R. Basketball Club was able to equip both the men's and women's teams with suits, balls, etc., pay current expenses, and create a surplus fund to be disbursed in the interests of civic improvement of the school playground in the Government camp at Coulee Dam.

Orland High School Honors

The agricultural department of the Orland High School won six first places and one third place out of 10 Orland project entries, in competition of 35 Future Farmers of America chapters. Places were awarded at a meeting of high-school instructors held in Chico on February 22. The showing made reflects credit not only on the participants, but upon their instructor, W. W. Coke. Orland project is badly in need of young, farm-minded individuals and no doubt the young men who brought credit to their school will continue their efforts after graduation and assist in building up the project to the point where it will take its rightful place as a national asset.

Progress of Investigations of Projects

Silt survey—Colorado River, Ariz.-Calif.—Surveys and borings along the Colorado River between the Parker and Imperial dam sites to determine the effect of desilted water released from the Parker Reservoir on the river channel, consisting of 18 cross sections, have been completed. The maps and profiles have been prepared and forwarded to the Denver office for review.

Weiser-Payette, Idaho.—Field work during the month consisted of securing topography of the site of the proposed pumping plant from Snake River and of a profile of the line to be followed by the discharge conduit from this plant. Water-supply studies were made to determine the irrigation requirements of the Boise project. Reservoir-operation studies were made for Arrowrock and Deer Flat Reservoirs in the critical period of 1929-34 to determine the extent to which past shortages could be alleviated by pumping from Snake River, with pumping plants of various capacities. Study was also made to determine the amount of winter water that could be recovered through the Phyllis Canal from Boise River and six of the project drains. A study was made to determine the firm power possibilities at the Twin Springs dam site on Boise River. Two conferences were held (one in Denver on Feb. 17 and one in Boise on Feb. 24) with officials of the Idaho Power Co. to ascertain their ideas on the probable rate of absorption and value of firm power and the probable cost of purchasing power from them for operation of the various pumping plants suggested to supplement the supply of the Boise project by this method. Estimates of cost were made for the canal from Snake River pumping plant to Deer Flat Reservoir, for the channel through Eagle Island, and enlargement of part of the Phyllis Canal. Cost estimates are being prepared for a power plant at Arrowrock Dam, five small pumping plants to recover drainage water on the Boise project, a pumping plant from the Snake River, a relief pumping plant into the Mora Canal, and a pumping plant from the Phyllis Canal to Deer Flat Reservoir.

Gallatin Valley, Mont.—Diamond drilling was continued at the lower basin dam site, hole no. 2 being completed from a depth of 60 feet to 352 feet. A leak occurring at a depth of 302 feet indicated the probability of a fault or solution channel crossing the bedding planes. The core at this point had some compacted silt attached. Better progress was made by the drill crew during

February than in December or January, in spite of the cold weather, and at the end of the month the drill had been moved across the river to hole no. 3 and all was in readiness to begin drilling that hole. The profile of dam site no. 2 at the lower basin reservoir site was completed, and the profile of the dam site at the Spanish Creek Reservoir was taken. Securing of topography downstream from dam site no. 1 at the lower basin reservoir site for road relocation was continued. Test-pit work was done along the 6200 contour on the east side of the dam site.

Madison River diversion, Montana-Idaho.—Investigations to determine the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henrys Lake, Idaho, were continued. Field surveys on these investigations have been completed. Water supply studies to determine the amount of water available for diversion will be completed upon receipt of data from the Montana State officials stating the conditions under which transmountain diversions will be permitted.

Deschutes project—North Unit, Oreg.—The location survey for the Mud Springs lateral was continued during the month, the work being from station 218 to station 736, a distance of 9.8 miles. Four and two-tenths miles of the previously surveyed line have been adopted as final, bringing the total length of the line surveyed to date of 14 miles. This lateral diverts from the main canal at the south end of Agency Plains, running easterly through the pass into the head of Mud Springs Basin, then around the head of the basin and northerly along the east side. The line is very crooked through broken terrain and at times along steep slopes. The material is earth and hardpan or cemented gravel. This survey was not carried on continuously during the month but will now be carried to completion as soon as possible. It is important to have this line since it defines the high-land boundary of the irrigable area. The Willow Creek lateral survey was begun and completed during the month. Its length is 11.1 miles. The lateral diverts from the main canal at the top of the drop near Metolius and contours easterly across the Willow Creek box canyon and thence northerly defining the high-land boundary. The lateral is crooked, and on some steep ground and will require a 300-foot siphon to cross Willow Creek. The irrigable area survey was completed on February 15. Seven thousand six hundred forty-eight acres were surveyed during the month, bringing the total to 77,244 acres, gross

area. Probably over 27,000 acres will be found nonirrigable. In the field office the Mud Springs lateral alignment was computed and plotted to mile 4.15. The main canal end areas were measured and quantities computed to mile 3.3.

Crooked River, Oreg.—A preliminary survey was made of the low-line pump canal, using plane-table and stadia methods. This canal line has a length of 6.5 miles from the river to the Ochoco pump site. It is the cheapest possible line, being shorter and less in rocky material than the others, and having only one drawback in that it requires a 24- to 28-foot cut through a gravel mesa for a length of one-half mile. Sufficient data were received in this survey to enable a fairly reliable cost estimate to be made. The site of the diversion dam at the head of the above canal was surveyed during the month. The dam site is about 4½ miles above Prineville. The site is not ideal and a long, low dam will be required, and should probably be collapsible to protect adjacent improved land in case of high water. The draft of the report on these investigations is nearly completed.

Black Hills (Rapid City), S. Dak.—A reconnaissance of the project was made and data available locally collected. The field work consisted of securing hydro-metric data, gaging stations being established at Deerfield and Rapid City in Rapid Creek Basin and at Beulah, Wyo., on Redwater Creek, a tributary of Belle Fourche River. Studies of water supply were made.

Salt Lake Basin, Utah.—Investigations are being conducted in pursuance of a cooperative contract with the State of Utah. The water-supply studies were brought up to date during the month, by the inclusion of the data for 1935. The land classification on the Ouray project has been completed. It is planned to complete the reports on these projects in the near future.

Dixie project, Utah.—The water supply and silt investigations previously initiated were continued during the month. An examination was begun of the applications on file in the State engineer's office to appropriate the water of the Virgin River and its tributaries, so that the effect of these appropriations, if consummated, on the water supply of the project may be determined. Arrangements were made for a land classification of the project area and for securing of such data as are available from previous surveys. A classification of the lands is in progress.

(Continued on p. 103)

Columbia Basin Investigations and Their Purposes

By Frank A. Banks, Construction Engineer

AN irrigation project, to be successful and to interest the Bureau of Reclamation, must have such a combination of soil, topography, water, and climate as to assure a properly qualified settler of an income sufficient to provide himself with a secure home, pay his share of the cost of operating and maintaining the project, and to repay to the Government his share of the cost of the irrigation works. Painstaking investigations are necessary to determine whether a development is feasible. After feasibility has been determined, further investigations and surveys are required in the process of actually planning and laying out the project.

Much of the information necessary to demonstrate the feasibility of the Columbia Basin project has already been secured and embodied in many published reports, among the principal of which in the order of their publication are the following:

(a) Soil Survey (reconnaissance) by A. T. Strahorn and others of the United States Department of Agriculture and State College of Washington. 1929.

(b) Columbia River and Minor Tributaries (2 volumes) by the United States Army Engineers. 1931.

(c) Hearings before the Committee on Irrigation and Reclamation, House of Representatives, Seventy-second Congress, first session, on the bill H. R. 7446, to provide for the construction, operation and maintenance of the Columbia Basin project in Washington and for other purposes. 1932.

The purpose of the surveys and investigations now under way is to supplement the general data so far obtained with such detailed information as may be necessary to permit a prompt start on construction of the irrigation features of the project on a broad scale whenever the necessary funds are provided by Congress. The preliminary work necessary to starting construction on an irrigation project is not so simple as it might appear and often requires years.

CONTRACTS

One of the first requirements is that there be a financially responsible organization representing the land owners with which the Government can make contracts providing for the construction of the project and the return of the Government's investment therein. This organization usually takes the form of an irrigation district, the formation of which, together with the confirmation of neces-

sary contracts, usually takes a year or more.

Past experience has demonstrated that the financial progress of the settler has been materially retarded in some instances by the high price he has been required to pay for the raw land and the heavy interest payments resulting therefrom. This can be avoided in two ways:

(a) The Government may, as a prerequisite to the construction of the irrigation features of the project, enter into a contract with each landowner providing for the purchase by the Government of his entire ownership or that part of his ownership in excess of a prescribed amount necessary to support a family, which the landowner may be allowed to retain under certain conditions. The Government would then resell the purchased land to prospective settlers on favorable terms.

(b) The Government may also, as a prerequisite to the construction of the irrigation features of the project, enter into a contract with each landowner, fixing the terms upon which the landowner himself may sell his ownership or that portion thereof in excess of a prescribed amount necessary to support a family and providing further that no water will be furnished for the ownership until such sale has been made.

As a protection to the Government in the return of its investment, contracts are sometimes made with each landowner under the terms of which the land is appraised and the landowner agrees that if it is sold for a sum in excess of the appraised value, the value of improvements made since the appraisal will be deducted from the excess and 50 percent of the balance paid to the Government to apply on the cost of the water right.

PROJECT PLANNING

These details of administration require an accurate knowledge of the area (both irrigable and nonirrigable) and the value of each tract of land on the project and the name and address of its owner.

The construction of a successful irrigation system involves a large amount of advance and long-range planning. Manifestly, the capacity and size of the main canal cannot be determined until the capacity of its principal branches has been fixed and the capacity of the branches likewise depends upon the amount of water to be carried by the various laterals, etc. Consequently, before we can begin construction at the

head end of the project, we must begin computations of irrigable areas and water duties at the tail end and work back through the entire system. This calls for an accurate topographic map of the entire project, upon which paper locations may be made of all canals, branches, laterals, and sublaterals, and from which the capacities of each may be computed. Such maps are also indispensable in classification and appraisal of the land, the design of the drainage system, the laying out of roads and other transportation facilities and utilities, and the planning of the towns and rural communities. Such maps are now being started for the Columbia Basin project.

Prior to completing the topographic surveys, it will be necessary to reestablish all the land corners and mark them with brass-capped iron pipe and establish a geographical and level control over the entire area. This involves the retracement of 7,000 miles of land lines and the setting of 11,000 new corners to be followed concurrently by the taking of 1,500,000 acres of topography.

For this work there has been allotted \$250,000 of E. R. A. funds for the fiscal years 1936 and 1937. Headquarters have been established at Ephrata, Wash., and a crew of 68 men employed on level control, retracement, and landownerships. This organization will be expanded somewhat as soon as weather conditions permit of a more extensive program.

With this preliminary work completed and the main canal and east and west branches located, construction work could be started over a large area and prosecuted as rapidly as funds would ordinarily be made available and the demands for new lands would justify.

Reclamation Convention

The Wyoming Reclamation Association met in annual convention at Casper April 2-3 and carried out a program of considerable interest. Some of the addresses delivered will no doubt appear in one or more issues of the Reclamation Era.

The Bureau of Reclamation sent display boards to be shown in the rotunda of the State Capitol Building prior to the meeting to show to the State officials and visitors the State development indicated by the pictures. The exhibit was later used at the convention proper.

Progress Made in Irrigation Research at Prosser

By H. P. Singleton, Superintendent Irrigation Branch Experiment Station, Prosser, Wash.

THE act creating the irrigation branch experiment station of the agricultural experiment station, State College of Washington was passed by the 1917 legislature. Selection of a site was authorized but no funds were appropriated. After the consideration of several sites by representatives of the State College of Washington, the United States Department of Agriculture and the Bureau of Reclamation, a 200-acre tract of virgin sagebrush land was selected 5 miles northeast of Prosser. This selection was made with reference to the location, soil type, and climate factors of the irrigation project then under operation and those of proposed future projects. The citizens of Prosser donated \$3,000 toward the initial development of the tract and assisted in clearing and leveling the land. The legislature of 1919 appropriated funds for the support of the station. A superintendent was appointed by the State College of Washington and the work of developing the station started in earnest. Clearing and leveling operations were quickly followed by the establishment of crops and all acreage was in crops in 1921.

Experimental work was started in agronomy and with livestock in 1921. The work in irrigation was started in 1922, and that in horticulture in 1923. All experimental projects are planned in cooperation with the respective departments of the agricultural experiment station and State College of Washington, and are approved by the director. The United States Department of Agriculture, through the division of Western Irrigation

Agriculture, has cooperated with the station in carrying on irrigation investigations since this work was started. The irrigation specialist at the station is a member of that office. His salary, travel, office, and incidental expenses are handled by them. All other expenses are handled on funds of the State of Washington.

Owing to the decrease in appropriations for the State College of Washington, it has been necessary to reduce the allowance for this station. Effective June 1, 1933, the position of horticulturist was discontinued, and the horticultural work from that time has been handled by a research fellow.

The station staff at the present time consists of H. P. Singleton, agronomist and superintendent; Dr. Carl A. Larson of the Division of Western Irrigation Agriculture, United States Department of Agriculture; and Walter J. Clore, research assistant in horticulture. During the growing season other graduate students assist in handling the experimental program.

The soil type of the station in general is representative of large areas now under irrigation in the State and those that will be brought under irrigation at a later date in the Roza and Columbia Basin projects. The soil on the station varies from a sandy to a silt loam; the larger part of it being fine sandy loam. A large part of the experimental program is carried on at the station. However, in order to study definite problems in various locations in the valley, a large number of cooperative trials with crops, soils, and

fertilizers, and other treatments are conducted in cooperation with farmers located from Ellensburg to Kennewick.

CROP TESTS

Since a permanent irrigation agriculture must be based largely upon the use of forage legume crops in the cropping system, studies with these crops were started in 1921. More than 30 varieties and strains of alfalfa have been tested. Northern common strains have proved their superiority over southern common strains, and the following varieties: Peruvian, Grimm, Canadian Variegated, and Baltic. Ladak shows promise as a cover crop. Good strains and varieties of sweetclover have proved to be very desirable pasture crops. These include White Madrid and Yellow Madrid. Alpha 1, a low-growing, fine-stemmed, leafy variety, is proving popular as an orchard cover crop. Grundy County White is less desirable than Alpha 1 as a cover crop and should never be seeded for pasture on account of its low yield. Many miscellaneous forages such as mixed grass pastures, Ladino clover, red clover, vetches, millets, sorghums, clovers, and grasses have been tested.

Corn is by far the highest yielding grain crop. Good local strains of yellow dent have yielded well but some of the new hybrids from the Middle West are much more promising. Yields in excess of 100 bushels of dry shelled corn per acre have been produced at several locations. Thayer yellow, an early maturing variety, is used extensively now by poultrymen. The small grained cereals in order of yield range as follows: Spring wheat, barley, and oats. Jenkin, Pilcrow (sometimes known as White Russian), and Dicklow are good varieties of spring wheat. Beldi, Giant, Blue, or Trebi barley and Markton oats are among the better varieties. Other grain crops that have been tested are soybeans, cowpeas, chickpeas, field peas, and safflower.

Fertilizer investigations in a 3-year rotation of potatoes, corn, and wheat were started on virgin soil in 1922. Additional plots were added later. Both organic and inorganic fertilizers containing nitrogen have been beneficial, but there have been significant differences between the different fertilizers. Phosphorus or potash applied alone have produced very little response. Yield differences on the original plot series have been as much as 540 percent of the check plot yield. Higher yields have been obtained from organic nitrogen fertilizers, including



Irrigation Branch Experiment Station. General view of buildings and grounds.

sheep and horse manure, fish meal, and alfalfa hay, than from inorganic nitrogen fertilizers.

An alfalfa fertilizer experiment was started in 1931. Various combinations of nitrogen, phosphorus, potash, calcium, and sulphur were used. With the exception of 1934, fertilizers have been applied each year. Observations and yield data indicate that phosphorus has increased plant growth and yield. Applications of nitrogen, calcium, potash, or sulphur, singly or in combination, did not cause any measurable increase in yield.

Early in the history of the station, duty of water studies were conducted to determine the water holding capacity of the soil and the duty of water on different crops. These important factors are still under consideration. Investigations were made on irrigation of crops such as alfalfa, corn, wheat, and potatoes with emphasis being placed on a study of the frequency of irrigation and the water requirement of the crop.

Salinity of irrigation and drainage water has been under investigation for several years. The inflow and outflow of salt on several areas in the Yakima Valley has been determined. Some work on reclamation of salty land has been accomplished.

CROP ROTATION

A crop rotation project was started in 1935. This study is conducted by the representative of the Division of Western Irrigation Agriculture. The crops used in the rotation are: Sugar beets, spring wheat, potatoes, corn, alfalfa, and sweet-clover. This project consists of 102 one-tenth-acre plots with 40-foot roads and 5-foot alleys between plots. The general object of the project is to determine the effect of different irrigated cropping systems upon crop production and soil fertility. Subordinate objects are: (a) To determine the effect of crop sequence upon plant growth and production of crops, (b) to determine the value of manure in maintaining soil fertility over a long period of time, (c) to determine the value of alfalfa and sweetclover in maintaining available nitrogen for the production of other crops.

The program in horticulture has been with tree fruits, small fruits, and truck crops. A variety orchard is maintained in which new and untried varieties of the many tree fruits can be tested. Irrigation investigations with 8-year-old apple trees was started in 1930. These investigations are conducted in cooperation with the Division of Western Irrigation Agriculture. They include the measurement of the water applied to each plot and the subsequent surface



Food for thought for tree planters

run-off water; soil moisture determinations before and after irrigation; and the tree and fruit responses to the various irrigation treatments. A 6-year-old cherry orchard and a 4-year-old pear orchard are being developed for future irrigation investigations.

Fertilizer studies with apples and pears are handled cooperatively at the A. L. Strauz apple orchard on Naches Heights near Yakima and the F. A. Norton pear orchard near Grandview.

Truck crops and small fruits that have received attention are lettuce, sweet-potatoes, sweet corn, tomatoes, and strawberries.

VALUE OF LIVESTOCK

A considerable number of livestock are owned by the station but since they do not consume all the feed crops grown, the practice of feeding beef cattle, lambs, or breeding ewes each winter is followed. No forage crops are sold off the station. Representative lots of livestock have been used in feeding experiments and a large amount of evidence has been accumulated with reference to the feeding value of various grains, succulent crops, and kinds of hay that are grown under irrigation. Corn has produced much larger gains per pound of grain fed than other grain crops. Barley, wheat, and oats follow in order. Processing grains for fattening lambs proved uneconomical, but hay chopping was profitable. When fed to lambs, the feeding value of cull potatoes, squash, rutabagas, apples, and carrots was greater than could be explained by the dry matter in the succulent feed.

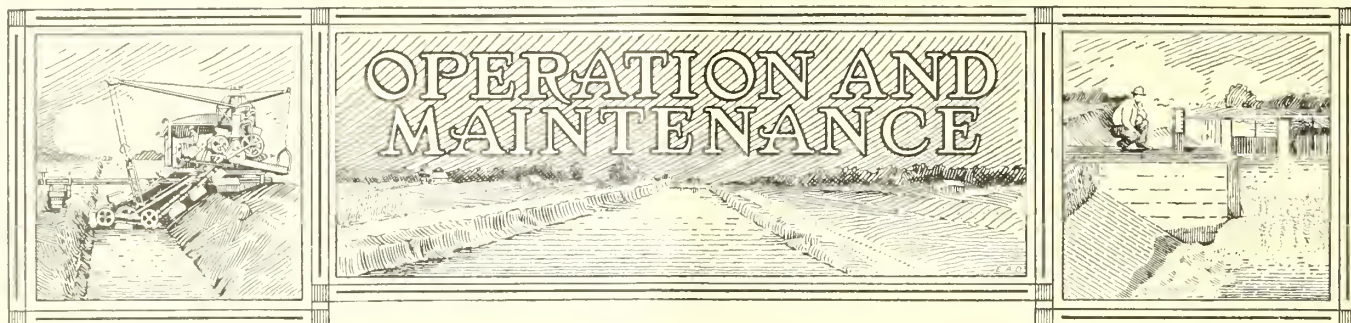
The value of livestock on the irrigated farm has been well demonstrated at the irrigation branch experiment station. Crop yields have been maintained or

increased by the following practices: The use of a crop rotation system in which forage legumes are used extensively, the feeding of all feed crops to livestock, and the returning of the manure to the cultivated crops in the rotation.

The value of the station to present farmers in the irrigated districts of Washington will continue to increase. Not only is more experimental evidence being continually accumulated regarding the many phases of problems now under investigation but new problems will be studied as other experimental projects are completed or additional funds are available. New settlers on future projects will find the station a source of reliable information on their many problems. The fact that the station was developed from the sagebrush and that the soil type and climatic conditions at the station are similar to much of the land included in such proposed projects as the Roza and Columbia Basin places the station in a position to serve adequately new settlers on these projects.

Parker recovering from fire

Erection of new buildings to replace those lost in the fire of February 3 at Parker Dam was begun as soon as the wreckage of the old buildings could be removed. A post-office and barber-shop building is practically completed and the mess hall and commissary is well on the way to completion. The new buildings will be more fire resistant, the walls being constructed of gypsum board. The remaining dormitory has been improved by the erection of four fire escapes and the plastering of the interior walls.



Value of Ladino Clover for pasture

By W. W. Coke, Head of Agriculture Department, Orland High School

FOR MANY years the margin of profit in all farm enterprises has been seriously shrinking. The recent years of depression have increased this difficulty to the point where something radical must be done about the matter if the producer is to remain on the job. In many farm enterprises the labor problem is one of the largest factors of expense. With increasing standards of living, labor costs have increased more rapidly than prices for farm products.

Pasture has always been one of the cheapest of livestock feeds, especially from the standpoint of labor, and so in order to reduce production costs, farmers generally have been looking more and more to pasture crops. Under most of California conditions pasture is limited to a few months in the spring, and most of the pasture crops designed to cover a longer period have not proven particularly successful. However, with the introduction of Ladino clover, experience has shown that we have found a crop that meets this need most admirably under most of the irrigated farm conditions in California. Ladino clover by actual experience is proving a boon to the Orland district and a survey of some of the local farms that have been using Ladino for a number of years, gives us the following data:

13 YEARS AGO

The first planting of Ladino clover in this district was made by John Tomasella about 13 years ago. The seed was secured from Italy and was scattered along the border of irrigating ditches in his alfalfa fields and within a few years had spread to cover the entire acreage. This stand of Ladino is in good condition today and is still carrying its quota of 15 dairy cows on 10 acres. These cows are fed a small amount of carbonaceous hay and light grain, otherwise they secure their entire feed from the pasture for 8 to 9 months during the year. The stand is

quite heavily mixed with Bermuda grass and some other weeds, but none has proven detrimental to the stand. In fact, Bermuda grass has proved one of our very best supplemental pastures and reduces the bloat hazard to a minimum.

Another farmer, John Pehrson, has $9\frac{1}{2}$ acres of Ladino clover 4 years old. Mr. Pehrson is a very careful farmer and permits no weeds of any kind in his place. His Ladino clover is clean, except that he has orchard grass as a supplemental crop in part of his acreage and western rye grass in other parts. Mr. Pehrson carries the equivalent of about 25 head of dairy cows besides a few small calves on this acreage and puts up 10 to 12 tons of hay in addition to all the pasture that the cows need. He also feeds lightly of hay and grain with the pasture. In fact the practice of feeding some carbonaceous hay and light grain with Ladino clover seems very desirable.

A. C. Cunningham has been running hogs on Ladino clover for several years. He finds that feeder hogs on Ladino clover pasture fed 1 pound of grain per 100 pounds of live weight do well and gain rapidly. The bunch he shipped last showed a gain of $1\frac{1}{2}$ pounds a day for 60 days on this treatment, but figures were not available as to the exact number of hogs an acre would carry. The hogs did not damage the pasture in the least, and while some weeds appeared that were undesirable, they were easily controlled by mowing the pasture occasionally.

M. G. Haigh, Glenn county supervisor, 3 years ago found his alfalfa so badly infected with nematode that it was gone. He seeded Ladino into this alfalfa ground without any other preparation than a light harrowing and secured a good stand. He has 14 head of dairy cows and 7 acres of Ladino. He feeds light hay supplement but no grain. His figures show that the 7 acres of Ladino supply about three-fourths of the total feed for his cows for the year.

Harry Hill, another of our progressive dairymen, has carried 40 head of cows and heifers on 25 acres, using some hay and a little grain feed as supplement. Mr. Hill has 5 acres of apricots interplanted with Ladino, which he uses largely for hay crop when the apricots are on the trees, but pastures later in the fall.

Frank Aguara, local dairyman, has Ladino in his olive orchard and by pasturing the cattle only a few hours at a time finds no difficulty in utilizing this Ladino as a pasture crop. Ladino is highly recommended also for sheep and poultry.

As to planting and maintenance cost, Ladino clover requires irrigation a little more frequently than alfalfa, but the total amount of water used is no greater and of course the cost would vary with the water cost in the particular community.

The preparation of land would be about the same as the cost of preparing land for alfalfa, and would vary with the condition of the land from \$5 an acre up. The very best conditions for planting Ladino are given by a field that has already been leveled and planted to alfalfa or some other crop, in which the Ladino can be sowed into the stubble without any other preparation than a light harrowing. In fact, one of the most serious mistakes in planting Ladino is to sow it on freshly prepared ground. Ladino requires a firm seedbed. Good stands have been obtained even in fields heavily sodded with Bermuda. From 3 to 4 pounds of seed per acre is generally recommended, sown either in the fall, if the water is available or in early spring. Many seedings in this district have produced one-third of a crop of pasture the first year.

ECONOMIC RECOVERY

The most recent census on Ladino in this district shows about 1,500 acres in crop, with considerable new plantings

being made. The unanimous consensus of opinion seems to be that Ladino is a much more profitable crop than alfalfa. In fact, the figures derived from the above survey would indicate that Ladino supplies the equivalent, in dairy feed per year, of about 8 to 9 tons of hay, that it involves less labor, and that gives a high-average milk production. By maintaining some supplemental grass in the pasture, bloating is not a serious problem. I think we can safely say that Ladino offers the most encouraging prospect to the farmers of this community for economic recovery. In fact, Ladino seems to point the way out for the farm needs in this district as no other crop has done.

CAUTIONS AGAINST ERRORS

I wish to call particular attention to two facts in regard to Ladino clover in which it is very easy to make serious errors.

There are three varieties of clover that belong to the same general class as Ladino clover, the seed from which is so similar that it is not possible for even an expert to distinguish between the seed of the three varieties. One is the common white Dutch clover used on the lawns; the other, known as Louisiana white clover, will not produce nearly so well as the genuine Ladino clover although it is a good pasture grass. Several plantings of this variety have been made in this community, and in spite of the fact that it makes a good pasture, our observation



Hired help in Ladino clover that never strikes—always faithful

indicates that it will not produce more than 60 or 70 percent of the amount of feed that the Ladino clover will. However, it is a heavy seed producer, hence it is very important in selecting Ladino clover seed to get only certified seed.

CARE IN FEEDING

The other caution is in regard to feeding Ladino clover. Ladino as fed in pasture is a heavy protein feed, and if the health of the animal is to be maintained, some carbonaceous supplement such as grain, grain hay, or silage must be fed with the Ladino clover in order to get a more nearly balanced ration. Many

people are tempted to feed Ladino clover exclusively, and the animals seem to thrive on it for a time, but the excess protein throws a heavy burden on the kidneys of the animal and sooner or later trouble is apt to follow. Much of the recent criticism directed against Ladino clover has been caused by feeding Ladino in an improperly balanced ration.

For further history and general cultural procedure on Ladino clover, I refer you to Extension Circular 81, issued in December 1933, by B. A. Madsen and J. Earl Coke. This circular may be secured at the University of California or at your local high school.—*The Orland Unit.*

Allotments Made

Public Works Administrator Harold L. Ickes has announced the allotment of \$280,000 for three surveys of water resources in the Rocky Mountain area by the Bureau of Reclamation of the Interior Department in cooperating with the National Resources Committee.

The total of \$100,000 was set aside for a survey to determine the feasibility of diverting water from the Blue River on the western slope of the Continental Divide in Colorado to the headwaters of the South Platte River on the eastern slope of the Rockies.

Another \$150,000 was allotted for the purpose of studying possible future irrigation and power developments in Colorado, particularly in that portion west of the Continental Divide.

Thirty thousand dollars was allotted for the study of water resources in the Rio Grande basin of Colorado, New Mexico, and Texas.

ATRIAL planting of sugar beets last season on the Owyhee project, under unfavorable conditions, averaged 15 tons per acre.

Big Siphon Pictured in German Newspaper

In its issue of January 9 the Illustrated Observer, published at Munich, Bavaria, Germany, carried a half-page illustration of the big siphon as it crosses the Malheur River valley. The caption, as translated for The Argus (Ontario, Oreg.) by Joe Fengler, reads:

"The almost 6 kilometer-long steel pipe of the water canal of the Owyhee project in Malheur River valley in western America. The pressure of the water is so strong that in spite of having to go over small mountains, no pump is required to bring the water through the pipe."

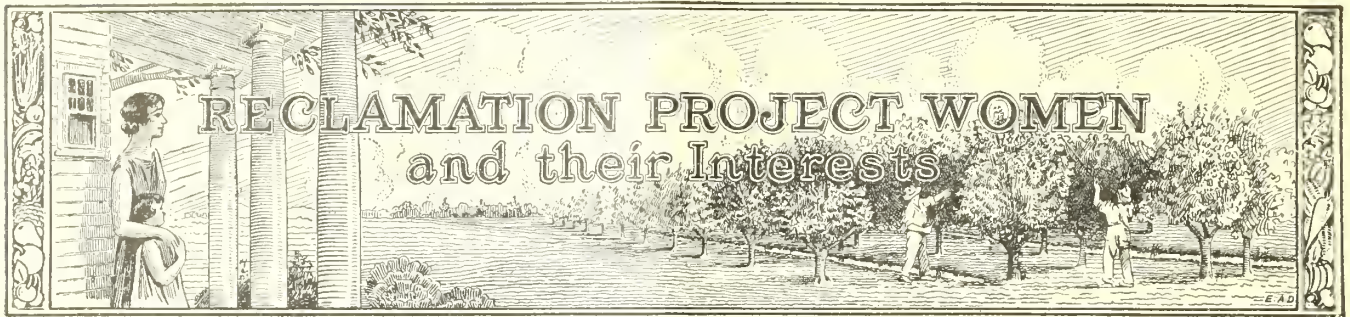
The paper was brought to the Argus by Joe Koopman for his wife, who received it from Germany.—*The Ontario Argus.*

RECENT statistics released by the cannery interests on the Yakima project show a production for 1935 of 904,350 cases at a valuation of \$3,171,415, pears and apples making up the bulk of the products handled.

Shipments from Yuma

For March 14, 1936, the local Southern Pacific freight office reported one of the largest daily shipments of farm products from the local station, the total amounting to 134 cars, of which 122 were lettuce, and the remainder, consisting of 4 cars each of earrots and grapefruit, 7 of livestock, 5 of hay, and 2 of mixed vegetables. An increase in the prices of spring lettuce created a very active market for the 10-day period March 5-14, and during that period also shipments of lettuce varied from 80 to 90 cars per day.

DURING the month of February several storms were had in western Colorado, and from all reports a very heavy snowfall was had on practically all the Colorado River watershed. It is believed that the accumulated snow in the high country at this time of the year is considerably above normal, which condition indicates that an ample water supply should be available for the coming season.



The Grandview Woman's Club

By Mrs. Ella S. Tuttle, Sunnyside, Wash.

THE Sunnyside division of the Yakima project has two Carnegie libraries, one at Sunnyside established in 1910, the other at Prosser.

Grandview was not thus favored, but on May 20, 1910, a woman's club was organized with 22 members. In 1911, this club gathered together 200 books and founded a library, which they operated and maintained, through their own efforts and by donations, until the year 1920, when the city appropriated \$300 per annum toward its support. From 1923 to the present time, the city has appropriated \$600 per annum for this purpose. The library now has books numbering 3,500 and during the year 1935 more than 12,000 books were loaned, which was not quite up to the average of former years.

The club at this time consists of 78 members, and, in addition to their work in connection with the library, they have given both money and trees toward establishing the city park; they have put tables, benches, and a drinking fountain in the park, a drinking fountain in the business section of the town, and each year give Christmas baskets to the needy. They also give \$5 a year each to the Veterans' Home and the Children's



Wading pool and two cement benches, gifts from Woman's Club. Aluminum frog with spray on standard

Home, and in addition help the Red Cross and tuberculosis societies.

Mrs. H. C. Daugherty, president, and Miss Elizabeth Rawlings, corresponding

secretary, to whom we are indebted for the above information, stated that they hoped, in the not too distant future, to be able to build a clubhouse which can be used as a community center. They also stated that much of the credit for the establishment and security of the library should go to Ann M. Hendricks, and that to Mrs. George Parchen, the only charter member who still retains her membership in the club, should go the credit for securing the West Side Park. Mrs. Parchen's daughter, Mrs. J. L. Purdue, is past president of the District Federation of Women's Clubs.



City Park with drinking fountain in foreground

PROGRAMS for noxious weed eradication on the Minidoka project have been adopted both in Cassia and Minidoka Counties, to be carried out under the auspices of the State Works Progress Administration. It is planned to spend about \$35,000 in Cassia County, and \$25,000 in Minidoka County on this work.

A Sunnyside Water User's Canning Operations

By M. D. Scroggs, Irrigation Manager, Yakima, Wash.

In 1912 Floyd L. Rinehold, a farmer near Granger, Wash., accidentally started a canning factory. Mr. Rinehold related that he had employed on his farm a man who had had experience canning clams on the coast. "This fellow kept at me to fix up a small outfit to can the surplus fruit and vegetables on the farm. I did so, and off and on for the next 12 years I operated a cannery in a small building back of the house."

In 1933 Mr. Rinehold began commercial canning. About 25 years before there had been a canning factory at Granger which failed. The equipment lay idly rusting away until Mr. Rinehold salvaged and moved some of it to his farm. In addition to farming, Mr. Rinehold engaged in a number of enterprises—road building, concrete-pipe manufacture, building construction, and operating a sand and gravel plant. It will be appreciated that he is an unusually versatile mechanic as well as a prodigious worker. Except for some of the equipment salvaged from the Granger plant and a leased sealer or lidding machine, he has designed and built all of the plant he is now operating.

Mr. Rinehold processes 18 separate items of fruit and vegetables. The most important ones have been green asparagus and tomatoes. However, corn, apricots, pears, peaches, apples, as well as grape and tomato juice, should be mentioned. In 1933 his output was 10,000 cans; in 1934, 160,000; and in 1935, 200,000. Until 1935, his output was marketed in the Yakima Valley through



Packing tomatoes at Rinehold cannery, Granger, Washington

Mornin' on the Desert

(Found written on the door of an old cabin in southern Nevada)

MORNIN' on the desert, and the wind is blowin' free,
And it's ours, jest for the breathin', so let's fill up, you and me.
No more stuffy cities, where you have to pay to breathe,
Where the helpless human creatures move and throng and strive and see the.

Mornin' on the desert, and the air is like a wine,
And it seems like all creation has been made for me and mine.
No house to stop my vision, save a neighbor's miles away.
And the little dobe shanty that belongs to me and May.

Lonesome? Not a minute! Why I've got these mountains here,
That was put here just to please me, with their blush and frown and cheer.
They're waitin' when the summer sun gets too sizzlin' hot,
An' we just go campin' in 'em with a pan and coffee pot.

Mornin' on the desert—I can smell the sagebrush smoke;
I hate to see it burnin', but the land must sure be broke.
Ain't it just a pity that wherever man may live,
He tears up much that's beautiful that the good God has to give?

"Sagebrush ain't so pretty?" Well, all eyes don't see the same.
Have you ever saw the moonlight turn it to a silvery flame?
An' that greasewood thicket yonder—well, it smells jes' awful sweet
When the night wind has been shakin' it—for its smell is hard to beat.

Lonesome? Well, I guess not! I've been lonesome in a town,
But I sure do love the desert with its stretches wide and brown.
All day through the sagebrush here the wind is blowin' free,
An' it's ours jes' for the breathin', so let's fill up, you and me.

various jobbers. That year's run was sold in Seattle and Spokane, and to

Canada will go the applesauce he was canning as the year closed. Except for the 4 months, January to April, Mr. Rinehold operated throughout the year 1935 but states year-around operation is practicable. He employed, while operating, a crew of 7 to 25 men and women.

Mr. Rinehold places his investment for plant at approximately \$10,000. However, he has designed and built so much of it himself it is apparent that it could not be duplicated for that amount elsewhere.

It has been necessary for Mr. Rinehold to purchase where and when available his fruits and vegetables. This has seriously handicapped his operations this year. He plans another year to contract in advance with the growers. Thus he will be surer of the varieties and quantities he requires, as well as a more orderly operation of his plant.

What Mr. Rinehold has accomplished, under none too favorable odds, is the result of practical planning, ingenious contriving, and, of course, hard work, none of which is accidental. With adequate financing, Mr. Rinehold is confident he could duplicate the success of his farm canning operations on a much larger scale in one of the lower valley towns.

Emergency Conservation Work Activities

By Alfred R. Golzé, Assistant to Supervising Engineer, E. C. W.

APPROXIMATELY one-third of the personnel actively engaged in the construction and rehabilitation of reclamation projects is composed of Civilian Conservation Corps enrollees and their supervisors employed on Emergency Conservation Work. In 14 States on 23 separate reclamation projects, this past winter has seen 34 Emergency Conservation Work camps engaged in a variety of important and urgent activities.

WORK ACTIVITIES

The work programs of the Bureau of Reclamation Emergency Conservation Work camps are of a general protective nature, whose ultimate object is conservation of the West's great natural resource—water.

General rehabilitation of the projects constitutes the major portion of the Reclamation Emergency Conservation Work. Included in this category are the restoration of canals, laterals, and drains to their original grades and cross-section, the

reconstruction of deteriorated checks, drops, turn-outs, small bridges, and other incidental waterway structures, the concrete lining and riprapping of canals and laterals where necessary to prevent excessive loss of water and channel erosion, the leveling of canal and lateral banks to provide operating roads for ditch-riders, and the repair of existing storage facilities including dams and appurtenant structures.

New construction of small storage dams, canals, and laterals has also been undertaken at locations where the need for such construction is unusually desirable and suitable as an Emergency Conservation Work activity. Rodent-control campaigns are being successfully engaged in by a number of the reclamation Emergency Conservation Work camps. Special emphasis is being given to the control of the destructive pocket gophers.

On projects where soil erosion has become a serious menace, control measures are being taken through the Emergency Conservation Work camps by the con-

struction of check dams and improvements to flood wasteways, including riprapping and straightening of river channels.

In addition to the work activities of a purely reclamation nature, recreational facilities are being provided at Elephant Butte Reservoir and the Leasburg Dam, N. Mex.; Guernsey Lake, Wyo., and at Lake Minatare, Nebr. Tourist accommodations are being provided at Grand Coulee Dam by the Civilian Conservation Corps enrollees. The programs at the Elephant Butte and Guernsey Lake Reservoir areas are being supervised by the National Park Service to provide for uniformity of appearance and standards of construction in keeping with the national parks.

EDUCATIONAL ACTIVITIES

The construction activities of the reclamation camps, in addition to their value to the Government and the water users, are proving to have a practical educational merit in teaching the men in the camps the desirability of acquiring a vocation that will enable them to earn their own way. Enrollees who entered the Civilian Conservation Corps untrained for any work are being acquainted with the possibilities and opportunities offered by the construction industry, as tractor and dragline operators, carpenters, mechanics, blacksmiths, concrete finishers, steel men, and allied construction tradesmen through the medium of "on-the-job" instruction by the foremen in the field.

To supplement the field instruction, classes are given in the camps by appointed educational advisors. A wide variety of subjects is taught in the camp classroom. The courses offered at Camp BR-14, Tempe, Ariz., are illustrative: Algebra, arithmetic, blue-print reading and lettering, cartooning, first-aid, English, group singing, journalism, letter writing, leathercraft, photography, physical culture, radio, reading, Spanish, spelling, typing, and writing.

In some localities Civilian Conservation Corps enrollees have been given the opportunity to attend night-school classes, notably at the Tule Lake, Calif., camp from which approximately 40 enrollees have been attending night classes at the Tule Lake High School.

RECREATIONAL ACTIVITIES

Recreational activities have their part in the life of a Civilian Conservation Corps enrollee. Trips are frequently



Upper: Franklin Canal, Ysleta, Texas, before concrete lining by CCC enrollees, Rio Grande project, New Mexico-Texas.

Lower: Same canal after concrete lining and general cleanup by CCC enrollees

made to nearby points of interest to acquaint the enrollees with the reclamation projects and their surrounding attractions.

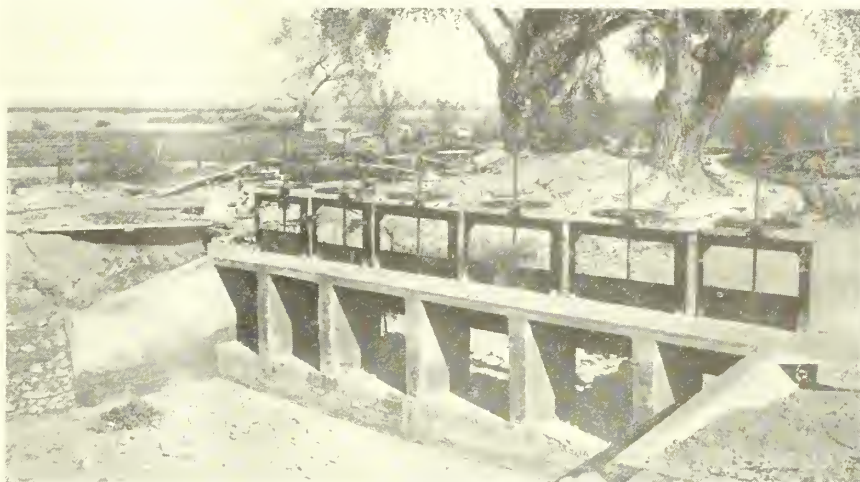
The Civilian Conservation Corps men working on the Parker Dam Reservoir clearing have been given an opportunity to visit the damsite and witness the construction work in progress. The enrollees at Grand Coulee Dam are part of one of the largest construction undertakings now in progress in this country. The Civilian Conservation Corps enrollees at Montrose, Colo., have been through the Gunnison Tunnel and visited the Black Canyon of the Gunnison. The camp at Merrill, Oreg., has made an excursion to the Lava Beds National Monument in nearby northern California and from the Yuma, Ariz. camp, expeditions have been made to the Laguna Dam, All-American Canal, and the Petrified Forest.

Radio broadcasting has afforded an opportunity for the Civilian Conservation Corps enrollees to demonstrate to the general public their ability as entertainers. The Emergency Conservation Work camp at Lake Lowell, Idaho, was invited to broadcast over their local station and the Vale, Oreg., camp has a regular half hour every 2 weeks on Monday night over radio station KFXD at Caldwell, Idaho. Solos, quartets, and dialogs are also regularly presented every Sunday over station KOH at Reno, Nev., by the reclamation camp at Reno, and musical talent from the camp at Palisade, Colo., was selected by competition for broadcasting over station KFXJ at Grand Junction, Colo. Enrollees from the Emergency Conservation Work camp at Merrill, Oreg., broadcast over the radio station in Klamath Falls, Oreg.

Other recreational activities for the Civilian Conservation Corps enrollees are provided by educational motion pictures usually given once a week. Sports of all kinds are participated in, and, in season, leagues are formed by the camps for football, basketball, and baseball. The reclamation camps have developed a number of basketball teams of championship caliber.

LOCAL INTEREST

The people living on the projects that are the beneficiaries of Emergency Conservation Work are evidencing an interest in the welfare of the enrollees and the work program accomplishments of the camps. The camp at Montrose, Colo., has had as dinner guests both the Uncompahgre Valley Water Users' Association and the Montrose Rotary Club. An open-house day held by the Reno, Nev., camp attracted 300 visitors, and at a corresponding event 500 project residents inspected the camp at Ontario, Oreg.



Typical concrete canal check constructed by CCC enrollees. Gates furnished by project. Salt River project, Arizona

The Newell, S. Dak., camp has been entertained by a play presented by the students of the Nisland High School, and the Grand Junction, Colo., camp has been similarly complimented by the Grand Junction High School Dramatic Club and orchestra.

WASHINGTON AND DENVER OFFICE ACTIVITIES

Under the direction of D. S. Stuver, supervising engineer, Emergency Conservation Work, the Washington office, organization has completed studies that indicate approximately 100 camps of the Emergency Conservation Work type could be usefully employed on excellent work programs on the reclamation projects throughout the West. Seventh enrollment period work programs were received from the field and after approval by the chief engineer were reviewed and approved in Washington.

Studies made of the Civilian Conservation Corps lost-time accident rate indicate that the Bureau of Reclamation camps have made a very good showing in this regard. In January the number of lost-time accidents per 1,000 enrollees employed on field work programs was 5.2 for the Bureau of Reclamation as compared with an average of 12.0 for the 11 agencies engaged in Emergency Conservation Work.

A study of the value of the work completed by the reclamation camps between April 1 and December 31, 1935, developed a worth of approximately \$2,000,000 for the 9-month period. Of this total, \$1,200,000 was accomplished in the last 3 months of the period when the greatest number of Emergency Conservation Work camps were in operation. This estimate, based on the cost of doing similar work by contract, is believed to be conservative, as intangible items, such as the increased value of land saved from

erosion or the quantity of water conserved by concrete lining, are not reflected in the developed valuation.

In the Denver office, in addition to the routine work of supervising the purchasing of materials and equipment for the reclamation camps, the seventh enrollment period work programs were reviewed and forwarded to the Washington office. L. S. Davis, engineer, Emergency Conservation Work, of the Denver office, has completed his third trip of inspection of the reclamation camps. Mr. Davis' last visit was to the northern camps, made at the peak of the extreme cold wave last February and enabled him to judge the effectiveness of Emergency Conservation Work under the adverse conditions encountered at that season of the year.

AIRPLANE travel was popular on the Belle Fourche project during the period of blocked roads, and the Newell Airport became the take-off point for interior towns to the north and east. Supplies, mail, and medicine, as well as doctors and patients, traveled by this means.

DURING the month of February the Resettlement Administration established construction headquarters in Malta, Mont. (Milk River project), preparatory to starting work on the "South Wagner" resettlement project as soon as weather conditions permit.

Investigations

(Continued from 94)

Bear River-Green River, Utah-Idaho-Wyo.—During January and February 1936 a cooperative contract by the Bureau and the States of Idaho, Utah, and Wyoming was under consideration for making these investigations.

Reclamation Organization Activities and Project Visitors

Following the death of Commissioner Elwood Mead on January 26, R. F. Walter, chief engineer, served as Acting Commissioner under authority of the Secretary of the Interior, and upon Mr. Walter's return to Denver on March 1, John C. Page, Chief of the Engineering Division, was designated by the Secretary as Acting Commissioner pending the appointment of a successor to the Commissioner.

A special committee appointed by the Secretary of the Interior and consisting of W. H. Code, consulting engineer of Los Angeles; Prof. William Peterson, of Utah Agricultural College; and Dr. Wilbur Powers, of the Oregon State College, met February 10-15 at Yuma, Ariz., to report on the feasibility of the Gila Valley project. Porter J. Preston, in charge of the Colorado River Basin, section 15, investigations, met with the board.

E. B. Debler, hydraulic engineer, visited Salt Lake City on February 25-26, at which time the status of the Deer Creek division and the work now being done were discussed, and a brief report was prepared by Mr. Debler in cooperation with the Provo project office regarding the feasibility of a smaller Deer Creek project.

Albert N. Burch 1863-1936

A. N. Burch, former project manager of the Orland project, California, died at his home in Sacramento on February 21, 1936, at the age of 72½ years. Mr. Burch entered the employ of the Reclamation Bureau in 1908 as superintendent of irrigation on the Umatilla project, Oregon. The following year he was transferred to the Orland project, California, in charge of the design and construction of the distribution system. In 1910 he was appointed project manager, serving in that capacity on the Orland project until his resignation in 1921. Subsequently he was reemployed by the Bureau to conduct some special investigations on the Truckee River in Nevada. At the conclusion of this special assignment he was employed in the office of the State engineer of California at Sacramento, in connection with the work of that office relating to irrigation districts.

Mr. Burch is survived by his widow and one daughter.

Frank Crowe, superintendent for the Six Companies during the construction of Boulder Dam, has been engaged by the Frank Shea Co., subcontractors of the Six Companies, in the construction of Parker Dam.

C. A. Lyman, field representative, arrived at the office of the Yakima project on February 25 to assist in reorganizing the project office clerical staff occasioned by the beginning of construction of the Roza division and by the death of R. K. Cunningham, chief clerk, on February 17.

Yakima Conferences

Pursuant to a suggestion made on January 14 by Dr. Elwood Mead, late Commissioner of Reclamation, to the Commissioner of Indian Affairs, a series of conferences were held in the office of the superintendent of the Yakima project, between representatives of this Bureau and the Indian Service, beginning on February 14 and terminating on the 18th. The purpose of the conference was to make a joint study and review of the Yakima project water supply with a view to determining the availability of additional water for the Wapato division of the Yakima Indian Reservation. Those present at the conference were as follows:

Representing the Bureau of Reclamation: E. B. Debler, hydraulic engineer, Denver; D. G. Tyree, associate district counsel; J. S. Moore, superintendent; Paul Taylor, assistant engineer.

Representing the Indian Service: H. V. Clotts, assistant director of irrigation; W. S. Hanna, supervising engineer; Geraint Humpherys, chief field counsel; N. W. Irsfeld, project engineer, Wapato project.

Attending the conference part of the time were H. F. Luhman, attorney for the Reservation Water Users Association, and C. R. Whitlock, superintendent of the Yakima Indian Reservation.

The main result of the conference was a recommendation to sell the Indian Service an additional 100,000 acre-feet of storage water, which it was determined was all the surplus storage water available at the present time. Draft of agreement was prepared for this purpose. A modification of the memorandum agreement of 1921 was also agreed upon, involving a change in the present schedule of monthly percentages.

Arthur P. Smyth, who was transferred from the Denver office, assumed the duties of resident engineer on Bull Lake Dam, Riverton project, on February 16.

R. S. Lieurance, engineer in the Denver office, who has been engaged in consulting work on the Passamaquoddy power project at Eastport, Maine, stopped in Washington on March 22 on his return to Denver.

Thomas H. Wigglesworth, assistant engineer in the Denver office, has been transferred to Washington and assigned to the Engineering Division.

Grand Coulee Schools

(Continued from p. 85.)

teachers, is also operating on a two-shift basis. This school will also benefit by a recent W. P. A. grant and, with the two additional rooms that these funds will provide, a normal school period will be inaugurated at the beginning of the fall term.

ELMERTON

On the east side of the Columbia River, about 3 miles downstream from Mason City is the small settlement of Elmerston, with a population of about 300. Although the community is little more than a year old, a two-room school for the elementary grades has been built by private subscription within the community, and is practically paid for. School furniture was provided by the Nespelem district, in which the school is located, and the district also maintains two teachers for the 40 pupils now in attendance. Children above the fourth grade are being transported by bus to the Nespelem school, about 12 miles distant.

SCHOOLS SOON ADEQUATE

In spite of the phenomenal demands made upon them, adequate school facilities will probably be available for all children in the Grand Coulee area by the time the fall term opens. It is evident from the above that the typically American pioneering spirit which brought these surrounding communities into existence, is accompanied by the determination of Americans to provide the best possible educational advantages for their children.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation John C. Page, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Asst. to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; B. W. Steele, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Deblor, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.		B. E. Stoutemyer	Portland, Oreg.
Boulder Dam	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird ¹	R. J. Coffey	Los Angeles, Calif.
Burnt River	Vale, Oreg.	Clyde H. Spencer	do		B. E. Stoutemyer	Portland, Oreg.
All-American Canal	Yuma, Ariz.	R. B. Williams	do	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Casper-Alcova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Vosen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do	William F. Sha.	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	E. A. Peek	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do	Do.
Hyrum	Hyrum, Utah	D. J. Paul	Resident engr.	H. W. Johnson	do	Do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do	do	do	do	do	Do.
Minidoka	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carnoly	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Rio Grande	El Paso, Tex.	L. R. Fiock	Superintendent	H. B. Berryhill	H. J. S. DeVries	El Paso, Tex.
Riverton	Riverton, Wyo.	H. D. Cmonstock	do	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Engineer	Geo. H. Bolt	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle ¹	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do	do	Do.
Stanfield	Ontario, Oreg.	R. J. Newell	do	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Lovelock, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Engineer	do	do	Do.
Upper Snake River Storage	Ashton, Idaho	H. A. Parker	Constr. engr.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do	Do.
Yakima	Yakima, Wash.	J. S. Moore	do		do	Do.
Roza div.	do	Chas. E. Crownover	Constr. engr.		do	Do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non-Federal.

³ Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Engineer-manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagau	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Pallade, Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do	Chas. A. Revell	Bonanza.
Klamath, Horsely	Horsely irrigation district	do	Jerome Smith	do	Dorothy Evers	Do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Project manager	O. B. Patterson	Sidney.
Milk River: Chinook div	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do	Fort 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.
do	Paradise Valley irrigation district	Zurich, Mont.	Amos Thompson	do	J. F. Sharpless	Zurich.
do	Zurich irrigation district	Harlem, Mont.	C. A. Watkins	do	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	Manager	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Geo. W. Lyle	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Alcorn	President		Fallon.
North Platte: Interstate div	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	Flora K. Schroeder	Mitchell.
do	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Nelle Armitage	Torrington.
Northport div	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn	Ogden, Utah	D. D. Harris	do	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div	Shoshone irrigation district	Powell, Wyo.	J. O. Roach	do	Geo. W. Atkins	Powell.
do	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn	Payson, Utah	Clyde Tertvort	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. F. Wanger	Fairfield.
Umatilla: East div	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West div	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	V. W. Russell	Manager	R. E. Rudolph	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15.	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	do.
Grand Lake-Big Thompson Transmountain Diversion	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Weiser-Payette	Boise, Idaho	J. A. Keimig	do.

SALLIE A. B. COE, Editor.



ABOVE: WINTER AT GRAND COULEE DAM. ICE COVERED THE COLUMBIA RIVER FROM SHORE TO SHORE
AS ZERO WEATHER BROUGHT WORK TO A VIRTUAL STANDSTILL IN LATE FEBRUARY
BELOW: AGENCY VALLEY DAM, VALE PROJECT, OREGON, COMPLETED DECEMBER 13, 1935

THE RECLAMATION ERA

VOL. 26, NO. 5



MAY 1936



ALL-AMERICAN CANAL. DRAGLINE SILHOUETTED AGAINST THE SUNRISE

The Water Users Relief Act of 1936

By the Act of April 14, 1936, Congress granted a moratorium on 50 percent of the construction charges due for the calendar year 1936, and appropriated \$5,000 to create a commission of three members to investigate the financial and economic condition of the various United States reclamation projects. The object of the investigation will be to determine the ability of each project to make payments of water-right charges without undue burden, and to report to Congress at the beginning of the 75th Congress its recommendations. The text of the act is as follows:

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby created a commission to be composed of three members, all of whom shall be appointed by the Secretary of the Interior, two from the personnel of the Department of the Interior and one who shall be a landowner and water user under a United States reclamation project. The commission is authorized and directed to investigate the financial and economic condition of the various United States reclamation projects, with particular reference to the ability of each such project to make payments of water-right charges without undue burden on the water users, district, association, or other reclamation organization liable for such charges. Such investigation shall include an examination and consideration of any statement filed with the commission or the Department of the Interior by any such district, association, or other reclamation organization, or the water users thereof, and, where requested by any such district, association, or other reclamation organization, said commission shall proceed to such project and hold hearings, the proceedings of which shall be reduced to writing and filed with its report. Said commission, after having made careful investigation and study of the financial and economic condition of the various United States reclamation projects and their probable present and

future ability to meet such water-right charges, shall report to the Congress, at the beginning of the Seventy-fifth Congress with its recommendations as to the best, most feasible, and practicable comprehensive permanent plan for such water-right payments, with due consideration for the development and carrying on of the reclamation program of the United States, and having particularly in mind the probable ability of such water users, districts, associations, and other reclamation organizations to meet such water-right charges regularly and faithfully from year to year, during periods of prosperity and good prices for agricultural products as well as during periods of decline in agricultural income and unsatisfactory conditions of agriculture.

Sec. 2. There is hereby authorized to be appropriated, out of any money in the Treasury not otherwise appropriated, the sum of \$5,000, which shall be available for expenditure, as the Secretary of the Interior may direct, for expenses and all necessary disbursements, including salaries, in carrying out the provisions of this act. The commission is authorized to appoint and fix the compensation of such employees as may be necessary for carrying out its functions under this act without regard to civil-service laws or the Classification Act of 1923, as amended.

Sec. 3. That all the provisions of the act entitled "An Act to further extend relief to water users on the United States reclamation projects and on Indian irrigation projects", approved June 13, 1935, are hereby further extended for the period of 1 year, so far as concerns 50 percent of the construction charges, for the calendar year 1936: *Provided however,* That where the construction charge for the calendar year 1936 is payable in two installments, the sum hereby extended shall be the amount due as the first of such installments. If payable in one installment, the due date for the 50 percent to be paid shall not be changed.

THE RECLAMATION ERA

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HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 5



MAY 1936

New Building and Department Dedicated to Conservation

LAYING the cornerstone, President Franklin D. Roosevelt dedicated the new Interior Department building April 16 to a national policy of conservation of natural resources.

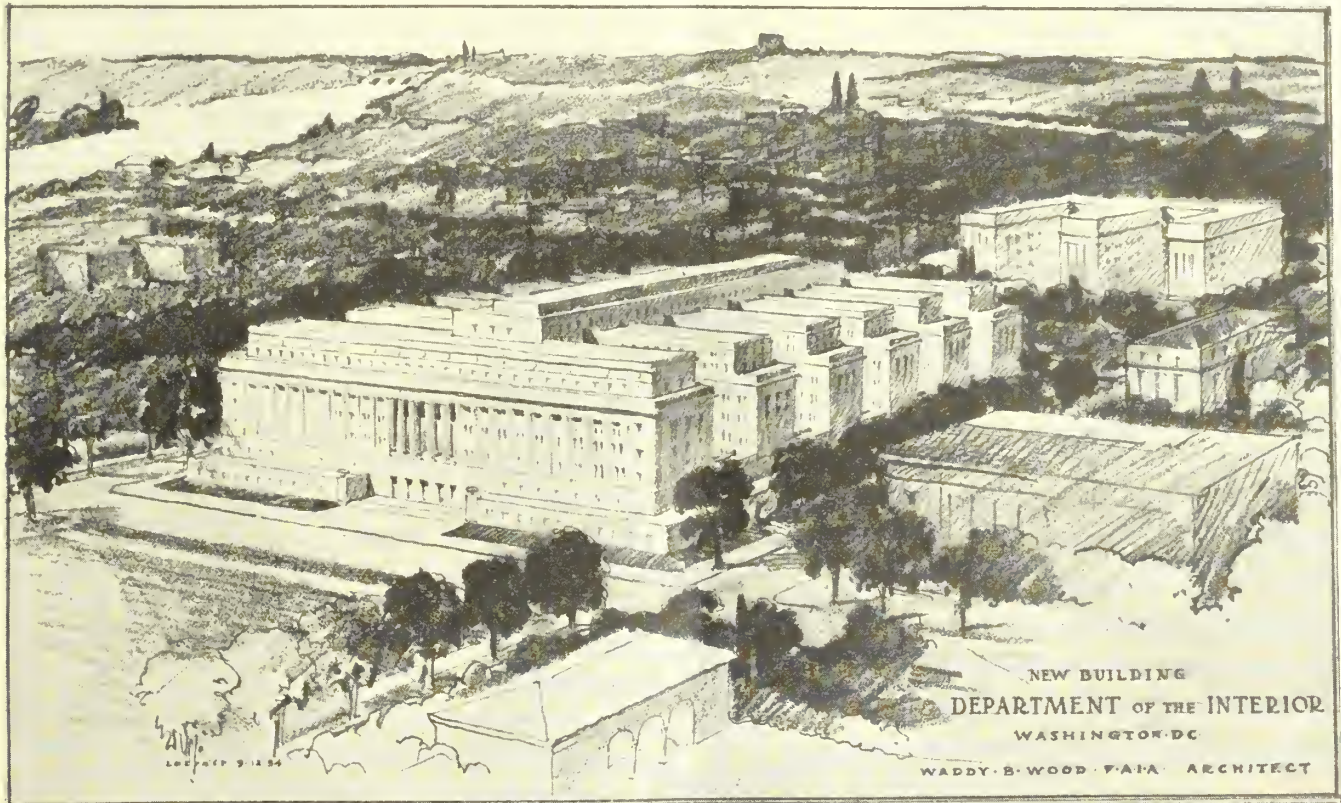
A colorful crowd of 5,000, including Cabinet members, diplomats, Members of Congress, and a large number of departmental employees attended. Those in attendance had heard Harold L. Ickes, Secretary of Interior, deliver a brilliant

The new building will be completed and occupied probably late this year. It is the first to have been constructed by the present administration in Washington.

Occupying a ground area of 5½ acres, extending from Eighteenth to Nineteenth and E to C Streets NW., the new building will dominate the "Northwest Rectangle", the group of buildings and formal parks long planned by the National Capital Park and Planning Commission, and

of the National Capital Park and Planning Commission, presided and made the introductory remarks. The Reverend Joseph R. Sizoo, D. D., pastor of the New York Avenue Presbyterian Church, offered the invocation and the Right Reverend P. J. McCormick, acting rector of Catholic University of America, the benediction. The United States Marine Corps Band played.

The President said:



address in support of intensifying activities on behalf of preservation of the natural wealth of the Nation before they watched the President fix the cornerstone with a trowel which first was used by George Washington in laying the cornerstone of the Capitol in 1793.

which eventually will include new quarters for the War and Navy Departments. The corridor space will be 2 miles long. Accommodations for approximately 5,000 persons will be provided.

At the ceremony of the cornerstone laying Frederic A. Delano, as chairman

"Every American who loves his country should take to heart the earnest plea of the Secretary of the Interior for a vigorous, continuing national policy of conservation. As for myself, I am dedicated in this cause. And the Department of the Interior, as now constituted, is

fully alive to the imperative necessity of protecting and preserving our natural resources.

"A nation less bountifully endowed than ours without a national policy of conservation would have ceased to exist long ago. The remarkable thing was that the people of the United States were so complacent for so long in the face of exploitation, waste, and mismanagement, yes, even larceny, of the natural wealth that belonged to all the people.

"Not all of the people remained insensible to what was happening. On occasion there came as cries from the wilderness warnings against the ravaging of our forests, the waste of our topsoil and water supplies, and the dissipation of our oil reserves and mineral deposits. Theodore Roosevelt, for one, rose up and battled against this squandering of our patrimony. He, for the first time, made the people conscious that the vast national domain and the natural resources of the country were the property of the Nation itself and not that of any class, regardless of its privileged status.

"Supported by an awakened country which by now is beginning to realize the truth of the old warnings we of this administration have devoted our thoughts and energies to the conservation of our God-given wealth. Employing every agency of Government at hand to protect our birthright, we have in the past several years made advances far beyond the hopes of earlier day conservationists. But the battle goes on and must be carried forward with renewed vigor if future generations are to receive the full benefits that are their due.

"The Department of the Interior, first known as the Home Department, was established four score and seven years ago, and since that time its activities have been intertwined with the internal development of the Nation itself. The report of the committee of the House of Representatives which favored creation of the Department gives us an interesting picture of the times. This report said:

"The general fact remains unaffected that war and preparations for war have been practically regarded as the chief duty and end of this Government, while the arts of peace and production, whereby nations are subsisted, civilization advanced and happiness secured, have been esteemed unworthy the attention, or foreign to the objects of this Government. It seems to us that this should not always continue, but that we should, as a wise people, reorganize the Government so far as to fulfill these duties also, which are suggested by the nature, aspirations, and wants of our race as physical, moral, and intellectual beings;

that it should do something toward protecting the people against those internal enemies—ignorance, destitution, and vice, as well as against those foreign foes who may invade or who it is apprehended may assail us."

"And so, the Department of the Interior came into being with a Secretary in the President's cabinet with jurisdiction over the Commissioner of the General Land Office, the Commissioner of Patents, the Commissioner of Indian Affairs, and the Commissioner of Pensions.

"Only one clerk was provided for, a chief clerk at \$2,000.

"Mr. Secretary, we have grown up since 1849.

INTERIOR DEPARTMENT EXPANDS

"As the country expanded and the needs of the people grew, the activities of the Interior Department broadened to new fields of endeavor.

"In the design for this new Interior Building, the cornerstone of which we are laying today, architects have been guided by sound principles of utility and economy. Without sacrificing any of the dignity deserving of a great department of the Federal Government, they have conceived a useful building of austere simplicity. They have been sparing in the application of rich ornament, but convenience, comfort, and sunlight have not been sacrificed.

"We have acted wisely, I believe, in erecting this new building at this time. We have incorporated it in our Public Works program, which was established as a means of providing sorely needed employment in the building trades and the industries supplying them and which has already been successful in aiding the return of the Nation to better times. This building rising above us is but a unit of our great Public Works program which is erecting thousands of schoolhouses, hospitals, and other public buildings throughout the land.

"Other factors in addition to the problem of relieving unemployment influenced our decision to erect this building without further delay. The great Federal family in Washington, like other large families, has its own serious housing problem. We have grown over a long period of years until governmental buildings have been taxed to capacity and every available square foot of space put to necessary use.

"Government departments have been forced to seek space in buildings other than those owned by the Federal Government. We are now leasing several million square feet of office space in over 100 privately owned office buildings and

have been obliged in a few cases to find quarters in residences and apartment buildings. We are eager to complete this building in order to reduce the rent bill. When this building is in use many Government workers will be gathered back under a roof owned by the Government.

"As I view this serviceable new structure I like to think of it as symbolical of the Nation's vast resources that we are sworn to protect, and this stone that I am about to lay as the cornerstone of a conservation policy that will guarantee to future Americans the richness of their heritage."

INTERIOR SECRETARY SPEAKS

Secretary Ickes' address, one of the most important on the subject of conservation in recent years, follows in full:

"The Treasury Department in 1849 came to feel that, with its other heavy duties, it could no longer administer the vast public domain that still constituted, so far as national revenues and acreage went, the richest part of the United States. So the Department of the Interior came into being. The chief function of this newest of the departments was to administer the public domain, and implicit in the mandate to do this was the obligation to see to it that new lands should be taken up by settlers as soon as possible and the resources of the public domain minted into the coin of the realm at a rapid rate.

"Frankly, the Department of the Interior was set up, to use language with which today we are so familiar, to be the 'exploiting' department of the Government. If anyone sounded a note of caution as to the rate at which exploitation was to take place; if anyone expressed a belief in the principle of conservation of our natural resources, his voice was not heard above the general refrain. We were still a race of eager, restless, pushing pioneers. A land-hungry people to begin with, our appetite for land grew on what it fed upon. Only in the rarest instances did it ever occur to anyone to attempt to abate this consuming hunger. Nor was this surprising. So far as our ancestors could see, there never could be any question that there would be enough land to go around; the only problem was what we could do with all that we had.

"EARLY SETTLEMENT OF THE WEST

"We saw in the vast domain that stretched ever westward, not only limitless wealth for America but the means of adding to our human resources so as to make the United States at the same

time the richest and the most powerful nation in the world. We encouraged the settlement of these lands by soldiers who had fought in our wars, by immigrants from foreign lands, and by farmers from further east who were looking for new lands in place of those the fertility of which had become exhausted as a result of their careless husbandry. It might be said that the Department of the Interior was the sales agency of a Government so rich in lands and natural resources that it was willing to sell them for only a fraction of their real value, willing to give them away on the slightest pretext, willing even to close its eyes in order that it might not see that some of the most rugged of our rugged individual lists were literally stealing large sections of the rich heritage of the American people.

"The confession that I am making is not a pleasant one for one who holds the views that I do on the subject of conservation, and yet it seems fitting that a frank statement should be made in order that we may understand the record and thereby chart the course for a more statesmanlike policy for the future. When the conscience of the country began to appraise, through slowly opening eyes, the wanton destruction, the insistent exploitation of the natural riches with which God had endowed this country, we began to look about, in true American fashion, for a victim who could be held up to contempt and scorn for that exploitation. The Department of the Interior supplied the need and citizens came to criticize its policies without comprehending the reason for or the origin of those policies. Even today self-righteous critics, some of them with an ulterior purpose, insist that the Department of the Interior cannot be entrusted with any of the natural resources of America because of the national policy in the past and particularly because of the misdeeds of one or two men.

"PRESIDENT JOHN QUINCY ADAMS EVOLVED
WISE LAND POLICY

"After all, it was the Congress that guided the policy of this Department and enacted the laws to which it must conform. It was the Congress that decreed how and when and in what manner the public domain should be exploited. Nor should all the blame rest upon Congress for it was but carrying out the will of the sovereign people. So far as I know, that great President, John Quincy Adams, whose luster as a statesman will grow in brightness as people come to study his career and thus to form a more just appraisal of his unusual qualities, was the only national leader until com-

paratively recent times who, as the result of quiet, detached, far-visioned thinking, evolved a policy which, if it had been adopted by the Nation, would probably have meant less flush wealth for present easy dissipation, but more solid, more enduring, and, in the aggregate, greater wealth for the people as a whole in the long run.

"URGES NAME CHANGED TO DEPARTMENT
OF CONSERVATION

"Accepting the fact, as the record clearly establishes, that the Department of the Interior was created in the beginning to exploit the resources of America, what is the most effective step that can be taken to put an end to a policy that has become suicidal? The answer is plain. Let the Congress decree a final end to the era of reckless exploitation and announce adherence to the policy of conservation of our natural resources which, as I understand conservation, means the prudent use of those resources. And as an effective means of declaring this change of policy so that all may clearly understand it, let the Congress enact the bill that is now pending, changing the name of this Department to that of Department of Conservation.

"The mere passage of this bill would be declaratory of the intention of the United States Government henceforth to go forward with a policy of conservation of our natural resources. It stands to reason that until we consciously and deliberately, with our eyes on the future,

make some such affirmative declaration, the stupid waste of those resources will continue.

"From the point of view of the future, I can see nothing more worth while that America could do at this time than to charge a great department of the Government with responsibility for such development and use of our natural resources as is consistent with their preservation for the benefit and continued use of future generations. Not only should there be such a declaration of purpose, there should also be an orderly and logical arrangement of conservation activities. There is grave doubt in my mind that conservation will ever become the major policy of Government that it should be until some such action is taken.

"If I were one of those interested in the continued exploitation of our comparatively few remaining riches of mine and forest and stream and public domain, I would resist with all my might any mandate by Congress that conservation should be made a principal function of Government under the charge of a responsible Cabinet officer. I would be satisfied with the irresponsible policy of division and spoliation that has prevailed in the past. I would want activities relating to conservation to remain scattered. I would encourage the misunderstandings, the jealousies, the overlappings and the wasteful expenditures of public funds that have grown up in the past and which were the inheritance of this administration. We conserva-



BOULDER DAM

A waterfall 13 feet higher than Niagara is formed by the Arizona canyon wall outlet with its six 84-inch needle valves open to capacity. Water shoots 175 feet a second and plunges 180 feet to the river. It will be noticed that the water issues not at right angles to the canyon, but slightly downstream. After long experimentation the engineers determined that if these streams issued downstream at an angle of 15 degrees, a turbulence in the tailrace at the power house would be held at a minimum as would the rising vapor.

tionists are like a posse comitatus, following each other with fitful lanterns while the thief that we were sent out to apprehend slips away to safety.

"We in the Department know that a definite stop to ill-advised exploitation has been too long deferred. The first faint flickering of a belief that perhaps after all we had not been altogether wise in putting all of our natural resources on the table and yelling in a voice that could be heard around the world, 'come and get it', began to manifest itself somewhat less than two generations ago. Theodore Roosevelt hinted that a new national policy might be necessary and while it was only a hint, it expressed a sentiment much more advanced than the current one of the period. As a matter of fact, opinion favoring the prudent management of our natural resources was almost nonexistent. There were still forests to be fed into the sawmills; there was still a public domain to be destroyed by overgrazing; there was still oil for flush production while billions of cubic feet of natural gas were allowed to be wasted into the air; there were still rivers and lesser streams to be polluted by the effluent from our sewers and by the refuse from our mills and factories; there were still apparently countless game birds and wildlife with which to fill the bags of the game hogs; there was still arable land to be homesteaded, to have its soil fertility exhausted and then to be deserted.

"Notwithstanding the widespread hunger for more land and selfish greediness for more wealth at whatever cost to the Nation, there grew into a steady blaze the spark that was struck by the flint of far-seeing statesmanship in the hand of Theodore Roosevelt from the tinder of hard fact that the way we were headed led toward the eventual impoverishment of our people. More and more people began to recognize the wisdom and the foresight of the early conservationists who had firmly stood their ground, despite the ridicule and contumely that were heaped upon them. The new cause gained friends, not only among the rank and file of the people but among the statesmen of the Nation, until it came to pass that the principle of conservation began to find expression in the platforms of political parties. I am afraid, however, that in many instances this was merely lip service. There has been observed no concentrated effort, resulting from a burning zeal for conservation, to make it, as it should have been made long ago, a major policy of our Government. We have done quite a lot of wishful thinking about conservation, but so far active foes from without and muddle-headed friends

within the ranks have formed an unnatural but powerful opposition that has been of benefit only to the exploiter.

"PRESERVATION OF NATURAL WEALTH

"Yet it is heartening that the sentiment to prevent further waste is growing and there is reason to hope that before a great while the Congress will respond to that sentiment by setting up a Department of Conservation and thus reverse the policy of exploitation that has existed heretofore. More and more the real statesmen of the country have come to believe in the preservation of what is left of the natural wealth of America. Nothing could be more encouraging than to realize that the present Chief Executive of the Nation not only believes as ardently as any conservationist could possibly believe in this theory, he himself has actually practiced conservation. He has practiced it on his own extensive farm lands in New York State. As a member of the New York State Senate he was one of the leaders in the fight for conservation legislation. As Assistant Secretary of the Navy he helped to protect and preserve the naval oil reserves. He made it a major policy as Governor of the State of New York. During his administration of the affairs of that State he did more for conservation than had all of his predecessors combined.

"Naturally, when he came to Washington as President he brought with him his belief in the principle of conservation. As a result, more has been done during the slightly more than 3 years of the present administration in the direction of preserving and rebuilding the natural resources of America than has been done in any comparable time in our history. As a matter of fact, I am well within the bounds in saying that more has been done under this administration in this regard than during all preceding administrations.

"Vast additions have been made to the areas of the national forests. New reclamation districts have been organized and additional water provided for others already in existence. Under the Taylor grazing law signed by President Roosevelt 80,000,000 acres of the public domain that are useful chiefly for grazing have been set up into grazing districts under Federal regulation. This does not mean the taking out of use of these lands, which are indispensable to the stockmen of the West, but it does mean the prevention of overgrazing with its threatened destruction of the range. It means also that, wherever possible, not only will deterioration of the range be stopped, it will actually be rebuilt so that our grazing area may be preserved and enlarged.

"ACHIEVEMENTS OF PRESENT ADMINISTRATION

"Under this administration the Soil Conservation Service was set up in this Department but later was transferred to the Department of Agriculture. This Service, by actual demonstration, is making it clear to the farmers of America that their own economic welfare, as well as the happiness and well-being of their children, depend upon using their lands so that they will not be washed or blown away. Proof is being made that soil erosion, which has taken such a heavy toll of our fertile lands, can be prevented or counteracted. Large sums of money have been spent under this administration in flood-prevention work. Under the Petroleum Code of the National Industrial Recovery Act and under the Connally Act, at least a beginning has been made toward stopping the reckless overproduction and consequent waste of petroleum and its products which are exhaustible and irreplaceable resources upon which not only the prosperity but the very life of the Nation depends.

"As a byproduct of the work this administration has obligated itself to do for the control of floods and to aid navigation, great water power projects such as Boulder Dam and the Tennessee Valley undertaking have been completed or are being developed, the energy from which is available to the people at a cost within the means of all. Reforestation and afforestation have made tremendous strides. The Guffey Coal Act represents an effort to conserve our coal supply and protect our miners. Realizing the important place of wildlife, not only in our domestic economy, but as related to the health and general welfare of the people, wildlife and bird refuges have been set up under this administration to an extent never before known. A notable start has been made toward solving the almost overwhelming problem of stream pollution. Submarginal lands from which farmers have struggled in vain to make a decent living are being purchased by the Government and taken out of agricultural use. Additional areas have been added to old national parks and new national parks have been brought into the system.

"And to implement his conservation policies in an effective and hitherto unthought-of way, President Roosevelt conceived the brilliant idea of setting up C. C. C. camps so that hundreds of thousands of the youth of the land, who otherwise would not be employed, might have the chance of building up their own bodies while grafting new skin to cover the scars and the burns from which our

land has suffered at the hands of man and the forces of nature.

"PRESIDENT ROOSEVELT A REAL CONSERVATIONIST

"This bare recital of actual achievements is ample proof of the statement that this administration has done more to advance the cause of conservation than all preceding administrations put together. Where others have torn down, Franklin D. Roosevelt has built up; where others have closed their eyes to reckless and often-times illegal exploitation, he has been alert in the public interest; where others have done lip service to the principle of conserving our national wealth, while expressing regret that nothing could be done about it, President Roosevelt has not only found a way, he has insisted that it be taken. Having already fairly won the right to be ranked as the greatest conservationist in American history, President Roosevelt will continue to give ample proof, not only of his theoretical interest in this policy but of his practical ability to give effect to it.

"Years ago I joined the ranks of the conservationists. That was during the administration of President Theodore Roosevelt. When the present President of that name did me the honor to invite me to Washington as head of the Department of the Interior I came as a convinced and steadfast believer in the proposition that our natural resources should be carefully conserved and prudently used in the interest, not only of every American of this generation, but of every American of the generations to come. No opportunity to advance the cause of conservation has been overlooked by the Department of the Interior under this administration. While the laws of the land have been conscientiously adhered to, all questions of doubt have been resolved in favor of the public as against any selfish private interest.

"BUILDING FOR THE FUTURE

"It always has been, and it probably always will be true, that those who stand vigilant guard over our treasures of forest and land and stream in order to protect them from the predators will be openly condemned and cunningly attacked. Notwithstanding, we must bear in mind that the true function of Government is to see beyond the current month or the present year. Casting our eyes into the future, we must think of the coming generations, remembering that the imprecations that are hurled today at those who would protect our national wealth tomorrow will reecho as the plaudits of a grateful Nation.

"Mr. President, whether the Department that is to occupy this splendid new building, which in itself represents an outstanding accomplishment of your administration, is to be christened with the name that we would be so proud to bear, that of the Department of Conservation, or whether it is to continue to be known as the Department of the Interior, as the head of the Department I pledge to you our active support and unwavering loyalty in advancing the cause that is as dear to our hearts as it is to your own. Under your leadership and with your encouragement every member of the staff has come to realize that all problems brought to us for solution must be considered, so far as may be possible under the law, from the point of view of the interests of the people as a whole and all doubts resolved in that same interest.

"As is well known, most of the major activities of the Department of the Interior at this moment are touched with a conservation interest. This new building represents much more to us than merely better and more desirable office space; it means something besides relieving the overcrowded conditions in our present building; it is to us a symbol of a new day; a turning in the long road that we have traveled since the time when the Treasury Department, with its blessing, sent us forth to do a work that was already clattering up that Department in a manner that could no longer be tolerated. Let us hope that a great new adventure lies ahead of us at a significant time in the internal affairs of the United States; that a definite and final reversal of our course of heedless exploitation of our national assets is at hand, to be followed by the adoption of a policy of prudent use of those same assets, which is true conservation.

"To this new policy, in grateful recognition of its adoption, belated though it may be, let us then dedicate this new building. And, more important still, let those of us who, as members of the Department of the Interior, have the great privilege of serving the people, rededicate ourselves anew to that service. In doing so may we ever have in mind that our supreme duty is to do all that we possibly can to advance the welfare of mankind."

CONTENTS OF CORNERSTONE

In a specially constructed copper box, to be placed in the cornerstone of the new Interior Department Building, reposes a file of documents sufficiently varied to give archeologists of the future a comprehensive close-up of official duties and civic accomplishments carried on in the year 1936 by one of the largest departments of the Federal Government.

Approximately 3 feet long by 1¼ feet wide, and 7 inches deep, the box had as contents a Bible; a silk American flag; a pamphlet on the Constitution of the United States; a bronze medallion of President Franklin D. Roosevelt; an autographed photograph of Secretary Ickes; miniature drawings of the new building showing the architectural, structural, and mechanical details; service monographs of the Bureau of Mines, Office of Education, Reclamation Service, National Park Service, and Office of Indian Affairs; a historical outline of the public-land system; copy of the Congressional Directory for the second session, Seventy-fourth Congress; laws relating to the National Park Service; Glances of Our National Parks, a publication of current information; current newspapers; and coins. Also enclosed are copies of the act approved June 16, 1933, under which funds for the building were authorized; of the latest annual report and telephone directory of the Department of the Interior; of the 1892 hearings before a House Committee on Appropriations for the Department of the Interior and of the hearings on the Department of the Interior appropriation bill for 1937; of the publication, The Department of the Interior, Its History and Proper Functions; of the invitation to the cornerstone ceremony and program; and a photograph and short history of the present Interior Department Building.

Twelve departmental units will be housed in this structure, into which will move the Office of the Secretary of the Interior, the General Land Office, Office of Indian Affairs, Office of Education, Bureau of Reclamation, National Park Service, Division of Territories, Division of Grazing, Division of Geographic Names, Bureau of Mines, National Capital Park and Planning Commission, and the Commission of Fine Arts.

Colorado Holds Conference

The second Colorado State-wide coordination meeting of all Federal agencies was held in the Albany Hotel in Denver on April 13, at which time an address on the Operations of the Bureau of Reclamation in Colorado was made by R. F. Walter, chief engineer, and several exhibits, prepared by the Public Relations Division of the Bureau in Washington and showing the entire irrigation system in general and the Colorado projects in particular, were on display.

IN excess of 1,200 acres of Owyhee project lands were sold to new settlers during the month of March.

The Building of Boulder City

By E. H. Heinemann, Junior Engineer

WITH the termination on March 1, 1936, of the contract with Six Companies Inc., comes a sudden realization that Boulder City wasn't always here. We've become used to it as a town with all ordinary luxuries, losing sight of the fact that while Rome wasn't built in a day, Boulder City almost was—our green oasis occupying a spot where, 5 years ago, water flowed only during cloudbursts, and life held sway in the insensitive bodies of rattlesnake and scorpion. We're not sure but that in the initial heat and flurry of construction, the building of Boulder City was lost sight of as a thing in itself, and only with the passing of a focused interest in the construction at the dam-site do we begin to appreciate its sudden advent.

In a project of such magnitude, it was necessary for the contractor to give infinite care to his part in the construction and maintenance of a large construction camp. Here was the site of the greatest engineering project yet conceived and here were six of the outstanding contractors of the West bonded together to consummate the plans of the Bureau of Reclamation. Habitable abodes for at least 5,000 had to be made on the desert lest the sun's rays and blistering wind become a major frustration before anything could be accomplished. Consequently, on April 6, 1931, the Boulder City Co. was organized as a wholly owned subsidiary of Six Companies Inc., and incorporated under the laws of the State of Nevada for the purpose of boarding, lodging, and housing employees, and for the sale of merchandise, all incidental to the construction activities of Six Companies Inc. The company was made responsible for all of the camp activities of the contractor, the most important of which were the following:

1. Lodging single men in dormitories.
2. Housing married employees.
3. Boarding employees. This was taken care of under a separate contract with the Anderson Bros. Supply Co.
4. Selling merchandise.
5. Furnishing recreation.
6. Fire protection.
7. Transportation of employees to and from the damsite.
8. Laundry service.

CONSTRUCTION STARTED

Construction was started in April 1931 on lodging and housing facilities for the employees of the Six Companies Inc. Eight of the dormitories were each capable

of housing 172 men including the "bull cook" (janitor) and one dormitory for office employees accommodated 53. All of these buildings, including the bungalows discussed later, were of temporary construction, frame and plasterboard with outside walls of stucco and asbestos shingle roofs. The eight 172-man dormitories were two stories in height, built in the form of an H, giving the impression that there were two buildings if one did not see the connecting hallways. The sleeping quarters consisted of a separate room for each man, 7 feet 3 inches by 10 feet with 8 foot 5 inch ceilings, furnished with a substantial iron bed with springs and mattress, blankets, two sheets, pillow with pillowcase, and chair. There was one window for each room, but not necessarily for ventilation, as each room was furnished with hot and cool air by an inside air-conditioning system, as required to meet climatic conditions.

Each bunkhouse was equipped with General Electric water coolers, electric lights, toilets, and one shower for each 13 men. Janitor service was furnished by the Boulder City Co. The eight 172-man dormitories and the 53-man office dormitory were built at a total cost of \$233,328, which includes the cost of heating, air-conditioning, and water-cooling systems. Each man lodged in the dormitories was charged \$1.60 per day for his board and lodging, 10 cents of that amount being for his transportation to and from the work, the rest being for individual room, janitor service, and board at the mess hall. The dormitories were equipped at a total cost of \$46,367. At the "Cape Horn" camp at the river, six dormitories and a mess hall were built and equipped at a cost of \$18,676. The six dormitories lodged 400 men and the mess hall seated 100.

EMPLOYEES' HOMES

Six Companies Inc. constructed 250 one-room, 260 two-room, 134 three-room cottages, and 14 cottages ranging from three to five rooms each. In addition to these, an executive lodge and a residence for the superintendent of construction, both permanent, were constructed on "Water Tank Hill." The frame cottages alone were built at a cost of \$477,331, which includes the electrical transmission system, and stoves and water heaters. The cost of construction of the superintendent's residence was \$13,800, and that of the executive lodge \$30,250, both

prices including the cost of heating and ventilating systems.

The one-room cottages rented for \$15 per month, the two-room cottages for \$19, and the three-room cottages for \$30. This covered the cost of the cottage amortized in a 60-month period plus interest of one-half percent per month. No direct charge was made for transportation of employees renting the houses. The cottages were equipped with electricity and water which was paid for separately by the tenant, and were connected with the Government sewerage system.

At a cost of \$41,339 the contractor constructed and placed under the management of the Boulder City Co. a completely equipped department store selling drugs, groceries, hardware, electrical fixtures, furniture, and meat. Although the store was built to serve the contractor's employees, they were not requested to trade with it. Its prices compared favorably with those of similar stores in the locality. The cost of clothing and furniture remained practically the same throughout the construction period, but food prices changed somewhat in accordance with the national trend. Because Boulder city is served by adequate transportation facilities, prices have been comparatively reasonable. Equipment for the store building was installed at a cost of \$78,966.

The contract with the Anderson Bros. Supply Co. provided that Six Companies, Inc., "shall furnish the buildings, water, and light, and the subsistence contractor all of the required equipment, supplies, and labor; that the service to be given by the parties of the second part (subsistence contractor) shall be absolutely first class in all respects and of such character and quality as to keep all those employed and using the service satisfied and contented." The contract was subject to cancellation on 24 hours' notice by the Boulder City Co. The contract provided further: "Section 9: In all its operations hereunder, the parties of the second part (subsistence contractor) agree to strictly and fully comply with all county, State, and Federal laws, regulations, orders, and ordinances, and to specifically comply with all orders issued by the Bureau of Reclamation in the matter of the operation of this service and facilities to be furnished hereunder."

In accordance with the contract, the subsistence contractor gave satisfactory service throughout the construction pe-

riod. Three meals a day were furnished to the day and night shifts, with an extra lunch to the latter. The lunches were selected by each man and any amount of food could be taken from a menu, which was changed daily. Following is a typical daily menu:

BREAKFAST

Grapefruit	Oranges
Oatmeal with cream	Grapenuts Corn flakes
Grilled pork sausage	Fried eastern ham
Bacon omelet	
Wheat cakes	Maple sirup Toast
Hot biscuits	Pineapple jam
Doughnuts	Stewed figs
Coffee	Fresh milk

DINNER

Dill pickles	Pickled beets
Hearts of lettuce, Thousand Island dressing	Chile con carne
Roast sirloin of beef, gravy	
Mashed potatoes	Creamed onions
Boiled spinach	Plum jam
Raisin and wheat bread	Mince pie
Rice pudding	Vanilla sauce
Milk Coffee Tea Buttermilk	

SUPPER

Pickled beets	Chow chow
Peal barley broth	
Coleslaw with cream dressing	
Grilled rump steak	
Spanish stew with vegetables	
French fried potatoes	Asparagus tips
Mashed turnips	Chile con carne
Spaghetti Italiane	
Hot rolls	Strawberry jam
Devil's food cake	Canned apricots Lemon snaps
Coffee Tea Buttermilk Milk	

The mess hall and the adjacent dormitory for lodging mess-hall employees were built at a total cost of \$71,888, including heating and ventilating equipment, and equipped for \$92,721. The building was capable of seating 1,200 men at once at 8-man tables in two dining-room wings. The center section, containing the storage and refrigeration rooms, kitchen, etc., was 54 by 194 feet, and the two parallel dining rooms were each 45 by 142 feet. The roof was supported by steel trusses, there being no supporting posts in the main dining rooms. Fresh meat, fruit, and vegetables were on hand at every meal. Meat was brought from Reno in 20,000 lots by truck, packed with dry ice, and upon arrival was immediately run into the meat-storage refrigerating room. Eggs were similarly brought from Reno. Some canned goods came from Utah, others from California. There being few dairies in southern Nevada, Anderson Bros. purchased a 160-acre alfalfa ranch 80 miles away at Logandale, Nev. They installed a water and sewer system, electric and refrigerating systems, a steam plant, four 50-cow semi-roofed corrals, and a 50-stall concrete-floored milk barn. Milk, cream, and butter were shipped daily in ice-cooled trucks, which made the trip to Boulder City in 2½ hours.



BOULDER CITY, NEVADA

1, Interior of main dining room, Anderson Bros.' mess hall; 2, homes of employees of Six Companies Inc., Ash Street; 3, birdseye view of Boulder City.

RECREATION AND TRANSPORTATION

The Boulder City Co. operated a recreational hall or clubhouse which was built by Six Companies Inc. at a cost of \$18,241 and equipped for \$22,934. This equipment included pool and billiard tables, soda fountain, cigar and candy vending counters, and a beer bar. The hall was largely used by the workmen during off shifts. Gambling was prohibited with the exception that under strict supervision the men were allowed to play poker with a dollar limit. Attempts were made by professional gamblers to participate in these games, but these were ejected from the reservation when discovered. Slot machines were not permitted.

One of the first problems in the construction of the dam was the transportation of men to and from the damsite, situated 8 miles from the construction camp and 1,800 feet lower in elevation. After attempting trailers and other methods, International A-6 trucks with 210-inch wheelbase were selected for the transports. These transports made three trips a day carrying crews back and forth between Boulder City and Black Canyon, averaging 75,000 passenger round trips per month. In addition to these International trucks, in 1933 Six Companies Inc. had three Mack 14 cubic-yard dump trucks converted into transports. Two of these were of 100-man and one of 150-man capacity, and all were constructed with two decks, seating half of their capacity on each deck. The largest of the three was later fitted with a second motor, transferred from a type A-6 International six-cylinder truck.

Transportation for the various superintendents was furnished by Ford pick-ups and light Ford service trucks. In addition, there were four Chevrolets and three Ford sedans in hospital and general office service. The Ford Motor Co. developed a four-blade fan and heavy-duty radiator to cure heating troubles induced by high summer temperatures and greater power required in the Ford pick-ups and touring cars. The improvements developed on the Boulder Dam units have since been made available for use throughout the hotter portions of the United States.

FIRE-FIGHTING EQUIPMENT

Fire protection is of prime importance in a community consisting almost entirely of frame buildings. Besides the fire-fighting equipment bought and put into operation by the Government, Six Companies Inc., under the management of the Boulder City Co., instituted a fire-fighting system composed of 4 volunteer

captains and 40 men under the direction of a full-time chief.

The fire equipment consisted of a 350-gallon pumper and a Ford ladder truck equipped with 1,500 feet of 2½-inch hose, 40 feet of extension ladder and other necessary fixtures. Six Companies Inc. buildings were protected with 1,500 water barrels that are inspected semi-monthly by the superintendent. In addition, the dormitories and individual dwellings were supplied with 1,200 2½-gallon soda and foamite extinguishers and each dormitory with eight interior standpipes. The dormitory area was separated by automatic water-curtain sprinkler system equal in volume to 12 standard fire hoses of 85 pounds pressure. The fire department was organized in December 1932 under the direction of the Boulder City Co. and during the 3 years of its operation has made an efficient record, successfully controlling a total of 107 fires, in cooperation with the Government's fire department.

The last, but not least important service to Six Companies Inc., employees controlled by the Boulder City Co. was a laundry operated in conjunction with the mess hall. The building was constructed and equipped at a cost of \$9,319. Laundry charges have been perhaps a little higher than in larger localities, but are in keeping with the general wage and standard of living. The same prices have been maintained throughout the construction period.

The above gives only a small picture of the thought given to the comfort of workers living in a desert region where temperatures vary from 20° to 120° F. and the mean temperature is 70° F. Construction prices have been included to show that Boulder City was more than just a "construction camp", it was (and still is, though dwindling in size) a city of consequence. The population at the height of the construction period was in excess of 6,000, making it the third city in Nevada in size. Up to December 1931 the Government spent \$1,135,000 in layout on the town, building streets and sidewalks, installing water, sewerage, and electrical systems, permanent houses, and in landscaping.

The contractor is leaving, and with him will go most of his little white bungalows, his dormitories, warehouses, stores, and office buildings, but Boulder City remains as a tribute to admirable foresight in housing, and housing well, the men who built the dam. The dam itself stands as a monument to the men who completed it 2 years and 28 days ahead of schedule, but that enviable record could not have been made without the shelter of Boulder City.

Labor Classification

Protests have been received in Washington and Denver against the classification of workmen established by the approved wage schedules for construction projects of the Bureau of Reclamation which are financed with emergency funds.

The schedules were established in accordance with Public Works Administration scales after an Executive order had exempted these projects from the security-wage restrictions. They are, then, in lieu of the so-called security wage originally proposed.

Since many of the protests have indicated a fear on the part of organized labor that a semiskilled classification, through abuse, might break down hard-won standards, Acting Commissioner John C. Page has indicated that especial care will be taken to see that no unfair classifications are made. In accordance with the desire to assure labor of the Bureau's determination to permit no abuses, R. F. Walter, the chief engineer, on April 8 sent the following letter to all field offices, further emphasizing the construction engineers' responsibility in the matter of protection of the workmen:

"1. Many protests are received in the Denver and Washington offices against the classification of workmen established by the approved wage schedules for construction projects financed with emergency funds.

"2. The labor classifications and hourly wage rates as set forth in the enclosure accompanying circular letter no. 2214, dated November 5, 1935, are based on the Public Works Administration zone minimum and are consistent with rates previously approved by the Public Works Administration. Many of the protests received are predicated on the apprehension that abuse of labor will result because of the semiskilled classifications. The requirements for posted wage scales, certified pay rolls, and other Public Works Administration and Emergency Relief Administration provisions in construction contracts are designed to prevent irregular classifications and improper wage payments.

"3. Construction engineers and other responsible field employees are hereby instructed to watch these matters particularly and to prevent improper wage classifications and wage rates; also to prevent any improper proportion of semiskilled workmen. All contracts have sufficient force to insure proper wage payments. A contractor can be required to make a change in rate retroactive, and a contract is subject to cancellation for violation of the provisions herein referred to."

King of Island in Lake Mead Assassinated

(Photo by Union Pacific System)



SULTAN was a fine specimen of bighorn sheep, and he ruled, for a few fleeting weeks, a rocky island empire in Lake Mead near Boulder Dam.

James Cashman and Walter Bracken, of Las Vegas, Nev., discovered Sultan after the rising water of the lake had surrounded his particular craggy pile, and they provided him with wives, 12 selected ewes, and regularly took feed to the herd. Old Sultan warmed to his new friends and appeared delighted to pose silhouetted against the sky for the benefit of hundreds of tourists who took boat rides up the lake to see a real big horn in his native habitat.

But Sultan after all was betrayed by his new found faith in man. Not by the men who found him and who cared for

him, but by some unknown vandal, some wretch who had a gun and insufficient intelligence to refrain from using it. Sultan and one of his wives were shot and left to the vultures.

The assassination of Sultan so outraged the good people of southern Nevada that, led by Cashman and Bracken, they offered \$250 reward for information which would lead to the arrest and conviction of the marauder. However, after several weeks no clue had been unearthed as to the identity of the perpetrator of the senseless killing, who had neither the desire for a trophy nor the need of meat for a motive, since the carcass of Sultan lay where it dropped, a useless sacrifice to human stupidity.

Ogden River Holds Dance

On March 14 the members of the Ogden Reclamation force held a dance in the new Utah Power & Light Co.'s auditorium. Invitations were extended to members of the Salt Lake, Provo, and Hyrum Reclamation offices and to the contractors on the Ogden River project. About 35 couples accepted this invitation and about 100 couples attended and spent a very enjoyable evening. During intermission a fine program was presented by local talent. The affair was such a success that everyone is desirous of a repeat performance and it is expected that another one will be held in the near future.

The Paul Bunyan Club Grand Coulee Dam

This club was organized during the winter to further discussion of engineering construction, and allied problems on the Grand Coulee Dam and other projects and also for the promotion of better understanding and appreciation as between the engineering and construction personnel employed on the Grand Coulee-Columbia Basin project. Open meetings are held twice each month and to date talks have been delivered as follows:

Geology of Grand Coulee Area, by Dr. C. P. Berkey, Columbia University.

Central Valley Staff

A. M. Torpen has been appointed division engineer in charge of the Friant division of the Central Valley project, thus completing the selection of keymen in the Bureau of Reclamation organization for construction of this great California water-conservation project.

Mr. Torpen formerly was construction engineer of the Pickwick Landing Dam for the Tennessee Valley Authority. He will have charge of the construction of Friant Dam and the Friant-Kern and Madera canals in the southern end of the Central Valley, reporting to Walker R. Young, construction engineer of the Bureau, who is in general charge of the whole project.

Two other divisional engineers previously had been selected. They are Roy M. Snell, a former Bureau of Reclamation engineer, who rejoined the Bureau and who will have charge of the work in the northern end of the Central Valley with headquarters at Redding, and Oscar G. Boden, who was transferred from the Bureau's Owyhee project to become resident engineer in charge of construction of the Contra Costa conduit with headquarters at Antioch.

Young, who was construction engineer of Boulder Dam, has established general project headquarters at Sacramento.

In addition, three consulting appraisers have been appointed to plan and direct the work of appraising properties which must be acquired to provide rights-of-way. They are B. A. Echeverry, of Berkeley; Frederick C. Herrmann, of San Francisco; and Curtis Walker, of Washington, D. C.

Construction Features of Norris Dam, by C. D. Riddle, job engineer, M. W. A. K. Co.

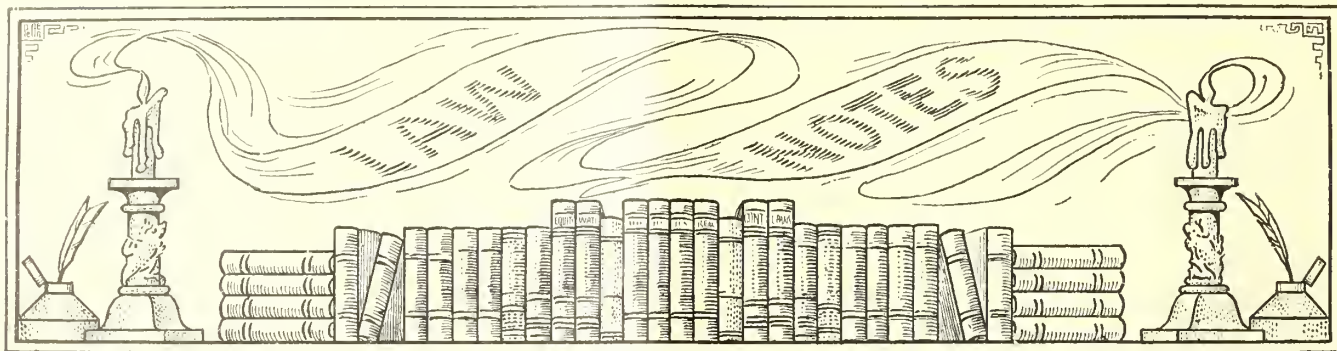
Owyhee Dam, by F. A. Banks, U. S. B. R. construction engineer.

Concrete Mixing Plant, by M. P. Anderson, M. W. A. K. Co. engineer.

Compressed Air in Construction of East River Tunnel, by R. L. Telford, M. W. A. K. Co. engineer.

Cofferdams, by S. H. Woodard, consulting engineer, New York City.

The club has a present membership of 70. Officers are as follows: F. J. Sharkey, president, U. S. B. R. engineer; A. F. Darland, first vice president, U. S. B. R. field engineer; R. L. Telford, second vice president, M. W. A. K. cofferdam engineer; P. R. Nalder, secretary, U. S. B. R. engineer; Ralph Hawkins, treasurer, M. W. A. K. engineer. Officials of the club are changed every 6 months.



Contractual Set-up of a Federal Irrigation Project¹

By J. R. Alexander, District Counsel, Bureau of Reclamation

INASMUCH as no set subject has been assigned to me but as I understand that information is desired by some of those present as to what requirements must be complied with where the construction of irrigation works is undertaken by the United States through the Bureau of Reclamation of the Department of the Interior, I will discuss briefly contracts covering the repayment of the cost of constructing irrigation works and matters involved therewith.

As no doubt you all know, the law requires that where an irrigation project is constructed by the United States under the provisions of the Federal Reclamation Act of June 17, 1902 (32 Stat., 388), and the various amendatory and supplementary acts of Congress relating to the construction of such works it is necessary that the cost of constructing said works be repaid to the United States and accordingly it is necessary that some financially responsible legal entity enter into a contract with the United States for the repayment of such cost. Necessarily, those who are trying to interest the United States in constructing an irrigation project desire information as to the nature of the repayment contract from the standpoint of what obligations must be assumed by those who will utilize the works and what kind of legal entity must be created for the purpose of making such a contract, and it is the purpose of my remarks to attempt to supply this information.

REPAYMENT CONTRACTS

Immediately after the passage of the Reclamation Act in 1902, a plan was adopted by which landowners in the area which would be supplied with water from the irrigation project would form a corporation known as a water users' association, which was simply a private corporation organized under the laws of the

State in which the area was located for the purpose of contracting with the United States to repay the cost of the project. Under the plan each landowner desiring water would execute a subscription for stock to the association in which he obligated the land therein described to take and pay for a project water right. The next step was for the association to enter into a repayment contract with the United States but work in constructing the project would not be started until a satisfactory number of valid subscriptions for stock to the association was secured.

This subscription contract, which by the way was a joint obligation, created a lien in the nature of a mortgage against the land described therein which could be resorted to in case the owner failed to pay water charges properly payable under the terms of the subscription to the association and the provisions of the repayment contract between the association and the United States.

The main purpose of the repayment contract between the association and the United States, while covering various matters pertaining to the construction of the irrigation project, was to provide for the repayment of the expenditures made by the United States in constructing the project without interest over the term of years authorized by the law existing at the time the contract was entered into.

The original reclamation act required that the cost be repaid in 10 annual payments. The repayment time was later increased by the Reclamation Extension Act in 1914 from 10 to 20 years and again later in 1924 the terms of repayment were changed so that repayment could be made on a crop-production plan which, of course, means an indefinite number of years. This latter plan of repayment was not found to be entirely satisfactory and the law was again changed in 1926 so as to provide for repayment in 40 (forty) annual instalments.

WATER-RIGHT APPLICATIONS

In addition to the subscription contract which the landowner made to the association he was also required, when the United States completed the construction of the project and announced that water was ready for delivery, to make what was known as a water-right application which runs direct to the United States, and which obligated the landowner and the lands to pay the water charges properly apportioned to the land described therein.

This plan was somewhat cumbersome as it involved the direct dealing by the United States with a large number of individual water users, and the taking and recording of numerous individual instruments, as most of the projects covered many thousands of acres of land in hundreds of individual ownerships, and as time progressed consideration was given to the use of the irrigation-district form of organization as the contracting entity with the United States, for the purpose of avoiding the great amount of work required in dealing with the individuals under the association plan and also because it seemed to offer other advantages over the association plan in that the revenues for the purpose of meeting the annual payments to the United States would be raised in the form of taxes upon the lands included within the district.

FORMS OF LEGAL ENTITY

You are all more or less familiar with the irrigation form of organization and I simply desire to mention at this time that it is now the form of organization which is generally required on Federal reclamation projects as it has proven itself to be, on the whole, the most satisfactory form of legal entity with which to deal.

In this connection, I also desire to mention that the irrigation-district form of organization is the form of organization which is mentioned in all recent

¹ Summary of an address delivered at Grand Junction, Colo., Feb. 27, 1936.

general-reclamation laws as the favored form of organization with which contracts for the construction of projects must be entered into. Also, generally speaking, the acts appropriating money for the construction of a new project require that before construction work is started, that a repayment contract be entered into with an irrigation district or irrigation districts.

However, where projects are being undertaken in old-established communities for the purpose of furnishing mainly a supplemental water supply to areas already irrigated, exceptions have been made which permit utilization of the old form of water-users' association as the contracting entity, but modified to the extent that instead of subscribers being individual landowners, they are existing ditch companies or other legal entities which are engaged in furnishing the water which already is being used in irrigating the area for which the supplemental supply is desired from the project. This plan, as indicated, is only used where the conditions are such that because of the divergent interests in the area it is not practical or advisable to use the irrigation-district form of organization.

In order to get approximately the same security and assurance that the cost of constructing the irrigation works will be repaid which is provided when dealing with an irrigation district, the old ditch and canal companies subscribing to the association are required to mortgage their ditch systems and water rights to the association and the United States so that in case they do not meet their obligations payment can be enforced either by the association or the United States resorting to the mortgage. Under this plan the various ditch companies desiring to participate in the project are thus brought into one legal entity which has the necessary legal responsibility, including financial ability by reason of the mortgages, to serve as an acceptable form of organization for contracting with the United States.

It is also desired to mention that where there are not sufficient responsible existing ditch companies in an area to furnish adequate security the same result can be accomplished by creating an irrigation district in this particular area which in turn can subscribe for stock to the association and thus permit the lands within this area to become responsible for their proper proportion of the cost of the project.

This plan has been and is being used in several instances in Utah where, owing to the conditions and facts and because the areas desiring works are more or less scattered, it is not practicable to utilize the irrigation district form of organization.

Dr. Elwood Mead

Marshall N. Dana, former President of the National Reclamation Association, and Associate Editor of the Oregon Journal, through the editorial columns, paid the following tribute to Dr. Elwood Mead, late Commissioner of Reclamation

Dr. Elwood Mead built his own monument. He built it of earth and concrete and with water. He built it of the desert turned into farms and flowers and homes.

Dr. Mead, at 78, and after only a week's illness, is dead in Washington, D. C. He had been United States Commissioner of Reclamation since 1924. To him was given the building of Boulder Dam on the Colorado, of Grand Coulee Dam on the Columbia, of Owyhee and Vale irrigation projects in Oregon, of Casper-Alcova in Wyoming, and of other great enterprises of reclamation throughout the West. He was a benefactor to the Oregon country.

The greatest work of his life he did after he had passed three score and ten. And after he was 75 he directed the spending of hundreds of millions of dollars allotted to reclamation in the recovery program. When he passed, 35 reclamation dams were under construction; \$170,000,000 was being spent, and \$30,000,000 of this amount in Portland's trade territory.

While Dr. Mead built, he prophesied. He predicted on the Pacific coast as great cities as have been built in the world. He prophesied a great and widespread population in the West, and activities that shall be titanic. He pointed to the West as the new opportunity for the drouth-stricken people of the Midwest. He found profound significance for the future in the fact that the Columbia River has the greatest water supply in the arid districts of this Nation.

In substance, and to reiterate to some extent, the plan has as its object simply the purpose of creating a responsible form of legal entity which can make a contract with the United States to repay the cost of the project, making use of the existing irrigation set-up in the community and largely leave existing conditions undisturbed, and at the same time avoid dealing directly with individual landowners.

As indicated, the association plan where used under conditions similar to those mentioned is elastic and will permit of most any form of legal entity becoming a subscriber which has the necessary power to subscribe for shares of stock therein and assume jointly with others the obligation of paying back to the United States the cost of the irrigation works. For instance, a subscribing ditch

He found the basis of his prophecy in the plains and valleys of volcanic ash made miraculously fruitful and beautiful by water scientifically led from nature's inverted reservoirs, the mountains. He had used in construction some of the most powerful machines yet devised. He had shown that every man employed on a reclamation project employs two elsewhere. He had given proof to Congress that every dollar invested in a reclamation project produced \$4 of additional value. He had shown eastern industries that reclamation projects were drawing upon them for \$100,000,000 of manufactured products a year. And in one accounting, below present totals, he revealed that upon 3,000,000 acres of land reclaimed in Federal projects, 41,000 country homes had been provided, cities and towns had been built, and a revolving fund investment of \$280,000,000 had been turned into \$2,000,000,000 of property values.

Isaiah, another prophet, wrote the epitaph to which Dr. Mead is entitled:

"And they that be of thee shall build the old waste places: thou shalt raise the foundation of many generations; and thou shalt be called the Repairer of the breach, the Restorer of paths to dwell in."

"I give waters in the wilderness and rivers in the desert."

Some months ago Dr. Mead confronted Mrs. Mead's proposal for retirement, for ease and for a trip around the world. He elected to stay on the job. Thus he was happiest, for when he had passed he left in full vigor the work that produces life.

company must have power by which it can mortgage its water right and ditch system, subscribe for shares of stock in other corporations, including of course an association, power to raise revenues by assessing without limit its shares of stock, and the power to assume jointly with other subscribers the obligation of the association to repay to the United States the cost of the project.

Other forms of legal entity which might desire to subscribe, such as an irrigation district, metropolitan water district, or conservation district, must have equivalent broad powers to permit them to participate upon the same terms and assume the same burdens as canal companies and other subscribers.

The Reclamation Era

Issued monthly by the Bureau of Reclamation,
Department of the Interior.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users organizations for mass subscriptions on Federal irrigation projects.

MAY 1936

Owyhee Reservoir Fills

"It is a sight worth seeing", said those who drove to Owyhee Dam Sunday to view the water surging over the rim of the "glory hole", to drop 300 feet into the spillway tunnel from whence it reaches the Owyhee River.

But it is more than just a sight, it is a guarantee of the future prosperity of thousands of people for it is an evidence of assurance that, unless a cataclysm of nature takes place there will always be more than enough water for the irrigation of the Owyhee project lands.

While it was not necessary to permit the water to flow down the glory hole last week, there was no point in keeping it back for there is an abundance of water yet to flow into the lake behind the concrete arch. Of course the glory hole can take it as it comes, since it is designed to transport twice as much water as any one day's flow brings into the reservoir. Were a greater amount required to be moved from the lake all that would be required would be the opening of the gate at the diversion tunnel to carry thousands of acre-feet per day to tunnel canyon and there turn it loose where it would do no harm.

The filling of the reservoir, the means provided to control the flow of the water, the successful delivery of water to project lands during its first year of operation, combine to prove that in its conception and construction the Owyhee project is an engineering achievement of which the Bureau of Reclamation and its officials may, indeed, be proud.—*The Ontario (Oreg.) Argus, April 2.*

Reclamation Benefits

The following editorial taken from the Powell (Wyo.) Tribune is a worthy discussion of a timely subject, and as such is presented here:

Just as the Wyoming reclamation association delegates are gathering at Casper for their annual convention to advance the general cause of reclamation, comes the news from Washington, D. C., that eastern Congressmen are preparing a renewed assault on the proposed \$58,000,000 western reclamation appropriation.

Their attitude remains as it has been all along, and at every urge on the part of Roosevelt and agricultural leaders for a curtailment of production they see increasing argument in opposition to the policy of spending millions to bring arid lands under the ditch.

What can be said of a Government policy that seeks appropriations of millions for a soil-conservation program that would cause millions of acres to be reseeded to pasture grasses and yet at the same time ask additional millions to build dams and irrigation ditches that water may be carried to more arid acres?

Right here in Wyoming, that very policy of removing marginal lands in a semiarid belt from cultivation, and yet at the same time spending millions to bring new acres under the plow is now going on. Easterners rebel at such apparent inconsistency, but to westerners the plan is most logical and progressive.

Millions of acres in the Nation's dust bowl were placed under the plow by a great governmental blunder. Settlers there have been gambling for a half century that they could make that land profitably produce crops of wheat and corn. They now concede failure and the Government wants to get them off of these lands of uncertainty, where they and their cattle have been literally starving, and to place them on a more secure footing. They want to return these borderline farms to their natural grazing state. Reclamation helps to solve the problem. Many families of agricultural people from just such predicaments have been brought to the new lands of the Shoshone reclamation project, where they are commencing to take hold and have hope. Their situation has been greatly improved. We know that it has, for we observe their coming and progress with our own eyes.

But reclamation is expensive. We cannot afford to reclaim arid lands with million-dollar dams merely for the salvation of one generation. Reclamation is a broad policy of building for the future. In a thousand years from now these reclamation projects will be here sustaining thousands of contented families, supporting numerous substantial cities and adding the products of thousands of fertile acres to the Nation's bread basket. That is empire building for the future; adding acre after acre of dependable farm lands to replace the gamble-farming of the dust bowl. Reclamation is the gradual development for a substantial agricultural future. To retard reclamation is to hamper our country's peaceful expansion. To retard reclamation is a narrow policy that would hold back our agricultural growth toward its most admirable possibilities all for the sake of eastern agriculture that fears competition. Western reclamation farming competes very remotely with the farmers in the land of corn and hogs. What matter is it to Iowa or Illinois farmers how much Wyoming's comparatively small agri-

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date) _____

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) _____

(Address) _____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

cultural acreage produces in the way of sugar beets, beans, potatoes, seed beans, seed peas, sweet corn for canning, honey? Why should there be objection from Corn Belt Congressmen if Wyoming can expand its production of turkeys and sugar? The actual competition we would bring to the Corn Belt farmer is but a drop in the bucket. We constitute an ever increasing market for his corn and hogs. We are a trading asset worth millions to eastern industry. We are a rapidly increasing market for their farm machinery, their motor cars, and trucks. Sometimes we think we give more than we take in the trade balance. Western reclamation is a dependable business stabilizer for eastern America. With security in production there develops a security in buying power.

California, Idaho, Wyoming, Colorado, and the other Western States have been developed by reclamation as invaluable assets to eastern industry, but western farmers have themselves paid with worry and toil for this national expansion. The money advanced for this all-time development has been derived not from the pockets of eastern taxpayers but from western soil, from the sale of western public lands and from oil royalties coming from western oil fields. Eastern taxpayers have not built our reclamation projects, but they will derive vast benefits from a wise Government policy that their Congressmen and Senators have too often opposed.

Reclamation is an increasing success; it is a success at Powell in northwestern Wyoming, it is a success in the great agricultural undertakings of southern Idaho and northern Colorado. We of the West can vision a wonderful future in reclamation, but it is a long program that can hardly be completed for generations to come. We ask for the broadminded forbearance of eastern statesmen in the solving of our many obstacles. If viewed as a long-range Government policy from a liberal, progressive standpoint, reclamation is our Nation's most practical investment. Reclamation is a cherished security in time of war, drought, and flood. The reclamation areas are a charming bit of agricultural beauty added to Uncle Sam's vast domain that appeal most forcibly to the informed. There is little opposition to reclamation by those thoroughly understanding the broad scope of its benefits.

WITH a resumption of farming and logging operations on the Klamath project, there has been a marked improvement in the unemployment situation.

John H. Pellen, 1860-1936



John H. Pellen, who was retired on June 30, 1932, after a continuous service in the Government of 32½ years, was born in Detroit, Mich., on January 31, 1860, and died at his home in Washington, D. C., on April 11, 1936.

Mr. Pellen's first appointment with the Government was in January 1899, when he was employed as paleontologic draftsman in the Geological Survey. On March 15, 1904, he became connected with the Bureau of Reclamation as draftsman and later was given the title of chief draftsman. His position was classified on July 1, 1924, as that of chief engineering draftsman, and he was appointed associate engineer (cartographic) on June 1, 1930, continuing to serve as chief of the drafting section in the Bureau until his retirement.

Mr. Pellen was active in the Bureau in the training of junior engineers who have become efficient draftsmen under his able direction. He had charge of eight exhibits of the Interior Department at the Sesquicentennial Exposition in Philadelphia in 1926. In 1930 the Royal Spanish Commission awarded him a diploma of honor for designing and preparing an exhibit of reclamation features for the International Exposition at Seville, Spain. The Bureau was represented at the Colonial and Overseas Exposition at Paris in 1931 by a display illustrating the results of irrigation on the desert, planned and prepared by Mr. Pellen, who was contact officer for the Department. His services were of inestimable value to the Bureau and his separation was felt to be a distinct loss.

Mr. Pellen had a very pleasing personality and was always keenly interested in the various members of the Reclamation organization. After his retirement he made many trips to the Bureau to visit among his former fellow employees.

Notes for Contractors

Colorado River project, Texas.—The Secretary on March 28 approved award of contract to the Republic Portland Cement Co., of San Antonio, Tex., for furnishing 365,000 barrels of portland cement for Hamilton and Arnold Dams, as called for in specifications no. 766 D. Award will be made on item 1, 20,000 barrels of standard in bulk; item 2, 5,000 barrels of standard in sacks; item 3, 290,000 barrels of modified in sacks; item 5, 50,000 barrels of modified in bulk. Republic bid \$2.3422 for bulk cement and \$2.799 for cement in sacks, both f. o. b. Beverly, Tex., and shipping from Loughorn, Tex. The total bid price was \$995,659 less a discount and sack allowance of \$0.50 per barrel, giving a total of \$841,159, of which \$235,314 is freight charges. Three other companies submitted identical bids: Trinity Portland Cement Co., Dallas, Tex.; Universal Atlas Cement Co., Chicago, Ill.; and Lone Star Cement Co., Dallas, Tex.

Three contractors submitted bids for construction of the North Dike at Hamilton Reservoir (specifications no. 770 D), opening at Austin on March 26. The bids were as follows: Brown & Root, Inc., Austin, Tex., \$38,507; H. B. Zachary & Co., Laredo, Tex., \$46,400; Dodds & Wedegartner, San Benito, Tex., \$75,250. The Secretary approved award of contract to Brown & Root on April 13.

The date for opening bids, under specifications no. 673 calling for construction of the Arnold Dam and power plant and processing sand and crushed rock for Hamilton and Arnold Dams was postponed until April 15.

Salt River project, Arizona.—Bids were opened at Denver on March 20 for furnishing 7,000 barrels of portland cement in sacks (invitation no. 42558-B). Identical bids of \$3.32 per barrel, f. o. b. Mesa, Ariz., less discount and sack allowance of \$0.60, were submitted by Monolith Portland Cement Co., Monolith, Calif.; California Portland Cement Co., Colton, Calif.; Riverside Cement Co., Crestmore, Calif.; Southwestern Portland Cement Co., El Paso, Tex.; Graham Bros., Inc., Long Beach, Calif.; Pacific Portland Cement Co., Redwood Harbor, Calif.; and Santa Cruz Portland Cement Co., Davenport, Calif. The Henry Cowell Lime & Cement Co., Cowell, Calif., bid \$1.65 f. o. b. Cowell less discount and sack allowance of \$0.50. With shipment on Government bill of lading and using land-grant freight rates, the Pacific Portland Cement Co. was found to be the low bidder on the basis of net delivered cost to the Govern-

ment. Award of contract was approved on April 15.

Bids opened at Denver on March 16 for furnishing hydraulic turbine and butterfly valves for the Mormon Flat power plant (specifications no. 671) were all rejected. The bids were as follows: Schedule no. 1 (11,500 horsepower hydraulic turbine) S. Morgan Smith Co., York, Pa., \$38,790; Newport News Shipbuilding & Dry Dock Co., Newport News, Va., \$48,403; Allis-Chalmers Manufacturing Co., Milwaukee, Wis., \$46,132.75; schedule no. 2 (draft-tube liner, scroll case, speed ring), S. Morgan Smith Co., \$16,425; schedule no. 3 (butterfly valve), S. Morgan Smith, \$14,650; Newport News Shipbuilding & Dry Dock Co., \$19,770; Allis-Chalmers, \$16,500; Joshua Hendy Iron Works, Sunnyvale, Calif., \$12,938; Hardie-Tynes Manufacturing Co., Birmingham, Ala., \$19,000. S. Morgan Smith offered a combination bid of \$51,440 on schedules 1 and 3, and \$65,865 on schedules 1, 2, and 3. Newport News submitted a combination bid of \$66,345 on schedules 1 and 3.

Boise-Arrowrock project, Idaho.—Four companies quoted prices on supplying 31,300 barrels of portland cement in sacks, invitation no. 21512-A, bids opened at Denver on March 19. The bids were as follows: Pacific Portland Cement Co., San Francisco, Calif., \$3.05 f. o. b. Barber Junction, Idaho; Oregon Portland Cement Co., Portland, Oreg., \$2.40 f. o. b. Lime, Oreg.; Henry Cowell Lime and Cement Co., San Francisco, Calif., \$1.65 f. o. b. Cowell, Calif.; Idaho Portland Cement Co., Inkam, Idaho, \$2.50 f. o. b. Inkam. All bids were subject to discount and sack allowance of \$0.50. On the basis of net delivered cost to the Government, the Oregon Portland Cement Co. was low bidder, and was awarded the contract on April 10. Net mill prices varied from \$0.992 to \$2 per barrel.

The following bids were opened at Denver on April 20 for supplying two 24-inch internal-differential control valves for drum-gate control at Arrowrock Dam, under specifications no. 785-D; John W. Beam, Denver, Colo., \$2,450 discount one-half of 1 percent; Joshua Hendy Iron Works, Sunnyvale, Calif., \$3,262; Western Foundry Co., Portland, Oreg., \$2,060, discount, one-half of 1 percent; General Engineering and Drydock Co., San Francisco, Calif., \$2,814; S. Morgan Smith Co., York, Pa., \$4,580; Hardie-Tynes Manufacturing Co., Birmingham, Ala., \$2,500; Steacy-Schmidt Manufacturing Co., York, Pa., \$2,500; Omaha Steel Works, Omaha, Nebr., \$3,496; Valley Iron Works, Yakima, Wash., \$2,600, discount 5 percent; Consolidated Steel Corporation, Ltd., Los Angeles, Calif., \$3,551; Koppers Construction Co., Fort

Wayne, Ind., \$2,800, discount 2 percent; Johnson City Foundry & Machine Co., Johnson City, Tenn., \$1,670, discount 1 percent.

Upper Snake River project, Idaho.—Bids were opened at Denver on March 20 for furnishing 10,000 barrels of portland cement in sacks, under invitation no. 40631-A, and the following bids were received: Idaho Portland Cement Co., Inkam, Idaho, \$3.15 f. o. b. Trude, Idaho, and \$2.50 f. o. b. Inkam; Oregon Portland Cement Co., Portland, Oreg., \$2.40 f. o. b. Lime, Oreg.; Henry Cowell Lime and Cement Co., San Francisco, Calif., \$1.65 f. o. b. Cowell, Calif.; Monolith Portland Midwest Co., Denver, Colo., \$2.15 f. o. b. Laramie, Wyo. All bids were subject to a discount and sack allowance of \$0.50. Net mill prices vary from \$1.15 to \$2. On the basis of net delivered cost to the Government the bid of the Idaho Portland Cement Co., \$2.50 f. o. b. mill less \$0.50 discount and sack allowance, was low and this company was awarded the contract on April 9.

Boulder Canyon project, Arizona-Nevada.—At Denver, on March 27, bids were opened for furnishing pipe and fittings for Nevada adits and power plant (specifications no. 768-D) as follows: Associated Piping & Engineering Co., Ltd., Los Angeles, Calif., \$6,016; Crane-O'Fallon Co., Denver, Colo., \$6,300; the National Valve & Mfg. Co., Pittsburgh, Pa., \$6,492; the Grimes Pipe & Supply Co., Denver, Colo., \$6,538; Midwest Piping & Supply Co., Inc., St. Louis, Mo., \$6,541; Standard Sanitary Mfg. Co., Denver, Colo., \$6,541; Grinnell Company of the Pacific, Los Angeles, Calif., \$6,927.55. All bids except the first named were f. o. b. Boulder City. Associated Piping & Engineering Co. was awarded the contract on April 3.

The following bids were opened at Denver, on March 30, under specifications no. 771-D, for furnishing diverter towers and capacitor supports for the Boulder switchyard: International Derrick & Equipment Co., Torrance, Calif., \$15,700; Pacific Iron & Steel Co., Ltd., Lynwood, Calif., \$15,940; American Bridge Co., Pittsburgh, Pa., \$15,755; Blaw-Knox Co., Blaw-Knox, Pa., \$16,465; Bethlehem Steel Co., Leetsdale, Pa., \$16,600; Emsco Derrick & Equipment Co., Los Angeles, Calif., \$21,442; Duffin Iron Co., Chicago, Ill., \$19,303; Missouri Rolling Mill Corporation, St. Louis, Mo., \$19,303 or \$18,463.

All bids received on February 18 for furnishing outdoor lighting fixtures and lighting standards for the Boulder power plant, specifications no. 765-D, were rejected and readvertised under invitation no. A-23381-A; bids opened at Denver on April 6.

The American Automatic Electric Sales Co., Chicago, Ill., bid \$10,668.60 and the Kellogg Switchboard & Supply Co., also of Chicago, bid \$18,915 for furnishing manual telephone apparatus for the Boulder Dam and power plant, as called for in specifications no. 782-D. Bids were opened at Denver on April 20.

The Secretary, on April 7, approved award of contracts for furnishing insulated wire and cable, under specifications no. 759-D; bids opened at Denver on January 31, as follows: Lavenson & Savasta, San Francisco, Calif., schedules 1 and 3, \$8,720.70 f. o. b. Boulder City, discount one-half of 1 percent; Simplex Wire & Cable Co., Boston, Mass., schedules 2 and 4, \$115,631.05 f. o. b. Boulder City, discount one-half of 1 percent. Eleven manufacturers and eleven agents submitted bids.

Bids will be opened at Denver on May 18 for furnishing four 55,000 kilovolt-ampere, 60-cycle, single-phase, water-cooled, 16,400- to 132,950/230,000-volt Y transformers for installation in the Boulder power plant. The specification number is 680.

Bids were opened at Boulder City, Nev., on April 11 for rubber tile floor covering for the Boulder power plant and switchyard relay house (specifications no. 780-D). The bids were as follows: L. D. Reeder Co., Los Angeles, Calif., \$6,000 f. o. b. Watertown, Mass., \$6,500 f. o. b. destination; D. A. Pancoast Co., San Francisco, Calif., \$6,322 f. o. b. South Braintree, Mass., and Philadelphia, Pa., \$6,735 f. o. b. destination; Barker Bros. Inc., Los Angeles, Calif., \$6,700 f. o. b. Akron, Ohio, or South Braintree, Mass., \$7,150 f. o. b. destination; Lindley Carpet Co., Inc., Los Angeles, Calif., \$6,790 f. o. b. West Braintree, Mass., and Los Angeles, \$7,300 f. o. b. destination; Broadway Department Store Inc., Los Angeles, Calif., \$6,800 f. o. b. Trenton, N. J., \$7,300 f. o. b. destination; E. H. O'Neill Floors Co., Chicago, Ill., \$6,761 f. o. b. Chicago, \$7,480 f. o. b. destination; Seaside Products Corporation, Los Angeles, Calif., \$8,000 f. o. b. Boston, Mass., \$8,400 f. o. b. destination; Van Fleet-Freear Co., Los Angeles, Calif., \$8,060 f. o. b. Chicago and Los Angeles, \$8,478 f. o. b. destination.

The International Derrick & Equipment Co., Torrance, Calif., submitted low bid of \$15,700 f. o. b. Torrance, one-half of 1 percent discount, for furnishing structural steel for four diverter towers and two capacitor supports for switchyard, as called for in specifications no. 771-D; bids opened at Denver on March 30. Other bids were as follows: Pacific Iron & Steel Co., Ltd., Los Angeles, Calif., \$15,940 f. o. b. Lynwood, Calif.; American Bridge Co., Denver, Colo.,

\$15,755 f. o. b. Pittsburgh; Blaw-Knox Co., Pittsburgh, Pa., \$16,465 f. o. b. Blaw-Knox; Bethlehem Steel Co., Bethlehem, Pa., \$16,600 f. o. b. Leetsdale; Emsco Derrick & Equipment Co., Los Angeles, Calif., \$21,442; Duffin Iron Co., Chicago, Ill., \$24,000; Missouri Rolling Mill Corporation, St. Louis, Mo., \$19,303 or \$18,463, discount one-half of 1 percent.

On April 20 the Secretary approved award of contract to the low bidder.

The following bids were opened at Denver on April 6 for furnishing, under specifications no. 676, structural steel supports (item no. 1) gratings (item no. 2) and pipe handrails (item no. 3) for tunnel walkways in the lower Arizona and Nevada tunnels: Dravo-Doyle Co., Pittsburgh, Pa., \$13,900 or \$16,100 (item 2) f. o. b. Boulder City; Associated Piping & Engineering Co., Ltd., Los Angeles, Calif., \$15,932 (item 2), \$7,296 (item 3), \$23,100 (combined), f. o. b. Boulder City; discount 2 percent; Renter Bros. Iron Works, Chicago, Ill., \$22,000 (item 1), \$22,712 (item 2), \$44,000 (combined), f. o. b. Boulder City, discount one-half of 1 percent; Reliance Steel Products Co., Rankin, Pa., \$15,840 (item 1), \$13,509 (item 2), \$28,080 (combined), discount 1 percent; Gary Structural Steel Co., Gary, Ind., \$9,967 (item 2), discount 1 percent; B. Katchen Iron Works, Irvington, N. J., \$19,703 (item 1), discount one-half of 1 percent; Atlas Pipe Railing Co., Inc., Long Island City, N. Y., \$12,630 (item 1), \$6,937 (item 3), discount one-half of 1 percent; Virginia Bridge Co., Denver, Colo., \$21,168 (item 1), f. o. b. Birmingham, Ala.; Kyle Steel Construction Co., Los Angeles, Calif., \$14,308 (item 1), \$14,991 (item 2), \$7,091 (item 3), discount one-half of 1 percent; Blaw-Knox Co., Pittsburgh, Pa., \$13,383 (item 2), f. o. b. Boulder City, discount 1 percent; Hendrick Mfg. Co., Carbondale, Pa., \$16,100 (item 2), f. o. b. Boulder City, discount 1 percent; William F. Klemp Co., Chicago, Ill., \$16,342 (item 2), discount 1 percent; Duffin Iron Co., Chicago, Ill., \$20,200 (item 1), \$7,543 (item 3); Worden-Allen Co., Milwaukee, Wis., \$21,290 (item 1), \$15,989 (item 2), f. o. b. Boulder City, discount one-half of 1 percent; Crane O'Fallon Co., Denver, Colo., \$6,357 (item 3) f. o. b. Boulder City, discount 2 percent; Des Moines Steel Co., Des Moines, Iowa, \$19,245 (item 1), \$14,472 (item 2), \$32,717 (combined), f. o. b. Des Moines and Jersey City, N. J.; Kerlow Steel Flooring Co., \$15,989 (item 2), f. o. b. Boulder City, discount 1 percent; Vulcan Rail & Construction Co., Maspeth, N. Y., \$8,642 (item 3), f. o. b. Boulder City; Hansell-Elcock Co., Chicago, Ill., \$16,000 (item 1), discount one-half of 1 percent; Bethlehem Steel Co., Los Angeles, Calif.,



HUMBOLDT PROJECT, NEVADA—RYE PATCH DAM

A slanting sun casts shadow patterns as the spillway construction of the dam is pushed toward completion on the Humboldt River. The dam will be completed shortly.

\$19,462 (item 1), f. o. b. Watts, Calif.; Levinson Steel Co., Pittsburgh, Pa., \$19,070 (item 1), discount one-half of 1 percent; Omaha Steel Works, Omaha, Nebr., \$20,900 (item 1), \$18,750 (item 2), f. o. b. Kansas City, Mo., \$8,200 (item 3); Fabricated Steel Products Co., Wheeling, W. Va., \$9,882.62 (item 3), f. o. b. Boulder City; Universal Manufacturing Co., Novi, Mich., \$11,400 (item 2), discount 2 percent.

Frenchtown project, Montana.—On April 27 bids were opened at Missoula, Mont., under specifications no. 679, for construction of structures and canal lining for the main canal and earthwork and structures for laterals and O'Keefe wasteway. The principal items and estimated quantities involved are as follows: 152,000 cubic yards of excavation for canal, laterals, and wasteway; 2,300 station cubic yards of overhaul; 3,600 cubic yards of excavation for structures; 4,000 cubic yards of backfill; 1,050 square yards of trimming canal section for concrete lining; 360 square yards of dry-dock paving; 90 cubic yards of concrete in canal lining; 870 cubic yards of concrete in structures; placing 63,000 pounds of reinforcement bars; laying 72 linear feet of 36-inch diameter concrete pipe; laying 1,400 linear feet of 12-inch to 36-inch diameter corrugated metal pipe; erecting 93 M feet b. m. of timber in structures; erecting 3,230 linear feet of no. 48 to no. 84 metal flume; installing 16,520 pounds of gates; and installing 1,600 pounds of miscellaneous metalwork. The Government will furnish cement, reinforcement bars, con-

crete pipe, corrugated metal pipe, metal flume, gates, and metalwork. The successful bidder will have 135 calendar days to complete the work.

Klamath project, Oregon-California.—Two bids were received for furnishing a ditch-cleaning and excavating machine, as called for in specifications no. 774-D, opening at Denver on March 30. Standard Steel Works, Vernon, Calif., bid \$15,600 and Ruth Dredger Manufacturing Corporation, Los Angeles, Calif., bid \$17,890. The Standard bid did not conform to specifications and Ruth was awarded the contract on April 20.

Columbia Basin project, Washington.—Bids were opened at Denver, on March 30, for furnishing portal assemblies (item 1), bronze liners (item 2), and liner supports (item 3), as called for under specifications no. 772-D. The bids for the various items were as follows: Bartlett-Hayward Co., Baltimore, Md., \$13,600, \$7,600, \$300, combined, \$20,500; John W. Beam, Peotone, Ill., \$15,300, \$8,000, \$126, combined, \$22,920; International Engineering, Inc., Dayton, Ohio, \$16,872, \$7,125, \$225; Renter Bros. Iron Works, Chicago, Ill., \$29,070, \$10,780, \$207, combined, \$39,450, all f. o. b. Odair, Wash.; Commercial Iron Works, Portland, Ore., \$18,228, item 1, f. o. b. Odair; Allis-Chalmers Manufacturing Co., Milwaukee, Wis., \$43,732, \$24,580, \$256, all f. o. b. Odair; California Steel Products Co., San Francisco, Calif., \$13,670, item 1, \$164, item 3; Pacific Car & Foundry Co., Seattle, Wash., \$20,860, \$9,700, \$184, all f. o. b. Renton,

Wash.; Associated Piping & Engineering Co., Ltd., Los Angeles, Calif., \$14,354, \$10,185, \$378. California was low on item 1, International on item 2, and John W. Beam on item 3, and have been awarded contracts.

Twenty-one manufacturers and agents quoted on 980 tons of reinforcing steel for the Grand Coulee Dam, invitation no. 38229-A; bids opened at Denver on March 25. Bids were as follows: Carnegie-Illinois Steel Corporation, Gary, Ind., or Duluth, Minn., \$48,885.04, f. o. b. Odair, Wash.; Concrete Steel Co., Gary, Ind., or Duluth, Minn., \$49,766.66, f. o. b. Odair; Colorado Fuel & Iron Co., Minnequa, Colo., \$49,766.66 f. o. b. Odair; Soule Steel Co., Pittsburg, Calif., \$49,864.62 f. o. b. Odair; Laclede Steel Co., Madison, Ill., \$50,452.37 f. o. b. Odair; Sheffield Steel Corporation, Kansas City, Mo., \$50,844.20 f. o. b. Odair; Republic Steel Corporation, South Chicago, Ill., or Buffalo, N. Y., \$50,942.16 f. o. b. Odair; Truscon Steel Co., Emeryville, Calif., \$50,942.16 f. o. b. Odair; Inland Steel Co., Indiana Harbor, Ind., \$53,391.11 f. o. b. Odair; Paper Calmen-son & Co., St. Paul, Minn., \$54,370.69 f. o. b. Odair; Mercer Steel Co. Inc., Portland, Oreg., \$54,762.52 f. o. b. Odair; Marshall-Wells Co., Portland, Oreg., \$51,860.48 f. o. b. Odair; Youngstown Sheet & Tube Co., Youngstown, Ohio, \$56,819.64 f. o. b. Odair; Baxter Foundry & Machine Works, Boise, Idaho, \$56,819.64 f. o. b. Odair; Intermountain Equipment Co., Boise, Idaho, \$56,819.64 f. o. b. Odair; Marshall-Wells Co., Spokane, Wash., \$56,819.64 f. o. b. Odair; Building Supplies, Inc., Spokane, Wash., \$56,819.64 f. o. b. Odair; Northwest Steel Rolling Mills, Inc., Seattle, Wash., \$35,366.84 f. o. b. Seattle; Bethlehem Steel Co., San Francisco, Calif., \$35,366.84 f. o. b. Seattle; Missouri Rolling Mills Corporation, St. Louis, Mo., \$41,193.34 f. o. b. St. Louis; Concrete Engineering Co., Inc., Omaha, Nebr., \$32,428.09 f. o. b. Duluth. All bidders offered one-half of 1 percent discount on basing-point values, and all except Paper Calmen-son, Baxter, Northwest, Bethlehem, Missouri, and Concrete offered to equalize the greatest saving to the Government obtained by using land-grant rates from the shipping point of any other bidder. On the basis of lowest delivered cost to the Government, the bid of the Carnegie-Illinois Steel Corporation was low and contract was awarded on April 20.

Bids were opened at Denver on March 27 for furnishing motor-driven centrifugal pumps and control apparatus for pumping plants for cooling concrete at Grand Coulee Dam (specifications no. 769 D). Seventeen manufacturers quoted prices and the three low

bids received on each item were as follows: Item 1, three pumps, 500 g. p. m., 220-foot head, Dayton-Dowd Co., Quincy, Ill., \$1,620; Gardner-Denver Co., Denver, Colo., \$1,795 f. o. b. Coulee, Wash.; Dana E. Kepner, Denver, Colo., \$1,657.64, discount one-half percent, f. o. b. Trenton, N. J.; item 2, four pumps, 750 g. p. m., 220-foot head, Fairbanks Morse & Co., Kansas City, Mo., \$2,575 f. o. b. Beloit, Wis.; Gardner-Denver Co., \$2,896 f. o. b. Coulee, Wash.; Woodin & Little, Inc., San Francisco, Calif., \$3,020 f. o. b. Coulee, Wash.; item 3, three pumps, 1,000 g. p. m., 220-foot head, Fairbanks Morse & Co., \$2,770 f. o. b. Beloit, Wis.; Worthington Pump & Machinery Co., Harrison, N. J., \$2,762; Palmer Supply Co., Seattle, Wash., \$2,892 f. o. b., Battle Creek, Mich.; item 4, one pump, 1,500 g. p. m., 220-foot head, Woodin & Little, Inc., \$1,443 f. o. b. Coulee, Wash.; Ingersoll-Rand Co., Denver, Colo., \$1,268 f. o. b. Phillipsburg, N. J.; Palmer Supply Co., \$1,297 f. o. b. Battle Creek, Mich.; item 5, two priming pumps, 30 g. p. m., 40-foot head, Worthington Pump & Machinery Co., \$104; United Iron Works, Oakland, Calif., \$168, discount 2 percent; Woodin & Little, Inc., \$180 f. o. b. Coulee, Wash.

Twenty-one manufacturers bid on supplying steel hulls for pump barges (specifications no. 677-D), bids opened at Denver on April 7, as follows: California Steel Products Co., San Francisco, Calif., \$5,968; Omaha Steel Works, Omaha, Nebr., \$8,400; Puget Sound Sheet Metal Works, Seattle, Wash., \$6,800; Pacific Coast Engineering Co., Oakland, Calif., \$8,560 discount one-half of percent 1; Hydraulic Supply Manufacturing Co., Seattle, Wash., \$6,875 or \$7,275 f. o. b. Odair, Wash.; Wallace Bridge & Structural Steel Co., Seattle, Wash., \$11,821; King Bros., Portland, Oreg., \$6,068 f. o. b. Odair, discount 1 percent; Chicago Bridge & Iron Co., Chicago, Ill., \$6,450; Dravo Contracting Co., Pittsburgh, Pa., \$6,300; Pittsburgh-Des Moines Steel Co., Des Moines, Iowa, \$5,060, one-half of 1 percent discount; Columbian Steel Tank Co., Kansas City, Mo., \$4,764 discount 1 percent; Ingalls Iron Works Co., Birmingham, Ala., \$5,520 or \$6,730 f. o. b. Odair; Southwest Welding & Manufacturing Co. Inc., Alhambra, Calif., \$5,285; Commercial Iron Works, Portland, Oreg., \$9,468 f. o. b. Odair, discount one-half of 1 percent; Western Pipe & Steel Co., San Francisco, Calif., \$5,890; Virginia Bridge Co., Roanoke, Va., \$5,844 f. o. b. Birmingham; Lakeside Bridge & Steel Co., Milwaukee, Wis., \$5,854; Olson Manufacturing Co., Boise, Idaho, \$5,814.70 f. o. b. Odair; Marine Iron & Shipbuilding Co., Duluth, Minn.,

\$10,000; Bethlehem Steel Co., Bethlehem, Pa., \$6,892 f. o. b. Leetsdale, Pa.; John W. Beam, Denver, Colo., \$6,000 f. o. b. Peotone, Ill., discount one-half of 1 percent. The bid of the Columbian Steel Tank Co. was low on the basis of net delivered cost and the company was awarded the contract.

The following bids were received at Denver on April 9 for furnishing, under specifications no. 783-D, a railroad track scale, either one 4-section 60-ton capacity scale (item 1) or one 2-section 100-ton capacity scale; Winslow Government Standard Scale Works, Terre Haute, Ind., \$4,492 and \$6,309, discount 2 percent; Fairbanks, Morse & Co., Chicago, Ill., \$5,025 and \$7,632; The McDonald-Hunt Scale & Supply Co., Denver, Colo., \$5,042 and \$7,504; Buffalo Scale Manufacturing Co., Buffalo, N. Y., \$5,042 and \$7,828. All bids were f. o. b. Odair, Wash.

All-American Canal (Boulder Canyon) project, Arizona-California.—Nine contracting firms submitted bids under specifications no. 773-D, opened at Yuma, Ariz., on March 30, calling for road-mix surface treatment of construction highway, Laguna Dam to Imperial damsite, and of streets and parking areas in the Government camp at the Imperial damsite. Bids were as follows: R. E. Hazard & Co., San Diego, Calif., \$5,044.50; A. S. Vinnell Co., Los Angeles, Calif., \$6,212.80; Clyde W. Wood, Stockton, Calif., \$7,206; Tiffany Construction Co., Mohawk, Ariz., \$8,071; Triangle Rock & Gravel Co., San Bernardino, Calif., \$8,242.50; V. R. Dennis Construction Co., San Diego, Calif., \$12,783; David H. Ryan, San Diego, Calif., \$13,007; Pioneer Truck & Transfer Co., El Centro, Calif., \$13,325.20; Arizona Sand & Rock Co., Phoenix, Ariz., \$13,331.75. R. E. Hazard & Co. has been awarded the contract.

Four steel companies submitted identical bids of \$43,012.94 for furnishing and delivering f. o. b. Potholes, Calif., 1,438,560 pounds of steel sheet piling, under invitation no. 42461-A. The bidders were as follows: Inland Steel Co., Chicago, Ill., shipping point Indiana Harbor, Ind.; Bethlehem Steel Co., Bethlehem, Pa., shipping point Buffalo or Lackawanna, N. Y.; Jones & Laughlin Steel Corporation, Pittsburgh, Pa., shipping point Pittsburgh, Pa.; Carnegie-Illinois Steel Corporation, Denver, Colo., shipping point South Chicago, Ill. All bids were subject to a discount of one-half of 1 percent on basing-point values. Each bidder agreed to equalize freight rates, giving the Government the advantage of the greatest saving obtained by using Government land-grant rates from the shipping point of any bidder.

Rio Grande project, New Mexico-Texas.—On April 3 bids for construction of the Caballo Dam (specifications no. 672) were opened at El Paso, Tex. Seventeen contractors submitted the following bids: J. C. Maguire Construction Co. and Lawler Corporation, Butte, Mont., \$1,605,902.10; Lewis Construction Co., Los Angeles, Calif., and F. M. Bodenhamer, Oakland, Calif., \$1,132,745; Macco Construction Co. and Emsco Derrick & Equipment Co., Clearwater, Calif., \$1,106,251.50; W. E. Callahan Construction Co., Dallas, Tex., \$1,314,282.20; Walsh Construction Co., Los Angeles, Calif., \$1,549,227.50; Peter Kiewit Sons Co., Omaha, Nebr., \$1,065,842.50; Utah Construction Co., Morrison-Knudsen Co., Inc., and Paul J. Tyler, San Francisco, Calif., \$1,253,641.83; Mittry Bros. Construction Co., Los Angeles, Calif., \$957,018; Hinman Bros. Construction Co., Denver, Colo., and Ed. H. Honnen Construction Co., Colorado Springs, Colo., \$1,303,853; Benjamin Foster Co., Inc., Ocala, Fla., \$1,618,509.50; Hallett Construction Co., Crosby, Minn., \$1,235,022.23; J. P. Shirley, Los Angeles, Calif., \$1,272,353; Boyce-Igo Co., Yuma, Ariz., \$1,552,250; Lee Moor and Lee Moor Construction Co., El Paso, Tex., \$1,292,128; Martin Wunderlich Co., Jefferson City, Mo., \$1,046,899; S. J. Groves & Sons Co., Pecos, Tex., \$1,182,835; Robert E. McKee, El Paso, Tex., \$1,298,063.70. The contractor must complete the work within 700 days after date of receipt of notice to proceed. The Bureau will purchase, for installation by the contractor 1,580,000 pounds of reinforcement bars, 600,000 pounds of steel sheet piling, 8,300 linear feet of drainpipe, and 825,000 pounds of metalwork.

Central Valley project, California.—The Youdall Construction Co., San Francisco, Calif., with a bid of \$16,125, was low bidder on excavation for investigation of Friant dam site (specifications no. 775-D) bids opened at Sacramento on April 2. Other bids received were as follows: Case Construction Co., Alhambra, Calif., \$16,187.50; Milton A. Purdy, Oakland, Calif., \$16,999.65; Barrett & Hilp, San Francisco, Calif., \$26,090.

Yakima-Roza project, Washington.—J. A. Terteling & Sons, Boise, Idaho, was low at \$275,213.50 according to bids opened at Yakima, Wash., on April 13, for the construction of earthwork, canal lining, and structures, Yakima Ridge Canal, station 315 to station 567+81.5 (specifications no. 675). Other bids were as follows: Morrison-Knudsen Co., Boise, Idaho, \$288,552.50; L. Romano Engineering Corporation, Seattle, Wash., \$292,895; Martin Wunderlich Co., Jefferson City, Mo., \$298,902; Guthrie-

Vale Project Goes Forward

By Henry L. Lumpee, Assistant Clerk, Vale Project, Oreg.

On the Vale project, Oregon, a gratifying growth, varying in scope from a gain of 61 in the number of irrigated farms to a 100-percent increase in church buildings, took place during the year just past, a comparison between the project census of 1934 and that of 1935 shows.

Although the churches led the way in percentage of increase by raising their number from 5 to 10, other more material institutions also made good progress. At Vale, principal town of the Vale project and county seat of Malheur County, deposits in the bank of Malheur grew from \$259,346 in 1934 to \$323,000 in 1935, a reflection of the growth of the project and the establishment of new business concerns in the city as a result of that growth. New firms founded included a creamery, grocery, jewelry shop, restaurant, etc.

Business conditions in general improved markedly. Attendance at the theater, and patronage of public social affairs, was larger. Car loadings for 1935 topped those for 1934 by the difference between 417 and 359. Other towns on the Vale project, Harper and Jamieson, also made gains, with the result that according to the census the population of towns advanced during the year by 800 persons, or to a total of 2,000.

Irrigated project farms increased in number from 156 to 217, and their total acres cropped expanded from 5,858 to 6,944. Alfalfa was the most prevalent crop in 1934, retaining its leadership in 1935 by occupying approximately 56 percent, or 3,873 acres, of the total cultivated area of the project. Alfalfa was followed in number of acres cropped by wheat and barley.

In 1934 the farm population was 577, an average of 3.7 persons per farm. By the end of the following year the number of persons living on farms became 876, and the average per farm raised to 3.9.

McDougall Co., Portland, Oreg., \$311,947; P. L. Crooks & Co. Inc., Portland, Oreg., \$323,280; F. J. Kernan, North Portland, Oreg., \$329,542.50; Barnard-Curtiss Co., Minneapolis, Minn., \$341,781.

THE total value of livestock on the Vale project, Oregon, increased from approximately \$62,000 on January 1, 1935, to \$107,200 on December 31. Horses and mules led the way with an increase in number from 455 to 661, their gain in value amounting to \$20,605.

The growth of the project and its towns resulted in an acute overcrowding of the schools at Harper and Vale. To relieve this condition it was found possible to erect new school buildings at both of these places. The one at Harper was finished in the fall of 1935, and construction of the Vale high school structure was begun early in 1936.

Another notable step forward was taken when power lines were constructed through the irrigated portion of the project in 1935. Farmers are taking advantage of this convenience by purchasing electrical appliances in numbers, including such major ones as ranges, refrigerators, water heaters, etc.

Graham Boulevard, an important market road through the Bully Creek West Bench and Bully Creek East Bench units of the project, has been designated a secondary State highway. It is being improved and will be maintained by the State Highway Commission of Oregon.

That the past year's growth of the Vale project as sketched above is but the beginning of future improvements may be concluded from these facts: The 6,994 acres cropped in 1935 is less than one-fourth of the project, which comprises 30,000 irrigable acres; construction of laterals to lands composing the largest unit of the project, the Willow Creek unit of 15,000 irrigable acres, was begun in the fall of 1935 by C. C. C. members of E. C. W. Camp BR-45, and it is expected that water will be available for the major part of this half of the project by the latter part of 1936.

When the laterals are finished and water is available for all the Willow Creek unit lands, the Vale project may look forward to its period of greatest development, wherein the accomplishments of the year 1935, satisfactory as they were, undoubtedly will be surpassed.

Contractual Set-up

(Continued from p. 115)

Where it is desired to use the association form of organization for contracting with the United States in the construction of an irrigation project, it is believed desirable that provision be included in the Federal legislation authorizing the project or appropriating money for its construction that the repayment contract can be made with a water users association and not limited solely to an irrigation district.

Articles on Irrigation and Related Subjects

Boulder Canyon project:

Editorial on acceptance of dam March 1 by Government. Southwest Builder and Contractor, Feb. 21, 1936, vol. 87, no. 8, p. 9.

The Construction of the Boulder Dam on the Colorado River (in French), illus. LeGenie Civil, Feb. 22, 1936, vol. 108, no. 8, no. 2793, pp. 173-178.

Boulder Dam penstock passes test at one and one-half times operating head. Western Construction News, Feb. 1936, vol. 11, p. 37.

Transmission line to carry power from Boulder Dam, 270 mile line, illus. Western Construction News, Feb. 1936, pp. 38-39.

Handling world's highest voltage current at Los Angeles, illus. G. E. Benkesser, Southwest Builder and Contractor, Feb. 21, 1936, vol. 87, pp. 12-15.

Columbia Basin project:

Contractors build trestle in fight against raging river, illus. Construction Methods, Feb. 1936, vol. 18, pp. 34-36.

Grand Coulee Dam concreting plant is notable for design efficiency, illus. Western Construction News, Feb. 1936, vol. 11, pp. 31-36.

Conchos project:

Conchos Dam project opens in eastern New Mexico, illus. Western Construction News, Feb. 1936, vol. 11, pp. 44-45.

Ickes, Harold L.:

The Uses of Criticisms. Address, Union League Club, Chicago, Feb.

26, 1936. U. S. News, Mar. 2, 1936, vol. 4, p. 12.

Mead, Elwood:

Tribute to the late Dr. Elwood Mead. Cong. Record, Mar. 5, 1936, vol. 80, no. 45, p. 3324. (Address by Chas. P. Squires, Las Vegas (Nev.) Chamber of Commerce, Feb. 18, 1936. Inserted in the Record by Hon. Key Pittman, Mar. 3.)

Elwood Mead, biography and portrait. Excavating Engineer, Feb. 1936, vol. 30, no. 2, p. 93.

"Tribute to Service." Editorial on designation of reservoir formed by Boulder Dam as "Lake Mead." Eng. News-Record, Feb. 13, 1936, vol. 116, p. 258; news item p. 260.

"Elwood Mead Dies; the West Loses a Friend." Portrait, Western Construction News, Feb. 1936, vol. 11, pp. 29 and 59.

Parker Dam:

Tunnel progress at Parker Dam aided by large drill "Jumbo", illus. Eng. News-Record, Feb. 13, 1936, vol. 116, pp. 249-250.

Taylor, P. I.:

Sixty-six dams in United States are 200 feet or more in height. Table, Southwest Builder and Contractor, Feb. 21, 1936, vol. 87, no. 8, pp. 10-11.

High dams in the United States. Table, Western Const. News, Feb. 1936, vol. 11, p. 49.

Taylor Park Dam:

Taylor Park Dam progress during the 1935 season, illus. Western Const. News, Feb. 1936, vol. 11, pp. 50-51.

Excerpts From March Project Reports

Owyhee.—The planting of seed crops, especially vegetable and grass seeds, on an increased acreage is anticipated. Idaho canneries have also contracted for an increased acreage for the planting of peas and sweet corn for canning. Approximately 1,000 acres have been signed up for the growing of sugar beets. The supply of hay in the county is practically exhausted.

Minidoka.—A total of about 10,300 acres on the project has been signed up by the Amalgamated Sugar Co., of which area 5,600 acres are on the gravity division, and 4,700 on the pumping division.

A movement has been started to merge the Cassia County Sheep and Wool Marketing Association and the Cassia Swine Pool. Last year livestock and wool growers were paid a total of \$93,884 for their products, which included 75,191 pounds of wool, 3,886 head of sheep and lambs, and 3,148 head of hogs. About 15,000 fleeces is the expected clip for 1936.

Milk River.—The hay market continued strong with prices improving slightly over the February high. Shipments reported were principally intra-project.

Shoshone.—Livestock has come through the winter in good condition. Six carloads of cattle and 12 carloads of sheep were shipped from Powell during the month.

Yuma auxiliary.—During March 106 carloads of packed grapefruit were shipped to Pacific coast and Midwestern markets, and the equivalent of 38.4 carloads of packed fruit was shipped by truck to the Pacific coast. In addition to the above 3 carloads of oranges were shipped by rail and an equivalent of 12.1 carloads by truck.

Klamath.—Heavy shipments of potatoes continued throughout the month, and at the end of the month shipments for the season totaled 3,750 cars. There is a heavy demand for seed potatoes. All livestock is in excellent condition, with the price of top steers averaging about 6½ cents.

Mrs. Ella S. Tuttle, Retired

At the close of business on March 31, 1936, Mrs. Ella S. Tuttle, assistant clerk



on the Sunnyside division of the Yakima project, was retired. Mrs. Tuttle entered the Sunnyside office as stenographer on December 9, 1910, and here she spent her entire official life of more than 25 years. In all this time she averaged sick leave of slightly over 3 days per year. To her friends and associates she was, on the day of retirement, as she has been for years, a marvel of sturdy good health and mental alertness.

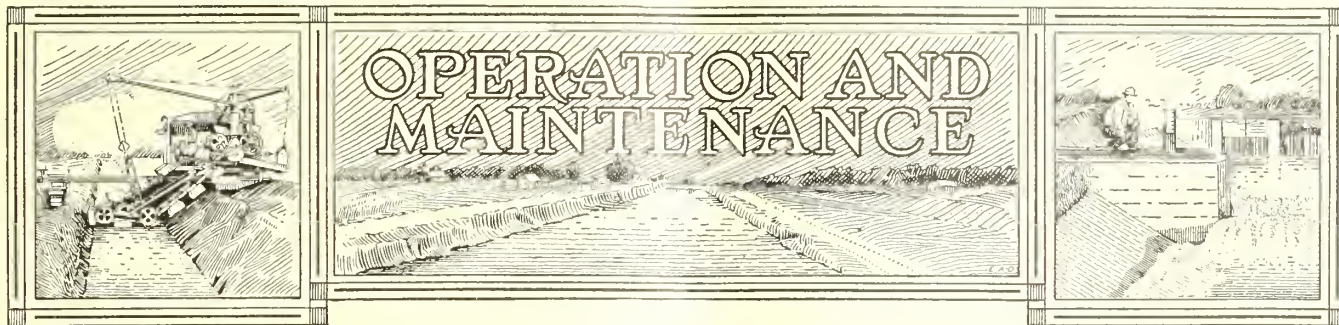
Before coming to the Sunnyside office, Mrs. Tuttle was employed as chief stenographer by the Pacific States Telephone and Telegraph Co. at Spokane.

Many affairs in Mrs. Tuttle's honor are being held in Sunnyside. On March 17, her birthday, the employees of the Sunnyside division gave a dinner for her at the Planters Hotel; 75 fellow employees on the project, and a few former employees, with their wives were present.

An appropriate gift was also presented to the honor guest.

Mrs. Tuttle will not be missed by the project organization alone. She has been always active in many community organizations, and is a charter member of the American Legion Auxiliary; she has held elective and appointive offices in the Eastern Star; she has been recording secretary of the Business and Pro-

(Continued on p. 131)



Feed the Plant and the Plant Will Feed You

By L. H. Mitchell, Field Supervisor in Charge of District No. 4

WHEN this issue of the Era arrives at the homes of our farmers some may be undecided what to do with a particular tract of land. Many conditions, such as winter killing of alfalfa, insufficient seed, a poor stand, frost damages, and many others, may necessitate a last-minute change in a program, and even if such conditions do not present themselves, serious consideration should be given to the old tried and true plan of devoting some portion of a farm each year to improving the soil fertility. Using a more modern term, soil conservation can be practiced to the benefit of many farms on most of the Bureau projects.

The question is often asked by one not familiar with the arid West: Does not the irrigation farmer have to contend with winds and excessive moisture that erode the soil? Fortunately an irrigated farm in the main does not suffer the ravages of floods or the expensive and unpleasant hazard of drought followed by dust storms, both of which have recently taken many lives and destroyed a large amount of property. Floods or drought occur nearly every year somewhere in the country. But with irrigation, where the water is controlled by man, and by planting windbreaks at proper intervals, when soil movement on account of prevailing high winds is the rule, there is no good reason for soil depletion on account of these acts of God.

SOIL FERTILITY CAN BE MAINTAINED AND IMPROVED

Soil fertility can be and is being depleted by acts of man. Irrigation farmers may be divided into two classes, namely the soil robber and the soil builder. The former depletes the soil through improper application of water. On every irrigated project there are fields where, on account of steep grade, some of the loose top soil fertility can be easily washed away if the irrigation water is not prop-

erly applied. When small particles of soil moving with the water can be seen, especially when irrigating in furrows or by the corrugation system, an old rule of the practical irrigation farmer is being broken. The soil robber plants and harvests but he never replaces any of the fertility used by the plant in the process of manufacturing a crop. The soil builder applies fertility either with barnyard manure, green manure, or commercial fertilizer, or a combination of these.

Green manure, although perhaps the least expensive to apply, is probably applied less than any other fertilizer. The main reasons for this, when following a proper application of green manure, are the loss of 1 year's cash crop and in some instances the lack of knowledge as to the crop yields. A good example of what can be accomplished with sweetclover for green manure has been demonstrated on the Milk River project in Montana. A field was seeded to grain and sweetclover in 1932. The following year the first crop of clover was harvested for hay. The second crop, when about 2 feet high, was plowed under. Following this the field was irrigated to facilitate decomposition of the green plants. Early in 1934 the field was dragged to make a mulch and conserve the moisture. Before planting the beet seed, phosphate was applied with a drill. Germination of the beet seed was prompt and the stand of beets was perfect. This field did not need irrigation until July, while about 90 percent of the beets on the entire project had to be irrigated up. Fifty acres of the beets yielded an average of a little more than 20 tons per acre, or practically two crops in one season. Realizing that this added soil fertility would be available for several crops, we do not need a large sheet of paper or a slide rule to determine whether this plan of soil building paid. This system of farming, although in the nature of an experiment with some, demonstrated conclusively that the old saying, "Feed the plant and the plant will feed

you", is especially true with the proper handling of green manure.

Since the above-mentioned procedure of soil building has been carried out, Mr. G. H. Bingham, now extension-irrigation specialist for Montana, recommends the following procedure for the best results with sweetclover as a green-manure crop.

1. Seed 15 to 20 pounds of perennial white sweetclover seed per acre with a grain nurse crop and irrigate thoroughly so as to insure a good stand.

2. Irrigate at least once after the grain crop is removed in order to stimulate the growth of the sweetclover the first year.

3. Irrigate sufficiently the second year so as to get a dense rank growth.

4. Plow under the first crop of sweetclover about July 1, so that there will be 2 months of hot summer weather to thoroughly decompose the sweetclover. (Most folks cut the first crop for hay and plow the second crop under sometime in August. This practice does not allow sufficient time for proper decomposition of the rank sweetclover growth. Farmers are therefore being urged to plow under the first crop for green manure instead of the second.)

5. The ground should be moist when plowing so as to insure a satisfactory job.

6. Plow deep enough to cover the clover thoroughly.

7. Immediately following plowing, the ground should be thoroughly harrowed in order to pack the surface and prevent moisture evaporation.

8. Irrigate the field immediately after harrowing so as to provide ample moisture for the decomposition process.

9. Complete all seed-bed preparation such as leveling and harrowing during the late summer and fall so that the seed bed need not be disturbed in the spring.

A few of the reclamation projects have experimental stations of the United States Department of Agriculture and a few of

(Continued on p. 125)

Emergency Conservation Work, Yuma Project—Arizona-California

By R. C. E. Weber, Superintendent, Yuma Project

EMERGENCY Conservation Work Camp BR-13 was constructed on the Yuma Mesa some 6 miles from the city of Yuma during the summer of 1935 and was occupied by a company of enrollees early in November of last year.

Originally, the program of work outlined for the camp provided almost exclusively for the rehabilitation of the canal and lateral systems in connection with both the Yuma and the Yuma Auxiliary projects. It later was expanded to include some reconstruction and extensions of the project telephone system, when it was found that there were a number of experienced linemen among the camp enrollees, as well as work of rodent control.

The program was planned with a view to performing urgent work on the project

system, which had been deferred during the depression period in the interest of reduced operation and maintenance costs, rather than for the purpose of using the camp forces to replace regularly employed maintenance crews of the project. To have followed such a policy would have added to the problem of local unemployment.

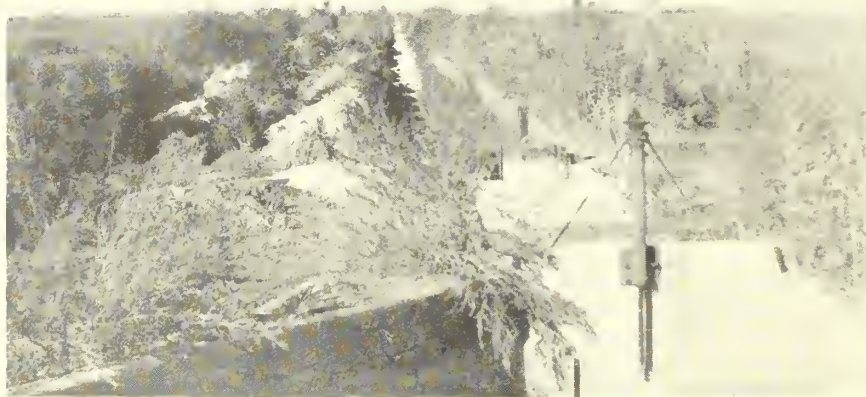
Work was started on November 12, 1935, shortly after the camp was occupied, and has continued steadily with interruptions only of minor duration because of light epidemics of sickness, together with a few days of inclement weather. Some lack of progress was occasioned during the early part of the camp period by a shortage of trucks for transporting the men from camp to the work and later by the company enrollment falling consider-

ably below full strength. All factors considered, however, progress and accomplishment of work were satisfactory.

CLEARING CANALS AND LATERALS

The major portion of the program of work was devoted to clearing and grubbing on canals and lateral rights-of-way, in connection with which only such work as was imperatively necessary for operating the system had been done by the project maintenance forces during the past 5 or 6 years. As a result, some of the canals and laterals were overgrown with trees and brush to the extent that clearing was prerequisite to operation of Ruth ditch-cleaning equipment in many locations. (See accompanying photographs.) In the prosecution of the E. C. W. clearing program, it was performed with the purpose of accomplishing a thorough job to the end that some degree of permanence would attach to the work when completed. With this in view, trees and brush were carefully grubbed and cut below the crown of the root system, the material piled and subsequently burned, leaving the premises in a neat appearance as well as in a condition to facilitate operations of mechanical cleaning equipment, such as dragline excavators and Ruth dredgers. The results of this work also left the rights-of-way in a more suitable condition for the trapping of burrowing animals such as gophers and muskrats, as well as making the areas less attractive sanctuaries for these troublesome rodents.

Included in the Yuma project telephone system are 200 miles of lines, serving the various ditchriders and watermasters in charge of making water deliveries to farmers, the Siphon Drop power plant, the two pumping stations, Laguna Dam, and the project headquarters office and shops, as well as points along the Colorado River front work and levee system. As was done on other maintenance work, telephone line repairs in recent years were drastically curtailed to effect greater operating economy. Consequently, the condition of the lines was such that there was much repair to which the E. C. W. linemen could be assigned. Some lines were relocated where past operation had indicated this to be desirable. On other lines, decayed and damaged poles were replaced with new ones and the wire restretched in order to place the lines in first-class condition. The work has resulted in greatly improved telephone service for the project operating force in facilitating the distribution of water to farmers.



Lateral before and after cleaning.

RODENT CONTROL

Burrowing animals, mainly gophers and muskrats, are a constant menace to the safe operation of the project canal and lateral systems as an ever-present source of breaks with resultant damage to private property and project irrigation works as well as delays and interruptions in water deliveries. Unfortunately, because of unavoidable delays, it was not possible to begin the program of rodent control by E. C. W. labor as soon as had been intended. Work was started late in February 1936, under the direction of a foreman recommended by the United States Biological Survey on account of his experience in this particular line of work. Operations were confined to trapping gophers and the work for the most part closely followed the clearing operations. The work performed has been very desirable and useful in the exterminating of a large number of gophers, reducing in some measure the possibility of further breaks in the distribution system as a result of their depredations.

There has been a sentiment on the part of the project water users decidedly favorable toward the work which has been accomplished by the Yuma E. C. W. camp enrollees. The business men of Yuma have similarly looked with favor on the presence of the camp in the community. Local interest was manifest when reports were received that the camp was to be disbanded, at which time representations were promptly made to various Government officials at Washington by organizations of Yuma water users and business men, strongly urging that the camp be continued.

The number of men available for field work has varied from about 75 to 145. A summary of the work accomplished on the Yuma and the Yuma Auxiliary projects by the local E. C. W. camp since inauguration of work in November 1935, to the close of March 1936, is as follows:

Cleaning and grubbing of 490 acres on 34 miles of canal and lateral rights-of-way.

Ninety-two miles of telephone line reconstructed and wire restrung.

Four hundred and fourteen acres trapped on 30 miles of canal and lateral right-of-way, on which 1,708 gophers were caught.

Work valuation of what has been accomplished with relation to the foregoing has been conservatively estimated as approximately \$19,000, a sum somewhat incommensurate with its intrinsic worth and utility as related to the benefits insuring to the future operation and maintenance of the project irrigation system.

Feed the Plant

(Continued from p. 123)

the farmers on those projects take advantage of the benefits derived from the various experiments. All projects have a variety of soils. Even on a single farm there may be several types of soil. For these reasons alone it is suggested that every farmer do at least a small amount of experimenting with the various ways of fertilizing. By this it is not meant that a considerable acreage is needed for experimental purposes. The cost of such experiments would be very small and our farmers could then tell the practicability of any soil-building program on his particular place and system of crop rotation. Seeing a neighbor or a United States Experiment Station do certain things, with results obviously highly beneficial, is valuable information, but for a farmer to put such or similar pro-

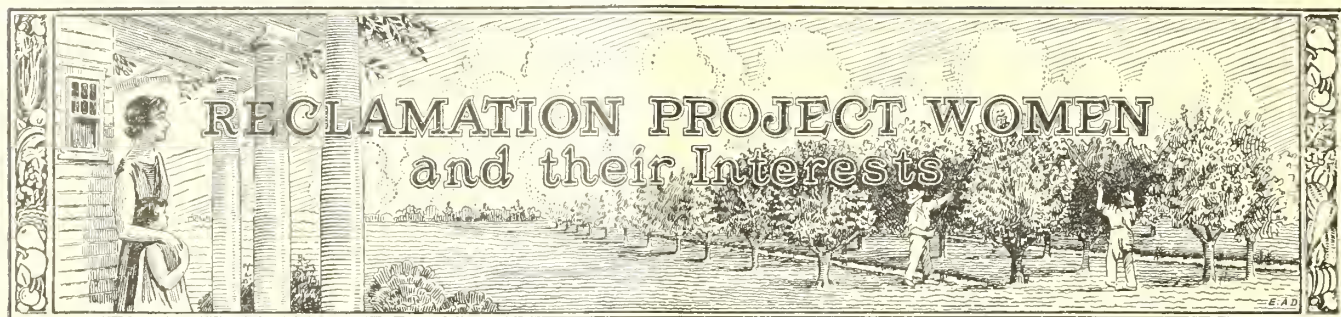
cedures into actual practice under a practical set-up is quite another thing. We can hear an attorney plead a case or see a physician perform an operation; we can read volumes about these subjects and yet not be able to handle successfully the simplest of cases. The same is true about soil improvement.

AT a recent meeting of the Hyrum Fish and Game Association held at Hyrum, Utah, ways and means of stocking the Hyrum Reservoir with fish were discussed. Representatives of the Utah State Fish and Game Commission were present.

EMPLOYMENT conditions on the Moon Lake project, Utah, are now better than they have been for the past 2 or 3 years.



Canal before and after cleaning.



E. R. A. Production Garden and Cannery on the Shoshone Project

By Miss Irene Wolden, Clerk, Bureau of Reclamation, Powell, Wyo.

IN THE fall of 1934 a production garden and canning project was held in Powell, Wyo., under the Emergency Relief Administration. The production garden, which was located near Powell, consisted of 20 acres each of green beans and dried beans. When the beans were ready for canning, they were taken to the factory at Powell. The E. R. A. furnished the building, canning equipment, and cans; and labor was obtained from the local relief roll. In addition to canning the products raised on the production garden, canning was also done for people on the relief rolls without cost providing they helped with the labor. People not on relief who desired articles canned were allowed to do so without cost, providing they helped with the labor and donated 25 percent of their products to the local cannery. Beans and apples were the only articles canned in 1934.

This project was so successful that the plan was enlarged for 1935. The production garden was increased to 40 acres each of dry beans and green beans. About five men were employed for approximately 1 month in planting this garden, getting it into shape, etc. Thirty men and women were employed during the harvesting season which lasted about 5 weeks. Forty-five thousand pounds of

dry beans were harvested, and enough green beans were obtained to fill 95,000 no. 2½ cans.

When the beans reached the proper stage for canning, the local E. R. A. cannery was put into operation. About 80 women and 10 men were employed for a period of 5 weeks in canning the 95,000 cans of beans. The equipment used consisted of steam-pressure retorts and a large automatic can sealer. Three carloads of cans were used during the process of canning.

Local people not on the relief rolls who desired to can were also given assistance by the E. R. A. Canning meetings were held at the several small clubhouses located near Powell. The women in each district met at their respective clubhouse and together did their canning, the E. R. A. furnishing the cans and necessary equipment. Where the women helped with the labor, they gave 25 percent of their canning to the relief cannery. Those who did not help with the labor were required to give 35 percent to the cannery. Beans, peas, corn, tomatoes, etc., were canned at these gatherings.

Powell furnished the entire supply of canned and dried beans later used for distribution to Wyoming people on the relief rolls. Similar canning projects

were held at Sheridan, Torrington, and Riverton, in Wyoming. Sheridan canned carrots, greens, and meat. Riverton canned additional carrots and kraut. Torrington supplied only canned corn. All these canned articles were sent to Thermopolis and Casper for distribution over the State where and when needed.

Powell was allowed a 40 percent share of green and dry beans, and similar arrangements were made with other canneries. When final distribution was made to Powell they received not only dried and green beans but also a fair share of the corn, carrots, greens, meats, etc., produced at the other canneries, to what would amount to practically 40 percent of their bean production.

This was a very successful project. It provided people on the relief rolls with canned vegetables and meat during the winter. It gave the local women not on the relief an opportunity to can to much better advantage than if they worked alone in their own kitchens. The production garden and cannery provided people on the relief rolls with employment. It was especially valuable in providing employment for local women on the relief rolls for whom it is difficult to obtain suitable work projects.

Fifty Thousand Turkeys

By Elizabeth Buttler, Klamath Falls, Oreg.¹

OF INTEREST to the poultry market comes this announcement: Two miles north of Malin, Oreg., in the heart of the Klamath project, an organization consisting of Oscar Kittridge, Dan and D. D. Liskey, and Henry Nichol, has built brooders to house day-old turkeys on an extensive scale—that means 50,000 turkeys will be turned out!

This necessitates three brooder houses, each 34 feet wide by 200 feet long. An

oil burner supplies the steam heat for these houses.

The first brooder holds 8,000 poults. Here they are kept on tables 8 feet long by 34 inches wide with 12-inch sideboards. One end of each table is covered with turkey board, an artificial mother; that is, a board having turkey feathers attached in such a way that they hang down. This board is placed over the troughlike table and here the poults cuddle for 2 weeks.

Then they progress to brooder house 2. Its outward dimensions are the same as the other, the difference being on the inside. It is divided into 10- by 10-foot pens, each of which has a small opening that permits the young turkeys to reach an attached sun porch, which is 10 by 16 feet.

At no time during their 2 weeks stay here are the poults allowed to touch the earth; they are kept on hardware cloth 3 feet off the ground.

¹ Data furnished by Henry Nichol.

Brooder no. 3 now awaits the turkeys for another 2 weeks stay. It differs on the inside in that its pens are 20 by 10 feet, which in turn have access to sun porches 20 by 50 feet, enclosed by wire netting and having a floor of earth.

Now the 6 weeks' old poults will move on to a tent that accommodates 4,000 turkeys, to spend an additional 2 weeks.

These tents, three brooders, a warehouse, two dwellings for brooder men, and a pump house are located in a cove which is protected from cold winds. This particular spot is peculiarly adapted to this purpose as it was once a lake bed. Sand, gravel, and shells abound; grain and alfalfa fields thrive; and two railroads, the Southern Pacific and the Great Northern, are in juxtaposition.

TURKEYS EAT GRASSHOPPERS

The 8 weeks old turkeys will be loaded into a truck. The truck bed is composed of nine decks which carry 1,400 birds at one time. In this they are hauled to grasshopper-infested areas to range in flocks of 3,000 each. Two men and two dogs care for this number of birds. The men live in a camp similar to a sheep camp.

Roosts consist of saw horses from which poles extend. This space will be canvas covered.

Over these grasshopper districts the birds will move, devouring the insects and supplementary food, such as grain.

Last year, C. A. Henderson, agricultural agent for Klamath County, estimated that 2,500 turkeys consumed a half ton of grasshoppers a day. This enterprise is an outgrowth of the combination grasshopper control-turkey growing program that was undertaken last year in Klamath County.

The turkeys are ranged according to this routine until September. Then they will be moved to stubble at Tulelake, Calif., just over the Oregon line and adjacent to Malin, Oreg.

The day-old poults come from Dr. R. A. Duganne's hatchery at Independence, Oreg., in 4,000 lots, beginning April 23 and continuing until August 1, when 50,000 turkeys will have been turned out.

The first 35,000 will be handled as mentioned; the last 15,000 will move as designated until it comes time for stubble, then they will be trucked to California rice fields to fatten.

The first lot will be ready for the Christmas and New Year's market, while the latter will care for February and March demands.



Small brooder house on the Geary ranch—feeding time.

Inasmuch as three of these men, in association with four others, successfully put 25,000 turkeys through last year, it is not a venture but a proven accomplishment.

The brooders last year, although a great success, were quite rudimentary as compared with these new, modern structures. These are permanent, being built with double walls, solid sheeting, and composition roofs.

The business serves many purposes as the eradication of grasshoppers saves Klamath County money that would necessarily be spent for poison, and also saves the farmer his crops. Then, too, it provides employment to many, utilizes grain and rice stubble, and puts turkeys on the market that are fine-grained as to meat, uniform in size, and delectable.

All of the men in the Crater-lake Mountain Turkey Co. are interested either in farming or cattle raising under the Klamath project.

Other farmers of the district bought from this organization 6- or 8-week-old poults and ranged them on their own land, or as last year they got range permits and ran the turkey herds on "egg-beds."

In many instances women have taken advantage of these advanced methods in turkey raising with outstanding results. A young son thrills to it and an older sister shares in the profits, for while the boys do the herding the girls drive the "whoops" to the camp with home-cooked food and the supplementary feed for the poults. This sister I speak of does the bookkeeping, for no angle of the business is overlooked.

In the fields or in his office you can find the county agent, C. A. Henderson, advising with these growers. There is no restraint; the conversation does not sound like a lot of statistics—they just

visit about this feed, or that gain or loss and each is learning, passing on the results of his experience and so are taking the work out of theory into practice.

Progress of Investigations of Projects

Silt survey—Colorado River, Ariz.-Calif.—Field investigations have been completed. A series of 18 monumented cross-sections have been carefully surveyed, with the maps thereof on file at the Denver office. Following closure of the Parker Dam, these sections will be reviewed to mark any changes. Wash borings are expected to be made in the vicinity of the Blythe intake to lay the ground work for the design of a diversion plan in the event that quick action should become necessary in future years to avoid interruption in irrigation service for the Palo Verde district.

Grand Lake-Big Thompson Transmountain Diversion project, Colorado.—The project is for the purpose of furnishing a supplemental water supply for the lands now irrigated by the Poudre, Big Thompson, St. Vrain, and South Platte Rivers in northeastern Colorado. The type of agriculture carried on in these areas is such that a late supply of water is extremely valuable, but cannot be secured from the streams therein. The plan of the proposed diversion contemplates a tunnel 13 miles long extending from the Colorado River near the outlet of Grand Lake to a point southeast of Estes Park, discharging into Wind River, a tributary of Big Thompson. The water will be passed through power plants along the Big Thompson for the production of power for pumping and sale. A diversion canal will conduct the water to storage

reservoirs west of Berthoud and from there it will be taken to the Big Thompson, Poudre, and St. Vrain Rivers by means of outlet canals. On the western slope a diversion dam will be built on the Colorado River, from which water will be diverted into the tunnel. The water level back of the dam will be automatically controlled at the level of Grand Lake. Below this dam, near Granby, Colo., there will be a storage reservoir which will impound the flood waters of the river. These waters will be pumped back to the tunnel inlet during the period of low natural flow, with power supplied from the power plants on the eastern slope. The Granby Reservoir will furnish hold-over capacity for supplying irrigation demands during a series of low years. Control surveys on the investigation have been largely completed, and work is in progress on the surveys of dam and reservoir sites and canal and power lines. Water supply studies have been made for the project, including the capacities required in compensating reservoirs for western slope water users.

During the month plane-table work was in progress on the east side of the mountains, covering reservoir sites and canal and power lines. Field reconnaissance was made of several existing reservoirs in the area with a view to possible enlargement. Geological studies were continued, and office computations were carried on throughout the month.

Boise (Boise-Weiser-Payette), Idaho.—A comprehensive investigation of the watersheds of Boise, Payette, and Weiser Rivers in southwest Idaho to ascertain ways and means of augmenting scanty water supplies and extending irrigation development, including transmountain diversions from the Salmon River watershed and the development of necessary power supplies to enable utilization by pumping of waters not otherwise usable is in progress. A report being prepared in the Denver office will be completed at an early date on the initial phases of these investigations comprising: (a) Recovery and utilization of ground waters within the Boise project by pumping for the dual purposes of drainage and augmented irrigation supplies; (b) pumping from Snake River to the Deer Flat Reservoir on the Boise project; (c) power development at Arrowrock Reservoir to furnish power for pumping; (d) storage and power development at Twin Springs site, 15 miles above Arrowrock Reservoir, to provide augmented storage capacity, and power for pumping with firm power sold for commercial purposes to assisting project repayment; and (e) bringing up to date the report of June 1932 on Salmon River diversion.

Gallatin Valley investigations, Montana.—The Gallatin Valley, with a gross area of 126,000 acres, apparently by soil, topographic, and climatic conditions well suited to intensive cultivation, has possibly 75,000 acres irrigated and much of that poorly watered. Of the remaining area a large part has been irrigated at some time but is now seeped and abandoned. The investigation comprises: (a) Survey and investigation of reservoir sites; (b) land classification of the arable lands; (c) studies of ways and means of reclaiming valley lands now abandoned and of irrigating lands now arid; and (d) plans and estimates for the construction of storage, distribution, and drainage works.

Field work was initiated in September 1935. Following a reconnaissance of reservoir sites, attention was centered on the Lower Basin site on West Gallatin River about 30 miles southwest of Bozeman. Diamond drilling was carried on through the winter and is now completed with test-pit exploration well advanced. Water-circulation tests with fluorescein indicate connected passages through the limestone rocks forming the site. Storage will surely be relatively expensive. Other winter work was limited to office studies, heavy snows precluding other activities. Field work will be resumed in April with completion of the investigations contemplated late in 1936.

Investigations of Saco Divide, Milk River project, Montana.—An allotment of \$10,000 has been made from the reclamation fund for the investigation of the cost and feasibility of irrigating 8,000 acres on the Saco Divide, near the town of Saco between the Nelson Reservoir canal and Milk River by pumping from that canal, now in progress. The promoters of this development propose to secure power for pumping by means of natural gas available at moderate depth in the vicinity. The irrigable area is now dry farmed, and with irrigation, would become one of the most productive areas on the project. A report on the engineering and economic feasibility of the project will be made about June 1.

Madison River diversion, Montana-Idaho.—An investigation on the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henrys Lake, Idaho, is being made. Field surveys on these investigations have been completed. Water supply studies to determine the amount of water available for diversion will be completed upon receipt of data. Surveys of the required 8-mile tunnel were carried out in October and November 1935. A geologic reconnaissance was made. The preliminary report indicates a feasible tunnel site with a cost of \$6,000,000 in-

cluding contingencies, etc., and a possible annual yield of about 500,000 acre-feet provided arrangements can be made for taking this water which is now largely in use, principally for power purposes.

Deschutes investigations, Oregon.—The investigations comprise: (a) Comprehensive investigation of all reservoir sites in Deschutes Basin above Bend, Oreg., to furnish supplemental water for present canals and for irrigation extension; (b) investigation of north unit, including land classification, most practicable canal line diverting near Bend to serve these lands, and plan and estimates for the distribution system. This investigation also includes consideration of alternative plan for pumping from Deschutes River opposite the lands with a high lift direct connected plant; (c) storage on Crooked River to furnish supplemental water for the Ochoco and other constructed projects. Field work is now practically complete and the final reports on all three features of the investigation is anticipated in May. During March the field parties completed the land classification of the north unit, the results of which were being compiled at the Bend office, with completion thereof anticipated for April 15. Field data on canal locations for that unit were also secured. At the Denver office a plan and estimate were prepared for the diversion dam on the canal to serve Ochoco project lands from Crooked River.

Black Hills investigation, South Dakota.—This is an investigation of streams leaving the eastern and northern slopes of the Black Hills, including the Belle Fourche and Cheyenne Rivers, with a view of irrigation extensions and supplementing the supply for existing canals. The areas now receiving principal consideration are: (a) Johnson lateral lands of Belle Fourche project and private canals in that vicinity; (b) Rapid City area along Rapid Creek with storage possibilities near Deerfield and southeast of Rapid City; (c) Angostura project.

Prevalence of snow throughout March limited the work to the establishment of a number of gaging stations on Rapid Creek and canals diverting therefrom, which after operation through the current irrigation year, will show the relation of surplus waters to a station record of some length a few miles above Rapid City. In April the investigation will be extended to reservoir surveys on the Rapid City project and to a review of the Angostura project to ascertain the possibility of an improved project plan.

Salt Lake Basin investigations, Utah.—Projects now included in the investigations are: (a) Ouray project, contemplating the rehabilitation and extension of a

project of possibly 10,000 acres immediately northwest of Ouray, Utah; (b) feed canal from Currant Creek to Strawberry Reservoir, to augment the water supply for the Strawberry project; (c) Gooseberry project, a reservoir at the head of a tributary of Price River, to facilitate a transmountain tunnel diversion to the Sevier River watershed; (d) Dixie project on the Ouray project, stream discharge observations extending over the past 2 years are complete as are the canal surveys and water-supply studies. Land classification is completed as to field work as a part of the work under section 15, Boulder Canyon Project Act, but a disagreement with results of a separate classification by the State awaits harmonizing, following which a report will be prepared. Field surveys on the Currant Creek feeder were interrupted by winter and will be resumed in late May or June. The survey was originally requested by project interests in the hope of securing a larger water supply from Currant Creek than now received from the small canal built by C. C. C. forces. Results so far indicate a project with a high-water cost and possibly infeasibility. A report on the Gooseberry project was issued in

May 1933. At the request of the State engineer, the water-supply study for this project is to be brought up to date.

Dixie project investigations, Utah.—An intensive, 1-year program of stream and canal gaging, with silt sampling, is under way to ascertain surplus waters available in the vicinity of St. George, Utah, in relation to stream flow recorded over a number of years at Virgin, Utah, to be completed late in 1936 or early 1937. If the results are attractive, it is expected that the investigation will then be enlarged to cover the construction of a project, the feasibility of which may be defeated by the small surplus of waters, silt-control difficulties, and limited areas of suitable land. The water-supply and silt investigations previously initiated were continued during the month. A land-classification survey of the lands proposed for irrigation is now in progress as a part of the work under section 15 of the Boulder Canyon Project Act and will probably be completed as to field work in 2 or 3 weeks. A survey will also be made of the areas now irrigated in this section of the Virgin River Basin.

Hawaii water-supply studies, Hawaii.—These investigations were undertaken for

the purpose of determining the amount of land for which an irrigation supply may be developed on the island of Molokai. The Hawaiian Homes Commission is administering the public lands in this area and developing homes and irrigated farms for the native Hawaiians. The particular phase of the problem under the jurisdiction of the Bureau is the determination of the amount of water that can be brought from the steep north slopes of the island to the more gentle south slopes which are suited to farms. A thorough examination of the watershed is necessary in order to determine the available supply of water and the proper points of diversion. Triangulation stations must be relocated and marked and new ones established to serve as control for an aerial survey which will be made by the Army Air Corps. Gaging stations will be established at different points along the streams so that the available supply at any point may be determined. Trails must be cut through the forests, and it is this work and the location of triangulation stations which have taken most of the time from the initiation of the work in December up to the end of February.

Operations of the Bureau of Reclamation in Colorado

THE Bureau of Reclamation was created under the Department of the Interior by the act of Congress approved June 17, 1902, for the purpose of making examinations and surveys for and constructing and maintaining irrigation works for the storage, diversion, and development of waters for the reclamation of arid and semiarid lands in the 16 States located west of the one-hundredth meridian, of which Colorado is one. By later acts of Congress the Reclamation Act was extended to the State of Texas, and the scope of its work broadened to include the development and sale of electric power in conjunction with irrigation works.

For the purpose of financing the work of reclamation, the original act provided for setting up a revolving fund, known as the reclamation fund, derived initially from the sale of public lands. By later acts, revenues from other sources, such as royalties from oil, sale of electric power, etc., were included. The act requires that all money expended in irrigation works shall be repaid by water users and others benefiting from such works, thus making the fund revolving.

Irrigation, naturally, first started on valley lands adjacent to streams where individuals could with some labor and little expense divert the natural stream

flow by gravity to their lands. Many such streams, although in flood at certain seasons of the year, dried up or had insufficient flow during periods of drought, usually at the critical time for crop production. Individuals did not have the means to build the large storage dams necessary to conserve flood waters against the time of drought, nor did they have the means to build large and expensive canals to convey the water onto the higher tablelands. By doing these things which the individual or group of individuals could not do, the Bureau of Reclamation has saved the crops under existing irrigation systems and has opened up new lands to agriculture. In connection with several projects, hydroelectric power plants have been built, providing cheap power for construction work, for pumping water to lands which could not otherwise be irrigated, for lighting homes, for operating farm machinery, and for the many uses to which electric power can be put. All projects must be self-liquidating.

RECLAMATION'S EXPENDITURES

From its beginning in 1902 until September 1933, the Bureau had expended in the examination, construction, and operation of irrigation and power projects, in all States and including Boulder Dam, approximately \$321,000,000. In Sep-

tember 1933 and through subsequent months approximately \$104,000,000 was allocated to the Bureau of Reclamation from N. I. R. A. funds for use in an enlarged construction program for the main purpose of providing immediate unemployment relief, although this amount was later reduced to approximately \$95,000,000. To date about \$73,000,000 of this allocation has been expended and the remainder largely obligated. Under the Emergency Relief Act of 1935, \$81,150,000 additional was allocated the Bureau to continue this enlarged program to June 30, 1937. The latter amount has since been reduced to approximately \$75,000,000, of which approximately \$8,000,000 has been expended and one-half or more of the remainder obligated.

Prior to inauguration of the enlarged program in 1933 the principal achievements of this Bureau in the State of Colorado were the construction of the Uncompahgre and Grand Valley projects, both on the western slope. About \$9,000,000 has been expended in the construction and operation of the former and nearly \$6,000,000 in that of the latter. For Colorado the enlarged program with N. I. R. A. funds includes \$2,000,000 for construction of Taylor Park Dam and Reservoir in Gunnison County, \$325,000 for rehabilitation of

the irrigation system of the Uncompahgre project in Montrose and Delta Counties, and \$400,000 for completion of concrete lining in the Gunnison tunnel. An allotment of \$150,000 was also made for investigation of the proposed Grand Lake-Big Thompson Transmountain tunnel project, having for its purpose the diversion of western slope water from the Colorado River to the South Platte Valley on the eastern slope; \$250,000 for Colorado River Basin surveys and investigations, a portion of which will be expended in Colorado, and a working fund for the expenses of the Denver headquarters office of the Bureau. Only recently \$100,000 has been allotted for surveys to determine the feasibility of diverting water from the Blue River to the South Platte; \$150,000 for study of possible irrigation and power developments in Colorado, particularly west of the Transcontinental Divide, and \$30,000 for a study of the water resources of the Rio Grande Basin in Colorado, New Mexico, and Texas, in cooperation with the National Resources Committee.

Preliminary work on the Taylor Park Dam was immediately begun and a contract for its construction awarded on April 22, 1935. About \$340,000 had been expended and an average of 238 persons was employed from May 1, 1935, until in December 1935 when work was suspended on account of extreme winter weather. Work will be resumed as soon as the weather permits. Preliminary work in connection with repairs and replacements on the canal system of the Uncompahgre project was begun in September 1934, and actual construction began in December 1934. From January 1 to September 30, 1935, an average force of 35 persons was employed on this work. In October a contract for canal lining and structures got under way and the total force employed increased to 213, an average which has since been maintained. By March 1, 1936, approximately \$160,000 had been expended. Some preliminary studies have been made of the proposed lining of the Gunnison tunnel on the Uncompahgre project. This work can only be accomplished during the non-irrigation season when no water is being carried through the tunnel. An inspection of the tunnel was made in December 1935, after which preliminary estimates were prepared and the board of directors of the water users association has authorized execution of a contract for repayment of the cost. Upon execution of a satisfactory contract and approval of final estimates and plans the work will proceed but probably not until after the close of the 1936 irrigation season.

Investigations of the proposed Grand Lake-Big Thompson transmountain tun-

nel project were authorized early in February 1935, but before field work could be begun the question as to the authority of the Bureau of Reclamation to operate within a national park was interposed and it was necessary to secure a decision thereon from the Solicitor General. This question was finally decided by the Secretary of the Interior in favor of the Bureau of Reclamation, but it was late in July 1935 before field parties could be organized. Field headquarters were then promptly established at Grand Lake, and survey parties began work in the vicinity of Grand Lake and Estes Park. In October heavy snow made it necessary to discontinue work out of Grand Lake for the winter, and the field headquarters were then moved to Loveland, Colo., on the eastern slope, for work in that vicinity during the winter. Work in the vicinity of Estes Park continued until about January 1, 1936, when winter weather forced discontinuance. Altogether a force of 48 to 50 men is being employed on this investigation, with the expectation that the force would be increased to approximately 75 men April 1, 1936. It is estimated that it will require all of this summer and early fall to complete the field work and probably until December 1936 to complete the report on this project.

Work is in progress under the \$250,000 allocated for Colorado River Basin investigations, about 21 men being employed at present in field investigations in western Colorado and 6 in eastern Utah. At present the work in Colorado is in the vicinity of Rifle and that in Utah is near St. George. This work is a continuation of the work authorized under section 15 of the Boulder Canyon Project Act.

Field parties are being organized to conduct the surveys and investigations under the recent allotments for Blue River-South Platte transmountain diversion, Western Slope surveys, and Rio Grande Basin water-resources surveys. It is planned to put a total force of 175 to 200 men on these three investigations about May 1.

General field headquarters for the Bureau of Reclamation have been maintained in Denver continuously since 1915. From 60 to 100 persons were employed until in 1931, when the Boulder Canyon project development necessitated an increase to approximately 200 persons.

The enlarged program begun in 1933 necessitated a further and larger increase in personnel until at present approximately 800 are employed. This number includes those employed in the various research laboratories in Denver, Boulder, and Fort Collins, and several inspectors working out of Denver. These employees consist largely of young college graduates in engineering who are being trained in the design and estimate of dams and large irrigation structures proposed for construction. They are selected from nearly every State in the Union. A monthly pay roll of approximately \$145,000, or \$1,740,000 per year, is a great aid to Denver and Colorado.

The Denver office organization supervises all construction work of the Bureau, designs and prepares estimates and specifications, studies and investigates proposed projects in all their manifold phases, and maintains concrete, hydraulic, and other research laboratories to obtain data for use in constructing dams, canals, and all kinds of irrigation and power structures and equipment. Legal purchasing, accounting, personnel, and related clerical departments are other important and necessary features of the office. Purchases of materials, equipment, and supplies made by and paid for through the Denver office since the enlarged program was inaugurated in September 1933, amount to \$20,198,000. This amount does not, of course, include the monthly pay roll nor payments on construction contracts which are paid in the States in which the projects are located.

Besides the regular programs of the Bureau of Reclamation, including the Boulder Canyon project (of which the All-American Canal is a part), costing \$165,000,000, the Denver office designed and supervised the construction of the Madden Dam in the Panama Canal Zone, and is now engaged in like work on the Norris and Wheeler Dams and power plants for the Tennessee Valley Authority, as well as other large works for other Government agencies.

C. C. C. CAMPS IN COLORADO

There are three C. C. C. camps in Colorado under the direction of the Bureau of Reclamation. They are on the western slope, two on the Grand Valley project, and one on the Uncompahgre.

Data on the camps are shown in the following table:

Camp	Post office	Occupied	Cost of camp	Approximate county strength
BR 22.....	Grand Junction.....	July 27, 1935	\$32,035. 11	198
BR 23.....	Montrose.....	July 31, 1935	20,721. 53	178
BR 59.....	Palisade.....	Oct. 17, 1935	9,202. 03	174

Camps 22 and 23 are of the permanent type and BR 22 has included in its cost a sewer system to connect with city system. BR 59 is the so-called knock-down portable type and was fabricated in Mississippi. The cost shown does not include this fabricated material.

The amount spent each month for salaries of enrollees and Army personnel

at each camp averages about \$2,500 in salaries and approximately \$2,800 per month is spent for rations and, depending upon the location, variable amounts are spent for light, heat, and clothing.

The supervisory personnel varies for each camp, but averages \$1,200 per month per camp in salaries.

Total expenditures each camp to date

	Camp 22	Camp 23	Camp 59
Cost camp.....	\$32,035	\$20,722	\$9,202
Salaries, Army and enrollees since camp occupied.....	54,930	48,961	32,165
Salaries, supervisory, personnel.....	6,640	6,810	3,285
Rations.....	23,915	20,790	11,690
Tools, equipment, and supplies.....	11,584	10,052	14,887
Total.....	129,104	107,335	71,229
Camp 23.....			107,335
Camp 22.....			129,104
Total, 3 camps.....			307,768

To this should be added the cost of the prefabricated camp 59 and the cost of light, heat, and clothing, but these costs

are not available at this time, costs being kept in Grand Junction.

Mrs. Ella S. Tuttle

(Continued from p. 122)

fessional Women's Club since its organization. Long a devoted and active worker in the Methodist Church, her greatest joy probably has been a Sunday-school class of 14 girls, who are this year graduating from high school. She is delaying her departure from Sunnyside until after their commencement.

Mrs. Tuttle plans to join her two children in California. They are Mrs. Edwin Keyes, of Pasadena, and William R. Tuttle at Los Angeles. There is also a much-prized young grand-daughter. It will be a wonderfully happy climax to her many years of service. The warm regard and good wishes of all her associates and neighbors go with her.

The Yakima Daily Republic paid the following tribute to Mrs. Tuttle:

"Seventy-five reclamation service employes met yesterday evening at Sunnyside—and for what? To pay tribute to Mrs. Ella S. Tuttle, stenographer and filing clerk, who has completed a quarter century of service in the Sunnyside office. Supt. J. S. Moore is a busy man but he could take time to join in the tribute, as could other reclamation executives. Mrs. Tuttle, during her long service, has been one of the loyal and efficient members of the staff ready always to do a little more than the duties for which she was employed and keeping fully abreast with business and professional advances. No organization, not even one as far reaching and influential as the Reclamation Service ever has too many workers of Mrs.

Tuttle's type. Recognition given her is not only fully deserved but will do much to inspire other toilers to attempt to emulate her record. Her attributes of faithfulness, consideration, and efficiency will bring success in any endeavor.

What To Do With Our Waste Men

By J. Rupert Mason, San Francisco

"What we have lost without, we must win back within", Capt. Enrico Mylius Dalgas told his countrymen of Denmark in 1864, when Prussia had taken as the spoils of war their most valuable agricultural lands.

Captain Dalgas referred to the vast waste lands of the Jutland Peninsula. In the following 40 years, this formerly uninhabited region was reclaimed from an unproductive liability into many thousands of small farms, gardens, and forests, enriching Denmark in an enduring manner and also bettering the climate and social conditions of the nation.

This achievement is recognized in our history books as one of the world's outstanding lessons in soil conservation and statesmanship, and affords a luminous example of what the influence of a single individual can accomplish. Who would not rather be a Dalgas than a Croesus?

Two valuable lessons from this bit of history are worth our study:

First. The potential value of millions of acres of our now waste land, subject to drought, floods, and soil erosion, could

with the aid of public improvement works, prove capable of supporting a large part of our now homeless and landless farmers and tenant families, and afford employment for many thousands during construction of the levees, canals, dams, drainage ditches, and related works.

Second. In Denmark, such works on the Jutland Peninsula were constructed by men otherwise idle and who would have to be fed at public expense, and Denmark's experiment also proved that its waste men were reclaimed, just as definitely as its waste land.

To get from our now misused or unused natural resources their best and fullest use is, or should be, our goal. For a hundred years and more this quest was the drama of our national life that gave color to our civilization and buoyancy to the hearts of our people. Not so many of us were then willing to stop and listen to political and economic crackpots, who told us they could pull any number of rabbits out of a hat, or to enterprising gentlemen seeking to monopolize essential public services and natural resources, for which their only claim is that they would like to own or control them.

The problem of our wasting land and men is indeed a challenge to the capacity of democracy.

BEEHIVES gained in number from 2 to 11 during the past year on the Vale project. On the adjacent Warm-springs irrigation district the production of honey is a relatively important industry.

CARLOAD shipments received on the Owyhee project during the month of March were as follows: Reinforcement steel, 1; coal tar, 2; cement 16.

AN 80-acre farm east of Paul, Minidoka project, recently sold for \$4,500, and another 80-acre tract south of Paul was sold at an unannounced price. Forty acres east of Rupert brought \$3,000, and another tract of the same size east of Heyburn was disposed of for \$4,000.

FAIRFIELD, headquarters of the Sun River project, Montana, has a new implement house and expects soon to have a second butcher shop.

A HOME modernization show was held at the Legion Hall in Powell, Wyo., Shoshone project, on March 25-26, attended by more than 1,000 persons from the Big Horn Basin.

Reclamation Organization Activities and Project Visitors

R. F. Walter, Chief Engineer, attended a meeting in Sacramento on April 18 of the board of consulting engineers on the Central Valley project of California. After completing an inspection of the Central Valley project Mr. Walter visited Yuma, Parker Dam, and Boulder Dam during the balance of the month.

Howard Leslie Perkins, inspector, and Max T. Hedges, instrumentman, have been transferred from Boulder City to the AH-American Canal project.

F. A. Shuckman, a representative of the Rural Electrification Administration, was a recent visitor on the Minidoka project.

Dana Templin, acting superintendent on the Minidoka project, visited the district counsel and attended the meeting of the northwest regional board at Portland, Oreg.

Jacob S. Matlock, from Pennsylvania, has been appointed to the position of junior clerk in the Washington office, being assigned to the Engineering Division.

H. H. Johnson, field supervisor of operation and maintenance, of Malta, Mont., was an official visitor on the Huntley project during March.

H. W. Bashore, Construction Engineer of the Casper-Alcova project, attended the State Coordination Meeting of the National Emergency Council at Cheyenne, Wyo., on April 13, as the representative of the Bureau of Reclamation.

Silas B. Mason Dies

Silas B. Mason, chairman of the Mason-Walsh-Atkinson-Kier Co., builders of the Grand Coulee Dam, died on April 14 at the hospital in Mason City, the community at the dam site which was named for him. He was stricken 15 hours before his death.

Mr. Mason, who was 65 years of age, was president of the Silas Mason Co., 106-year-old contracting firm founded by his grandfather.

Mr. Mason's death will be felt keenly by the Bureau of Reclamation, as well as by many other friends. Mrs. Mason survives him.

Out of respect to Mr. Mason's memory it was decided by the board meeting of the Mason-Walsh-Atkinson-Kier Co. on April 28 that the position of chairman of the board will remain vacant.

Dr. F. A. Nickell, associate geologist in the Denver office, visited the Provo River project during March for the purpose of inspecting the testing work accomplished for the Deer Creek division.

G. H. Bingham, irrigation specialist at the Montana State College, visited the Frenchtown project, Montana, early in March and, in cooperation with the county agent, plans to aid the farmers in their irrigation problems.

W. J. Burke, district counsel, spent several days during March on the Frenchtown project in connection with main canal right-of-way negotiations.

A FARMERS' cooperative service station and grocery has been erected recently at Vale, Oreg., on the Vale project.

THE value of motor vehicles on the Vale project, Oregon, increased slightly in excess of 100 percent during 1935.



Yuma date palm, Yuma project, Arizona-California.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation **John C. Page**, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; B. W. Steele, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
Belle Fourche.....	Newell, S. Dak.....	F. C. Youngblutt.....	Superintendent.....	J. P. Siebeneicher.....	W. J. Burke.....	Billings, Mont.
Boise.....	Ontario, Oreg.....	R. J. Newell.....	Constr. engr.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
Boulder Dam.....	Boulder City, Nev.....	Ralph Lowry.....	do.....	Gail H. Baird.....	R. J. Coffey.....	Los Angeles, Calif.
Burnt River.....	Vale, Oreg.....	Clyde H. Spencer.....	do.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
All-American Canal.....	Yuma, Ariz.....	L. B. Williams.....	do.....	.....	R. J. Coffey.....	Los Angeles, Calif.
Carlsbad.....	Carlsbad, N. Mex.....	L. E. Foster.....	Superintendent.....	J. C. Thraillkill.....	H. J. S. DeVries.....	El Paso, Tex.
Casper-Alcoeva.....	Casper, Wyo.....	H. W. Bashore.....	Constr. engr.....	C. M. Voyen.....	W. J. Burke.....	Billings, Mont.
Central Valley.....	Sacramento, Calif.....	W. R. Young.....	do.....	E. R. Mills.....	R. J. Coffey.....	Los Angeles, Calif.
Colorado River in Texas.....	Austin, Tex.....	H. P. Bunger.....	do.....	William F. Sba.....	H. J. S. De Vries.....	El Paso, Tex.
Columbia Basin, Grand Cou- lee Dam.....	Coulee Dam, Wash.....	F. A. Banks.....	do.....	C. B. Funk.....	B. E. Stoutemyer.....	Portland, Oreg.
Frenchtown.....	Missoula, Mont.....	J. W. Taylor.....	Resident engr.....	.....	W. J. Burke.....	Billings, Mont.
Gila Valley.....	Yuma, Ariz.....	R. B. Williams.....	Constr. engr.....	.....	R. J. Coffey.....	Los Angeles, Calif.
Grand Valley.....	Grand Junction, Colo.....	W. J. Chiesnan.....	Superintendent.....	E. A. Peek.....	J. R. Alexander.....	Salt Lake City, Utah.
Humboldt.....	Lovelock, Nev.....	L. J. Foster.....	Constr. engr.....	George B. Snow.....	do.....	do.
Hyrum.....	Hyrum, Utah.....	D. J. Paul.....	Resident engr.....	H. W. Johnson.....	do.....	do.
Klamath.....	Klamath Falls, Oreg.....	B. E. Hayden.....	Superintendent.....	W. I. Tingley.....	B. E. Stoutemyer.....	Portland, Oreg.
Milk River.....	Malta, Mont.....	H. H. Johnson.....	do.....	E. E. Chabot.....	W. J. Burke.....	Billings, Mont.
Chain Lakes Storage.....	do.....	do.....	do.....	do.....	do.....	do.
Minidoka.....	Burley, Idaho.....	E. B. Darlington.....	do.....	G. C. Patterson.....	B. E. Stoutemyer.....	Portland, Oreg.
Moon Lake.....	Duchesne, Utah.....	E. J. Westerhouse.....	Constr. engr.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
North Platte.....	Gunnery, Wyo.....	C. F. Gleason.....	Supt. of power.....	A. T. Stimpfig.....	W. J. Burke.....	Billings, Mont.
Ogden River.....	Ogden, Utah.....	J. R. Iakisch.....	Constr. engr.....	H. W. Johnson.....	J. R. Alexander.....	Salt Lake City, Utah.
Orland.....	Orland, Calif.....	D. L. Carmody.....	Superintendent.....	W. D. Funk.....	R. J. Coffey.....	Los Angeles, Calif.
Owyhee.....	Ontario, Oreg.....	R. J. Newell.....	Constr. engr.....	Robert B. Smith.....	B. E. Stoutemyer.....	Portland, Oreg.
Parker Dam.....	Parker Dam, Calif.....	E. A. Moritz.....	do.....	Geo. W. Lyle.....	R. J. Coffey.....	Los Angeles, Calif.
Provo River.....	Salt Lake City, Utah.....	F. O. Larson.....	Engineer.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
Rio Grande.....	El Paso, Tex.....	L. R. Fiock.....	Superintendent.....	H. H. Berryhill.....	H. J. S. DeVries.....	El Paso, Tex.
Riverton.....	Riverton, Wyo.....	H. D. Comstock.....	do.....	C. B. Wentzel.....	W. J. Burke.....	Billings, Mont.
Salt River.....	Phoenix, Ariz.....	E. C. Koppen.....	Engineer.....	Geo. H. Bolt.....	R. J. Coffey.....	Los Angeles, Calif.
Sanpete.....	Salt Lake City, Utah.....	F. O. Larson.....	do.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
Shoshone.....	Powell, Wyo.....	L. J. Windle.....	Superintendent.....	L. J. Windle.....	W. J. Burke.....	Billings, Mont.
Sboshone-Heart Mountain.....	Cody, Wyo.....	Walter F. Kemp.....	Constr. engr.....	do.....	do.....	do.
Stanfield.....	Ontario, Oreg.....	R. J. Newell.....	do.....	Robert B. Smith.....	B. E. Stoutemyer.....	Portland, Oreg.
Sun River, Greenfields div.....	Fairfield, Mont.....	A. W. Walker.....	Superintendent.....	.....	W. J. Burke.....	Billings, Mont.
Truckee River Storage.....	Lovelock, Nev.....	L. J. Foster.....	Constr. engr.....	.....	J. R. Alexander.....	Salt Lake City, Utah.
Umatilla (McKay Dam).....	Pendleton, Oreg.....	C. L. Tice.....	Reservoir supt.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
Uncompahgre: Taylor Park.....	Gunnison, Colo.....	A. A. Whitmore.....	Constr. engr.....	Ewalt P. Anderson.....	J. R. Alexander.....	Salt Lake City, Utah.
Repairs to canals.....	Montrose, Colo.....	C. B. Elliott.....	Engineer.....	do.....	do.....	do.
Upper Snake River Storage.....	Ashton, Idaho.....	H. A. Parker.....	Constr. engr.....	Emmanuel V. Hillius.....	B. E. Stoutemyer.....	Portland, Oreg.
Vale.....	Vale, Oreg.....	C. C. Ketchum.....	Superintendent.....	do.....	do.....	do.
Yakima.....	Yakima, Wash.....	J. S. Moore.....	do.....	do.....	do.....	do.
Roza div.....	do.....	Chas. E. Crownover.....	Constr. engr.....	do.....	do.....	do.
Yuma.....	Yuma, Ariz.....	R. C. F. Weber.....	Superintendent.....	Noble O. Anderson.....	R. J. Coffey.....	Los Angeles, Calif.

¹ Acting.

² Non-Federal.

³ Island Park Dam.

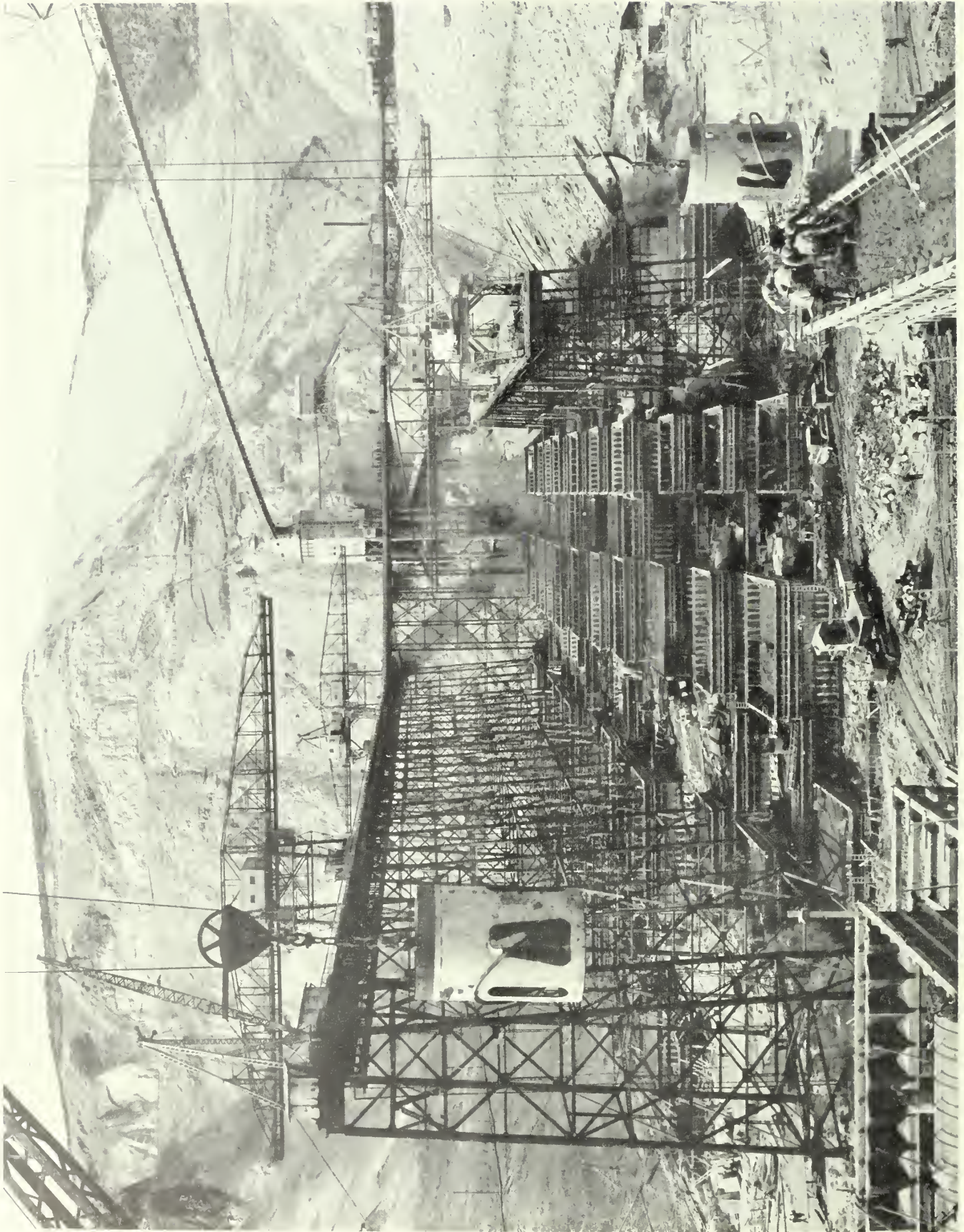
Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division).....	Lower Powder River irrigation dist.....	Baker, Oreg.....	A. J. Ritter.....	President.....	F. A. Phillips.....	Keating.
Bitter Root.....	Bitter Root irrigation district.....	Hamilton, Mont.....	N. W. Blindauer.....	Engineer-manager.....	Elsie H. Wagner.....	Hamilton.
Boise.....	Board of Control.....	Boise, Idaho.....	Wm. H. Tuller.....	Project manager.....	F. J. Hanagan.....	Boise.
Grand Valley, Orchard Mesa.....	Orchard Mesa irrigation district.....	Pallisade, Colo.....	Charles Tharp.....	Superintendent.....	C. J. McCormick.....	Grand Jctn.
Huntley.....	Huntley irrigation district.....	Ballantine, Mont.....	E. E. Lewis.....	Manager.....	H. S. Elliott.....	Ballantine.
Klamath, Langell Valley.....	Langell Valley irrigation district.....	Bonanza, Oreg.....	Chas. A. Revell.....	do.....	Chas. A. Revell.....	Bonanza.
Klamath, Horsedly.....	Horsely irrigation district.....	do.....	Jerome Smith.....	do.....	Dorothy Evers.....	do.
Lower Yellowstone.....	Board of Control.....	Sidney, Mont.....	Axel Persson.....	Project manager.....	O. B. Patterson.....	Sidney.
Milk River: Chinook div.....	Alfalfa Valley irrigation district.....	Chinook, Mont.....	A. L. Benton.....	President.....	R. H. Clarkson.....	Chinook.
do.....	Fort 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.
do.....	Paradise Valley irrigation district.....	Zurich, Mont.....	Amos Thompson.....	do.....	J. F. Sharpless.....	Zurich.
do.....	Zurich irrigation district.....	Harlem, Mont.....	C. A. Watkins.....	do.....	H. M. Montgomery.....	do.
Miuidoka: Gravity.....	Minidoka irrigation district.....	Rupert, Idaho.....	Frank A. Ballard.....	Manager.....	W. C. Trathen.....	Rupert.
Pumping.....	Burley irrigation district.....	Burley, Idaho.....	Hugh L. Crawford.....	do.....	Geo. W. Lyle.....	Burley.
Gooding.....	Amer. Falls Reserv. Dist. No. 2.....	Gooding, Idaho.....	S. T. Baer.....	do.....	P. T. Sutphen.....	Gooding.
Newlands.....	Truckee-Carson irrigation district.....	Fallon, Nev.....	W. H. Alcorn.....	President.....	.....	Fallon.
North Platte: Interstate div.....	Pathfinder irrigation district.....	Mitchell, Nebr.....	T. W. Parry.....	Manager.....	Flora K. Schbroeder.....	Mitchell.
do.....	Gering-Fort Laramie irrigation dist.....	Gering, Nebr.....	W. O. Fleenor.....	Superintendent.....	C. G. Klingman.....	Gering.
do.....	Goshen irrigation district.....	Torrington, Wyo.....	Bert L. Adams.....	do.....	Nelle Armitage.....	Torrington.
Northport div.....	Northport irrigation district.....	Northport, Nebr.....	Mark Iddings.....	do.....	Mabel J. Thompson.....	Bridgeport.
Okanogan.....	Okanogan irrigation district.....	Okanogan, Wash.....	Nelson D. Thorp.....	Manager.....	Nelson D. Thorp.....	Okanogan.
Salt Lake Basin (Echo Res.).....	Weber River Water Users' Assn.....	Ogden, Utah.....	D. D. Harris.....	do.....	D. D. Harris.....	Ogden.
Salt River.....	Salt River Valley W. U. A.....	Phoenix, Ariz.....	H. J. Lawson.....	Superintendent.....	F. C. Henshaw.....	Phoenix.
Shoshone: Garland div.....	Shoshone irrigation district.....	Powell, Wyo.....	J. O. Roach.....	do.....	Geo. W. Atkins.....	Powell.
do.....	Deaver irrigation district.....	Deaver, Wyo.....	Floyd Lucas.....	Manager.....	Lee N. Richards.....	Deaver.
Strawberry Valley.....	Strawberry Water Users' Assn.....	Payson, Utah.....	Clyde Tervort.....	President.....	E. G. Breeze.....	Payson.
Sun River: Fort Shaw div.....	Fort Shaw irrigation district.....	Fort Shaw, Mont.....	E. J. Gregory.....	Manager.....	E. J. Gregory.....	Fort Shaw.
do.....	Greenfields irrigation district.....	Fairfield, Mont.....	A. W. Walker.....	do.....	H. P. Wangen.....	Fairfield.
Umatilla: East div.....	Hermiston irrigation district.....	Hermiston, Oreg.....	E. D. Martin.....	do.....	Enos D. Martin.....	Hermiston.
do.....	West Extension irrigation district.....	Irrigon, Oreg.....	A. C. Houghton.....	do.....	A. C. Houghton.....	Irrigon.
Uncompahgre.....	Uncompahgre Valley W. U. A.....	Montrose, Colo.....	Jesse R. Tompson.....	Acting supt.....	J. Frank Anderson.....	Montrose.
Yakima, Kittitas div.....	Kittitas reclamation district.....	Ellensburg, Wash.....	V. W. Russell.....	Manager.....	R. E. Rudolph.....	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15.....	Denver, Colo.....	P. J. Preston.....	Senior engineer.
Columbia Basin Economic Survey.....	Coulee Dam, Wash.....	F. A. Banks.....	Construction engineer.
Deschutes.....	Bend, Oreg.....	C. C. Fisher.....	Engineer.
Gallatin Valley.....	Bozeman, Mont.....	R. R. Robertson.....	do.
Grand Lake-Big Thompson Transmountain Diversion.....	Denver, Colo.....	P. J. Preston.....	Senior engineer.
Island of Molokai.....	Honolulu, Hawaii.....	Hugh Howell.....	Engineer.
Weiser-Payette.....	Boise, Idaho.....	J. A. Keimig.....	do.

SALLIE A. B. COE, Editor.



COLUMBIA BASIN PROJECT, WASHINGTON-GRAND COULEE DAM.
VIEW LOOKING WEST ACROSS THE WEST AREA. WORKMEN TAMPING CONCRETE IN BLOCK 40 G AT ELEVATION 860 SHOWN ON THE RIGHT.

27.5:1936

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GOVERNMENT PUBLICATIONS

THE RECLAMATION ERA

VOL. 26, NO. 6



JUNE 1936



LAKE MEAD, FORMED BY THE WATERS OF THE COLORADO RIVER STORED BEHIND THE GREAT BOULDER DAM, IS THE WORLD'S LARGEST ARTIFICIAL LAKE AND ONE OF ITS MOST SCENIC STRETCHES OF WATER.

Lake Mead is Growing Rapidly



With the flood season on the Colorado River barely under way, Lake Mead, created by Boulder Dam, had caught 6,000,000 acre-feet of water May 26, an increase of a million acre-feet in a fortnight.

From a consideration of the snow pack accumulated between October 1, 1935, and March 31 this year on the watershed of the Colorado River it was estimated that the run-off of the river at Boulder Dam between April 1 and December 31, 1936, would amount to 17,900,000 acre-feet, of which only about 5,000,000 acre-feet will be released for irrigation and power purposes. Taking into consideration the amount of water in Lake Mead on April 1 and the probable loss through evaporation and seepage along the banks, it was estimated that a total of 15,800,000 acre-feet of water would be carried over in storage in Lake Mead next winter.

Indications were bright generally for good water supplies on all the Federal reclamation projects. On May 1 storage for all projects totaled 12,319,108 acre-feet against 10,016,359 a month earlier and 6,226,928 on May 1, 1935, and 6,474,054 on the same date in 1934. Subtracting the entire content of Lake Mead of May 1, which amounted to 4,343,000 acre-feet, the total storage in other reservoirs was 7,976,108, or an increase of nearly 2,000,000 acre-feet over the total last year.

"By and large," John C. Page, Acting Commissioner, informed Secretary of Interior Harold L. Ickes, "prospects are good for an excellent season on all Federal projects. In addition, it may be possible to store some water in excess of seasonal needs so that we can carry some over into the 1937 season."

"The carry-over in the past two years has been very low. If a surplus can be built up this year in our reservoirs, the possibility that 1937 may be dry will cause us less concern."

The growth of Lake Mead will be interesting to watch this Spring. Already the largest man-made lake, it is expected to quadruple in size. On May 1 it contained 1,633,500 million gallons of water, about eight times the capacity of the 24 reservoirs making up the New York City water supply system. The lake was 85 miles long, almost half the length of Lake Ontario, and had a depth of 303 feet at the dam, 93 feet more than the maximum depth of Lake Erie. It covered 42,000 acres.

The permanent plug was placed in the fourth diversion tunnel at Boulder Dam May 6. This marked the end of the period during which the dam had been operated on a temporary basis. All water diverted at the dam now must pass through the penstocks, the permanent channels. The second penstock system was successfully tested under a pressure of one and one-half times the maximum possible during operation. One penstock on either side of the river now has been tested. The remaining two will be tested in the near future.

Ralph Lowry, construction engineer in charge at Boulder Dam, reported May 1 that installation of the first battery of generators at the power house was 60 percent complete.

THE RECLAMATION ERA

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Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 6



JUNE 1936

Federal Reclamation¹

By Honorable Carl A. Hatch, United States Senate

MUCH has been said and much will be said during the progress of your meeting, I am sure, about the problems of conservation, the evils which have resulted from the exploitations of our lands and natural resources. Events of the past 3 years, droughts, dust storms in the West, tornadoes in the South, and floods and disaster in the East, have brought these subjects to our attention in a most striking manner. The people of the Nation are awake today to these problems as they have never been before. You gentlemen of the Rivers and Harbors Congress have long been aware of the various aspects of the entire situation.

I do not come from a country which is supposed to have floods, nor do the rivers of my State present any great problems of navigation. Seagoing vessels, merchant ships, or armored fleets rarely visit the ports of Albuquerque or Santa Fe. But yet, even in our semi-arid regions, floods are not unknown, and entirely too frequently waste and destruction of crops and lands result from disastrous floods. Lives have been lost in the flood waters of New Mexico, and the waters from my own State do contribute, as many of you know, to the serious problems of streams and rivers of other States. But it is not of floods nor of primary problems of rivers and harbors I shall speak today, although floods, excess waters, and regulation thereof are a part of the general problem of reclamation and irrigation.

All my life has been spent in regions which have been affected by a lack of water, by droughts, and windstorms. As a small boy, I recall the hot winds of western Kansas, which destroyed corn and wheat and products of the farm within a few short days. In later years,

in another State where I grew to maturity, I have seen vast fields of cotton wilt, wither, and die because the rains came not and the hot winds blew. I have seen men and women struggle year after year against the adversity of climatic conditions, of insufficient rainfall in sections of the country where the annual precipitation was sufficient to have raised ample crops, but the rains did not come at the right time and seasons of the year.

In my own State of New Mexico, where I have resided many years, I have seen the sand and dust and the dry winds do all the things which bring disaster and ruin to an earnest, industrious, and intelligent people trying to make their own way, trying to be independent and seeking to live by their own efforts, as American citizens should live. In addition to all this, I have seen land itself practically destroyed. I know of farms in various parts of the country, which 20 or 25 years ago were rich fertile farms, but which today do not produce enough to pay the taxes.

Therefore, when I speak of reclamation, I speak not from an academic standpoint of one who has read and considered the ill effects of dry winds and lack of moisture, but I speak of these things with the voice of one who knows whereof he speaks from personal observation and actual experience. When I say to you that the waters of my State, in certain sections, go uncontrolled, down mountain side, over valley lands into streams and rivers, impoverishing the soil over which they flow, and destroying other lands below, when at the same time that water, by proper control, conservation, and impounding could be applied to the growing of useful crops, to the prevention of the hardship of insufficient rainfall and to the building of independent, self-supporting, honest citizenry, I speak truly and I speak with vigor and earnestness about it, because to my mind, there has

long been a misconception and a misunderstanding of reclamation, its purposes, its ends, and its accomplishments.

In the past many people unfamiliar with actual conditions have viewed reclamation from a standpoint which is entirely incorrect. They have thought of it as a local issue, beneficial only to the community where the project is located. Some have been so blind or so unkind as to think of it in terms of pork-barrel politics. Some have even thought of reclamation projects as a form of waste and extravagant use of Federal funds in aid and assistance to communities whose citizens would better return to labor in shop and factory. With those who so believe, I am, of course, in sharp disagreement. The waste and extravagance have not been in the storage and impounding of our excess waters, and the application of such waters to practical and beneficial use, but the waste has been these many years in permitting those excess waters to escape and run wild and rampant throughout the country, laying low, wasting, and destroying valuable crops, food supplies, property, and even human lives. Here lies extravagance.

I believe in reclamation as a national policy; it is not only of local interest. The preservation of lands, the conservation of our water, the control and regulation of our rivers are things which constitute the life and blood of America. In that program reclamation plays a most important part; it walks hand-in-hand with all efforts for soil conservation and for the regulation and control of the stream system of the country.

When you have builded dams and reservoirs, such for instance as are located at Elephant Butte or Carlsbad, N. Mex., and have made thousands of acres of dry land fertile, crop-producing lands, you have not only conserved excess waters, but you have made it possible to estab-

¹ Address delivered before Rivers and Harbors Congress, in Washington, Apr. 27, 1936.

lish a community of thousands of American citizens, prosperous, happy and contented; you have removed the fear of drought, flood, and disaster; you have builded, in every way, not only for today, but for the years to come. Further, the activities under the Federal reclamation policy create an endless chain of benefits to the Nation as a whole. Direct benefits occur in the arid and semiarid region which covers one-third of the United States. Indirect benefits, in the form of taxes and the creation of purchasing power, affect every State in the Union. It might be surprising to you to know it is estimated that about one-half of all funds for construction of irrigation structures goes to industry for the purchase of material and supplies, and that for every man engaged on the job, 1.8 persons are given indirect employment. Funds spent on Federal reclamation have, therefore, been a major factor in relieving unemployment, both at the site of construction and in the industrial centers of the East.

BUREAU OF RECLAMATION MAJOR CONSERVATION UNIT

Federal reclamation as a national policy is now 34 years old. It is an important factor in the Federal Government's conservation program, accomplishing as it does the control of floods, improvement of navigation to meet the needs of irrigated agriculture, domestic requirements of cities and towns, and the generation of hydroelectric power as an adjunct of irrigation development. The Federal reclamation policy was adopted by Congress in 1902, only after it had been demonstrated that larger and costlier works for conservation of the unregulated flow of western rivers for irrigation purposes could not be constructed from private funds.

Great impetus has been given to the construction program of the Bureau of Reclamation by the generous allotment of emergency funds and the money so allotted during the past 2 years nearly equals the amount set aside by Congress in 30 years. Twenty-one dams have been completed or started with such funds since 1933, in comparison with 125 dams constructed during the 30-year period. It may thus be seen that the interests of the West are being given sympathetic aid by the Federal Government to carry out a program of conservation most vital to the West.

IRRIGATED AREAS CREATE OPPORTUNITIES FOR HOMES

Every farmer settled with his family on a Federal reclamation project is tendered the means under provisions of good soil

and a regulated flow of water to go about the business of irrigated agriculture as a livelihood for his family. As I have before pointed out, this means economic independence, that security of which so much is said today. I am one of those who believe that many of our economic problems today arise from an unwise congestion of human beings in cities and towns of the land.

A large part of our population is altogether dependent upon the fruits of daily wages from industry and business, and susceptible to all the ills and evils which arise from wide fluctuation of business and industrial activity. The problem of unemployment constantly menaces not only the happiness and well being of the individuals so living and so dependent, but it constitutes a menace to the welfare of the country itself. Men were never designed to live in crowded, congested, unhealthy, unsightly, and disagreeable tenement and slum districts like ants in a heap or bees in a hive. Man is essentially a creature dependent upon the land; from it he came, to it he returns. Between the Alpha and Omega of his existence, all his life, his wealth, prosperity, and happiness depend upon the earth.

If we can so extend our agricultural program so that thousands and millions of our citizens can return to the soil and farm under a regulated program of the West, a large portion and part of our present perplexing, yes, some say, terrifying problem of unemployment will be solved in a way that will bring not only independence and happiness to the individual, but will add material wealth to America.

RECLAMATION A GOOD FEDERAL INVESTMENT

No other policy of the Government has added more to national prosperity than Federal reclamation. The benefits are endless. During construction, they put people to work at the site. The purchasing of materials and supplies keeps the factories of the East going, thereby supporting the families depending on work in these fields. The settlement that follows irrigation development takes care of families on the land, creates purchasing power, and brings into the treasury of county, and State governments such needed revenue in the form of taxes. The National Government also is a beneficiary of income tax, inheritance tax, and Federal taxation on purchases. Everyone receiving a part of the appropriation made for construction, whether it be in the form of wages or payment for materials and supplies, keeps the money moving to the best possible advantage

and best of all, dwindles the line of the unemployed and helps business to help itself.

RECLAMATION FUNDS REIMBURSABLE

Money spent on Federal reclamation projects is covered by contract with the water users benefited for repayment of the cost over a period of years. The maximum permissible under the law is 40 years, but in some cases repayment of cost is aided by application of power revenues created by Federal development. The repayment record is an enviable one. Of the amounts that have become due the Government, 98.9 percent have been repaid.

DOES FEDERAL RECLAMATION ADD TO THE SURPLUS?

There is a widespread misconception that Federal reclamation contributes to the agricultural surplus and should be curtailed until such time as the demand increases. Informed people know that this is a mistake. The greater part of the crops grown on these lands are nonecompetitive. Long-staple cotton, the products of the orchards, sugar beets, and our winter gardens of the Southwest are all outstanding examples of the noncompetitive character of irrigated lands. Do you realize that, because of favorable climatic conditions, soil, and water, the delicacies enjoyed in New York, for instance, during the winter months come from these favored spots? They are nonecompetitive because they cannot be grown elsewhere, except at prohibitive cost. The steadily growing population of western cities is absorbing the increasing products of the irrigated territory.

OPPORTUNITIES FOR IRRIGATED AGRICULTURE LIMITED

Let me make this surprising statement—that there are few opportunities left for good storage sites on western rivers to serve good fertile soil under them. Probably the largest remaining compact body of land which can be economically irrigated with a plentiful water supply is the Columbia Basin project in the State of Washington, where 1,200,000 acres of fertile soil are awaiting water for irrigation from the storage created by Grand Coulee Dam.

I have but hurriedly mentioned some of the outstanding features concerning Federal reclamation, but I must say this program of reclamation and of irrigation, of soil conservation, of wise and expedient protecting and safeguarding of the natural resources, of which Mother Nature has so richly and bountifully endowed us, is, to my mind, one of the

most, if not the most important contribution we of this generation are making to the welfare of America as a whole, and I must reiterate and declare that it is a program which must be carried on and must be further developed and expanded. We of today have no right to waste, neglect, and destroy the land and thereby impoverish and pauperize the generations which are to follow us. The richness of our lands, the fertility of our soil, the protection and regulation of our streams mean the protection, the development, and enrichment of America and

American citizens for all time to come. Reclamation has its share, its contribution, and its part in this great national program.

Again, and in conclusion, may I stress that while reclamation has been considered almost altogether in connection with the West, this idea is entirely erroneous. Reclamation and its program dovetail exactly into the general plan of conservation of both land and water. Problems of river and stream regulation and control, from the Mississippi and all its vast region to its smallest tributary,

including the prevention of devastating floods east and west of that mighty stream, and the building and developing of great reclamation and irrigation projects from the far reaches of the Pacific and the great Northwest, and all the arid and semiarid districts, constitute, in reality, but one program, all linked together and all a part of the general plan for the conservation of land, water, property, and even human lives. I repeat, it is not local; it is national in scope, character, and effect.

Conference Held at Ontario

On April 10 a conference was held in Ontario, Oreg., headquarters of the Owyhee project, attended by parties interested in forecasting run-off by means of snow measurements made during the late winter. Those present were Prof. M. R. Lewis of Oregon State College, R. A. Work of Medford, Oreg., J. C. Marr of Boise, Idaho, all connected with the Bureau of Agricultural Engineering, Department of Agriculture; J. H. Ryan, assistant State engineer of Oregon; O. D. Lanning, engineer, Eastern Oregon Power & Light Co. of Baker; Stanley Mallet, Malheur County watermaster; W. C. White, manager, Warm Springs irrigation district; C. C. Ketchum, superintendent of the Vale project; and R. J. Newell, construction engineer, of the Owyhee project.

Plans were made for continuation and extension of the snow measurement courses and predictions were made of run-off during the present season, based on last winter's snow measurements. It was predicted that the run-off on the Owyhee River would be 900,000 acre-feet.

Boulder Dam in Miniature

To give visitors to the Century of Progress at Chicago a conception of Boulder Dam, the Bureau of Reclamation prepared a model in the form of a diorama. It is arranged so that a 4-minute eye of operations will show how the water will be handled during normal and flood periods. This model, built on a scale of 1 inch to 30 feet, has since been made the central feature of a Boulder Dam exhibit at the Museum of Science and Industry in Chicago. Supplementing it are groups of photographs, maps, and colored drawings illustrating various phases of the project and of the construction work at the dam site.—

Compressed Air Magazine.

Cyrus Hall McCormick Gold Medal To Be Awarded Posthumously to Dr. Elwood Mead



This 18-carat gold medal, 2 3/8 inches in diameter, is conferred each year by the American Society of Agricultural Engineers for outstanding scientific achievement in the field of engineering as applied to agriculture. Dr. Mead was notified shortly before his death in January 1936 that he was to receive this honor at the annual meeting of the society to be held at Estes Park, Colo., June 22-25. The award will now be made to his widow, Mrs. Mary Lewis Mead, on the closing day of the coming annual session.

In the July issue of the ERA will appear a further notice concerning the annual meeting, the presentation to Mrs. Mead, and a statement of the life and work of Commissioner Mead by Miss Mae A. Schnurr, who for the past 12 years has been associated with him.

Progress at Boulder

At 8 a. m. on May 1 the last sluice gate in diversion tunnel no. 1 plug was successfully closed, marking another milestone in the harnessing of the Colorado River. Henceforward, all release of waters from Lake Mead will be made through the intake towers and ultimately the spillways. The flow on May 1 at Bright Angel Point was 50,400 cubic feet per second, and the lake level is rising at the rate of approximately 2 feet per day. The present water surface elevation of 925 is within 3 feet of the high water level of last year. Ten thousand cubic feet per second are being released through the 84-inch needle valves in the upper Arizona system. Five valves are now being employed.

It is estimated that the snowfall on the Colorado River watershed for this year is 126 percent normal, and with this in view a normal run-off is expected. With

a run-off between 17,000,000 and 20,000,000 acre-feet, the lake surface will rise to elevation 1100 by fall, and half the capacity of the reservoir will have been attained.

It was anticipated that by June 1 water for regulation would be shifted into the upper Nevada system, and for a short time all 12 canyon wall valves would be in operation.

Child Welfare Conference

The tenth Iowa conference on child development and parent education, to be held in Iowa City, June 16, 17 and 18, has been announced. The general theme is to be Education for Family Life and the program speakers include men and women from many States who are authorities in their fields. No admission fee is charged for any of the conference sessions. For further information, address Iowa Child Welfare Research Station, State University, Iowa City.

The Reclamation Era

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Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users organizations for mass subscriptions on Federal irrigation projects.

JUNE 1936

California-Pacific and Texas Centennial Expositions

SAN DIEGO

Funds for Government participation resulted in the preparation of an interesting exhibit for the Bureau of Reclamation. It is hoped by a reference to this exposition many of our readers will be urged to go to San Diego and view the exhibits so painstakingly made representing activities of the Department. The exposition closes September 9. A general view of the Department of the Interior section appears on this page.

Miss Edith Bennett, the Interior Department representative at the exposition, will be there to greet you. Miss Bennett writes the following description of the general exhibit and the reclamation section in particular:

"The central feature of the exhibit houses seven dioramas, depicting the work of the P. W. A. Housing Division, National Resources Board, and the Sub-sistence Homesteads Division. The National Park Service and the Division of Territories and Island Possessions also have displays in this central feature. The Bureau of Reclamation, Office of Educa-



tion, Geological Survey, Bureau of Mines, Howard University, and St. Elizabeths Hospital are represented by panels of transparencies to the right of this central feature. To the left is a panel and two cases in which are displayed exemplary pieces of weaving, basketry, pottery, and miscellaneous arts of the American Indian. Some of these pieces are quite old and others are the work of Indian students in the modern schools on reservations administered by the Office of Indian Affairs.

"The Bureau of Reclamation is represented by transparencies attractively mounted in the panel facing the National Resources Board diorama.

"An information desk is also included in the exhibit at which someone is constantly in attendance to meet visitors, answer inquiries, and distribute publications."

The Bureau would be glad to hear of any project people visiting the exposition and their reaction to the Bureau's exhibit.

Texas Centennial

The period of this exposition extends from June 6 through November 29, 1936.

It is understood that the President of the United States will visit the exposition in June and Mr. G. C. Dickens, director of exhibits for the Interior Department, will be on hand to view final results of installation and make arrangements to see that visitors to the Government Building who are interested in knowing what activities the Interior Department is engaged in are given every opportunity to understand.

The Government Building, one story high, housing all Government exhibits, has a total area of approximately 63,000 square feet. The details of the Bureau's exhibit are being worked out and after the exhibit opens another article will appear. Those visiting the Bureau's exhibit will be greeted by Mrs. Wilma H. Eason of the Washington office staff, who will act as a Department representative at the exposition.

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date)_____

SIR: I am enclosing my check ¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name)_____

(Address)_____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Wholesome Lessons Taught by Depression¹

By O. S. Warden, President of the National Reclamation Association

THE people of the United States have learned a great deal during the depression. Perhaps, the lessons will largely compensate for the hardships of a 5-year period. Tough picking has compelled study. There have been new surveys; there have been important conclusions. We are trying to paint a new general-welfare picture. National policies are changing whether we study the farm, the factory, peanuts, pigs, or personal pursuits. I think we are finding out that the farm cannot get along well without the factory, and, conversely, the factory is intimately interested in what happens upon the farm. The East cannot really prosper apart from the West. You can reverse the formula and it will stand. Wherever you go, in the Congress, in every State and unit of government, there is an interdependence—and those relations must coordinate if our people are to be well-to-do.

On the basis of this much, we are ready for a second conclusion. The dependable resources of the United States are the fields and the pastures and the timber lands. Mines produce great wealth but they are eventually worked out. Factories and mills and civic institutions rise and fall. They are continually transitory and dependent upon sectional conditions, opportunity, and other elements that enter into civilization.

Such transitions take place in every country. It has been so throughout all history. The future will not be different from the past and, may I add, if a country shall despoil its forests, if it shall neglect or misuse or destroy its lands, there will be ultimate damage to prosperity that cannot be avoided. Indeed, throughout the United States we are finding out how these things enter into and contribute to the general welfare of the Nation. It has become apparent that we have spoiled many acres—that we are not properly using the land. For one reason or another we are misusing just about as much land as we are cultivating correctly. We have left abandoned cultivation to the mercy of the winds. We have grossly misused great natural resources.

PLANNED LAND POLICY

I was born and reared in New England. I have lived 40 years in the West. Experience teaches that we need a carefully

developed national land policy, one that would be developed for different parts of the country; one procedure in New England, another for the Middle West, and a different one perhaps for the South. Reclamation would be the important bracket for the great West and the Northwest with their tremendous mountains and plains; the storage and use of water is clearly the problem we must solve if we are to correctly use our land. We must store the rush waters of the springtime and thereby fully open the opportunity for development. How we use the land is more important than how much we use. Each section of the country is entitled to a developed agriculture. With the acceptance of this fundamental principle, reclamation takes its place as a great conservation enterprise.

We need, then, a policy that will protect adequately our land and water resources, and the problem is manifestly a differing one in different places. Lands should stand the tests of productive value. There should be no sectional prejudice in American agriculture. A national land policy should reach from ocean to ocean and be a properly balancing factor in general progress. These are fundamental principles which apply whether we farm by the aid of natural moisture, precipitation, or the storage of flood waters. We must have a land policy if we are to bring about a new and lasting prosperity.

The National Reclamation Association, at its annual meeting in Salt Lake, recommended to the Congress a national land policy suited to the needs of each area, a policy that shall adequately protect our land and water resources and at the same time bring about the highest possible beneficiary use by the people of all States.

I think it has been quite clearly established that reclamation is a sound economic policy suited to the needs of our great Western States, a policy that can be successfully defended as a procedure well within the general welfare. In order to find a yardstick which may be used in continued defense of reclamation, the officials of the National Reclamation Association have endeavored, since the annual meeting, to devise qualifications for the determination of feasibility as we choose other and additional projects while the years come and go. The following are these qualifications and they will be submitted for further approval at the next annual convention:

1. When there is assurance that there will result additional well-to-do communities and self-supporting sections of the country.

2. When there will be an increasingly advantageous use of land together with a reasonable opportunity to use or dispose of the production.

3. When the transfers of population to land of higher utility will not unduly add to agricultural surpluses or create objectionable demand and supply situations but will rather, through differing production, subtract from surpluses and thereby contribute to the general welfare of the Nation.

4. When the project is economically sound, using as a yardstick estimated revenue over a reasonably determined period for the recovery of construction costs or a sufficient general benefit to justify the expenditure.

It is generally admitted that there should be regional agencies or authorities for a continuous study of reclamation and a general determination of correct development throughout the great States of the West.

The Northwest Planning Commission, at a conference in Boise, Idaho, a few days ago, adopted fundamental principles, four in number, with the following wording:

1. The use of water for domestic and irrigation purposes is superior to all other uses.

2. The prior right to the beneficial use of water as near the source as is feasible is a necessary protection to the semiarid headwater regions.

3. Control measures upstream should be given prior consideration as to time of construction.

4. A majority membership of the controlling board, or boards, should be made up of qualified citizens of the region who have an intimate knowledge of the problems involved.

If we are to have a national land policy, and if reclamation is to be an important bracket within this policy, then I would say that the States themselves should contribute in a practical way. They should have an intimate part in planning and ultimately supplying a part of the construction money.

MONTANA'S PLAN

The State of Montana has tackled this problem. Through legislative enactment, it established a water conserva-

(Continued on page 141)

¹ Address delivered at the annual convention of the Wyoming Reclamation Association in Casper, Wyo., Apr. 2, 1936.

OWYHEE Reservoir fills

THE Owyhee project this year is offering a fruitful example of the achievements of Federal reclamation. A fine new agricultural community is coming into existence in eastern Oregon and western Idaho. Farms are pushing back the sagebrush, and another pillar is being added to strengthen that irrigation structure which supports the arid West.

Two recent occurrences bring the Owyhee project forcefully to the fore at this time. In April the reservoir created by Owyhee Dam filled for the first time. In May, 107 public-land farm units were opened for homesteading on the Mitchell Butte division between Adrian and Nyssa, Oreg.

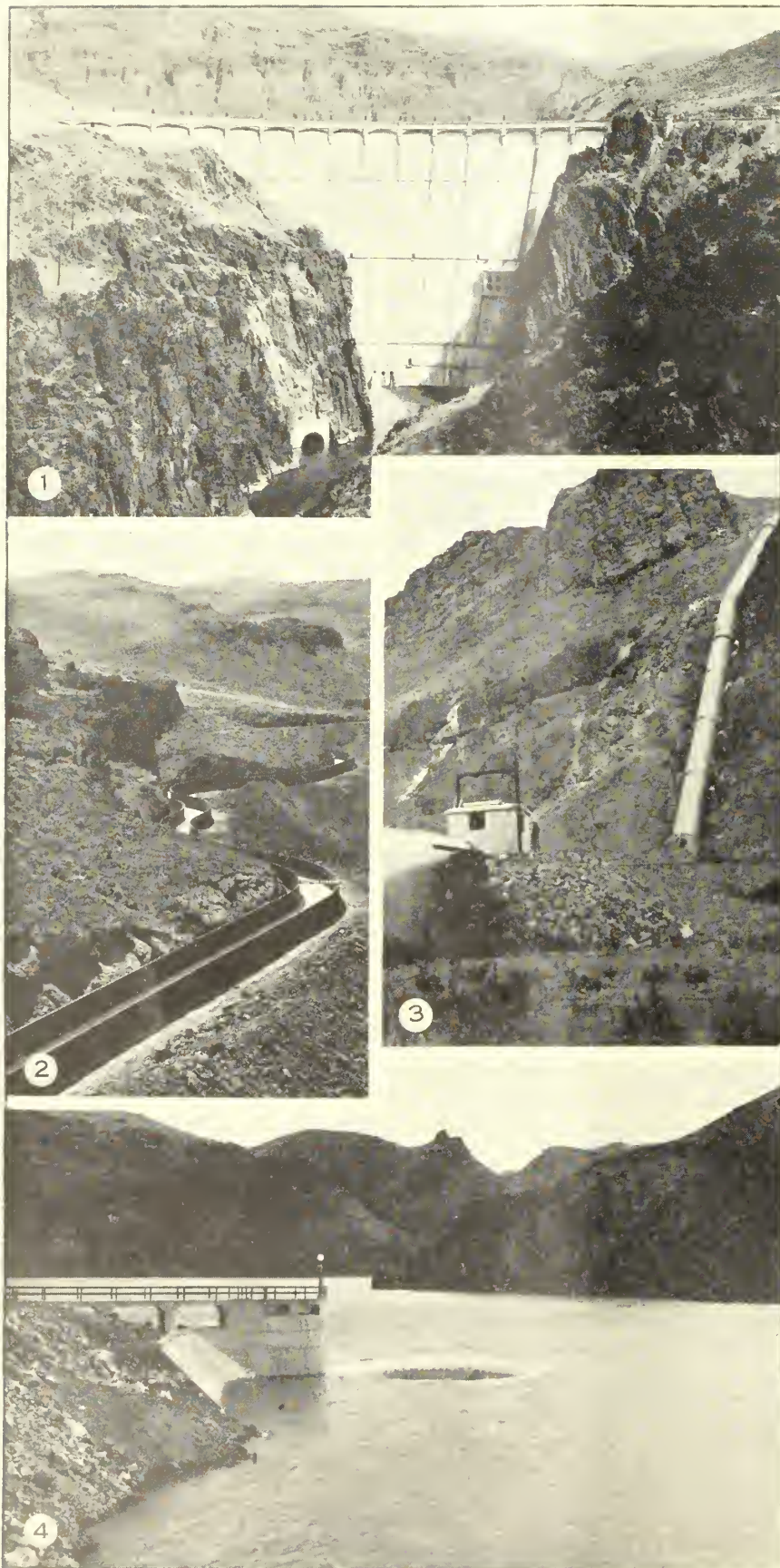
The Owyhee project was authorized by Congress in 1924. The preliminary work on Owyhee Dam, 417 feet high and second only to Boulder Dam in the United States, was begun in 1928. The dam itself was completed in 1932. The canal system which serves the 112,000 acres included in the project is nearing completion at this time. Water was supplied to some acreages on the project for the first time last year. Many more farms will receive their first water this season.

The Owyhee Reservoir, 52 miles long, has a capacity of 1,120,000 acre-feet of water, of which 700,000 represent live storage. When the reservoir filled to the point at which it overflowed into the "glory hole" of the spillway this spring, sufficient water had been stored to fill all the needs of the project for 2 years. With this margin of safety, the project lands virtually are assured of a perpetual water supply.

The farm units offered to homesteaders on the Owyhee project comprise a total of 6,289 acres. Applications were received at the project office at Ontario, Oreg., beginning May 16. Veterans had a 90-day preference.

In addition 27 public land farm units comprising a total of 1,021 were offered on the nearby Vale project May 15. The offering on the Owyhee project was the largest made by the Bureau of Reclamation since 1927.

At top is Owyhee Dam, 417 feet high, the chief engineering feature of the project. In the center is a lined canal winding its way along a bad-lands bench and a siphon. These are typical of the water system. At bottom is the "glory hole", with water spilling into it, marking the filling of the reservoir.



as settlers carve NEW HOMES

In addition to the public lands being offered on these projects, there is available tracts which were in private ownership. This land represents excess holdings of settlers in the vicinity. All of it has been appraised at the unimproved value by the Bureau of Reclamation to prevent land speculation. Appraised values of the dry-land range between \$5 and \$15 an acre.

The filling of the Owyhee Reservoir and the opening of the new lands have been the source of much excitement in the vicinity of the project. Thousands journeyed to the dam to see the water pouring into the "glory hole" and to celebrate this last final evidence that the project was complete.

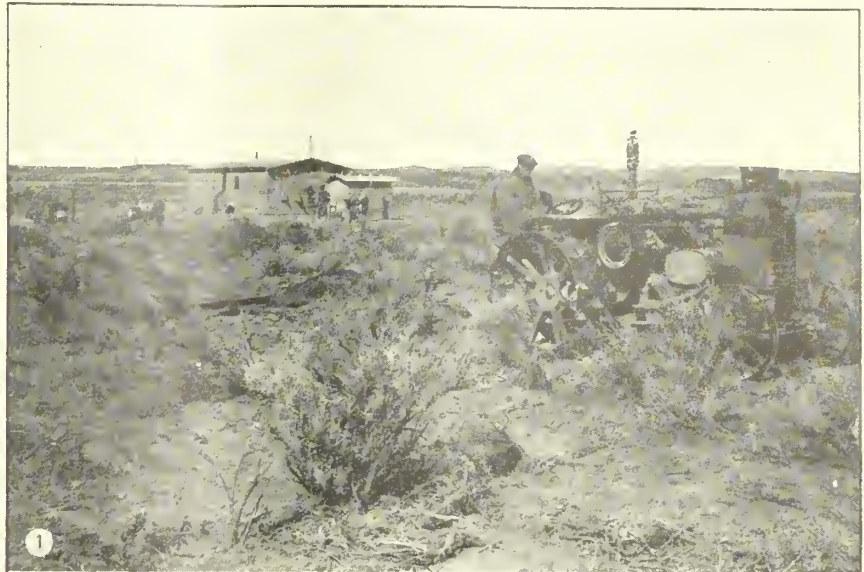
The name, Owyhee, is a source of some speculation. Usually it is believed to have originated with the Indians. However, this name traces back to a group of Hawaiian trappers brought to eastern Oregon by the Hudson Bay Co. early in the last century. These men were reminded of their island homes by the volcanic hills and mountains. Much later, when the permanent white settlers came to write down the name of the hills and the river running from them, they spelled it phonetically, Owyhee. The dam and the project, of course, get their name from the river.

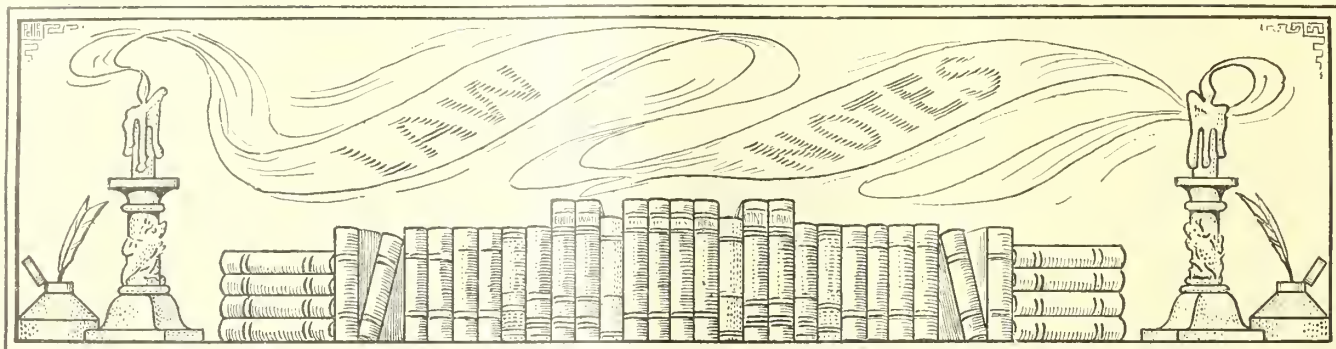
The public land offering on the Owyhee project was the largest made by the Bureau of Reclamation since 1927. One opening, 28 farm units on the Sun River project in Montana, was made earlier this year. Twenty-one of the farms were filed on during the first day. Since January 1, 1924 a grand total of 1,244 farm units comprising 93,705 acres have been opened for homesteading by the Bureau.

With completion of the present construction program, approximately 390,000 acres of new land, largely public land, will be irrigated in the arid states. This program looks at least 10 years to the future.

While the present construction program is comparatively large, the objectives of many of the projects are confined to protection of areas now in irrigation, but with insufficient supplies of water. Through elimination of uncertainties in project water supplies they will stabilize, rather than create, agricultural communities.

At top is a settler on the Owyhee project breaking down the sagebrush, the first step in clearing desert land. In the center is a six-horse team at work disking up a field for its first crop. Below is a group of farm buildings constructed by a new settler on what so recently was desert.





Opinion of the Circuit Court of Appeals, Ninth Circuit, in American Falls Reservoir District No. 2, Appellant, v. Crandall, et al., Appellees

THE Circuit Court of Appeals in the Ninth Circuit dismissed the case of *American Falls Reservoir District No. 2 v. Crandall et al.*, on the ground that the United States is an indispensable party defendant.

The following opinion by Circuit Judge Haney was filed March 30, 1936:

The trial court entered a decree dismissing appellant's complaint, and this appeal is prosecuted from that decree.

On March 30, 1921, the United States, acting through its reclamation service filed an application with the Department of Reclamation of the State of Idaho to appropriate 8,000 second-feet of theretofore unappropriated water of the Snake River, pursuant to the provisions of 2 Idaho Code Ann. 41-202. This application was approved by the Commissioner of such Department of Reclamation as permit no. 15134, hereinafter, for convenience, referred to as the diversion permit. A portion of the application and permit is as follows:

"2. Quantity of water claimed: 8,000 second-feet for new lands * * *

"5. Water is to be used for: Domestic, irrigation, and power purposes * * *

"7. Estimated cost of work: Estimated cost of American Falls Reservoir \$15,000-, 000. Estimated cost of other works of Minidoka north side pumping unit \$9,000,000.

"8. Kind of works: Reservoir, diversion dams, pumping stations, canals, distribution systems, etc. * * *

"15. (a) Is reservoir to be used? Yes. If so, fill in (b) and (c) below.

"(b) Name of reservoir and number of storage permit: American Falls Reservoir No. 269.

"(c) Date of filing of application for storage permit being filed simultaneously with this application * * *

"Under this permit it is proposed to furnish all the lands now irrigated from Snake River above Milner Dam and from

the South Fork of Snake River below the mouth of the lower canyon and some of the lands now being irrigated from Wood River with sufficient storage to provide them with a good and sufficient water right * * *."

Simultaneously with the filing of the above permit, the United States, acting through its reclamation service filed another application with the same department to store 3,000,000 acre-feet of water per annum from the Snake River. This application was also approved as permit no. R-269, hereinafter, for convenience, referred to as the storage permit. In this application and permit, we find the following:

"2. Quantity of water to be stored three million (3,000,000) acre-feet per annum * * *

"4. Water is to be used for: Domestic, irrigation, and power purposes * * *

"7. (b) The available capacity of the reservoir is three million (3,000,000) acre-feet * * *

"13. The water stored in accordance with this permit will be conducted to the place of use through the Riley Canal, and other systems, constructed under the terms of permit no. 15134, filed by United States, on March 30, 1921."

The approval of this permit by the Commissioner of Reclamation contained the following:

"Beneficial use of water stored in accordance herewith, to be made on or before April 23, 1936, as set out in permit no. 15134 for the appropriation of the public waters of the State of Idaho, which is hereby referred to and made a part hereof."

On April 7, 1923, the Commissioner entered an order, which after referring to both of the above described permits, provided "that the time within which proof of completion of works under the said permits must be made and filed in the office of the Department of Reclama-

tion, be and the same is hereby extended to April 23, 1931."

The Commissioner also entered an order dated July 10, 1926, providing that "The time set for proofs of completion of works under permits R-269 and 15237 (15134?) is hereby extended to May 18, 1931, and July 29, 1931, respectively, and such extension of time for completion of works under these permits shall automatically extend the time for completion of one-fifth of the work required to be done in one-half of the time, and for making proof of application of water to beneficial use."

On July 27, 1928, the United States filed an application for amendment of the diversion permit, which was approved "only insofar as the rights of others will not be adversely affected thereby." The amendment merely added 46,419 acres of land to the acreage to be irrigated under the original permit.

On September 21, 1927, the United States "acting in this behalf by John H. Edwards, the Acting Secretary of the Interior," entered into a contract with appellant, which is an irrigation district organized under the laws of Idaho, wherein, among other things, it is provided:

"Whereas, the district includes (a) approximately eighty-one thousand (81,000) irrigable acres of land which have a partial water supply from Little and Big Wood Rivers, but which need a supplemental water supply, which lands are hereinafter referred to as the 'old lands' of the district, of which approximately forty thousand (40,000) acres can be served directly by gravity with Snake River water; and (b) approximately thirty-six thousand (36,000) irrigable acres of dry lands, the major portion of which are public lands of the United States and which have no source of water supply except out of the water supply to be provided under the terms of this con-

tract, hereinafter referred to as the 'new lands' of the district;

"3. And, whereas, the United States has constructed that certain reservoir on Snake River known as the American Falls Reservoir having an estimated storage capacity of approximately one million seven hundred thousand (1,700,000) acre-feet;

* * * "The United States out of its share of said American Falls Reservoir will furnish the district the use and benefit of a proportionate part thereof, to wit, a four-seventeenths (4/17) part or share of said reservoir, estimated to be equivalent to four hundred thousand (400,000) acre-feet of storage capacity, and will deliver to the district each year from said reservoir the same proportionate part of the stored water actually available therefrom subject to the same operation and maintenance charges and the same charges for the expense of the protection and distribution of the stored water and subject to the same hold-over rights and other conditions (except as herein otherwise provided) applicable to the other districts and companies which have rights in said reservoir under their respective contracts, a copy of one of which * * * is hereto attached, marked 'Exhibit A' and made a part hereof. The said stored water will be delivered by the United States to the district at the downstream outlets of the reservoir, immediately below the various power plants at American Falls."

By this contract the Government agreed to build the necessary canal, diversion works, and system, to make available for use by appellant water from the Snake River. Appellant agreed to pay the Government the cost of construction of the canal and distribution and drainage system, and the cost of the storage rights in the American Falls Reservoir, within 40 years from the date of a notice to be issued by the Secretary stating that the water was ready for delivery. The United States had certain powers to withhold benefits in event of nonpayment, as specified in the contract.

On June 25, 1929, in a suit wherein an adjudication of water rights of a number of parties was sought, a decree, which will be referred to as the Woodville decree, was entered adjudicating the rights of the parties. A stipulation was embodied in the decree. The Secretary of the Interior was a party to the suit, and to the stipulation. In the stipulation it was provided:

"It is further stipulated and agreed that *there shall be decreed in the above entitled cause of action, to the Secretary of the Interior of the United States, and his successors in office, for use upon the various projects which have heretofore*

or may hereafter become entitled to the same by reason of contracts with the United States therefor, the water filed upon by the United States in connection with the construction of the American Falls Reservoir under permit number 15134, and reservoir permit number R-269, under date of priority of March 30, 1921, the amount of water to be decreed to the Secretary of the Interior of the United States and his successor in office for such use under said date of priority of March 30th, 1921, to be one million seven hundred thousand (1,700,000) acre-feet per annum for storage in the American Falls Reservoir, and eight thousand (8,000) second-feet for direct diversion.

"It is stipulated and agreed that the rights of contract holders and any others beneficially interested, now or hereafter claiming or having storage reservoir rights in American Falls Reservoir, shall not be affected or determined by the decree to be entered in this action, as to the use to be made of the waters decreed, under such decree, to the Secretary of the Interior under permits described in paragraph no. 4, of this stipulation, the same being permits no. 15134 and R-269."

The decree also provided:

"All of the rights hereby awarded and decreed are made subject to the terms of

the stipulation incorporated herein and made a part hereof.

"To the Secretary of the Interior of the United States of America, and his successor in office, *for use upon the various projects which have heretofore or may hereafter become entitled to the same by reason of contracts with the United States therefor, the water filed upon by the United States in connection with the construction of the American Falls Reservoir under permit number 15134, and reservoir permit number R-269, under date of priority of March 30, 1921, the amount of water to be decreed to the Secretary of the Interior of the United States and his successors in office for such use under said date of priority of March 30, 1921, to be one million seven hundred thousand (1,700,000) acre-feet per annum for storage in the American Falls Reservoir and eight thousand (8,000) second-feet for direct diversion.*"

On May 16, 1931, the United States filed proof of completion of works under the diversion permit, and another proof of completion of work under the storage permit, and on July 12, 1932, two certificates of completion of works under the two permits were issued by the Commissioner.

(Continued in July issue)

Depression

(Continued from p. 137)

tion board. This board has funds for research, planning, and construction. It is now cooperating with the Government in the construction of seven projects. We can borrow money from the Public Works Administration or otherwise. We can sell bonds which are a lien upon the stored water. The repaying cost is obtained from the sale of the right to use the water. A water users' association is organized of farmers who desire to purchase water. Each share of stock entitles him to 1 acre-foot of water annually and he enters into a contract to pay for this stock over the period in regular payments. The annual cost to farmers is approximately 80 cents an acre-foot on most of the projects. The plan retires the debt in 30 years. The association assumes responsibility for operation and maintenance.

Montana has one project under construction and contracts have been let for six other projects. The total cost of approved projects is approximately \$2,000,000.

With regional planning, with State organization, with cooperation on the part of the Government, with an intelli-

gent procedure, there ought to be a new West—a greater West—and many new homes for contented people.

Orland Industries

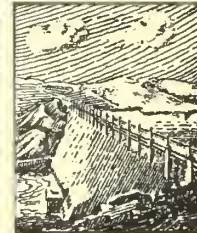
Two of Orland project industries, dairying and poultry raising, are served by industrial plants that are doing yeoman service. The dried milk plant of the Golden State Creamery is now handling more than 70,000 pounds of sweet milk daily and the indications are that its full capacity of 100,000 pounds per day will be reached in the not too distant future. The Poultry Growers Association of Central California, in its Orland plant, is providing an excellent market not only for eggs, but for meat birds as well.

A new industry that promises well is the shipping of turkey eggs for hatching purposes. The Orland unit is the authority for the statement that 1,250,000 turkey eggs valued at \$225,000 will be shipped from Orland this year.

FROM the standpoint of land sales, April was the best month of its existence for the Vale-Owyhee Land Settlement Board, 2,207 acres having been sold. The number of land seekers is still on the increase.



ENGINEERING



Aggregate Production for Grand Coulee Dam

By O. G. F. Markhus, Assistant Engineer, Columbia Basin Project

AMONG the interesting and "largest" construction features of the Grand Coulee Dam, Columbia Basin project, now under construction by the Bureau of Reclamation in central Washington, are the aggregate plant, cement storage and blending plant, and the concrete mixing plants in use by the general contractor, the Mason-Walsh-Atkinson-Kier Co.

Excavation of sand and gravel at Brett Pit.—The sand and gravel deposit selected as a source for the aggregate for the 11,000,000 yards of concrete in the dam, and known as Brett Pit, is located about 1½ miles downstream from the dam on the east bank of Columbia River and some 900 feet above the river surface. The pit was located by Bureau of Reclamation engineers, prior to letting the general contract in June 1934, and was explored to a depth of about 300 feet. Here are contained all the sizes of sand and coarse aggregate required, and in sufficient quantity for completion of the dam, powerhouses, and pumping plant.

Mass concrete in the dam is composed of 1 part cement, 2.7 parts of sand, and 7 parts of coarse aggregate. Pit run shows an average of about 34 percent of coarse aggregate, 55 percent of sand in usable sizes, and 11 percent of sand too fine for use. The largest size aggregate used in the Grand Coulee Dam is 6 inches (cobbles) and the finest sand is that passing a 100-mesh screen. The aggregate is combined in the following proportions: 6 to 3 inches, 18 percent; 3 to 1½ inches, 20 percent; 1½ to ¾ inch, 16 percent; and the ¾ inch to no. 4, 19 percent; no. 4 to 0, 27 percent, or about 27 percent sand and 73 percent coarse aggregate.

Pit run carries a quantity of rock over 16 inches, the largest size passed to the crusher, and has a large surplus of sand, resulting in about 50 percent of the amount excavated going to the waste pile.

Brett Pit fortunately lies at an elevation permitting the assistance of gravity in processing, in transportation to stock

piles, and in disposing of impurities. The material is excavated to a depth of 40 to more than 100 feet by two 4-yard electric shovels, making cuts about 460 feet wide. The first cut is along the center line running through the various operations of the processing plant, and is about 1,200 feet in length. Successive cuts are then made on both sides of the original cut and at right angles, loading to the collecting conveyor belt on the center line, resulting in a 40-foot slice being taken off the 70-acre surface.

Each shovel dumps directly to a steel hopper on the end of a pivoted "pendulum" type conveyor 200 feet long, supported on the moving end by a crawler chassis powered by electric motors on each tread. Rocks larger than 16 inches are rejected by a hinged grizzly on top of the hopper, operated by hydraulic jacks. (These rocks are later hauled out in tractor-drawn wagons and dumped overside.) Underneath the hopper is an electric vibrating-feeder and steel-apron arrangement for loading to a 42-inch belt on the 200-foot boom. This feeder in turn discharges to an extensible lateral conveyor connecting with the main floor collecting conveyor belt. The pivoted end of the boom conveyor is supported by a steel structure spanning the floor conveyor belt and running on tracks on either side to provide for forward movement in following the advance of the shovel. The lateral pit-floor conveyor belts running from the boom to the main collecting belt are 42 inches wide, 8-ply, 32-ounce duck, with a rated capacity of 1,250 tons per hour.

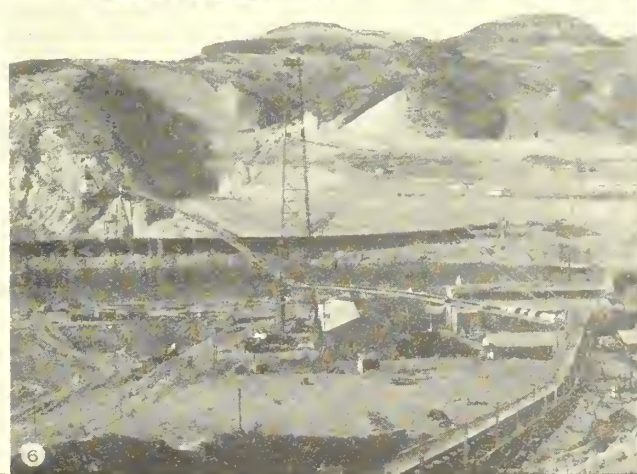
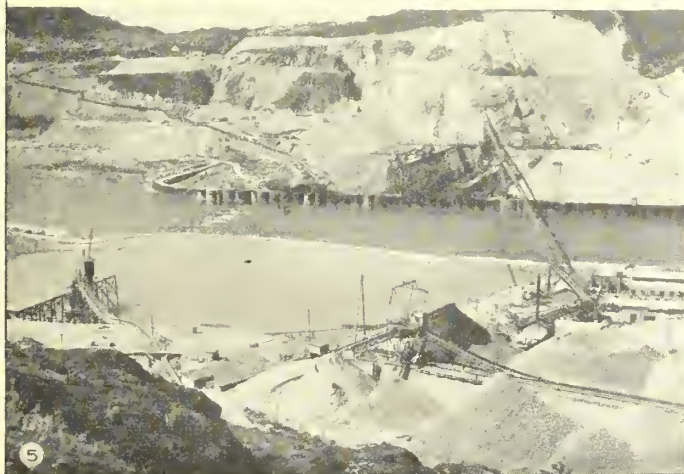
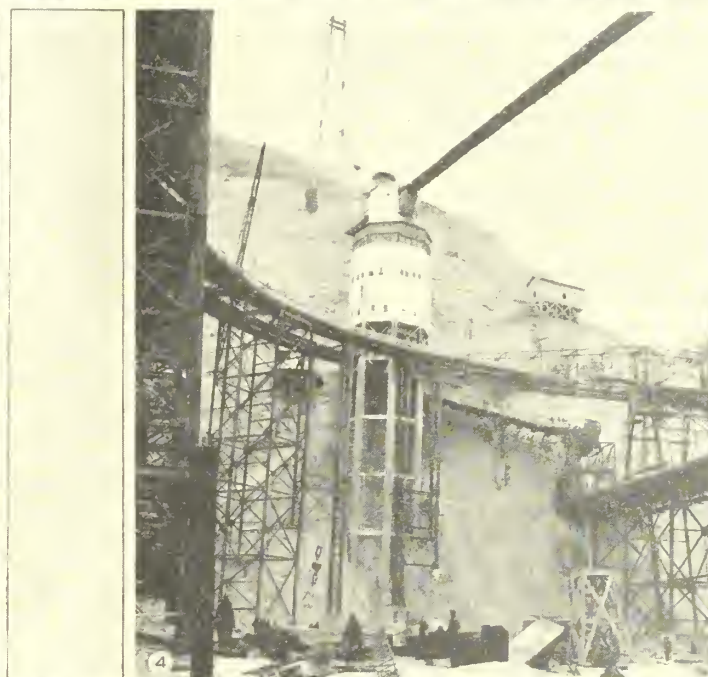
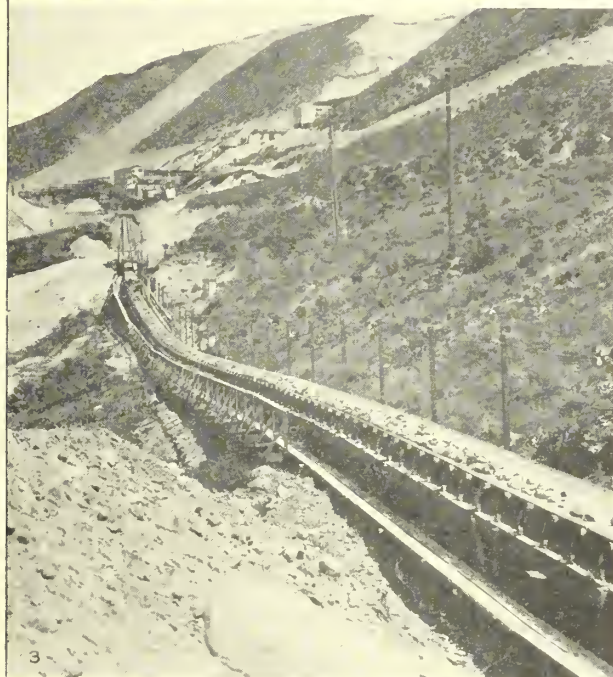
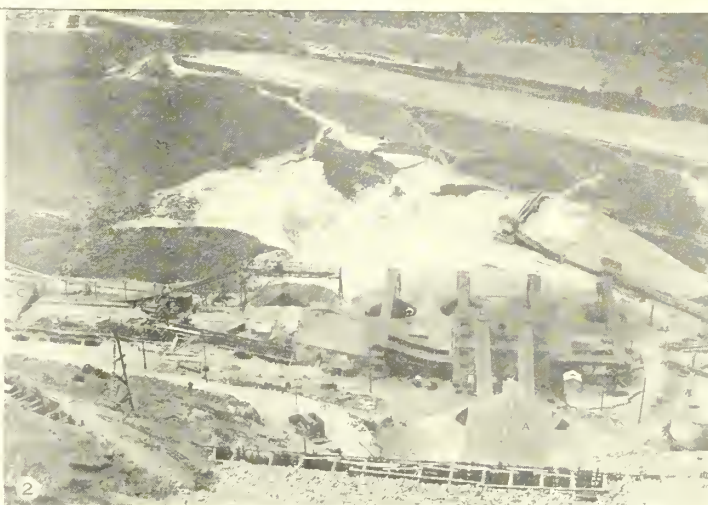
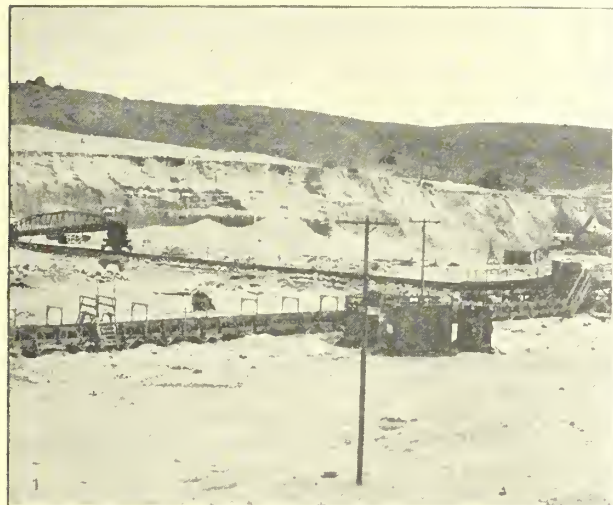
Crushing plant.—The main collecting conveyor belt is 60 inches wide, 8-ply, 32-ounce duck, and has a capacity of 2,500 tons per hour. This conveyor runs out on a high timber trestle on the edge of the pit and discharges to a raw-stock pile below. Underneath this stock pile is a laminated timber tunnel terminating in a concrete structure containing an electric Jeffrey-Traylor vibrating feeder for loading a 60-inch conveyor belt that in turn runs to the crusher. In the crusher house are two rotary 6- by 22-foot

trommel screens that pass rocks larger than 6 inches to a 20-inch gyratory Telsmith crusher. The material is then recombined on a belt running to a balancing pile, underneath which are two similar timber tunnels, equipped with like feeding arrangements, delivering sand and gravel to two 42-inch conveyor belts. These belts, running to the washing and screening plant, carry 1,250 tons per hour each.

Aggregate screening and washing.—The screening plant is housed in a substantial steel building, five stories in height, and has identical installations of screening and washing equipment for handling the full load of each of the two belts, or a total capacity of 2,500 tons per hour of raw aggregate. The material is sprayed with water at several points before entering the screening house, but the principal wash water is applied where it enters the top floor. On the next two floors are double sets of 5- by 10-foot Symons double-deck vibratory screens equipped with nozzles to apply wash water and rinse during the screening process. On the floor beneath are the finished aggregate collecting conveyors running out to the plant storage piles.

The used wash water, carrying sand and impurities, is passed through steel troughs to the dewatering plant where the sand is raked out and delivered to a 36-inch conveyor belt running in turn to the sand classifier plant. Used water runs back to two Dorr clarifier tanks having a combined capacity of 3.6 million gallons.

Part of the sand raked out goes to the waste dump as surplus, with the remainder entering the first classifier unit. Here sufficient water is added to make a fairly thick sludge and the coarse sand settles, is raked out, washed, and rinsed. Overflow from this unit goes to the no. 2 classifier, where water is again added until the resulting liquor is just thin enough so that the medium size sand will settle out. The overflow is then passed on to the third unit, and again diluted until the finest sand that can be used in making concrete is recovered. The three sizes of sand from the classifiers are car-



GRAND COULEE DAM, COLUMBIA BASIN PROJECT, WASHINGTON

1, Two 4-yard electric shovels excavating at the top of Brett pit are loading to the laterals to the main 60-inch conveyor 2. (a) crusher plant, (b) screening and washing plant, (c) sand mixing plant 3, belt carrying the finished sand and gravel, one size at a time, from the plant stock piles to the mixer stock piles below 4, west side mixing plant, capacity 6,000 cubic yards per day, with suspension bridge carrying sand and gravel to the bins 5, mixer storage bins—east side mixing plant to the left, airplane loader, suspension bridge running to the west side mixer, and 2 placing trestles 6, the conveyor suspension bridge carrying sand and gravel to the west-side mixing plant on a belt 36 inches wide, having a capacity of 700 tons per hour. The suspension bridge is 3,500 feet in length and has 2 spans of 1,437 feet in length.

ried by belts to three drainage bins from where they go to a belt in measured proportions for blending at a squirrel-cage type mixer, and from there are delivered to the plant stock pile. Water used in the sand classifying plant is passed back to the Dorr clarifiers while surplus sand from the classifier units goes to the waste pile. The plant has a capacity of 1,250 tons per hour of finished aggregates.

The screening and washing plant is located about 600 feet above the river, and as the total amount of wash water required is about 20,000 gallons per minute, a considerable saving in power and in pumping equipment is effected by the use of Dorr clarifiers. About 85 percent of the water used is reclaimed and recirculated through three 6,000 gallons per minute Worthington pumps, the lost water being made up direct from the river where there is an installation of three six-stage Worthington pumps with a capacity of 2,500 gallons per minute connected to a 16-inch diameter steel supply pipe.

Delivery of refined aggregates.—Underneath the plant-stock piles is another laminated-timber tunnel, with vibrating feeder gates under each pile for loading a 48-inch conveyor belt, transporting the finished aggregate to the live-storage piles, located near the east end of the dam, some 4,000 feet upstream. This belt is unloaded through what is called an aeroplane tripper arrangement running on rails between two tunnels similar to the one under the plant-stock piles. One set of stock piles serves the east mixer plant and the other a belt carried on a 3,500-foot suspension bridge across the river to the west-side mixing plant. Supply for the live-storage piles is regulated by means of remote control of the pneumatically operated gates under the plant storage, one size being brought down at a time and deposited on the respective piles through boom-

conveyors extending out from the aeroplane tripper and hinged to prevent excessive drop of the aggregates.

Live storage has 77,000 tons capacity and aggregate plant storage amounts to 13,000 tons. The total 90,000 tons of storage is equivalent to a 3½-day run for the two mixing plants operating at full capacity. A bin man, stationed at the top of the mixing plant, obtains the various sizes of aggregate, one at a time, by remote control of feeder gates under the live-storage piles.

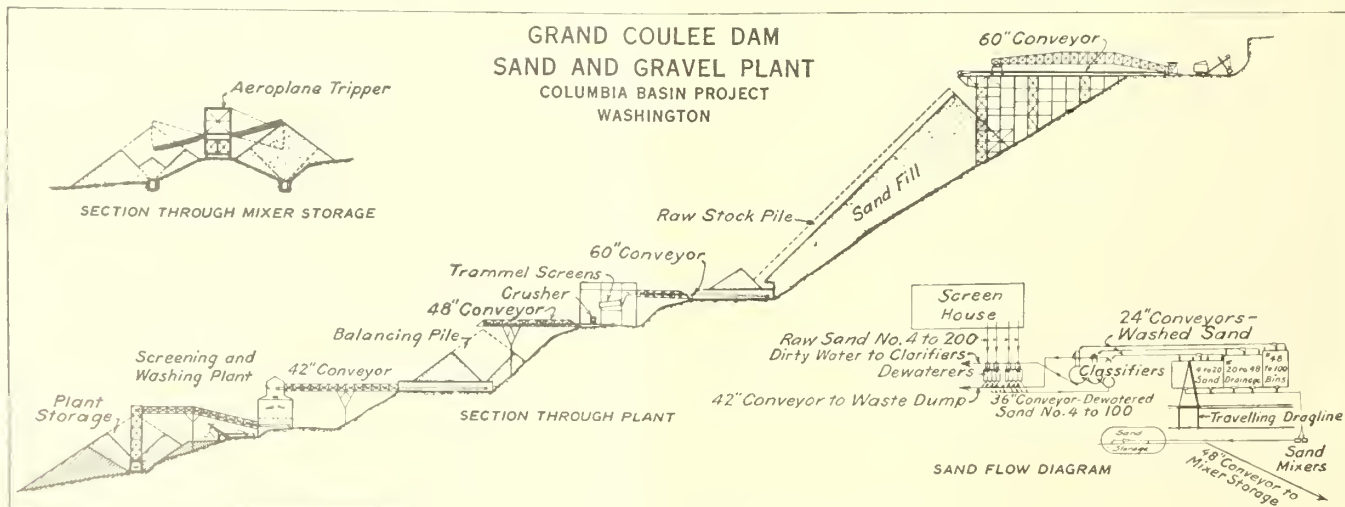
In the sand-and-gravel system are 43 separate conveyors totaling 4½ miles in length, with belts varying from 60 to 24 inches in width, and entirely electrically operated, the connected load being 4,200 horsepower. Maximum capacity of the 36-inch belts from the mixer storage to the two mixing plants is 700 tons per hour each.

Handling bulk cement.—Cement for the present contract, which includes 4½ million cubic yards of concrete, is obtained from five cement mills located within the State of Washington, is brought in in bulk, and stored in eight 5,000-barrel steel silos along the tracks of the U. S. Construction Railroad which connects with the Northern Pacific Railway line at Odair, near Coulee City. In addition to the eight storage silos are two 5,000-barrel silos for storing the blended product from the several mills. Unloading from box cars is accomplished by four Fuller-Kinyon pumps. Transportation to the mixing plants is through an 11-inch steel pipe supplied by Fluxo cement pumps with a capacity of 1,000 barrels per hour. The pipe line running to the west side mixing plant is 2,000 feet in length while the line to the east side is 6,000 feet long. Approximately 6,000 barrels of bulk cement is unloaded daily under the present operation of the one mixing plant.

Concrete production.—Concrete is man-

ufactured in two mixing plants, one at each end of the dam. Each plant is housed in an octagonal structure, 42 feet in diameter and 102 feet in height. Each plant sets up against the abutment directly outside the downstream slope of the dam and rests on concrete columns, the longest of which, under the west side plant, is 120 feet. The top part of the plant contains bins for a 2-hour supply of aggregates and cement. On the floor below is the batching equipment, consisting of a single set of five air-operated, electrically interlocked C. S. Johnson Co. batchers. Each batcher is equipped with a Johnson hopper scale having five different weigh beams, permitting prompt selection of batches for any one of five possible mixes. Batching can start only when the discharge gates are closed, and discharge can occur only when the chute is actually connected to one of the four mixers on the floor below. Weighing is electrically controlled. When about 90 percent of the batch has been received, the scale beam operates a major cut-off, this being followed by a minor cut-off that permits aggregate to dribble into the batcher until the scale registers the proper weight. When all batchers are filled, they are simultaneously discharged by a hand operated air valve into a dust-tight collecting cone. At the bottom of the collecting cone is a swivel chute that can be turned by an air ram to any of the four mixers. All operations are both electrically and mechanically interlocked, thus insuring proper sequence of operations.

The dispatcher is in control of concrete production and distribution, being in direct contact by telephone with the foremen at various points of pouring. His signal panel board informs him of the type of mix in each mixer, when the mixer has been emptied, the number of mixes on order (up to eight future batches), and when a particular order has



been filled. The batcher operator is responsible for quality of the mix and also for continuous and regular manufacture of concrete, receiving instructions from the dispatcher as to kind and number of batches required. Communication between dispatcher and batcher operator is by a speaking tube and a system of signal lights. Another device records the number of batches delivered to the mixers. An autographic recorder provides a continuous check on operation of each batcher and indicates any mechanical or electrical fault that may develop. Also, through a watt meter the consistency of each batch is recorded.

On the floor below the batchers are four 4-cubic yard Koehring mixers, arranged concentrically and charged from the front through the swivel cone chute. After a 2½-minute mixing time, these mixers discharge from the same opening by tilting to 60° below the horizontal. Mixing is accomplished at 15° above the horizontal. The cradle, drum, and rotating power unit are tilted through the total swing of 75° by air cylinders interlocked to prevent premature tilting. This arrangement of concentric feeding and discharging serves to speed up mixing time and also saves a considerable amount of space. The mixers are 98 inches in diameter and the opening is 38 inches, each mixer having a capacity of cubic yards.

Delivery of concrete to forms.—Mixers discharge to 4-yard bottom-dump buckets carried on steel flat cars. These cars are hauled over steel construction trestles by Diesel-electric locomotives to the point of use. Here hammerhead or revolving cranes pick up and lower the buckets into forms for various blocks in the dam. Only the west side mixing plant is operating at present. On May 7 this plant turned out a total of 7,150 cubic yards, or about 92 percent of its theoretical capacity. Erection of the east side mixing plant has just been completed and operation will commence after the east excavation has been unwatered, probably about September 1.

Summary.—The outstanding, and, at least unusual, fact is that the fine quality of aggregates for concrete manufacture was found within the short distance of 1½ miles from the dam and in sufficient quantity for the entire job. These aggregates were fortunately provided by operations of nature in prehistoric times, which also arranged for the gulch, known as Rattlesnake Canyon, as a depository for dam site overburden spoil banks, and the deep granite layer for dam foundations. The location of the sand and gravel deposit has made it possible to use electric shovels for excavation and gravity to assist in transportation and in processing.

Cement is obtained from the five mills located in the State of Washington and is stored within close proximity to the mixing plants. Cement is thence transported by pipe line and compressed air, and concrete is manufactured in two modern and thoroughly automatic mixing plants at convenient locations on either end of the dam. These mixing plants have the unusual capacity of being able to place a cubic yard of concrete in the dam every 7 seconds, and because of their intricate operation have won the popular title "House of Magic."

The plant was designed and built by the Mason-Walsh-Atkinson-Kier Co., contractors for the Grand Coulee Dam and power plant. Mr. George H. Atkinson is job manager for the company; Mr. Harvey Slocum, general superintendent; and Mr. C. D. Riddle is chief engineer.

Notes for Contractors

Colorado River project, Texas.—Morrison-Knudsen Co., Inc., Boise, Idaho, was the successful bidder on construction of the Arnold Dam and power plant (schedule no. 1), and the Austin Bridge Co., Dallas, Tex., was low on processing sand and crushed rock for the Hamilton and Arnold Dams (schedules nos. 3 and 5), both under specifications no. 673. Their bids were \$783,773.50 and \$448,120, respectively. Bids were opened at Austin, Tex., on April 15 for the following schedules: (1) Arnold Dam and power plant, gravity type dam; (2) concrete slab and buttress type dam; (3) processing sand for Hamilton and Arnold, gravity type dam; (4) processing sand for Hamilton and Arnold, slab and buttress type dam; (5) processing crushed rock for Hamilton and Arnold, gravity type dam; (6) processing crushed rock for Hamilton and Arnold, slab and buttress type dam. Other bids received for the various schedules were as follows: R. W. Briggs & Co. and S. E. McCullough, Pharr, Tex., (1) \$865,745, (3) \$130,000, (4) \$104,000, (5) \$393,200, (6) \$311,250; W. E. Callahan Construction Co., Dallas, Tex., (1) \$1,010,107, (2) \$1,101,879.50, (3) \$160,000, (4) \$144,000, (5) \$378,480, (6) \$296,700; Brown & Root, Inc., Austin, Tex., (1) \$1,193,220.75, (2) \$989,585.75, (3) \$128,000, (4) \$102,400, (5) \$353,850, (6) \$265,820; Waterways Construction Co., Minneapolis, Minn., (1) \$1,195,150, (2) \$1,364,260, (3) \$124,000, (4) \$107,200, (5) \$454,920, (6) \$354,830; McKenzie Construction Co., San Antonio, Tex., (1) \$1,168,153.50, (2) \$1,278,124, (3) \$170,000, (4) \$152,000, (5) \$465,900,

(6) \$351,420; Kansas City Bridge Co., Kansas City, Mo., (1) \$928,623, (2) \$974,769; Case Construction Co. and Bent Bros., Inc., Los Angeles, Calif., (1) \$956,142.75, (2) \$940,838.75; J. De Puy, San Antonio, Tex., (1) \$1,041,931.50, (2) \$1,147,032.50; Hardaway Contracting Co., Columbus, Ga., (1) \$1,399,758; Peter Kiewit Sons Co., Omaha, Nebr., (2) \$1,088,427; Austin Bridge Co., Dallas, Tex., (4) \$83,200, (6) \$259,590; R. E. Jones Gravel Co., Inc., Austin, Tex., (3) \$119,000, (4) \$95,200; the Acme Wire & Iron Works, San Antonio, Tex., (3) \$146,000, (4) \$116,800; Stewart Sand & Materials Co., Kansas City, Mo., (3) \$204,000, (4) \$174,400; R. Newton McDowell, Inc., Kansas City, Mo., (5) \$383,520, (6) \$297,270; S. J. Groves & Sons Co., Minneapolis, Minn., (3) \$160,000, (4) \$136,000, (5) \$393,700, (6) \$314,950; Peterson Construction Co., Minneapolis, Minn., (5) \$397,100, (6) \$300,000. It is required that the work under schedule 1 be completed within 600 days and under schedules 3 and 5 within 400 days. The Government will purchase for installation by the contractor 500,000 pounds of reinforcement bars; 135,000 pounds of steel, brass, and cast-iron pipe, fittings, and valves; 285,000 pounds of structural steel; 415,000 pounds of gates, gate hoists, control mechanism, power penstock, cranes and crane rails, metal pier noses, hand railing, trashrack, and metal work.

Frenchtown project, Montana.—Six contractors submitted bids for construction of main canal structures and concrete lining, earthwork, and structures for laterals, and O'Keefe wasteway (specifications no. 679), bids opened at Missoula, Mont., on April 27. The bids were as follows: Ralph Davis, Conner, Mont., \$47,312.15; Morrison-Knudsen Co., Boise, Idaho, \$48,129.85; Nick Burggraf, Inc., and J. W. Brennan, Idaho Falls, Idaho, \$59,398.50; C. & F. Teaming & Trucking Co., Butte, Mont., \$59,882.45; Max J. Kuney Co., Spokane, Wash., \$67,901.65; Basil L. Hunt, Butte, Mont., \$72,554.60.

The low bidder was awarded the contract on May 18.

Riverton project, Bull Lake Dam, Wyoming.—The following bids were opened at Denver on April 23 for furnishing four pier-nose sections (item 1) and four 5-by 5-foot gate assemblies (item 2) under specifications no. 677; Koppers Construction Co., Fort Wayne, Ind., \$1,250 and \$30,050; Hardie-Tynes Manufacturing Co., Birmingham, Ala., \$473 and \$33,941; S. Morgan Smith Co., York, Pa., \$770 and \$46,260; Fulton Iron Works, St. Louis, Mo., \$675 and \$35,525; Joshua Hendy Iron Works, Sunnyvale, Calif., \$745, and \$40,712; Bartlett Hayward Co., Baltimore, Md., \$600 and \$34,800;

combined \$35,250; Steacy-Schmidt Manufacturing Co., York, Pa., \$435 and \$45,000; Michigan Valve & Foundry Div., Detroit, Mich., \$750 and \$55,160. Steacy-Schmidt was awarded item 1 and Koppers Construction Co. item 2.

Boulder Canyon project, Arizona-Nevada.—At the opening of bids on specifications no. 782-D, manual telephone apparatus for Boulder Dam and power plant, at Denver, on April 20, two bids were received as follows: American Automatic Electric Sales Co., Chicago, Ill., \$10,668.60, f. o. b. Depew, N. Y., and Chicago, Ill.; Kellogg Switchboard & Supply Co., Chicago, Ill., \$18,915, f. o. b. Chicago.

On May 7 a contract was awarded to L. D. Reeder Co., Los Angeles, Calif., for the construction of rubber tile floor covering for Boulder power plant and switchyard relay house (specifications no. 780-D) at their bid of \$6,500 f. o. b. Boulder City. Other bids were as follows: D. A. Pancoast Co., San Francisco, Calif., \$6,735; Barker Bros. Inc., Los Angeles, Calif., \$7,150; Lindley Carpet Co., Inc., Los Angeles, Calif., \$7,300; Broadway Department Store, Inc., Los Angeles, Calif., \$7,300; E. H. O'Neill Floors Co., Chicago, Ill., \$7,480; Seaside Products Corporation, Los Angeles, Calif., \$8,400; Van Fleet-Freear Co., Los Angeles, Calif., \$8,478.

The Sanitary Construction Co., Indianapolis, Ind., on May 15 was awarded the contract for furnishing and installing structural glass for the Boulder Dam and power plant, schedule 1, specifications no. 779-D, at their bid of \$12,700 f. o. b. Boulder City. Westco Co., Ltd., Santa Ana, Calif., with a bid of \$1,539 f. o. b. Boulder City was awarded contract for schedule 2, furnishing and installing marble and tile. All bids for schedule 3, furnishing and installing railings, posts, and gates, were rejected. A. J. Bayer & Co., Los Angeles, Calif., with a bid of \$2,688, furnishing and installing aluminum doors, was the successful bidder on schedule 4.

Columbia Basin project, Washington.—The following contracts have been awarded under specifications no. 769-D for supplying motor-driven, centrifugal pumps and control apparatus for pumping plants for cooling concrete at Grand Coulee Dam: Item 1, three pumps, 500 gallons per minute, 220-foot head, Dayton-Dowd Co., Quincy, Ill., \$1,620; item 2, four pumps, 750 gallons per minute, 220-foot head, Gardner-Denver Co., Denver, Colo., \$2,896 f. o. b., Coulee, Wash.; item 3, three pumps, 1,000 gallons per minute, 220-foot head, Fairbanks-Morse & Co., Kansas City, Mo., \$2,770 f. o. b. Beloit, Wis.; item 4, one pump, 1,500

gallons per minute, 220-foot head, Woodin & Little, Inc., San Francisco, Calif., \$1,443 f. o. b. Coulee, Wash.; item 5, two priming pumps, 30 gallons per minute, 40-foot head, Worthington Pump & Machinery Co., Harrison, N. J., \$104. There were 17 bidders.

Casper-Alcova project, Wyoming.—The following bids were received at Denver on May 6 for furnishing an electric freight elevator for outlet works at Alcova Dam (specifications no. 788-D) either commercial or Government bill of lading: Kimball Bros. Co., Council Bluffs, Iowa, \$14,718 and \$13,790; Westinghouse Electric Elevator Co., Chicago, Ill., \$36,610 and \$34,700; Houghton Elevator & Machine Co., Toledo, Ohio, \$20,995 and \$19,535; Otis Elevator Co., St. Louis, Mo., \$19,378 and \$16,789; Montgomery Elevator Co., Moline, Ill., \$15,168 and \$13,958.

Upper Snake River storage project, Idaho.—Six bids were received at Ashton on May 4 for clearing the Island Park Reservoir site (specifications no. 681). The totals for the four schedules were as follows: Nevada Construction Co., Nevada, Mo., \$66,890; Jonovich & Co., Seattle, Wash., \$107,600; Holmberg & Norman, Inc., Port Orchard, Wash., \$109,470; Max J. Kuney Co., Spokane, Wash., \$115,900; Morrison-Knudsen Co., Boise, Idaho, \$76,608. The Idaho Timber Clearing Association, Rexburg, Idaho, bid \$45,866 on schedule 1 only.

Carlsbad project, New Mexico.—Thirteen cement companies submitted bids on furnishing 25,000 barrels of standard portland cement in cloth sacks for the Alamogordo Dam (invitation no. 2229-A) opening at Denver on April 27. Nine submitted identical bids of \$3.31 per barrel, shipment on commercial B/L and \$3.136-944, shipment on Government B/L, both f. o. b. Fort Sumner, N. Mex., and subject to discount and sack allowance of \$0.50. These mills were as follows: Oklahoma Portland Cement Co., Ada, Okla.; Monarch Cement Co., Humboldt, Kans.; Consolidated Cement Corporation, Fredonia, Kans.; Lehigh Portland Cement Co., Iola, Kans.; Trinity Portland Cement Co., Fort Worth or Dallas, Tex.; Universal Atlas Cement Co., Independence, Kans.; Lone Star Cement Co., Dallas, Tex.; Dewey Portland Cement Co., Dewey, Okla.; and Ash Grove Lime & Portland Cement Co., Chanute, Kans. Three companies also bid \$3.136944, as follows: Colorado Portland Cement Co., Portland, Colo.; Southwestern Portland Cement Co., El Paso, Tex.; and United States Portland Cement Co., Portland, Colo. The Monolith Portland Midwest Co., Laramie, Wyo., bid \$3.190668. The bids, 12 of which were equal, show a

variation in net mill price from \$0.45 to \$1.65 per barrel. Based on net delivered cost to the Government, and evaluating bids for cost of inspection, the Colorado Portland Cement Co. and United States Portland Cement Co. were low.

All-American Canal (Boulder Canyon) project, Calif.—The Virginia Bridge Co., Roanoke, Va. on May 15 was awarded the contract for furnishing 1,339,500 pounds of structural steel for railroad and highway bridges (specifications no. 670) at their bid of \$42,672 f. o. b. Birmingham, Ala. Bids of 10 other companies varied from \$44,730 to \$75,203.

On May 13 the Secretary approved award of contract to David H. Ryan, San Diego, Calif., for construction of railroad and highway bridges and Araz wash overchute (specifications no. 665) at his bid of \$155,447 for the three schedules. Other bids were as follows: V. R. Dennis Construction Co., San Diego, Calif., \$163,412; Frazier-Davis Construction Co., St. Louis, Mo., \$215,952.25; Morrison-Knudsen Co. Inc., Los Angeles, Calif., \$229,867.25. The Lynch-Cannon Engineering Co., Los Angeles, Calif., bid \$94,865 for schedules 1 and 2 only.

Boise (Arrowrock Dam) project, Idaho.—At Denver on May 7 the following bids were opened for furnishing diversion pipes for power and irrigation outlets, under specifications no. 787-D: S. Morgan Smith Co., York, Pa., \$3,326; Berkeley Steel Construction Co., Inc., Berkeley, Calif., \$3,670; John W. Beam, Chicago, Ill., \$5,100 discount one-half percent; Beall Pipe and Tank Corporation, Portland, Oreg., \$4,414; Biggs Boiler Works, Akron, Ohio, \$3,815 discount 1 percent; Hydraulic Supply Manufacturing Co., Seattle, Wash., \$4,875; Pittsburgh-Des Moines Steel Co., Des Moines, Iowa, \$8,800; Southwest Welding & Manufacturing Co., Inc., Alhambra, Calif., \$4,392 discount one-half percent; Western Pipe & Steel Co. of California, South San Francisco, Calif., \$3,578; Lakeside Bridge & Steel Co., Milwaukee, Wis., \$3,722; Bethlehem Steel Co., Leetsdale, Pa., \$3,995; Olson Manufacturing Co., Boise, Idaho, \$6,300; California Steel Products Co., San Francisco, Calif., \$3,848 f. o. b., Barber Junction, Idaho.

SEVERAL houses in Rupert, Minidoka project, Idaho, have been bought by the Amalgamated Sugar Co. for the use of some of their employees who will operate the Paul Sugar Factory.

SETTLEMENT activity on the River-ton project continues. Twenty-two farm units are still available.

Progress of Investigations of Projects

Grand Lake-Big Thompson transmountain diversion project, Colorado.—The project is for the purpose of furnishing a supplemental water supply for the lands now irrigated in the Poudre, Big Thompson, St. Vrain, and South Platte Rivers in northeastern Colorado. The Granby Reservoir will furnish hold-over capacity for supplying irrigation demands during a series of low years. Control surveys on the investigation are practically complete and additional plane-table parties have been placed on the work in order that the surveys of the dam and reservoir sites and canal and power lines may be completed by the middle of the summer. Water-supply studies have been made for the project, including the capacities required in compensating reservoirs for western slope water users. Estimates of cost have been made for the irrigation and power features separately, and a financial set-up for the project is briefly discussed in a preliminary report.

Blue River transmountain diversion, Colorado.—The project contemplates transmountain diversion by means of a tunnel through the Continental Divide of waters from the Blue River near Dillon to the South Platte watershed above Denver. Five possible alternative plans are being investigated: (1) Hoosier Pass diversion into Antero, Eleven Mile Canyon and Cheeseman Reservoir; (2) Georgia Pass diversion in Cheeseman Reservoir; (3) Montezuma Pass diversion into Standly Reservoir; (4) 22-mile tunnel from a point above Dillon to the North Fork of South Platte River; (5) diversion from the Blue River into Clear Creek. Field work on these investigations was started during the latter part of the month. A reconnaissance was made of several reservoir sites within the Blue River watershed to locate storage possibilities for use in connection with the transmountain diversion, as well as for replacement storage for use within the Colorado River Basin.

Western slope, Colorado.—The investigations are for the purpose of making a study of possible irrigation and power developments in the State of Colorado, particularly in that portion west of the Continental Divide. These investigations will be limited to those projects where the water users are willing to repay the cost of the works in the event that the investigations should show feasibility of the projects and the irrigators should then desire their construction. The principal projects considered for investigation include the following: Fruitland (North Fork of the Gunnison), La Plata, Yampa Reservoirs, West Divide Creek,

Florida Mesa, Roan Creek, Mancos Valley, Silt, and Williams Fork Reservoir. Gaging stations on various streams that are tributary to the North Fork of the Gunnison River have been established in order that water-supply studies may be made of the information obtained. Investigation of the Mancos Valley project at Durango, Colo., was begun. One field party was placed on a survey of the Weber Reservoir site near Mancos and another will begin the mapping of the Mancos Irrigation District during the first week in May. All of the available geologic data pertaining to the projects proposed have been collected for use in making geological observations at various dam sites.

Rio Grande Basin, Colo.-N. Mex.—The investigations being made by the National Resources Committee have as their aim the assembly of data useful to the States of Colorado, New Mexico, and Texas in formulating a compact for the use of the waters of the Rio Grande and its tributaries. The investigations to be made by the Bureau of Reclamation consist of: (a) Reservoir and dam site surveys in the basin of the Rio Grande with designs and estimated costs of necessary dams and related structures, (b) possibilities of transmountain diversion of water from the San Juan River and tributaries to the basin of the Rio Grande, including storage and the design and estimated cost of all necessary conduits and work, (c) possibilities and cost of hydroelectric development in the basin of the Rio Grande, including economic feasibility, possible markets, and power income.

Investigations of the Wagon Wheel Gap, Vega Sylvester, Conejos, and State Line Reservoir sites on the headwaters of the Rio Grande were begun. Topographic surveys were initiated for the Wagon Wheel Gap dam site, these being made on a scale of 50 feet per inch with a contour interval of 5 feet, and extending to an elevation of 500 feet above the stream bed. Former reconnaissance surveys indicate that a reservoir at this site would have a capacity of about 1,000,000 acre-feet. Preliminary geological examination was made of the Wagon Wheel Gap and Vega Sylvester dam sites prior to the formulation of a more extensive program for exploration by diamond drilling and test pits. The engineer in charge began field reconnaissance to ascertain the work to be performed in connection with the investigation of the San Juan Transmountain diversion near Chama, N. Mex. Surveying a base line to be used in connection with surveys in this region was commenced.

A conference at Santa Fe, N. Mex., from April 30 to May 2, 1936, with officials of the States of Colorado and New Mexico and of the National Resources Committee was held to discuss further plans for the execution of these investigations.

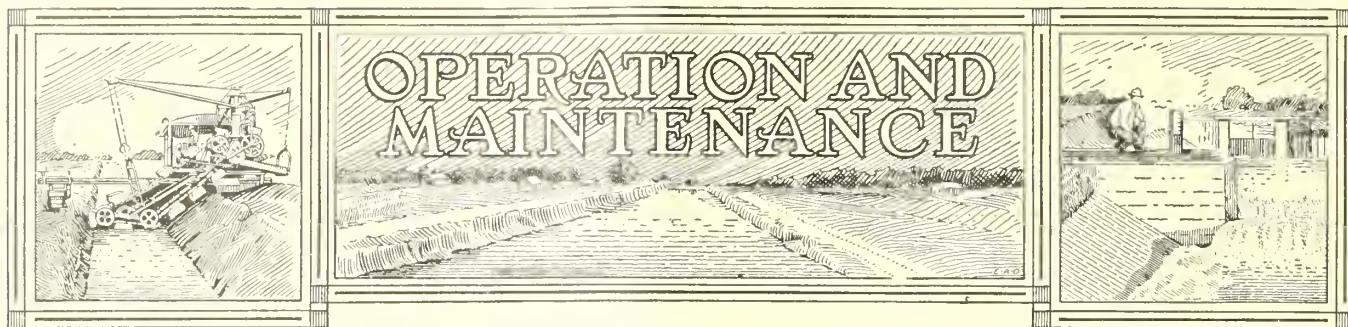
Boise (Boise-Weiser-Payette), Idaho.—A comprehensive investigation of the watersheds of Boise, Payette, and Weiser rivers in southwest Idaho to ascertain ways and means of augmenting scanty water supplies and extending irrigation development, including transmountain diversions from the Salmon River watershed and the development of necessary power supplies to enable utilization by pumping, of waters not otherwise usable. A report being prepared in the Denver office will be completed during the early part of May on the initial phases of these investigations.

Gallatin Valley, Mont.—The investigation of the Gallatin Valley comprises (a) survey and investigation of reservoir sites, (b) land classification of the arable lands, (c) studies of ways and means of reclaiming valley lands now abandoned, and of irrigating lands now arid, and (d) plans and estimates for the construction of storage, distribution, and drainage works. Field work was initiated in the latter part of 1935, and, following a reconnaissance of reservoir sites, attention was centered on the Lower Basin site on West Gallatin River, about 30 miles southwest of Bozeman. Diamond drilling was carried on through the winter and completed in April. Water circulation tests with fluorescein indicate connected passages through the limestone rocks forming the site and storage will surely be relatively expensive.

Saco Divide, Milk River project, Mont.—Investigation is in progress of the cost and feasibility of irrigating 8,000 acres on the Saco Divide, near the town of Saco, between the Nelson Reservoir Canal and Milk River, by pumping from that canal. The irrigable area is now being dry-farmed; but with irrigation, would become one of the most productive areas on the project. Field work is being continued and it is anticipated that a report on the engineering and economic feasibility will be completed at an early date.

Madison River diversion, Montana-Idaho.—An investigation on the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henry's Lake, Idaho, is in progress. Field surveys on these investigations have been finished and water supply studies to determine the amount of water

(Continued on p. 153)



One Crop Versus Diversification

By L. H. Mitchell, Field Supervisor, District No. 4

IN PRESENTING both sides of this question a project that is growing a diversity of crops and one that has consistently confined its crop acreage to one or two crops are selected. The two projects used in comparing cropping conditions have soil and climatic conditions quite similar and marketing conditions not materially different. They are the Newlands project in Nevada and the Garland division of the Shoshone project in Wyoming. In 1935 Newlands had in crops 42,522 acres, while Garland had 31,491 acres. In the early days both these projects were known as desert areas. They are strictly arid, as the average annual rainfall is less than 6 inches. The soil of the Newlands project as a whole is more sandy but the expense of leveling was greater than on the Garland division. Both, however, have been considered good alfalfa-producing projects, with the Newlands having an advantage in the per acre yield of this crop. The markets for hay and forage have been very similar. On both projects there has been a limited demand for local livestock feeding. The surplus hay on the Newlands project was shipped to Pacific coast markets while that from the Garland division was shipped to Kansas City and other Missouri River points.

The area in hay and forage on the Newlands project has not changed materially during the past two decades. While on the Garland division the percentage of crops in hay and forage was never as large as on the Newlands project, there has been a steady increase in the acreage of cultivated crops but it is not intended by this to hold up the Garland division as a model project. Many have contended that the alfalfa mill on the Garland division was a liability rather than an asset because with every ton of alfalfa meal that left the project, much valuable soil fertility was also leaving, never to return. It is the opinion of the writer that the acreage now devoted to beans is

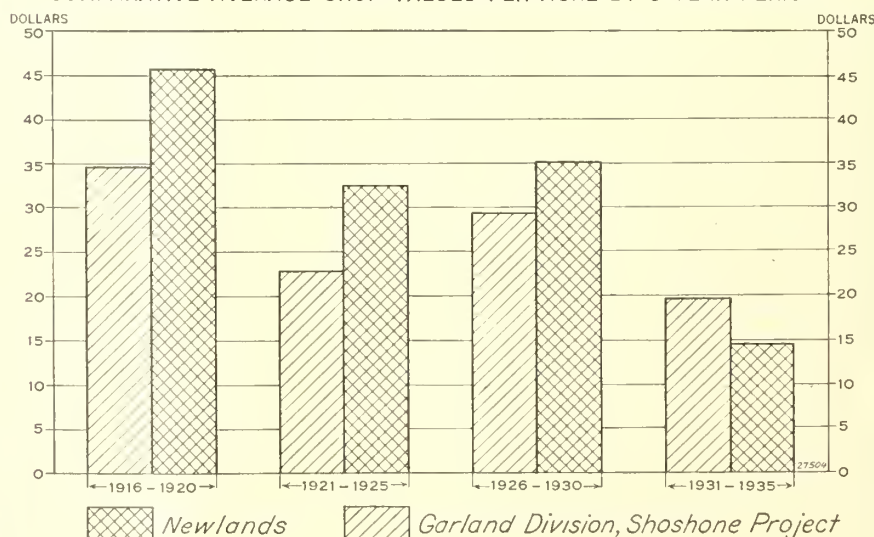
much too large. A freeze can occur either in late spring or early fall, and other crop damages from hail or insects not only could affect the total project returns but farmers with beans as a major crop would be in financial difficulties. The chance for losses from such uncontrollable hazards could be greatly lessened by increasing the acreage now in tame pasture and sugar beets. Farmers on all projects have a tendency to go to extremes by growing crops that bring the greatest returns for the current year.

A study of the diagram accompanying this article, which shows comparative average crop values per acre during the 5-year periods 1916-20, 1921-25, 1926-30, and 1931-35, indicates that during the first two periods the average per-acre returns were about \$10 more on the Newlands project than on the Garland division. During the third period this spread was a little less than \$6 and in favor of the Newlands project. For the last period, 1931-35, this difference was approximately \$5 but in favor of the Garland division.

In 1925 seed peas and beans were introduced as an experiment on the Garland division. These crops, with the commercial bean, deserve no small amount of credit for the healthy condition now prevailing on the Shoshone project.

Another advantage that generally goes with intensively cultivated crops is the opportunity for employment offered families living in town. A concrete example of this benefit is found on the Garland division where in 1935 one seed company alone had an average monthly payroll of \$10,000. In addition to the regular company employees, about 150, mostly women, were employed in the plant in the fall, winter, and early spring picking and cleaning the seeds preparatory for shipment to distant points. During portions of the crop-growing season 50 to 100, mostly high school boys, are engaged in a roguing crew. This seed industry has benefited the farmers, the families in town, and indirectly those at distant points. This type of development is badly needed, not only on the Newlands project, but on many others.

COMPARATIVE AVERAGE CROP VALUES PER ACRE BY 5 YEAR PERIODS



When the diagram showing the per cent of cropped area for both projects is also carefully analyzed, there can be only one answer to this important question. Variety of crops, that is, assuming crops adapted to the locality are grown, gives a greater per acre return than if a one-crop system is followed. What is true of a project, is likewise true of the individuals making up a farming community.

Consultants Appointed for Water Study

Assignment of 15 water consultants to the different river drainage basins as the next step in fulfilling President Roosevelt's recent request for a national water plan has been announced by the National Resources Committee.

In line with a policy of decentralizing and expediting the study of the major drainage basins of the country, the Committee announced that the new consultants would work in the field in cooperation with State and regional planning organizations.

The program contemplates a long-range plan for each important drainage basin in the United States and a priority list of projects for its execution. Flood protection plans, consistent with the best conservation and use of waters for all purposes, will be developed.

The drainage basin districts in the West and the water consultants' assignments are as follows:

Drainage basin district 6 (a): Royce J. Tipton, water consultant, 2083 Clermont Street, Denver, Colo. Southwest Gulf of Mexico drainage, south and west of Vermilion River, La., and including drainage in the United States entering the Rio Grande south of Fort Quitman, Tex.

Drainage basin district 6 (c) and 6 (d): Wesley W. Horner, water consultant, 1325 International Bldg., St. Louis, Mo. Western Mississippi River drainage in Louisiana, Texas, New Mexico, Colorado, Oklahoma, Kansas, and Missouri, from the Red River Basin northwardly to the Arkansas Basin, both inclusive.

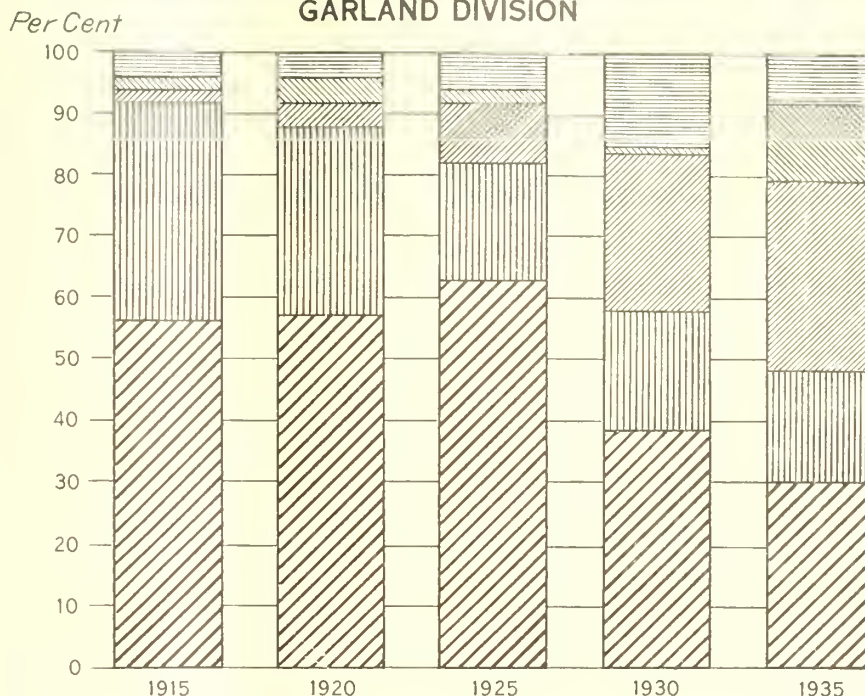
Drainage basin district 8: Prof. S. T. Harding, water consultant, University of California, Berkeley, Calif. The northerly portion of the Missouri River Basin, to and including the basin of the Platte River on the west side, and to and including the basin of Mosquito Creek on the east side, in Iowa, Minnesota, South Dakota, North Dakota, Montana, Wyoming, Colorado and Nebraska.

Drainage basin district 9: Frederick H. Fowler, water consultant, 4308 Interior Bldg., Washington, D. C. The portion of the Missouri River Basin south

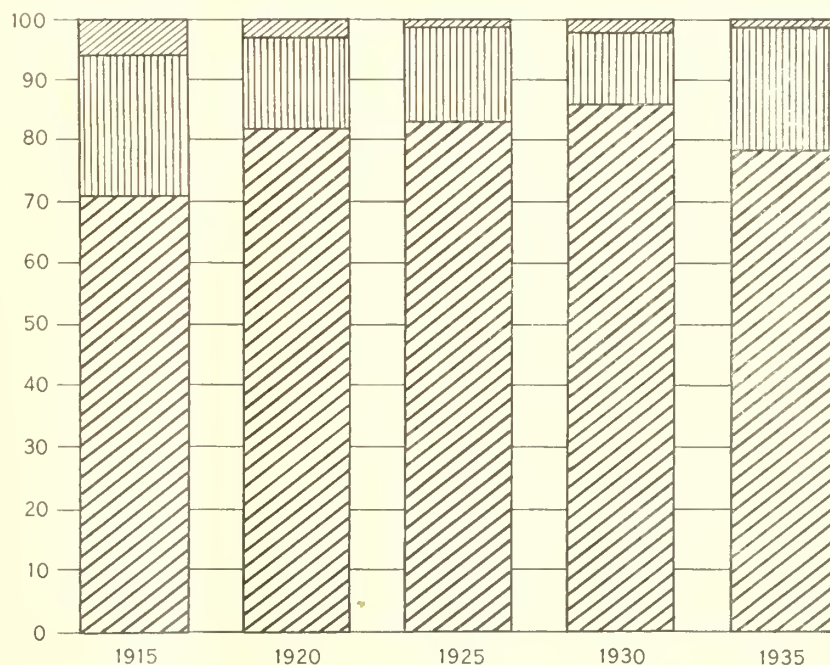
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PER CENT OF CROPPED AREA

SHOSHONE PROJECT, WYOMING GARLAND DIVISION



NEWLANDS PROJECT, NEVADA



Cereals

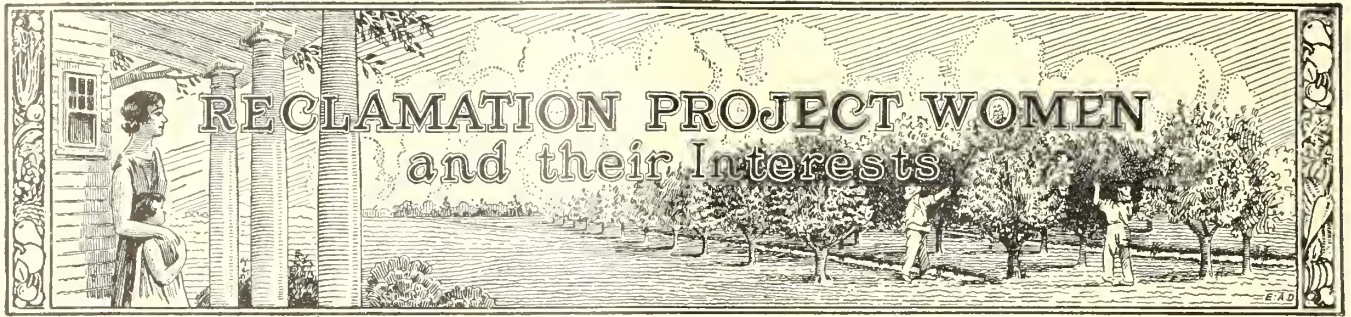
Seeds

Miscellaneous

Hay and Forage

Vegetables and truck

Fruits and nuts



Activity in the Klamath Basin

By Elizabeth Butler Loosley, Klamath Falls, Oreg.

HAVING two assets, farm land and timber, the Klamath Basin has become nationally known. Thousands of acres of farm land surrounded by 40,000,000,000 feet of merchantable timber was here awaiting development when the white man first entered the Klamath Basin. Both were equally important for the country's success whenever irrigation and transportation should come.

As early as 1910 the newspapers were cognizant of the importance of the country. They said, "Of late stages * * * have been loaded with homeseekers."

HOMESEEKERS! A homely word, a lasting and pleasant word.

To quote further: "* * * spirit of improvement is rife; The most important is that of enlarging irrigating canals and building new ones."

And this is the keynote of the situation, irrigation, water for the parched and thirsty, virgin soil. Result activity: Timber sales boomed, mills were consequently erected, and—a railroad came. What if it were only a branch of the main line and a logging road at that. A quotation from an address given by B. E. Hayden, superintendent of the Klamath project, before the Rotary Club of Klamath Falls on "Transportation in the

Klamath Basin, Then and Now," may place conditions before you more clearly:

"Early in the morning of May 28, 1906, the writer with his Texas girl bride got off the Shasta Limited at Thrall, Calif., and there transferred to the jerk-water logging railroad that twisted and turned and puffed and switchbacked up the mountain side a distance of about 26 miles to a lumber camp called Pokegama. At that point we transferred to an old-fashioned stage coach and four; in fact two such conveyances were waiting to speed the travelers on their way to Klamath Falls * * *."

Then Mr. Hayden speaks of the terrible roads, of taking the flat-bottomed steamer *Canby* at Keno which in turn landed them in Linkville, for the town was so called then. Now this mode of travel may seem crude, but if you will look at the accompanying picture of a freighter, which shows the way supplies came before this, you will realize even this change was a boon to the countryside.

PROJECT'S WATER RESOURCES

To put before the reader a graphic idea of the water resources available for the project we will look at it as a whole. We find a chain of lakes and rivers lying in a

semicircle around the basin. First there is Upper Klamath Lake; then Link River (Ripley states this is the shortest river in the world); next Euwana Lake and Klamath River followed by Lower Klamath Lake all along the west side of the project. Tule Lake lies well to the south or bottom of the circle, then about 20 miles farther on is Clear Lake (there is a distance of only 6 miles between shore lines of Clear and Tule Lakes). Still north is Willow Valley Reservoir (privately owned), and finally Gerber Reservoir. Out of Clear Lake Lost River flows to wind horse-shoe shape for 100 miles, completing the top of our circle, only to return to within 6 miles of its source by dumping into Tule Lake—a strange phenomena. It is this same river about which Zane Grey wrote his book, *Forlorn River*. The story has been "screened" and if you want a description of a desolate, sand-swept, sage-grown country read this. It will show what the land was before irrigation reclaimed it.

What a set-up as viewed and outlined by John T. Whistler in 1903, followed by H. E. Green and T. H. Humphrey, the first project engineer.

KLAMATH PROJECT STARTED

Following their recommendations, the Reclamation Service in 1907 bought the famous Carr holdings and began the construction of the Klamath project—built a dam at Clear Lake, under engineer W. W. Patch which Humphries claimed would require 10 years to fill and on May 15, 1917, water dashed over the spillway. This dam held the waters of Willow and Boulder Creeks so that they did not run freely into Lost River, but were turned down slowly and carried through a diversion canal into Klamath River. Thus was the unwatering of Tule Lake and the reclamation of all this section started. This reservoir was to serve in irrigating Alkali, Langell, and Yonna Valleys.



A typical freighter of Central Oregon. Before irrigation developed the Klamath Basin all supplies came this way.



Main Street in Klamath Falls, Oregon—a city of more than 16,000, the growth of irrigation development.

In a way, the reclamation law, which was passed in 1902 under President Roosevelt, was still in its infancy. It stated that money paid into the National Treasury from sale of public lands was to be spent within the States from which it came. This led to a rush for new development; too many projects were begun at once, therefore none could be completed promptly. Delays ran up overhead expenses and at least for a time the cart seemed to be before the horse and many farmers would not sign up on account of the cost.

In 1911-12, on Lost River at what is known as the Poplars, the old Kilgore ranch, the Lost River diversion dam and channel were built, distributing water to the Stukel Mountain area as well as diverting the flood waters of Lost River to the Klamath River and controlling the annual flow.

To revert to the Clear Lake unit, years later, 1923, at the upper end of Langell Valley a diversion dam, known as Malone, and a canal around the west side of the valley were built.

Then in 1924-25 Horsey or Gerber Dam was constructed, which held back the floodwater from Tule Lake.

The difference between the elevation of Lower Klamath and Lost Rivers in their natural state is only a few feet, so when Klamath River got high it ran into Lost River and vice versa. A major factor in drying up Lower Klamath Lake was the construction of the Southern Pacific Railroad, which in building made a natural dam and did a thorough job—Klamath Lake became dry. To be frank, after the lake was drained the land, generally speaking, had no value as it is alkaline; years of tule growth formed a substance that carried no humus; parts of this caught fire, so all in all it might better have been left as a bird refuge.

Other work is the Link River Dam to raise Upper Klamath Lake so when the dry season comes the flow can be regulated, and a dam on the Klamath River at Keno to regulate the California Oregon Power Co.'s use; both dams were built by the company.

In dry years Summer and Goose Lakes were practically dry. At Goose

Lake were seen the tracks of an early emigrant train across the lake's bed and the debris left along such a trail; this proved that cycles of drought do appear. In 1930 the waters of Clear Lake receded so that it was necessary in 1931 to dredge a channel to tap the water that was there.

Since 1924 the Klamath project has served its purpose well, for it has supplied winter feed for Lake and parts of Deschutes Counties, also part of the arid regions of Klamath County in Oregon, and Modoc and part of Siskiyou Counties in California.

There is now under irrigation a total of 85,704 acres from which the returns are \$3,408,943, or an average of \$35.50 per acre. This does not include the Tule Lake leased lands comprising 52,829 acres which earned \$787,041, or an average of \$14.90 an acre.

We accept these vast changes, great undertakings without thought of the labor and hazards that have made them possible; those who know the hardships are the farmers, the engineers, the contractors and the Government who pay the bills. Blasting through solid rock, a leak in a dam, a break in a canal, a mired steam shovel, dry years, dikes breaking, all these—innumerable griefs are surmounted—and they are easily overlooked by the layman. But the reward is there.

for those who have made this possible, as Klamath Falls now has a population of 16,686; 20,863 when we include the outlying suburbs. Merrill, Malin, Bly, Bonanza, and Dairy are small towns that have come into being. There are 36 grade and 8 high schools in Klamath County. Tuelake, the town, lies in California and its growth has been so outstanding we will tell you of it later.

RECREATION

Last summer we had late hot weather; taking a coffee pot and a quickly assembled lunch we drove to Crystal Springs for a swim. In the shelter of the banks of one of the canals we made a fire. A tiny clear stream trickled into Crystal Spring that is fringed with large willow and cottonwood growth. Water cress swayed in the little stream, mint grew along its edge, which when crushed underfoot blended pungently with the coffee aroma, and from across acres and acres of hay fields in shock the smell of new hay. The canal, bank-full, gave out a moist-fresh odor as it wound above the broad expanse of fields. A shrill whistle and the tapestry of rural scene was broken, for across its weave a trainload of logs swayed on the Great Northern Railroad, and away to the east a crack passenger train of the Southern Pacific rumbled. These two railroads have now changed the conditions even as much as Mr. Hayden found them changed when he returned to again take up his duties as project superintendent after an absence of 15 years, during which time he was assigned to other work under the Bureau of Reclamation.

Mr. Newell had succeeded Messrs. Bond, Camp, Patch, and Humphreys, and Mr. Hayden came back in 1929 to carry on much of this work we have men-



Waterways such as this account for the success of the Klamath project. Lost River diversion channel.

tioned. Mr. Hayden remarks—quoting from his talk previously spoken of—, “* * * On the evening of November 5, 1929, accompanied by Mrs. Hayden who had come over the mountain with me on the old stage coach a little more than 23 years earlier, I drove the Studebaker over Green Springs Highway in less time than it takes to tell this story and found at the end of the journey a thriving modern city surrounded by the best agricultural district in the State of Oregon * * * and the project, enjoying the benefits of a network of modern highways and ample transportation, was inhabited by a contented population that would not trade their birthright for the best country in the land.”

On our return trip into town we drove along a paved highway bordered by prosperous farms and saw: Canals, ditches (a regular network); bridges that spanned the rivers, power lines that transmitted energy, railroads that stretched, and smoke stacks that towered. We counted 12 sawmills and knew that 3 more lay on up the lake. These mills cut 463,850,000 feet of timber in 1935 and they employed 5,000 men. It takes quantities of food to supply so many people. The Klamath Basin furnishes that food and many other necessities—not for these employees alone but for the people of the countryside—from her vast herds and broad fields. What has made the production of all these commodities possible? IRRIGATION.

A NUMBER of farm sales on the Willow Creek unit of the Vale project were made during a recent month. Much interest is being shown in the public land opening scheduled for May 15 on the Vale project.

Excerpts from April Project Reports

Frenchtown.—The livestock industry is in good condition. About 1,500 head of cattle are being fed for early market. Prices being received for livestock, grain, and potatoes are satisfactory.

Belle Fourche.—The lambing season ended about mid-April and farmers were generally well satisfied with the crop that averaged more than 100 percent. The grazing season is starting auspiciously, with grass already available, water holes well filled, and livestock prices favorable.

Boise.—Alfalfa crops generally are looking good. Wheat that was put in early is up and will be watered by the middle of May.

Owyhee.—As a result of rains and cool weather late in the month, the crops are in exceptionally good shape and the range is in a better condition than for the past several years. The supply of hay is exhausted, with some occasional demands unsatisfied.

Yuma Auxiliary.—Picking of the season's grapefruit continued all month. At the end of April approximately 90 percent of the crop had been harvested. The grade and quality of the fruit remained good. The demand is better than that of the past month, with an average advance in price of 14 cents per box. Indications for the new crop were good.

Minidoka.—A total of 11,294 acres of sugar beets was planted on the project, of which 4,807 acres are in the Burley district and 6,487 acres in the Rupert-Paul district. This area is well above the average. The beets are thriving and the growers are encouraged by the present outlook. Alfalfa also is growing well.

Shoshone.—Most livestock has come through the winter in good condition. The lamb crop was good and the lambs are making excellent growth. The moisture received during the past 2 months has caused great improvement in the condition of the range, and salt sage is making a good growth. There is considerable optimism over the present price of wool and a good price is expected on this year's wool crop. Five carloads of sheep were shipped from Powell during the month.

Rio Grande.—All crops made rapid progress during the month. It is believed that about 90 percent of the cotton so far planted will make a good stand without replanting, which is an unusual condition, as considerable replanting is the general process. New planted alfalfa has made unusually good progress. A number of truck growers in the El Paso Valley planted small patches of lettuce earlier in the year and this crop was being harvested during the latter part of the month. The quality was excellent and yields unusually good. The acreage devoted to this crop is comparatively small; however, the returns this year will be larger per acre than in previous years.

A SWIMMING pool is now being built for use of Lovelock citizens on the Humboldt project. This pool is located on the grammar-school grounds, and is being financed by Pershing County, by the city of Lovelock, and with a cash contribution of \$2,000 from the American Legion.

THE Amalgamated Sugar Co. is spending some \$300,000 for the rehabilitation of the Paul Sugar Factory on the Minidoka project. Because of the large acreage of beets on the project, it is planned to operate this factory during the coming winter, in addition to the factory at Burley.

A CORN cannery will be opened at Toppenish, Yakima project, this year by the California Packing Corporation, to take care of a new type of sweet corn that is being tried in the valley.

THE Colorado Fuel & Iron Co. mine at Sunrise, Wyo. (North Platte project), has increased employment from 160 men working 4 days per week to 210 men working 5 days per week.



Ogden-Brigham Canal, Ogden Project, Utah. Starting lining operations.

Yuma Pastures Aged Mule

W. A. Boettcher, Engineer



"Jack", the last mule owned by the Yuma project, has been retired for several years from active service and is now on pasture for the remainder of his life. This mule was acquired at the age of 3 years along with 175 others from Kansas City, Mo., in August 1906. He was used for 10 years on survey work, hauling supplies to the different camps. From 1916 to 1920 he was hitched to a buckboard and used by the late R. M. Priest, former Yuma project superintendent and All-American Canal construction engineer, on his trips of inspection over the project. Nine years were then spent on light Fresno scraper work in the repair of canals and laterals. The last 5 years of "Jack's" work for the project consisted of pulling cables on Ruth dredgers used on canal and lateral cleaning operations.

During the past 2 years he has been relieved of all work.

At the close of the past winter "Jack's" condition was such that he required assistance in rising. However, with the advent of warmer weather he has been able to move around with little apparent difficulty.

"Jack", 33 years old, who has seen the development of the Yuma project almost from the beginning, now finds his place taken by machinery. As the oldest living mule owned by the Reclamation Bureau, it is only fitting that his last days be made as comfortable as possible, and with that in view he is now kept on pasture on the 5-acre tract occupied by the watermaster on the reservation division, where he can be watched and fed.

Investigations

(Continued from p. 147)

available for diversion will be completed upon receipt of data from the State of Idaho.

Deschutes, Oreg.—The investigations comprise: (a) Comprehensive investigation of all reservoir sites in Deschutes Basin above Bend, Oreg., to furnish supplemental water for present canals and for irrigation extension; (b) investigation of North Unit, including land classification, most practicable canal line diverting near Bend to serve these lands, and plan and estimates for the distribution system. This investigation also includes consideration of alternative plan for pumping from the Deschutes River opposite the lands with a high lift direct connected plant; (c) storage on Crooked River to furnish supplemental water for

the Ochoco and other constructed projects.

Land classification areas and the field work for these investigations have been about completed. Final reports covering the three features of the investigation are being prepared in the Denver office and are expected to be available at an early date.

Black Hills, S. Dak.—This is an investigation of streams leaving the eastern and northern slopes of the Black Hills, including the Belle Fourche and Cheyenne Rivers, with a view of irrigation extensions and supplementing the supply for existing canals. Unusually cold weather and snow was experienced during the first week of the month, but later it was possible to make three reconnais-

sance trips over the territory: (1) The Angostura project near Hot Springs and through the Castle Creek Canyon, the main tributary to Rapid Creek, in search for dam and reservoir sites; (2) the Angostura project near Hot Springs, on April 12 and 13, in company with local promoters and other interested parties; (3) through the Castle Creek Canyon from Deerfield to Castleton where geology and topography were noted and stream measurements taken. Numerous stream measurements were made at the recently established gaging stations on Rapid Creek and canals diverting therefrom.

Dixie project, Utah.—The water supply and silt investigations previously initiated were continued during the month. A land classification survey of the area proposed for irrigation as a part of the work under section 15 of the Boulder Canyon Project Act is completed as to field work. A survey was made of the area now irrigated in this section of the Virgin River Basin.

Bear River-Green River, Utah-Idaho-Wyo.—A general reconnaissance proposed to lay the foundation for a comprehensive program of investigations to ascertain the location and extent of requirements for supplemental water in the Bear River Basin in Wyoming and Utah, including storage, and the ways and means of diverting from the Green River Basin in Wyoming to the Bear River Basin such waters as may not be needed for present and future development in the Green River Basin. An applicable cooperative agreement was executed by the States of Utah and Idaho, but Wyoming authorities did not consider that the investigation proposed was broad enough.

Hawaii water supply studies, Hawaii.—The investigations were continued for the purpose of determining the amount of land for which an irrigation supply may be developed on the Island of Molokai. A thorough examination of the watershed is in progress to determine the available supply of water and the proper points of diversion. Triangulation stations must be relocated and marked and new ones established to serve as control for an aerial survey which will be made by the Army Air Corps. Gaging stations will be established at different points along the streams so that the available supply at any point may be determined. Trails must be cut through the forests, and it is this work and the location of triangulation stations which has taken most of the time since the initiation of the work in December 1935.

A YAKIMA chapter of the National Association of Practical Refrigerating Engineers has been organized with a charter membership of 40 engineers.

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Engineers' services on Boulder Dam commemorated (short). Civil Engineering, April 1936, vol. 6, no. 9, p. 283.

Work on Boulder Dam completed 2 years ahead of contract time, illus., Water Works Engineering, April 1936.

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Proceedings of the Fourth Annual Meeting of the National Reclamation Association, Salt Lake City, Nov. 15-16, 1935, 106 pp. 1936.

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Fishways:

Millions to be spent on stairways and elevators for fish (Bonneville dam, illus.). Frank T. Bell, Southwest Builder and Contractor, April 3, 1936, vol. 87, no. 14, pp. 12-13.

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Federal Reclamation, Address Rivers and Harbors Congress, Cong. Record, May 8, 1936, vol. 80, no. 95, pp. 7214-7216.

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Ickes, Harold L.:

Social Problems in a Changing World, Cong. Record of Mar. 18, 1936, vol. 80, pp. 4151-4153 (Extension of remarks of Hon. Herman P. Kopplemann, address of Hon. Harold L. Ickes, March 16, 1936, Convention of United Synagogue of America).

Laying of cornerstone of Interior Department building, Addresses by President, Secretary Ickes, and Mr. Delano on Conservation, Cong. Record, April 16, 1936, vol. 80, pp. 5823-5827.

Kensit, H. E. M.:

The completion of Boulder Dam, illus., World Power, April 1936, vol. 25, no. 148, pp. 199-200.

Knapp, Geo. S.:

Watering the Great Plains, Eng. News-Record, May 7, 1936, vol. 116, pp. 664-665.

McClure, Thos. M.:

Plugging old artesian wells to stop underground water loss, Pecos River Basin, Eng. News-Record, March 19, 1936, vol. 116, pp. 425-427.

Minnigerode, Fitzhugh L.:

New Mecca opened up (Lake Mead) illus., New York Times, May 3, 1936.

Mono Basin:

The Mono Basin project, illus. and map. H. A. Van Norman, Civil Engineering, May 1936, vol. 6, no. 5, pp. 306-308.

Parker Dam:

Parker dam operations centered on diversion tunnel driving and plant, Western Construction News, April 1936, vol. 11, pp. 102-104. Portrait of Frank Crowe, p. 130.

Randolph, E. S.:

Sealing reservoir (Madden lakes) with clay grouting, illus., The Military Engineer, May-June 1936, vol. 28, pp. 208-214.

Rio Grande:

Flood control work on the Rio Grande Delta, illus., Eng. News-Record, March 19, 1936, vol. 116, pp. 407-411.

San Diego Water:

San Diego asks about Colorado Aqueduct Water, Western Construction News, March 1936, vol. 11, p. 90.

Taylor, P. L.:

Largest reservoirs in the United States listed by Reclamation Bureau (table) Southwest Builder and Engineer, April 24, 1936, vol. 87, pp. 10-11.

Twin Falls Power:

Twin Falls Hydro-electric development, illus., Electrical West, April 1936, vol. 76, no. 4, pp. 18-24.

Consultants Appointed

(Continued from p. 149)

of the basin of the Platte River on the west side and south of the basin of Mosquito Creek on the east side, in Missouri, Iowa, Nebraska, Colorado, and Kansas.

Drainage basin district 10 (a): J. C. Stevens, water consultant, Spalding Building, Portland, Ore. The Colorado River Basin in Arizona, New Mexico, Colorado, Wyoming, Utah, Nevada, and California.

Drainage basin district 10 (b): Walter L. Huber, water consultant, 1325 Crocker First National Bank Bldg., San Francisco, Calif. The Great Basin drainage in California, Nevada, Utah, Wyoming, Idaho, and Oregon.

Drainage basin district 10 (c): Ralph I. Mecker, water consultant, 303 Flat Iron Bldg., Denver, Colo. Southwest Pacific drainage in California and Oregon, to and including Smith River Basin on the north.

Drainage basin district 11: Prof. Samuel B. Morris, water consultant, Leland Stanford University, Palo Alto, Calif. Northwest Pacific drainage in Oregon, Nevada, Utah, Idaho, Wyoming, Montana, and Washington, from and excluding Smith River Basin on the south.

The director is Frederick H. Fowler, of San Francisco. The work will be conducted in cooperation with regional and State planning boards and the Water Resources Committee of the National Resources Committee.

In discussing the broader aspects of the program, Secretary Harold L. Ickes, who is also chairman of the National Resources Committee said: "In our report it is proposed to cover the following three points with respect to each of the major drainage basins:

"1. The outstanding problems of water use and control,

(Continued on p. 156)

Reclamation Organization Activities and Project Visitors

Chief Engineer R. F. Walter arrived at Sacramento, headquarters of the Central Valley project, on April 17. The board of consulting engineers for the project, consisting of Charles P. Berkey, R. V. Meikle, and C. H. Paul, chairman, assembled at Sacramento for their scheduled meeting on April 18. W. F. Durand, the fourth member of the board was absent. Chief Designing Engineer J. L. Savage arrived with the board, and after a brief conference, the members proceeded by auto to Redding, accompanied by the chief engineer, chief designing engineer, and the construction engineer. Deputy State Engineer George W. Hawley, in charge of dams, and Hydraulic Engineer T. B. Waddell of the State department of public works accompanied the Bureau engineers.

April 19 and 20 were occupied with detailed inspection of exploratory tunnels and drilling records on Kennett dam site, and inspection of the related features—railroad relocation, bridge sites, and camp sites. The board and engineers returned to Sacramento on April 21, where a preliminary draft of a report was prepared. On April 22 the board and engineers examined the Table Mountain site, some 50 miles downstream from the Kennett site, on the Sacramento River. On April 23 inspection was made of the Baird dam site on Pit River below the mouth of McCloud River, the party returning to Sacramento that evening, when they disbanded.

Chief Engineer Walter is planning to attend the sessions of the American Society of Agricultural Engineers to be held at Estes Park, Colo., June 22–25.

At the request of the American Society of Agricultural Engineers, Miss Mae A. Schnurr, Assistant to the Commissioner, will attend the meeting in Estes Park on June 22–25 of the American Society of Agricultural Engineers, and will deliver an address on the life and work of the late Commissioner, Dr. Elwood Mead, on the occasion of the presentation to Mrs. Mead of the gold McCormick medal. Miss Schnurr's address will appear in the July issue of the Era.

William Killmore, assistant engineer, has been transferred from the rehabilitation work at Montrose to the Taylor Park Dam at Gunnison, Colo.

Oliver L. Johnson, employed as ditch rider since the early days of the Orland project, was retired for physical disability on April 30. Mr. Johnson, 68 years of age, had rendered faithful and loyal service for almost 25 years.

L. H. Mitchell, Divisional Supervisor of Operation and Maintenance, Bureau of Reclamation, left Washington on May 12 for the West where he will represent the Bureau at three meetings of Educational advisors of Emergency Conservation Camps in the Eighth Army Corps Area. The first meeting will be at Phoenix, Ariz., May 14–16; the second at Albuquerque, N. Mex., May 21–23, and the third at Denver, Colo., May 25–27.

At the conclusion of the meetings, Mr. Mitchell will take up his regular duties in the field. He will be engaged on operations problems on eight Federal reclamation projects during the summer. He will visit the Strawberry Valley, Hyrum, and Weber River projects in Utah, the Grand Valley and Uncompahgre projects in Colorado, the North Platte project in Nebraska and Wyoming, the Belle Fourche project in South Dakota, and the Shoshone project in Wyoming. From Denver he will go first to the Strawberry Valley project.

Mr. Mitchell supervises operation and maintenance in the fourth division. Supervision of operation and maintenance of Federal projects was segregated last year from the construction activities of the Bureau and placed under the jurisdiction of George O. Sanford, general supervisor, with offices in Washington. Federal projects were divided into five divisions with a field supervisor appointed for each.

Ray B. Dame, Chief Photographer in the Bureau of Reclamation, has been appointed Associate Chief of the new Division of Motion Pictures of the Department of the Interior. This division, established by order of Secretary Ickes, effects consolidation of all still and motion picture work in the Department and its various bureaus and agencies.

Homer T. Wells, hydraulic engineer with the Resettlement Administration, visited the Yakima project the latter part of April and conferred with the

superintendent relative to project water rights.

Prof. H. P. Boardman and his class of engineering students from the University of Nevada were recent visitors at the Rye Patch Dam, on the Humboldt project, Nevada.

Ray B. Dame, Associate Chief of the Division of Motion Pictures in the Department of the Interior, gave an illustrated lecture on April 7 before the members of the Florida Photographers' Association in session at the short course of photography at the University of Florida. His subject covered the use of 16 millimeter sound motion pictures as used by the Department of the Interior for visual education. A paragraph from the letter of appreciation concerning Mr. Dame's services, received by the Department, is as follows:

"Of especial interest was the picture 'Water Lure' made at Warm Springs, Ga. This particular subject being very close to our hearts drew very favorable comment, both as to its excellence and the unusually interesting manner in which Mr. Dame presented the picture and lecture."

J. R. Alexander, district counsel at Salt Lake City, visited the Humboldt project the latter part of April, at which time the Rye Patch Dam was inspected and legal matters pertaining to the Humboldt project were discussed.

F. F. Smith, senior engineer for the earth dam section in the Denver office, was a recent official visitor on the Hyrum project, Utah.

A. F. Johnson, engineer of the Bureau of Reclamation in the Denver office, left Washington on May 14 for the Virgin Islands, where, at the request of the Governor, he will make a study of water resources. The study will determine what unused water is available for municipal and irrigation purposes and how it can be diverted to points where it is needed. Mr. Johnson was loaned by the Bureau. He had been working on the Central Valley project in California.

J. O. Roach, superintendent of the Shoshone irrigation district, Shoshone project, Wyoming, died on March 30 after a long illness. He was retired from active work in July 1935 on account of ill health. Mr. Roach was an employee of the Bureau of Reclamation for approximately 15 years and was well acquainted with all parts of the Garland division. He was employed as superintendent of the Shoshone irrigation district when the operation and maintenance of the Garland division was turned over to the district in 1927.

John Lundberg, Jr., instrumentman, and James C. Doman, assistant engineering draftsman, have returned to their headquarters on the Upper Snake River project, having been temporarily assigned to duty in the Denver office.

Fred H. Betts, senior engineering draftsman, has been transferred from the Colorado River investigations to the Roza division of the Yakima project.

J. E. Nelson, the contractor's superintendent of the Moon Lake Dam construction since the commencement of operations a year ago, has resigned and will probably take charge of a large construction job in San Francisco. He has been succeeded at Moon Lake Dam by Earl Walsh, his former assistant.

Richard J. Coffey, district counsel at Los Angeles, was a recent visitor on the Yuma project in connection with project legal matters.

Robert F. Herdman was transferred from the position of associate engineer in the Denver office to that of resident engineer, Bartlett Dam, Salt River project, effective April 1, 1936.

M. P. McLaughlin, who has been employed by the Shoshone irrigation dis-

trict as assistant superintendent, was designated acting superintendent following the death of Superintendent Roach, and pending the selection of a successor.

Edgar Read, special agent, Division of Investigations, Public Works Administration, recently visited the Colorado River project, Texas, in connection with the opening of bids under specifications no. 673, for the construction of Arnold Dam.

B. E. Stoutemyer, district counsel at Portland, Oreg., will attend and represent the Bureau of Reclamation at the western regional conference of the American Farm Bureau Federation at Walla Walla, Wash., the latter part of June. Mr. Stoutemyer will appear on the program on June 27. Further notice concerning this meeting will appear in the July issue of the Era.

Miss Kathryn E. Cooksey, artist-illustrator, the latest addition to the Public Relations Division, left Washington May 17 in company with a friend, Miss Ericka Langhammer of Springfield, Mass., on a 35-day automobile tour of the West, visiting some of the reclamation projects, including Boulder Dam, and several of the national parks.

Charles G. Anderson, engineer in the Denver office, was transferred to the Casper-Alcova project, Wyoming, effective May 6.

Francis J. Thomas, associate engineer in the Denver office, was transferred and assigned to duty in connection with the construction of Caballo Dam, effective May 4.

Thomas R. Smith, associate engineer, was transferred from the Denver office to the Central Valley project, effective April 22.

Consultants Appointed

(Continued from p. 151)

"2. The broad outlines of a reasonable and integrated plan of development, and

"3. The specific construction and study projects which, in the light of available information, are consistent with the broad plan.

"The limited time and resources available for the preparation of this report emphasize the need for the close cooperation of State and regional planning agencies with Federal bureaus and organizations concerned with water problems.

"State and regional planning boards have offered help in organizing the cooperation of local and State agencies logically interested. The water consultants will need the assistance of such agencies as State and local health departments, office of the State engineer State department of conservation, and other agencies.

"Experience with a similar survey now in progress in the basin of the Red River of the North furnishes an example of what we hope may be done in the national survey.

"In that area the State planning boards of Minnesota and of North and South Dakota have been cooperating with Federal, State, and local officials in a study which is being given general supervision by a consultant appointed by the Water Resources Committee. The respective State boards initiated conferences leading to the present survey, and the splendid progress being realized will make possible the completion of a comprehensive report within 2 or 3 months from this date."

A STEADY improvement in employment conditions in Malheur County, Oreg., is apparent. According to representatives of the W. P. A., Malheur County has the best record in the State for the placement of men of relief status on work paying prevailing wage scale.

THE Black Hills sugar plant, Belle Fourche project, won the Utah-Idaho efficiency trophy for 1935, consisting of a bronze plaque, and the principal employees received bonus checks in recognition of their services and factory attainments.

SIX Yakima County dairies are above the 97-point mark in raw-milk tests made during the month of April by the county bacteriologist. Several other dairies rank as high in the pasteurized milk division.

SEVERAL new homes have been built recently on the Yuma project, both in town and on farms. The Bomberger Seed Co. has begun construction of an addition to its warehouse on Third Avenue, which will nearly double its storage capacity.

THE Utah-Idaho Sugar Co. has announced satisfaction with the results obtained on the Yakima project from the new blight-resisting sugar beet seed accession no. 34, being used this season. Prospects for this year's crops are far ahead of a year ago.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page**, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kuhach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; B. W. Steele, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thraikill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.		B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do.	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	do.	Wilfred W. Baker	Engineer		do.	do.
Casper Aleova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voven	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunzer	do.	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.	E. A. Peek	R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	George B. Snow	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	H. W. Johnson	do.	do.
Hyrum	Hyrum, Utah	D. J. Paul	Resident engr.	W. F. Tingley	B. E. Stoutemyer	Portland, Oreg.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	E. E. Chabot	W. J. Burke	Billings, Mont.
Milk River	Malta, Mont.	H. H. Johnson	do.		do.	do.
Chain Lakes Storage	do.	do.	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Minidoka	Burley, Idaho	E. B. Darlington	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr.	A. T. Stimpfle	W. J. Burke	Billings, Mont.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Orland	Orland, Calif.	R. L. Carmody	Superintendent	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent		do.	do.
Cahallo Dam	Hatch, N. Mex.	S. F. Creelhus	Constr. engr.	C. B. Wentzel	W. J. Burke	Billings, Mont.
Riverton	Riverton, Wyo.	H. C. Comstock	do.	Geo. H. Bolt	R. J. Coffey	Los Angeles, Calif.
Salt River	Phoenix, Ariz.	E. O. Koppen	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent		do.	do.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Stanfield	Ontario, Oreg.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Sun River, Greenfields div.	Fairfield, Mont.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Truckee River Storage	Lovelock, Nev.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Umatilla (McKay Dam)	Pendleton, Oreg.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Uncompahgre: Taylor Park	Gunnison, Colo.	C. B. Elliott	Engineer	do.	do.	do.
Repairs to canals	Montrose, Colo.	H. A. Parker	Constr. engr.	Emmanuel V. Hallius	B. E. Stoutemyer	Portland, Oreg.
Upper Snake River Storage	Ashton, Idaho	C. C. Ketchum	Superintendent		do.	do.
Vale	Vale, Oreg.	J. S. Moore	do.		do.	do.
Yakima	Yakima, Wash.	Chas. E. Crownever	Constr. engr.		do.	do.
Roza div.	do.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.
Yuma	Yuma, Ariz.					

¹ Acting

² Non Federal.

³ Island Park Dam.

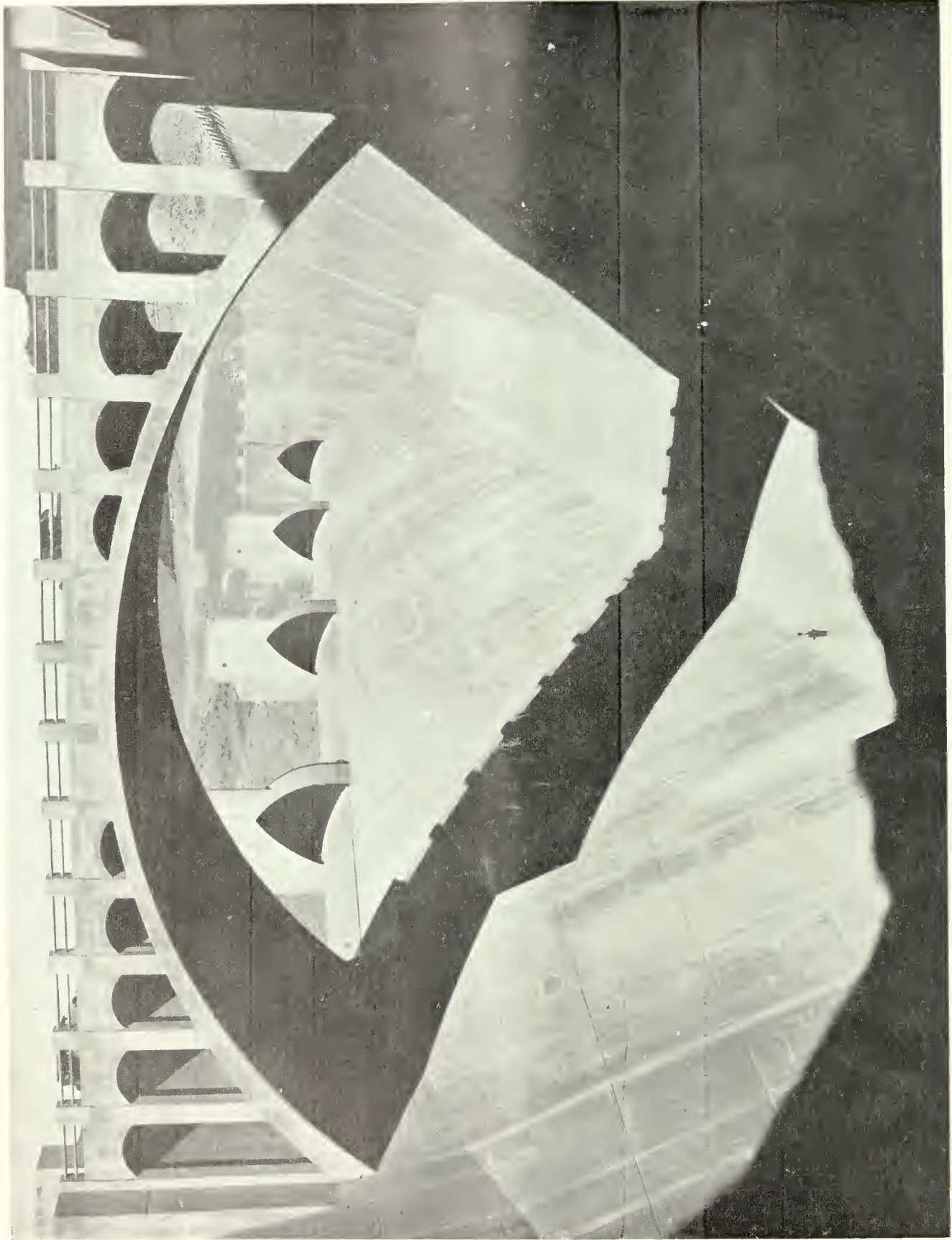
Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do.	Chas. A. Revell	Bonanza.
Klamath, Horsely	Horsely irrigation district	do.	Henry Schmor, Jr.	President	Dorothy Evers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Project manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
Do.	Fort 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.
Do.	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich.
Do.	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do.	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Alcorn	President	Flora K. Schroeder	Fallon.
North Platte: Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	Manager	C. G. Klingman	Mitchell.
Fort Laramie div.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	Mary Harrah	Gering.
Do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mabel J. Thompson	Torrington.
Northport div.	Northport irrigation district	Northport, Nebr.	Mark Iddings	do.	Nelson D. Thorp	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	D. D. Harris	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	F. C. Henshaw	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	Geo. W. Atkies	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Lee N. Richards	Powell.
Frannie div.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	E. G. Breeze	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. J. Gregory	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	H. P. Wangen	Fort Shaw.
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	Enos D. Martin	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	A. C. Houghton	Hermiston.
West div.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	J. Frank Anderson	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Thompson	Acting supt.	G. L. Sterling	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager		Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Conlee Dam, Wash.	F. A. Banks	Construction engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Engineer.
Grand Lake-Big Thompson Transmountain Diversion	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Weiser-Payette	Boise, Idaho	J. A. Keimie	Do.

SALLIE A. B. COE, Editor.



BOULDER DAM, BOULDER CANYON PROJECT, ARIZONA-NEVADA.

THE ARIZONA SPILLWAY IS LARGE ENOUGH TO DOCK AMERICA'S LARGEST BATTLESHIP. THIS VIEW, LOOKING UP STREAM, SHOWS THE HIGHWAY BRIDGE CROSSING THE SPILLWAY CHANNEL. NOTE THE MAN STANDING IN THE BOTTOM OF THE CHANNEL. THE ARIZONA SPILLWAY IS DUPLICATED ON THE NEVADA BANK OF THE COLORADO RIVER ABOVE THE DAM. THESE GREAT CHANNELS PROVIDE PROTECTION FOR THE DAM FROM THE SUDDEN RISES IN THE RIVER. TOGETHER THEY ARE CAPABLE OF BY-PASSING 400,000 SECOND FEET OF WATER. THE GREATEST KNOWN FLOOD ON THE RIVER TOTALED 250,000 SECOND FEET.

1. 1936

THE RECLAMATION ERA

VOL. 26, NO. 7



JULY 1936



GRAND COULEE DAM, COLUMBIA BASIN PROJECT, WASHINGTON

A JACKHAMMER CREW ON THE EAST ABUTMENT OF THE DAM. THIS GROUP SILHOUETTED AGAINST A MORNING SKY IS PREPARING FOR A BLAST THAT WILL STRIP A SECTION OF THE EMBANKMENT TO THE FOUNDATION ROCK.

Conservation

When I am asked what I mean by conservation I define it as the prudent use of our natural resources, which is the negation of waste and destruction. A policy of conservation that would look to the locking up of our treasures of mine and forest and soil and stream could not be tolerated. Of course we must use what we need from day to day in order to contribute to the happiness and well-being of our people. But we must not commit waste. We must have ever in our minds the thought that if we need these resources to enrich our own lives, they will be needed in ever greater degree with the passing of the years as our population increases and our resources have been steadily and increasingly drawn upon. The importance of conserving and using wisely our natural resources cannot be over emphasized, since our well-being, our liberty, and our very lives in the final analysis depend upon the land and water of our great common estate, upon what they produce and the uses to which they can be put.

The mere designation of a department of conservation, as is proposed in the bill now pending in Congress, would advance materially a cause in which every citizen should be interested. It would give conservation an entity heretofore lacking in the scheme of government; it would create a consciousness of conservation in the minds of legislative and executive officials alike; and it would place upon the officials of the new department a definite responsibility that is now lacking. Even though conservation agencies might be continued in other branches of the Government, the influence of sound conservation policies could be impressed upon them from the central department.

It always has been, and it probably always will be true, that those who stand vigilant guard over our treasures of forest and land and stream in order to protect them from the predators will be openly condemned and cunningly attacked. Notwithstanding, we must bear in mind that the true function of government is to see beyond the current month or the present year. Casting our eyes into the future, we must think of the coming generations, remembering that the imprecations that are hurled today at those who would protect our national wealth tomorrow will reecho as the plaudits of a grateful Nation.

A true conservationist will not hesitate to pay whatever personal cost may be involved in his championship of the right of future generations to have preserved to them some of the wealth that we have inherited from our fathers.—Hon. Harold L. Ickes, Secretary of the Interior.

THE RECLAMATION ERA

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HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 7



JULY 1936

The Life and Work of Dr. Elwood Mead¹

By Miss Mae A. Schnurr, Assistant to the Commissioner, Bureau of Reclamation

I STAND here tonight, Mr. Toastmaster and my friends, inspired by the purpose of this meeting and the man to be honored, and say to you that I have a feeling of sincere humility, but nevertheless considerable pride, to speak for someone so great as Dr. Elwood Mead. I am touched when I think that Dr. Mead planned to be here in person to accept the honor which must now be posthumously awarded and accepted by his widow. This award with its designation "for exceptional and meritorious engineering achievement in agriculture" is profoundly eloquent. Even with this inspiration, however, my attempt at a eulogy of Dr. Elwood Mead must necessarily be feeble. The American Society of Agricultural Engineers by conferring its highest honor—the Cyrus Hall McCormick Gold Medal—has signally recognized this leader. This high recognition, combined with the achievement and enduring good works which Elwood Mead has bequeathed to the Nation, speaks for itself, and my words act only as an echo of appreciation.

I deem it a very great honor and one that I shall ever cherish to stand here in my former chief's place, thank you for this honor—and give you my impression of his life and work.

HIGHLIGHTS OF DR. MEAD'S ACTIVITIES

Our honored absent guest attained the highest scholastic degrees in engineering. It is a little-known fact that he aspired to enter West Point. He passed the entrance examination but because of parental objection did not enter that school of learning. This yearning was given expression when Dr. Mead's son John graduated from West Point 2 years

ago. No one but those close to Dr. Mead realized what pleasure and satisfaction John's graduation gave his father.

Many of you present know about Dr. Mead's achievements in engineering, research, planning, education, and administration, his capacity as adviser to foreign governments, builder of reclamation projects, his writings, treatises, and the degrees conferred upon him. However, for the benefit of the new and younger members of the society I would like to give just a brief outline that they may picture the breadth and scope of Dr. Mead's activities.

For the past 12 years he was Commissioner of the Bureau of Reclamation, Department of the Interior. During that period he fulfilled assignments to numerous commissions, boards, and coordinating units of the Federal Government. He was Chairman of the International Water Commission, United States and Mexico, which, over a period of 5 years, did much to clarify the international water question common to the United States and Mexico, and gathered invaluable records, later printed as a Senate document. He was Chairman of the Board of Experts reporting to the Joint Palestine Survey Commission on the Zionist Movement. He was a member of the board of directors of the National Bureau of Economic Research, a member of President Roosevelt's Allotment Board, adviser to the National Resources Board, chairman of the Committee to Coordinate Power and Irrigation in Nebraska, Government representative of the National Power Policy Committee, and held other assignments too numerous to mention. Picture the man, 78 years of age, with a major appointment as Commissioner of Reclamation having in charge a 200 million dollar construction program, spreading himself over these assignments, also appearing before the Budget, con-

gressional committees, and governmental boards on the business of the Bureau. If you can see that picture you see Elwood Mead as his associates viewed him and you have nothing but admiration for the man, his mental capacity, and his physical strength.

ACTIVE IN SOCIETY AFFAIRS IN THE INTEREST OF THE WEST

Ten years ago Dr. Mead addressed this society at Lake Tahoe, Calif., on the subject of "A National Reclamation Policy." That same year he went to Haiti as consultant on irrigation and to Cuba as consultant on hydraulic development.

Thirteen years ago he made an extensive tour throughout European countries investigating foreign conditions.

Sixteen years ago his publication "Helping Men Own Farms" came from the press.

Twenty years ago he made an outstanding address at the Governors' Conference in Denver on "Systematic Aid to Settlers."

Twenty-three years ago he was Professor of Rural Institutions at the University of California.

Twenty-nine years ago he was in Australia as Chairman of States Rivers and Water Supply Commission. For 6 years he served the Australian Government with distinction. Its colonization and riparian questions were similar to ours here in the West in the early days.

Thirty-three years ago his book Irrigation Institutions was published, and to this day is being used as a text book in leading colleges.

Forty years ago he addressed the Cheyenne Chamber of Commerce on "Reclamation of Arid Lands."

I might interject now, Mr. Toastmaster, that I am probably reaching the

¹ Address delivered June 24 at the annual meeting in Estes Park, Colo., of the American Society of Agricultural Engineers.

point when most of us had not learned our A B C's.

Forty-five years ago Dr. Mead was territorial engineer of that wild and woolly region now known as the great State of Wyoming.

Exactly half a century ago Elwood Mead was Professor of Irrigation Engineering at Colorado Agricultural College.

ELWOOD MEAD, THE MAN

Now that I have sketched a picture of Dr. Mead's activities over the years, I would like to give you a view of this personality that I was privileged to observe during 12 of the most fruitful years of this man's long and useful career. I am sure my dear friend, the modest Mrs. Mead, his devoted widow here at my side, would be willing to attest to the few thoughts that I am going to leave in your minds for she, more than anyone else, was his confidant and worthy helpmate, but if I know anything at all about Mrs. Mead, and I believe I do, she, like Dr. Mead, always considered duty well performed a satisfaction in itself.

Dr. Mead had a legion of friends, and this did not just happen. His ability prompted admiration, his strength of character and the urge to go on in the face of discouragement with respect to a principal in which he believed, created international recognition. His democratic nature drew people to him. His kindness and consideration for everyone around him made friends of all his associates. It is true there were people who did not agree with him just as all active men experience opposition, but the painstaking way in which he went about educating those whom he felt were misinformed made friends of his adversaries.

Our Bureau had the reputation of being a courteous and friendly spot to come to. Each visitor was made to feel that he

was the only one we had to see that day, and Dr. Mead's confidence and trust in his associates were contagious so that persons dealing with the Bureau could sense immediately on contact with him that he had the happy faculty of developing a loyal and conscientious organization. It was hard to get Dr. Mead to talk about himself, but judging from the records he leaves throughout the world of his activities others were proud to boast about their contact with him and his achievements.

M'CORMICK MEDAL A THING OF BEAUTY

Reverting for the moment to the Cyrus Hall McCormick Gold Medal, it is not only a thing of beauty but the donors deserve high praise for the bestowal of it each year to an outstanding member of the agricultural engineering profession. The designer comes in for his share of praise because it is inspired with the true spirit of an agricultural engineer. The symbolism expressed thereon shows the bond existing between the science of engineering and the science of agriculture. The welding of the bond, without doubt, was the high endeavor of Dr. Mead's life.

On one face of the medal is pictured the laborer in the field tilling the soil, while in the distance are others with their backs bowed in toil gathering the crops. Against the horizon can be seen America's great contribution in agricultural machinery—the harvester.

On the reverse of the medal is portrayed the figure of a man seated hand on chin in the pose of the "Thinker." I take this to mean promptings of a higher intelligence and here the agricultural engineer steps into the picture with his aid and advice to farmers. The life work of Elwood Mead and that of each member of the American Society of Agricultural Engineers will always be considered the

link between toiling labor and fulfillment of a satisfying agricultural life.

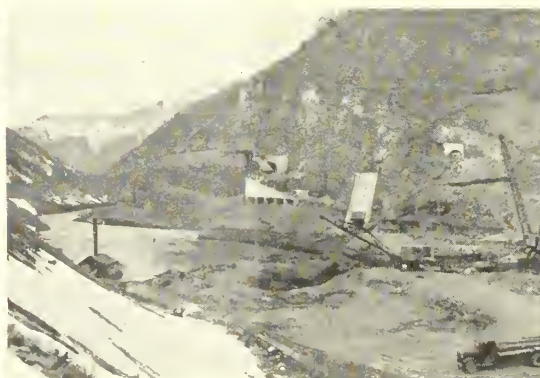
DR. MEAD WORTHY RECIPIENT OF MEDAL

The society has done honor to itself in conferring this award upon Elwood Mead, for the reflected glory which a discerning Nation observes in you does much to point out the zeal and devotion which this society displays in the interests of agriculture. I feel somewhat abashed, however, looking into the faces of so many experts, who constitute a highly critical audience, you gentlemen, who in all your endeavors have sought the "how" and "why" of the activities designed to make agriculture a dignified and profitable profession.

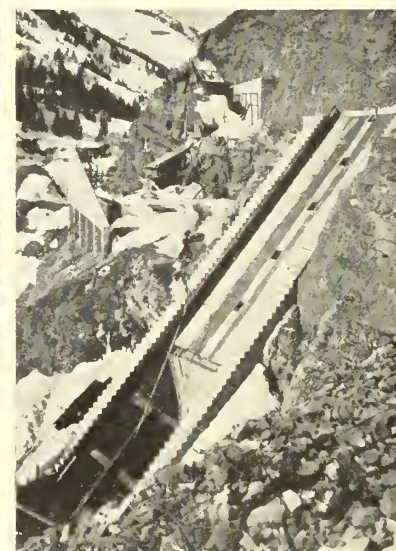
But, Mr. Toastmaster, I am strengthened and consoled by the fact that we meet here upon common ground. That common ground is in the depths of our hearts recognition of the humane and unselfish motives which guided the footsteps of Elwood Mead. That recognition brings us closer together this evening.

SIGNIFICANT THAT HONOR SHOULD BE CONFERRED IN COLORADO

It is of some significance that this meeting is being held here in the grandeur of the State of Colorado on the top of the Continental Divide. Dr. Mead began his career as an educator in this State 50 years ago. The mighty climax of engineering achievement in Elwood Mead's life had to do with the Colorado River, which has its source close by us. Its waters are now stored behind the highest dam in the world—Boulder Dam—and fills that greatest of man-made lakes, appropriately named "Lake Mead," in honor of him whose privilege it was to take a prominent part in early studies, authorization of the project, and



Pine View dam site, Ogden River project. Left: Looking into cut-off trench from road bridge at south abutment; center: Bridge being constructed at upper end of flume, also catwalk near Wheeler Creek; right: Trash rack spillway, and Eden Highway Tunnel portal.



finally the satisfaction of starting and completing the Boulder Canyon project.

ELWOOD MEAD AGRARIAN MINDED

Dr. Mead specialized and devoted his life to the science of irrigated agriculture and the creation of a satisfying home life supported by irrigated agriculture. By a thorough study of experiences of older countries than ours he acquired a background of knowledge and with his analytical mind developed principles that would adjust themselves to conditions in the United States. Elwood Mead believed that a nation of many small farms could be a peaceful nation. These small farms, backed by progressive leaders at the head of the Government, he believed, would become a prosperous nation. His judgment was good. We like to believe that Elwood Mead was inspired. With really no pattern to work from he evolved in his mind policies governing western water rights that have stood the test of the years and are used today.

Dr. Mead stood for national long-time planning the many years during which I was associated with him, and by a process of education of public opinion and the winning of advocates, the country is plan conscious, and we have such organizations as the National Resources Board, set up for the coordination of plans for conservation in all its branches of national resources.

MEN OF SCIENCE DRAFTED FOR FEDERAL SERVICE

Certainly unselfishness must prompt the urge of many men of science to enter the Federal service. I know that was true in Dr. Mead's case. Those leaders who have been selected for the portfolios in the Cabinet have fortunately recognized the able men of science and drafted them to head important bureaus. While Dr. Mead held a Presidential appointment, it is significant to note that politics did not enter into his retention. Appointed by President Coolidge in April 1924, his appointment was continued not only through the two succeeding administrations of President Hoover and President Roosevelt, but even when he reached the retirement age of 70 years his appointment was extended to retain his talent for the service.

TRIBUTES BY NATIONAL LEADERS

Following the death of Dr. Mead, President Roosevelt said:

"Dr. Mead was one of the country's outstanding engineers. He was a builder with vision, whose loss will be keenly felt."

Secretary of the Interior Harold L. Ickes, and Dr. Mead's immediate superior, said:

"As Commissioner of the Bureau of Reclamation Dr. Mead has left many monuments in work well done. Perhaps no man contributed more to the planning of Boulder Dam, and certainly no one had a more important part in the actual construction of it than Dr. Mead. If his place in the memory of his Nation were to rest on that accomplishment alone it would be secure, but there were many other accomplishments in his long and exceptional career as an engineer, lawgiver, teacher, and administrator in the field of irrigation."

Plaudits of the world Dr. Mead always accepted in grateful humility, but his supreme joy was in doing some simple act of kindness. When he died the watchman at the door, the messenger, the charwoman, and everyone who ever had occasion to meet him along the way of his travel to the office were shocked at the passing of this fine man, because, as they stated, he always had a word of cheer and greeting. He never was too harassed or busy to greet them.

MUTUALITY IN AIMS

There seems no need for me to say that the close relationship between the aims of the American Society of Agricultural Engineers and the aims of the Bureau of Reclamation were largely brought about through the efforts of Dr. Mead. His service to agriculture in this respect alone seems sufficient to gain for him the honor bestowed on him tonight. He did not attempt to build the society but through the society he endeavored to reach individual thought. He profoundly believed that the farmer deserved a full measure of prosperity and that prosperity in farming communities would make for a more unified nation. He was sold on the idea that the scientific method applied to irrigated agriculture was the first step toward that goal. My idea of a real statesman is a man whose thoughts are unselfish and for future generations. Dr. Mead's were. He was never more saddened than to find his plans frustrated for aiding people who needed help to help themselves.

If I have in some measure portrayed for you the natural forces that it was my good fortune to observe in the character of Elwood Mead I am content. If I have been able through a somewhat feeble analysis of the characteristics of this man to leave with you the thought that Dr. Mead really was a great man I shall ever cherish the memory of this evening.

We miss Dr. Mead of course, but there isn't a spot in the irrigated agricultural world today that is not affected by his legacy of sound principles to guide us in carrying on.

What happened at Estes Park

I have returned from Estes Park, Colo., which gives me an opportunity, just before "The Reclamation Era" goes to press, to insert this short statement of what took place there.

The American Society of Agricultural Engineers had a record attendance at this annual meeting. At the banquet, before a group of 450 to 500 agricultural engineers and their families, Mrs. Elwood Mead accepted the beautiful McCormick Gold Medal from the hands of the outgoing president, L. F. Livingston, in charge of agricultural extension for E. I. Dupont de Nemours & Co. of Wilmington, Del. Mrs. Mead bowed her grateful acceptance, and immediately curtains were drawn aside and revealed an enlargement of Dr. Mead's latest photograph. Then I was introduced to a very quiet and appreciative audience to deliver the speech of acceptance and the statement of the life and work of Dr. Mead, which appears above.

These associates and friends of Dr. Mead received my message with feelings of admiration mingled with unabashed tearful emotion—a beautiful tribute which I shall never forget.—M. A. S.

Monument Unveiled at Hyrum

An elaborate celebration at Hyrum, Utah, was held on June 5-6 on the occasion of the unveiling of a monument erected at the Hyrum Dam site to commemorate the activities of the early fur traders of Utah. Tradition is that some of these early traders were accustomed to cache their furs at a point now within the reservoir area, and from this tradition the Cache Valley takes its name.

The ceremonies were under the auspices of the Cache Valley Council of the Boy Scouts of America. A large number of scouts were present and made their encampment in the wooded area below the dam.

A BEET-SEED cleaning plant is being built at Mesilla Park, Rio Grande project, which will permit the final cleaning of beet seed without shipment to another plant. There has been an increase in building, consisting of improvements to business buildings and new residences in several of the project towns.

The Reclamation Era

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JULY 1936

A Well Deserved Honor

On June 25 at Estes Park, Colo., before admirers and friends of Dr. Elwood Mead, deceased Commissioner of Reclamation, the American Society of Agricultural Engineers posthumously awarded its highest honor, the Cyrus Hall McCormick Gold Medal to Dr. Mead "for exceptional and meritorious engineering achievement in agriculture." Mrs. Mary L. Mead, his widow, with members of her family, was there to accept this honor.

Dr. Mead helped to organize this society and was himself an honorary member. He believed in its policies, its progressiveness, and its high ideals. He was always ready to assist in any way he could to further its purposes and his advice and counsel were often sought by members of the society.

It is only natural, therefore, that the society should so honor him. The action on award was made by the council of the society before Dr. Mead's death. He knew of the award and was tremendously pleased. He planned to go to Estes Park for the formal presentation of the medal.

This acclaim by the society adds another honor to the many conferred on Dr. Mead during his lifetime. Those who were closely associated with him,

and knew him best, will attest to the humble and appreciative manner in which he accepted the many attentions and numerous honors of which he was the recipient, both here and abroad.

One of Dr. Mead's greatest pleasures was in the frequent meeting with students who had attended his classes in the University of California. His former students, many of whom are holding positions of responsibility and prestige, are located in all parts of the world, but to them Dr. Mead was the unfailing source of sound counsel. Their affection for him, together with the realization of his proven ability, inspired confidence in his mature judgment and drew them to him for assistance in the solution of their problems.

At the annual meeting of the American Society of Agricultural Engineers held at Kansas City, Mo., in December 1929, Dr. Mead stated he felt solicitous that the policies and platform of the society should reflect a constructive and progressive attitude. Of course, he was dealing with his specialized subject—Federal reclamation—and from that time until today by a process of contacting agricultural engineers with Bureau of Reclamation officials and by an exchange of their ideas, a better understanding has been created in the minds of members of the society. Dr. Mead leaves this as a heritage and with the award of the McCormick Medal, the society can point with pride to the name of Elwood Mead on its honor roll.

Why the Wool Grower Needs Reclamation

On another page of this issue of the RECLAMATION ERA appears an article by Marvin L. Bishop, secretary of the Natrona (Wyo.) County Woolgrowers' Association, in which he tells why stockmen of the West need reclamation.

Mr. Bishop, who knows the history of the sheep business in Wyoming, glances over his shoulder at the past, and turns without regret to the future, where he finds hope and confidence flourishing as a result of reclamation. He finds in the Casper-Alcova project the realization of "the dreams" of the wool grower.

"If most of his sheep died", Mr. Bishop said, "the wool grower in the old days of open ranges and raging blizzards considered himself unlucky and suffered the consequences."

When homesteaders staked out the range, the wool grower followed their example and gave up his nomadic ways, improved his flock and settled down to graze his own 640-acre ranch and what additional land he could afford to rent. This second step in the progress of wool growing in Wyoming also had its drawbacks, Mr. Bishop declared. There was

insufficient feed to carry the sheep through the worst of the winters. Losses continued, either through actual loss of sheep, the expenses connected with purchase and importation of feeds, or, in dire emergencies, through the cost of shipping the sheep to other States.

The completion of the Casper-Alcova project will be welcomed by Mr. Bishop as a guaranty of supplies of winter feed, as a haven of protection and refuge. He sees in it further evolution of the sheep industry toward a stable industry.

"I do not believe that many of the wool growers of today would like to go back to the hardships of the old system", Mr. Bishop said. "Reclamation will make a further change in the raising of sheep. There will be smaller herds, a better breed of sheep, shearing more pounds of wool than today. With the assurance of sufficient feed at a reasonable price there will be more early shed lambing, resulting in a larger percentage of lambs."

These are the things the Natrona County wool growers can look forward to, in the opinion of Mr. Bishop, as a

(Continued on p. 171)

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date)_____

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

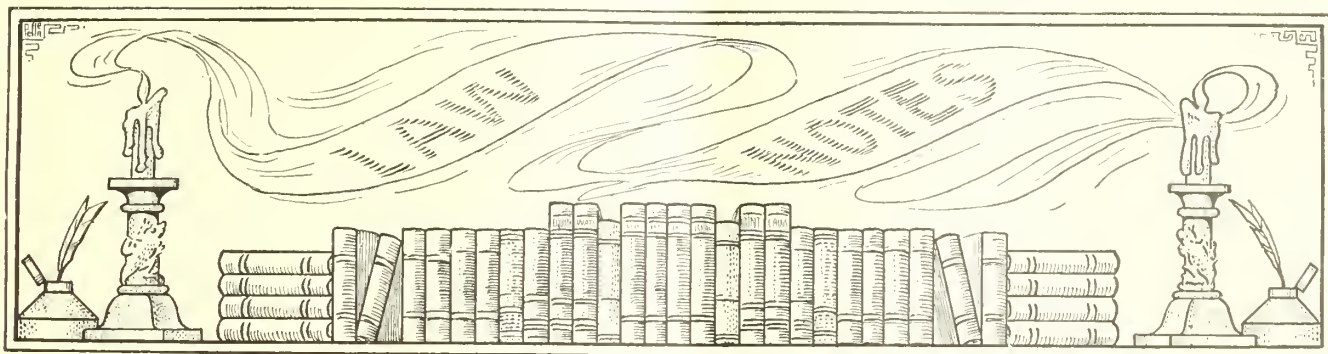
Very truly yours,

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Opinion of the Circuit Court of Appeals, Ninth Circuit, in American Falls Reservoir District No. 2, Appellant v. Crandall et al., Appellees

(Continued from June issue)

THE works were practically completed in the year 1930, and the evidence shows that during that year 3,000 acre-feet of water was diverted from the natural flow of the river, as distinguished from storage water, into the main canal serving the appellant district; that 11,000 acre-feet of natural flow water was diverted in 1931 into the main canal; and that there was delivered into the main canal in 1932 a total of 110,000 acre-feet of natural-flow water. The capacity of the head of the works serving the appellant district is 1,550 second-feet. In 1933 no natural-flow water was delivered to appellant district, whereupon appellant filed this suit to require delivery to it of the natural-flow water to the extent of the capacity of the main canal serving its district, which would be 1,550 second-feet.

The basis of appellant's claim is section 4, article 15, Constitution of Idaho, which is:

"Whenever any waters have been, or shall be, appropriated or used for agricultural purposes, under a sale, rental, or distribution thereof, such sale, rental, or distribution shall be deemed an exclusive dedication to such use; and whenever such waters so dedicated shall have once been sold, rented, or distributed to any person who has settled upon or improved land for agricultural purposes with the view of receiving the benefit of such water under such dedication, such person, his heirs, executors, administrators, successors, or assigns, shall not thereafter, without his consent, be deprived of the annual use of the same, when needed for domestic purposes, or to irrigate the land so settled upon or improved, upon payment therefor, and compliance with such equitable terms and conditions as to the quantity used and times of use, as may be prescribed by law."

This provision is substantially reenacted in 2 Idaho Code Ann., 41-814. In accordance with these provisions, appellant claims that the United States had dedicated to the use of appellant district not only the storage water under its contract with the United States, but also, because of the delivery of the natural-flow water hereinabove outlined, such natural flow, to the extent of 1,550 second-feet.

The remedy used by appellant is a peculiar one. A form of action in Idaho is given by statute (2 Idaho Code Ann., 41-1305) for a summary supplemental adjudication of water rights. The statute in part provides:

"Where the priority rights upon any stream canal or reservoir in this State shall have been determined by decree of any court of competent jurisdiction, and thereafter it shall appear that any person or corporation having the right to the use of any part of said water was not included in said decree as a party thereto and said right was not determined thereby, or that any person who subsequent thereto has acquired any right to the use of such waters, any such person or corporation may have such right adjudicated in the following manner:

"He may bring an action in the District Court of the county wherein such decree was entered * * * that the said party shall in his complaint, set out his own right as he is now required to do in cases involving the right of priority of use of water, and he shall further set forth his acceptance as binding upon him of the said decree and the findings of fact and conclusions of law upon which it is based. * * * The court by its decree in said action shall determine the rights of said plaintiff in accordance with the proof submitted, but subject to the terms of the original decree hereinbefore referred to: *Provided*. That the right thus

established shall not be deemed adjudicated, but *prima facie* merely, and may be attacked by suit brought in a court of competent jurisdiction at any time by any person deeming himself aggrieved thereby. * * *

Under this statute appellant sought to become a party to the Woodville decree, and have its right to the natural flow adjudicated. Harold L. Ickes "as Secretary of the Interior of the United States of America" was made a party defendant.

The real and basic reason for this suit is shown by the following testimony of Watermaster Crandall:

"The Gooding project had a hold-over from 1932 for use in 1933 of 189,695 acre-feet. During 1932 they drew 110,000 acre-feet of natural flow. Had the Gooding project been charged with the 110,000 acre-feet as against their storage, the hold-over would have been decreased to 79,000 acre-feet. The benefit received by the Gooding project in 1932, by the use of the direct flow, permitted an additional hold-over for irrigation in 1933 of approximately 110,000 acre-feet at American Falls."

Thus it can be seen that if appellant district can maintain their claim, in the years where a natural flow is available, it will be able to restrict its use of water to natural-flow water at such times, and if the amount of such natural-flow water is not charged against its storage rights, the amount of unused storage water would be an additional amount upon which to draw during the following year, owing to the "hold-over" rights under its contract with the Government.

The Secretary of the Interior filed a motion to dismiss in the lower court, which was not granted. He argues that the motion should have been sustained, because (1) The United States is an indispensable party, since the suit, as the trial court found, is a suit for partition

of real property; (2) that all other parties having similar contracts with the Government as that of appellant are vitally interested and may be deprived of their contract rights, and therefore are necessary parties; (3) the statute under which the suit is brought does not authorize a suit against the Secretary, nor does it authorize a suit by a contract holder, but only by an "appropriator."

As to the first ground, it should be noted that the Woodville decree adjudicated the right of appropriation in the Secretary of the Interior. 43 U. S. C. A., section 373 provides:

"The Secretary of the Interior is hereby authorized to perform any and all acts and to make such rules and regulations as may be necessary and proper for the purpose of carrying the provisions of this chapter into full force and effect."

If this suit be considered one for the enforcement of purely administrative duties, such as the assessment of the charges of construction, the United States would not be a necessary party.

See *Moore v. Anderson* (C. C. A. 9), 68 F. (2d) 191; *Moody v. Johnston* (C. C. A. 9), 55 F. (2d) 999; and *Id.*, 70 F. (2d) 833. In 43 U. S. C. A., section 383, it is provided:

"Nothing in this chapter shall be construed as affecting or intended to affect or to in any way interfere with the laws of any State or Territory relating to the control, appropriation, use, or distribution of water used in irrigation, or any vested right acquired thereunder, and the Secretary of the Interior, in carrying out the provisions of this chapter, shall proceed in conformity with such laws * * *"

Of course, it could be considered that appellant has acquired a vested right, and is merely attempting to require the Secretary to proceed in conformity with the constitutional provisions hereinabove quoted. However, it seems to us that the nub of the question would be, first, whether or not appellant has acquired a vested right, and to determine in favor of appellant on such a question would be depriving the United States of its prop-

erty right (claimed by appellant in this suit) without giving the United States an opportunity to defend the suit. This we cannot do, therefore we hold that the suit should have been dismissed on that ground. We pass, as not needing discussion, the other grounds urged for a dismissal.

In view of the foregoing the decree of the court below must be modified (*Gnerich v. Rutter*, 265 U. S. 388, 68 L. Ed. 1068, 44 S. Ct. 532; and see *Moody v. Johnston* (C. C. A. 9) 66 F. (2d) 999), by inserting in lieu of paragraph, therein designated "1.", the following:

"That said bill of complaint herein be, and the same is hereby, dismissed, without prejudice, and with costs to the defendant taxed at \$143.60, for want of a necessary party; that the United States is a necessary party to this suit; that because the United States was not made a party to this suit, the court is without jurisdiction to adjudicate the water rights set up in the bill of complaint."

As modified the decree of dismissal is affirmed.

Cooperate to preserve benchmarks

By Howard S. Rappleye, United States Coast and Geodetic Survey

THIS is a plea for the cooperation of engineers in preserving benchmarks, in their own interest as well as that of profession and public.

The United States Coast and Geodetic Survey during the past 65 years has been extending lines of precise levels ("first-order" levels) throughout the country. These first-order lines are spaced at intervals of about 100 miles, while within these areas the leveling is of second-order accuracy. The leveling in the vertical control net now totals slightly over 250,000 miles of lines, with benchmarks set at intervals of several miles on the oldest work, and on the latest leveling about 1 mile.

This work has established well over 100,000 benchmarks, most of which are marked by properly inscribed metal tablets set in concrete posts, bridge abutments, culvert head walls and other structures such as buildings, monuments, and seawalls.

Frequently new construction or repair to existing structures makes it necessary to destroy these marks, in spite of the fact that every effort has been made to place them where they will be as permanent as possible. This Bureau has no funds from which to pay field parties to go about and relocate these marks when they must be moved. The result is that, if these marks are to be preserved for the use of

all engineers and surveyors who may have occasion to use them, we must depend on the cooperation of engineers and others throughout the country for assistance in their preservation.

We have worked out a routine method of handling such cases. If engineers who encounter our marks in the course of construction, repair, or maintenance operations will cooperate as outlined below, the destruction of useful benchmarks, will be very much reduced.

As soon as it becomes known that a mark must be moved, a letter should be sent to the Director, United States Coast and Geodetic Survey, Washington, D. C., attention Section of Leveling, stating the necessity for moving the mark and giving its designation. The designation consists of the letters and numbers found to have been stamped with dies on the disk. It is desirable to furnish a rubbing of the disk as well. A rubbing can be made by placing a piece of mediumweight paper over the disk and then rubbing over the paper with a hard pencil to bring out the legend cast in the disk, especially the letters and numbers stamped on it with dies.

Upon receipt of this information, this office will send out a new disk properly stamped to show that it has been reset. Necessary instructions for the establishment of the new mark and the transfer

of elevation will also be sent. The proper procedure, in most cases, is to establish the new mark in a safe place nearby and transfer the elevation from the old mark to the new one by means of an engineer's level and rod. The levels should be run in duplicate to avoid the possibility of large errors, and all readings should be made to three decimal places in order to preserve the accuracy of the original elevation.

The old mark should not be disturbed until the observations involved in the transfer have been checked by the observer or the recorder. An assumed elevation for the old mark may be used in the transfer, since what we are primarily concerned with in a case of this sort is the difference in elevation between the old mark and the new one established to replace it.

After the new mark has been established and the elevation transferred to it, the old disk should be broken out and returned to this office in a franked mailing sack which will be supplied for the purpose. A complete report on the action taken, including a description of the location in which the new mark is established and a copy of the field notes involved in the transfer of elevation, should also be forwarded to this office;

(Continued on p. 174)

Western Wool Grower Needs Reclamation¹

By Marvin L. Bishop, Secretary, Natrona (Wyo.) County Woolgrowers' Association

RECLAMATION has become of paramount importance to the western wool grower. Only a few years ago cattle and sheep roamed at will on the free and open ranges of this western country and very little interest, if any, was manifested by the owners of livestock in reclamation. The wool grower could graze his sheep without restriction on the open ranges. During the winter months if the snow became too deep in one locality the sheep were moved to other places where range feed could be obtained. During winter blizzards the sheep would "drift with the storm" without running into fences or trespassing on privately owned land. In those early days some wool growers of this county ranged their sheep in the wintertime from Casper as far north as the Pumpkin Butte country and back. It is difficult for the younger wool grower to realize the change that has taken place in raising sheep during the past quarter of a century. Feeding sheep in the wintertime was practically unheard of. During a severe winter when it was impossible to get out of deep snow larger numbers of sheep perished, with resulting loss to the owner. In those days sheep raising was certainly speculative. If a wool grower was able to bring his sheep through a severe winter he considered himself lucky. If most of his sheep died he considered himself unlucky and suffered the consequences. The sheep wagon was the only shelter for the owner, herder, and faithful sheep dog. If some of those old wagons could talk they would tell some mighty interesting experiences—some pleasant perhaps, some of tragedy and many of extreme hardships, privations and bitter disappointments, for the wool grower has suffered a lot in an effort to gain a livelihood from the plains and mountains of the West.

Occasionally some daring young man would file a homestead on a choice stream and fence it. Some of these early homesteaders would engage in the livestock industry in a small way, others would engage in farming. Finally the woolgrower with vision and foresight could hear the tramp of thousands marching westward and realized what homesteading would do to the open range and came to the conclusion that if he intended to remain in the business it would be necessary to acquire land of his own and establish permanent headquarters. With the

passage of the 640-acre homestead law, a large portion of the land in many of the counties in this State was filed on and subsequently became patented. The large sheep outfits were forced to reduce their herds, due to the shortage of range. Today practically every wool grower in Natrona County has his own ranch or headquarters. He realizes that the so-called day of open range is gone forever and that to roam with his herds at will is a part of the past securely locked away in the rugged mountains and rolling plains of the vast domain which was so freely used.

Being now greatly restricted in the use of the open range and either owning or leasing most of the land used for the grazing of his sheep, the wool grower does not take the chances that were taken years ago. Preparations are made for the feeding of sheep during the winter months, as the wool grower cannot afford to lose his sheep, as dead sheep pay no dividends—we expect the live ones to some day. The wool grower realizes that it costs as much to feed a poor sheep as it does a good one, so the culling of herds has been going on in Natrona County for several years. A better grade of bucks is used, more scientific methods of breeding are pursued, with a result that the sheep in this county are a better grade than in former years. The wool grower is convinced that the proper feeding of his sheep in the winter time is a good investment, for he gets returns in a larger percentage of lambs, more wool, and a less death rate.

A few years ago the range in this county was in a precarious condition. Sheepmen realized that it would be impossible to winter their sheep without the necessity of feeding them during the entire winter months. There was no available feed in this county and it was too expensive to ship in feed from other States. Consequently a large number of our sheep were shipped into other States and fed there. Some sheep went as far south as the State of Texas. The expense to the wool grower was enormous. Some were unable to survive this burden of expense, and financial ruin was the result. How soon this same condition may occur again we do not know. Such fear and anxiety of the wool grower can only be relieved through reclamation. If the Casper-Alcova project had been completed at that time and the land placed in crops our sheep could have remained at home and wintered nicely on feed grown on the project, with a great saving to the wool grower.

At the present time practically all of the feed that is fed to the sheep in this county during the winter months is shipped in from other States. The wool grower pays the transportation and extra handling charges. All this could be saved by purchasing feed from the farmers on the project. The wool grower has no assurance that a sufficient quantity of feed can always be shipped in from other States. Quite frequently railroads and highways are blocked with heavy snows so that the feed is delayed just at the time when it is needed the most. A delay of only a few days would be disastrous to hungry sheep.

So one of the perplexing questions which confront the wool grower of this county today is "What assurance do we have that we can always get a sufficient amount of feed for our sheep during a severe winter?" The answer is by raising the feed at home, which can and will be done on said project. There is no better insurance for a wool grower than growing crops in close proximity to his sheep. The hazards of the old system are greatly reduced and winter losses are negligible.

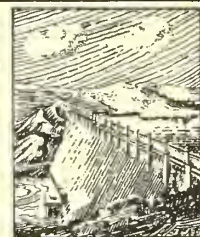
The Alcova project would provide the wool grower with a new and better outlet for the feeding of his old ewes and lambs. There is no reason why lambs could not be fed on land reclaimed by said project. The feeding and finishing of lambs would in a few years develop into a major industry in this locality and would bring associated industries such as packing plants and sugar-beet factories.

From the beginning of time the march of civilization has altered the old system. I do not believe that many of the wool growers of today would like to go back to the hardships of the old system. Reclamation will make a further change in the raising of sheep. There will be smaller herds, a better breed of sheep shearing more pounds of wool than today. With the assurance of sufficient feed at a reasonable price there will be more early shed lambing resulting in a larger percentage of lambs. The farmers on the project will have a few sheep of their own. Even though less sheep are run in this country the profit per head will be greater than it is today. So with the changing conditions that are inevitable the wool grower will welcome reclamation. He will patiently watch the development of the reclamation project now under way in this country. His dream of protection and his haven of refuge will be in crops growing on this project.

¹ This article is taken from the Wyoming Stockman-Farmer, of Cheyenne, which says Mr. Bishop presented it originally as a paper at the recent meeting of the Wyoming Reclamation Association.



ENGINEERING



Malheur River Siphon

By Richard A. Young, Assistant Engineer

THE Malheur River Siphon is a feature of the Owyhee project in eastern Oregon and carries the waters of the North Canal across the valley of the Malheur River near Ontario to irrigate

17,000 acres of bench lands on the Dead Ox Flat division.

The structure consists mainly of arc-welded plate-steel pipe, 80 inches in diameter, with comparatively short lengths of

monolithic reinforced concrete pipe on the ends. The maximum head on the pipe is 268 feet and the total length is 23,178 feet, or nearly $4\frac{1}{2}$ miles, making it one of the longest siphons of its size and type in the country. The carrying capacity of the siphon is 325 cubic feet per second.

The pipe line crosses the John Day Highway, the Burns branch of the Oregon Short Line Railroad, a market road, three or four small canals, and the channel of the Malheur River. It is encased in concrete and buried in the ground under the highways and railroad and is supported across the river channel on high concrete piers. Except for the undercrossings, and for several depressions in the ground profile, the pipe is supported about 15 inches above the ground surface on concrete piers, spaced, on the average, 60 feet apart, with anchors placed at approximately 1,000-foot intervals and at each major bend in the pipe line. Pin bearings grouted into the top of each concrete pier carry rocker arms which in turn support brackets attached to stiffener rings which are welded to the shell of the pipe. The rocker arms are usually 18 inches in length but vary at depressions in the ground surface up to a maximum of 24 feet. The shell of the pipe varies from one-quarter to nine-sixteenths inch in thickness and is self-supporting for the 60-foot spans between piers. A design stress of 14,000 pounds per square inch was used in the pipe shell with an efficiency of 90 percent in the shop-welded longitudinal joint.

Expansion joints are provided midway between the anchors. Twenty-six expansion joints, each packed with five rings of $\frac{3}{8}$ inch square lubricated flax packing, allow for a change in length of the pipe line between anchors due to contraction and expansion caused by temperature changes. Sixty-one manholes, spaced to about 350-foot intervals allow access to the inside of the pipe. Six-inch air valves for vacuum relief are provided at abrupt bends in the pipe and a 4-inch air pressure and vacuum relief valve was placed at the downstream end of the railroad crossing.



River crossing and outlet, Malheur River siphon.

The siphon can be drained through one 18-inch needle valve and one 12-inch gate valve installed at the river crossing and four 4-inch valves located at various points of the line.

CONSTRUCTION

The construction of the siphon was advertised under Specifications No. 598, which provided for alternative proposals on precast concrete pipe to be buried underground and on plate steel pipe to be supported above the surface as above described. The work under each alternative was divided into two schedules, one including roughly the construction of inlet and outlet structures, piers, anchors, etc., and the second, the furnishing and installing of the pipe. Three hundred and thirty calendar days were allowed for completion. Twelve bids were received on November 26, 1934. The lowest combination was on the steel pipe design, as follows:

Parker-Schram Co., Portland, Oreg.:

Schedule No. 1..... \$64,764.50

Consolidated Steel Corporation, Los Angeles, Calif.:

Schedule No. 2..... 522,457.00

Total..... 587,221.50

The lowest bid on precast concrete pipe was submitted by the American Concrete & Steel Pipe Co., of Los Angeles, at \$561,834 for the pipe schedule, or about \$40,000 more than steel. The concrete type of construction was also questioned on account of the low, flat, wet, heavily-alkalied land traversed by 1 mile of the siphon line. Award was made to the Parker-Schram Co. and the Consolidated Steel Corporation on December 28, 1934. The Parker-Schram Co. sublet their excavation work to J. A. Terteling & Sons and the concrete to John Klug. The Consolidated Steel Corporation sublet the field erection of the pipe to the Olson Manufacturing Co., of Boise, Idaho.

There was much discussion among the bidders as to whether steel pipe should be fabricated at the home shops and shipped made up or whether freight should be kept down by shipping the plates flat and fabricating in a temporary shop set up on the project. The lowest bid was based on the fact that the Union Pacific Lines between the shop at Los Angeles and the project offered clearance enough to allow loading the fabricated pipe two high on cars. And so the pipe was shipped, more than 400 carloads of it, on racks 14 feet high from the deck of the cars.



MALHEUR RIVER SIPHON.

Upper: Malheur siphon under railroad and county road.
Middle: Completed section of siphon.
Lower: Erection pipe line.

PIERS AND ANCHORS

Excavation for piers and anchors was begun on March 10 and concrete work followed within a week. All of Schedule No. 1, including the siphon inlet and outlet and all the piers and anchors, was completed in July.

Some difficulty was experienced in securing suitable foundation for the piers across some of the low wet bottom lands. A drain was dug parallel to the siphon to keep the ground water below the surface and several of the piers were overexcavated 8 to 12 feet in depth to reach shale, the overexcavation being backfilled with coarse gravel.

The monolithic concrete pipe at the ends of the siphon was poured in the warm weather of May and June and in lengths of 48 feet. Curing was done with Hunt process coating. Unseasonable cold weather in October found some of this pipe not yet covered and round-about cracks developed at intervals of about 10 to 15 feet.

The alinement, grade, and spacing of the piers was very successfully managed, the supporting rings on the steel pipe almost centering the piers throughout.

FABRICATION OF STEEL PIPE

The pipe was fabricated in the shops of the Consolidated Steel Corporation at Los Angeles. Alternate lengths of about 36 and 24 feet were made up, the short lengths being of heavier plate, carrying stiffener rings, which consist of two plates 4 inches high by seven-sixteenths inch thick, 8 inches apart. Bell- and spigot-type joints were used. All shop welds were stress-relieved in an annealing furnace. All pipe lengths were subjected to a hydrostatic test in the contractor's shop, which included a hammer test, the test pressure used being about 40 per cent above the working pressure. Pipe was given an inside coat of bituminous primer and an outside coat of red lead before shipment.

ERECTION OF PIPE

On delivery at Ontario, pipe was unloaded in an extensive yard by means of a caterpillar crane. In this yard it was made up into 60-foot lengths and some inside painting was done before hauling on a truck and trailer to the location of the siphon. The first pipe was received on May 19 and placed in the highway undercrossing on May 22. Pipe laying was completed in October 1935.

An erection crew of eight men with a caterpillar crane could easily place 200 to 300 linear feet of pipe per 8-hour shift. The program of erection was to place

first a length of pipe on an anchor pier and grout the anchor. After allowing 3 or 4 days for the grout to set, the pipe was then erected from each anchor toward the expansion joints and final connection was accomplished by telescoping the expansion joints closed as far as possible, which allowed the last length of pipe to be placed in the opening freely, after which the connection was made by pull-jacks welded to the pipe.

As shown in a photograph, the lengths of pipe were swung into place by the crane with the pipe hanging about 30° from the horizontal. The top of the circle at the low end of the pipe was then entered into the end of the line and tacked by a welder. The pipe was then lowered slowly to a horizontal position while the fitters completed entering the joint as the pipe came down.

Rocker arms were set at correct location and the pin bearings grouted fast to the piers at night after the temperature of the pipe was uniform on all sides so that the pipe would occupy its normal position with a minimum of internal stresses.

During hot weather a length of pipe laying in the sun would be noticeably longer on its sunny side and, if placed with the free end on true center line, would shift position when the temperature of the sides became uniform if the end remained free.

In the erection of the pipe, all field joints were arc-welded in and outside. Covered welding rod (Lincoln Fleetweld) was used throughout. After a long series of try-outs in an effort to qualify local men, or at least Oregon residents as welders, it was finally admitted that field welding of pressure pipe is a specialized and difficult job in which not many are experienced and a great many could never become adept. Qualified men were then employed wherever they could be found. For the first 2 months, progress was constantly retarded on account of lack of welders. After this time, progress was rapid and well balanced.

Welding inside the pipe during the hot summer days was punishing to the welder and night-shift assignments were in demand. As the pipe shell varied in thickness, from two to three beads or passes by the welder were required on the inside and the outside of each girth joint, two being sufficient for the one-fourth inch and three for any greater thickness. The average good welder could make six beads around the 80-inch pipe in a shift and make a joint that would not leak. Each bead was thoroughly peened with an air hammer before the next one was applied.

Joints were tested for watertightness by forcing soap suds under 50 pounds pressure into the space between the spigot and the bell after the inside and outside girth welds were completed. Very few joints showed any leakage. The bells were entered into the spigots 1½ inches and the joints fitted so tightly that much difficulty was experienced in getting the suds to circulate around the joint.

The Malheur siphon has not yet been filled with water, but the Owyhee siphon, constructed similarly in 1934 with the same inspector and several of the same welders and under a head of 350 feet, did not show a damp spot on the outside of a field weld when filled with water.

Specifications provide for an inside shop coat of primer and a second coat of primer in the field followed by a hot coat of bituminous enamel not less than one-sixteenth inch in thickness. The outside shop coat of red lead is covered in the field by a final coat of aluminum paste in varnish. The bituminous primer and the aluminum were sprayed on with air brushes and the enamel applied hot with hand daubers. Thickness of the enamel coating and the presence of pin holes or "holidays" were checked by a spark tester adjusted to spark through any coating of less than the specified thickness.

It was first attempted to apply the enamel coating inside the pipe in the yard where the pipe could be rolled and all painting done downhand. This method requires much less material and makes a smoother job because there is not splash and waste from overhead work. However, hot sunshine on the outside red lead coat caused the enamel to sag and run. Experiments showed that an aluminum outside coat would protect the enamel up to 95° F. and gloss white would protect it up to 110° F. The latter was then used until a cool day in August showed that the enamel would crack from handling at 45° F. Painting in the yard was then abandoned and the pipe was painted after erection until a sharp cold snap of around zero weather in late October showed that the enamel would crack and loosen from the pipe in extremely cold weather. Painting was then stopped for the winter.

Aluminum in rather thick varnish covered 325 square feet per gallon. The bituminous primer covered 400 square feet per gallon.

The enamel required was 0.74 pound per square foot for painting in the yard as compared with 1.15 pounds per square foot for painting after erection.

Old and new settlers on the Dead Ox Flat are beginning to prepare for irrigation and it is planned to put the miles-long siphon into service to carry water for fall seeding this year.

Russia builds huge plants to water Armenian deserts scheduled to cost millions

Erivan, Armenia, U. S. S. R.—Soviet Armenia has received from the State Planning Commission at Moscow an appropriation of 60,000,000 rubles (over \$12,000,000) for use during 1936 in developing the Lake Sevan hydroelectric power and irrigation project, which is expected to create within a few years the largest water power base in the Soviet Union, and to fertilize 320,000 acres of unwatered land in two Armenian deserts.

An Armenian engineer, Ter Astvatsaturian, perfected and is directing construction of this remarkable project, which is based upon the unusual position of Lake Sevan at an altitude of 6,250 feet in the mountains above Erivan. This lake (formerly known as Lake Gotka), a great natural reservoir 328 feet deep, contains more than 3,000,000,000 cubic feet of water. It is fed by 30 mountain streams but has only one outlet, the Zanga River, which drops abruptly 3,080 feet from its source in Lake Sevan to its juncture with the Aras (Araxes) River. Because of this restricted drainage, the lake has extended over an area of 550 square miles, and much of its water is lost every year through evaporation.

PLAN FOR CONSERVATION

On the basis of surveys begun in 1926, in which foreign consulting engineers participated, Mr. Astvatsaturian devised an elaborate and original scheme to save the water lost through evaporation and to utilize it for irrigation of nearby deserts and development of hydroelectric power. His plans were accepted by the Soviet Commissariat of Heavy Industry in 1932, and work started the following year upon one power station at Kanakir, 6 miles from Erivan, and upon a subterranean station at the point where the Zanga River leaves Lake Sevan.

The subterranean station, the central feature in the Armenian engineer's scheme, is scheduled for completion in 1938. Through this station it is proposed to drain off the lake every year about 35,000,000,000 cubic feet of water in place of the 1,000,000,000 cubic feet which is now discharged annually through the Zanga River. In this way the engineer proposes to obtain 35 times as much water for irrigation and power as is now available.

LAKE'S LEVEL TO BE REDUCED

By the increased drainage of Lake Sevan, Mr. Astvatsaturian estimates that the lake's level will be reduced by 165 feet in 60 years, at the end of which time the lake's surface will be reduced

from 550 to 62 square miles; evaporation from this smaller surface will be much less. The engineer computes that it will then be possible to drain off about 20,000,000,000 cubic feet of water annually without further reduction in the lake's level.

The project provides for construction of eight power stations along the Zanga River, and for creation of a huge artificial lake by damming a volcanic valley at an altitude of 4,275 feet, which is in a dominant position above the Great Sardanabad Desert. This lake, with an estimated capacity of 5,000,000,000 cubic feet will be fed by a diversion canal

scheduled for completion in 1939, will be the largest of the eight, and will develop 263,000 kilowatts of power, about one-third of the estimated total output. At Gumush a dam 1,245 feet long is being built, and a reservoir will be constructed with a capacity of 140,000,000 cubic feet of water. This reservoir will facilitate the development of extra power when needed.

FOR TRANS-CAUCASIA

This project is designed to provide a power base not only for Armenia but for the other republics of the Trans-Caucasian Federation, Georgia and Azerbaijan, where industry is much further advanced. The hydroelectric-power stations in the other republics are subject to drastic reduction in output during autumn and winter, when snow-fed rivers almost disappear.

But the Lake Sevan project can develop more power at this time of year than in the spring and summer, when much of the water from its reservoirs must be used for irrigation. It is particularly valuable because it includes three great reservoirs, Lake Sevan itself, the Gumush Reservoir which will soon be completed, and the artificial lake above the Sardanabad Desert, upon which construction is expected to begin within the next 2 years.—*The Christian Science Monitor*.



from the Zanga River. It will provide water both for hydroelectric power and for irrigation of desert land which experts agree can be made as fertile as any in Armenia.

POWER FOR INDUSTRIES

Of these eight stations, the one at Kanakir will be completed this year, and will provide power for Erivan's growing industries, which include factories making cement, synthetic rubber, machinery, and building materials.

The subterranean station at the lake will be completed in 2 years, and work will begin this summer upon a third, at Gumush, where the Zanga River is joined by its principal tributary, the Maman River. The Gumush station,

Australian Reservoir Filled

The report for the Department of Public Works of New South Wales for the year ending June 30, 1935, just received, gives information in regard to the progress of construction of the Hume Reservoir. The dam on the Murray River was practically completed June 30, 1935, and the reservoir was filled for the first time on October 27, 1934; on November 3 the spillway discharge reached a maximum depth of 4 feet 8 inches. The report states that algal infestation was very light during the year and there was no need for an application of copper sulphate. The reservoir has only been built to the present capacity of 1,250,000 acre feet.

A SWIMMING pool is being built on the Humboldt project for use of Lovelock citizens. This pool, which is located on the grammar school grounds, is being financed by Pershing County, by the city of Lovelock, and with a cash contribution of \$2,000 from the American Legion.

The Parker Dam Project

By Robert R. Nicholas, Junior Engineer

PARKER DAM is located on the Colorado River in California and Arizona 300 miles east of Los Angeles, about 150 miles south of Boulder Dam, and 150 miles north of Yuma. It is 16 miles north of Earp, Calif., which is the nearest railroad station on a branch line of the Atchison, Topeka & Santa Fe Railway. The dam is being built pursuant to contract dated February 10, 1933, between the United States of America and the Metropolitan Water District of Southern California under the provisions of which the district agrees to advance funds for its construction. It was designed and is now being constructed by the Bureau of Reclamation. It will be owned by the United States and operated by it for the benefit of the district and other participating agencies. The United States retains one-half the power privilege at the dam and a limited right to regulate the top 10 feet of storage in the reservoir for control of floods from the Bill Williams River which flows into the Colorado just above the dam site. The other half of

the power privilege belongs to the district. Construction of the power plant is not included in the present program of construction.

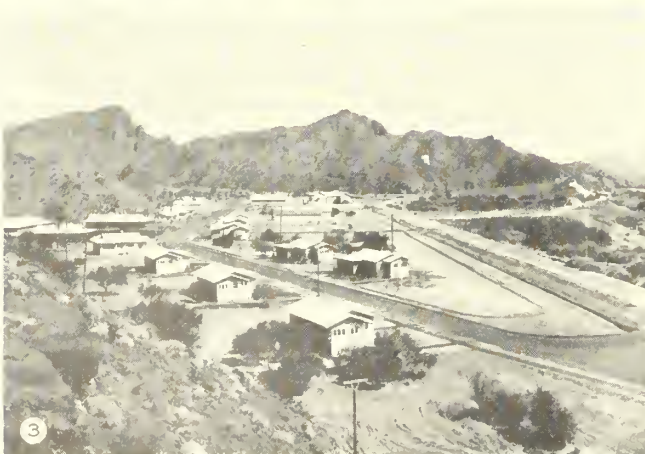
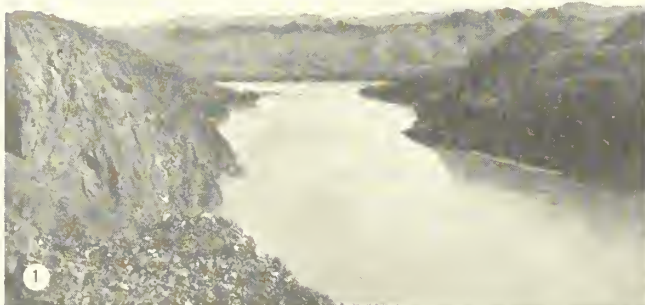
WATER SUPPLY FOR SOUTHERN CALIFORNIA

The primary purpose of the dam is to provide a reservoir of clear water from which the Metropolitan Water District may eventually pump a supply of 1,100,000 acre-feet of water per year at the rate of 1,500 cubic feet per second. This water will be delivered to Los Angeles, Calif., and 12 other district cities by means of an aqueduct 242 miles long, now in the process of construction. The work of building the aqueduct, one of the largest engineering construction projects ever undertaken, is being done by the district, but a brief description of it seems appropriate in any article dealing with Parker Dam.

The metropolitan area of southern California is semiarid, the average annual rainfall being approximately 15 inches. Development has progressed here to such

an extent that it is now far beyond the limits capable of being permanently supported on a 15-inch annual average rainfall plus the run-off from a restricted mountain area, even with the most complete conservation. Thirty years ago the city of Los Angeles built an aqueduct 233 miles long to deliver, when available, 450 second-feet of water into the city from the eastern slope of the high Sierras. But, even with this, the supply is entirely inadequate to furnish the needs of the basin or even the city of Los Angeles. The excess of use over the normal supply has been made possible by the down drawing of underground reservoirs. The water levels in practically all wells in the basin are dropping continuously. Large areas have been overpumped to the extent that the fresh-water table is lower than sea level and salt-water intrusion has ruined large water-bearing areas.

Since there are no further important unappropriated flows of water available from the Sierras, within a reasonable distance, the Metropolitan Water District is



PARKER DAM PROJECT, CALIFORNIA.

1. Parker dam site; 2. Government laboratory, dormitory, and office buildings after landscaping; 3. Government camp after landscaping; 4. Government office building.

now going to the Colorado River. The natural flow of this river is fully appropriated, but through the control now possible at Boulder Dam, the useful flow will be greatly increased. After careful study of all possible routes, the present location of the aqueduct and consequently the location of Parker Dam were determined.

DAM AND APPURTENANT WORKS

Parker Dam is a concrete arch with a maximum height of about 340 feet from the lowest point in the foundation to the roadway on the top of the dam. The length across the top is about 800 feet, the width at the base is 100 feet, and at the spillway level it is 50 feet. The depth of the required excavation below the river bed is approximately 240 feet. The great depth of this excavation is a unique feature of Parker Dam. The proposed high-water elevation is 450 feet above sea level, 75 feet above the present river level, and the total capacity of the reservoir is about 700,000 acre-feet. Five spillway openings are located across the top of the dam each controlled by a gate 50 feet wide and 50 feet high.

The river will be diverted during construction of the dam by means of two 29-foot horseshoe-shaped tunnels through the left abutment of the dam and earth-fill cofferdams in the river channel upstream and downstream from the dam site. Plans for future construction include a power plant containing four generating units, located on the right side of the river immediately downstream from the dam. Four penstock tunnels will lead from the forebay to the powerhouse, the flow being regulated by penstock gates in the forebay structure. The forebay will be protected by a trash-rack structure immediately adjacent to the right end of the dam. An oil-surfaced highway is being constructed from the existing road near the dam site to the top of the dam.

The contract was awarded to Six Companies, Inc., on a low bid of \$4,239,834. All construction materials, except sand and gravel, are furnished by the Government.

Houses have been provided for 14 families in the Government camp at Parker Dam, and the contractor has erected a total of 34 residences in addition to furnishing a hospital, stores, theater, and other activities essential to a construction camp. Approximately 350 men are now employed on the job.

PROGRESS OF WORK

The driving of the two 29-foot diversion tunnels was begun November 1, 1935. Tunnel no. 2, with a total length of 1,704 feet, holed through April 5, 1936, and tunnel no. 1, with a total length of



Timbering and drilling Tunnel No. 1.

1,759 feet, holed through April 13, 1936. In addition to making preparations for lining the tunnels, the present work includes operation of the gravel-screening plant, erection of the concrete mixing plant, erection of the cableway over the dam, excavation of the forebay and spillway approach cut, and other surface work. Excavation for the permanent road to the dam was completed in February 1936.

Aggregate for all concrete required on the project will be obtained from gravel deposits on the Bill Williams River about 2 miles from the dam site. The gravel-screening plant which has been installed by the contractor has a rated capacity of 250 tons per hour. The graded material

which is separated dry will be trucked from the live storage piles directly to the concrete plant located at the dam site. From the mixing plant buckets of concrete for the dam will be transported on flat cars operating on a 200-foot shuttle track to a position where they can be handled by the cableway. The cableway will have a span of 1,385 feet with a fixed tail tower in California and a 75-foot head tower with 600 feet of radial travel on the Arizona side.

Diversion of the river is scheduled for the latter part of the summer of 1936. Excavation for the dam will continue throughout the winter and concrete placing in the dam is expected to begin about March 1937.

Notes for Contractors

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
674	May 16	Salt River, Ariz.	Construction of Bartlett Dam.	Barrett and Hulp and Macco Corporation.	Clearwater, Calif.	\$2,228,272.00		
				Bent Bros., L. E. Dixon Co., Johnson, Inc.	Los Angeles, Calif.	2,630,989.00		
				General Construction Co. and J. F. Shea Co.	Seattle, Wash.	2,730,255.00		
1007-A	May 14	Boise-Payette, Idaho.	Cement, 22,000 barrels.	Oregon Portland Cement Co.	Lime, Oreg.	(Mill) 2.40	Less \$0.50 discount and sav.	May 29
36161-A	Apr. 30	Owyhee, Oreg.	Cement, 25,000 barrels.	Idaho Portland Cement Co.	Inkom, Idaho.	(Mill) 2.50	do.	
				Oregon Portland Cement Co.	Lime, Oreg.	(Mill) 2.40	Less \$0.50 discount and sav.	May 25
				Henry Cowell Lime & Cement Co.	Cowell, Calif.	(Mill) 1.65	do.	
784-D	May 18	Salt River, Ariz.	Construction of laboratory and combined warehouse, garage, and shop building.	J. R. Lippincott.	Los Angeles, Calif.	5,868.50		May 22
				Lee Construction Co.	do.	5,970.00		
				C. O. Johnson.	Pboenix, Ariz.	7,884.00		
680	do.	Boulder Canyon, Ariz.-Nev.	Four 55,000-kilovolt-ampere power transformers.	Westinghouse Electric & Manufacturing Co.	Sharon, Pa.	391,040.00	F. o. b. shipping point	
				Allis-Chalmers Manufacturing Co.	West Allis, Wis.	401,800.00	do.	
				General Electric Co.	Schenectady, N. Y.	407,760.00	do.	
42001-A	May 12	All-American Canal, Ariz.-Calif.	Fabricated metalwork for flexible joint seals in Imperial Dam.	Virginia Bridge Co.	Memphis, Tenn.	17,517.63	Schedule 2, f. o. b. Pot-holes, Calif.	May 12
				John W. Beam.	Denver, Colo.	19,174.00	Schedule 1, f. o. b. Peotone, Ill.	
				Do.	do.	16,365.54	Schedule 2, f. o. b. Peotone, Ill.	
				Do.	do.	2,615.00	Schedule 3, f. o. b. Peotone, Ill.	June 15
				Dravo Contracting Co.	Pittsburgh, Pa.	18,482.70	Schedule 2, f. o. b. Neville Island, Pa.	
				Do.	do.	3,819.00	Schedule 3, f. o. b. Neville Island, Pa.	
2229-A	Apr. 27	Carlsbad, N. Mex.	Cement, 25,000 barrels.	United States Portland Cement Co.	Denver, Colo.	3.13+	F. o. b. Fort Sumner, N. Mex.	May 22
787-D	May 7	Boise-Arrowrock, Idaho.	Outlet diversion pipes.	California Steel Products Co.	San Francisco, Calif.	3,848.00	F. o. b. Barber Junction, Idaho.	May 14
681	May 4	Upper Snake River Storage, Idaho.	Clearing Island Park reservoir site.	Nevada Construction Co.	Nevada, Mo.	66,890.00		May 23
788-D	May 6	Casper-Alcova, Wyo.	Electric freight elevator for outlet works at Alcova Dam.	Kimball Bros. Co.	Council Bluffs, Iowa.	13,790.00	Item 1, f. o. b. shipping points.	May 26
682	May 28	Yakima-Roza, Wash.	Yakima Ridge Canal—Lower half of tunnel no. 1.	Morrison-Knudsen Co.	Boise, Idaho.	292,013.00		June 16
				Sam Orino.	Spokane, Wash.	353,191.00		
				V. R. Dennis Construction Co.	San Diego, Calif.	384,540.00		
678	May 26	Casper-Alcova, Wyo.	96-inch ring-follower gates for outlet works at Alcova Dam.	Steacy-Schmidt Manufacturing Co.	York, Pa.	36,000.00	F. o. b. York.	June 13
				Bartlett-Hayward Co.	Baltimore, Md.	37,000.00	F. o. b. Baltimore, ½ percent discount.	
				Hardie Tynes Manufacturing Co.	Birmingham, Ala.	37,819.00	F. o. b. Birmingham.	June 16
792-D	May 28	Yakima-Storage, Wash.	Radial gates for spillway at Cle Elum Dam.	Valley Iron Works.	Yakima, Wash.	10,800.00	F. o. b. Yakima, 5 percent discount.	
				Bartlett-Hayward Co.	Baltimore, Md.	10,200.00	F. o. b. Baltimore, ½ percent discount.	
				Lakeside Bridge & Steel Co.	Milwaukee, Wis.	11,462.00	F. o. b. Milwaukee, ½ percent discount.	
795-D	do.	Boulder Canyon, Ariz.-Nev.	Steel cable racks and supports for Boulder power plant.	Worden-Allen Co.	do.	1,450.00	F. o. b. Milwaukee, ½ percent discount.	June 5
				Nashville Bridge Co.	Nashville, Tenn.	1,550.00	F. o. b. Bessemer, Ala.	
				California Steel Products Co.	San Francisco, Calif.	1,799.00	F. o. b. San Francisco.	
782-D	Apr. 20	do.	Manual telephone equipment.	American Automatic Electric Sales Co.	Chicago, Ill.	10,668.60	F. o. b. Depew, N. Y.	May 29
675	Apr. 13	Yakima-Roza, Wash.	Yakima Ridge Canal—Station 315 to station 576—\$1.5, earthwork, canal lining, and structures.	J. A. Terteling & Sons.	Boise, Idaho.	275,213.00	Chicago, Ill.	Do
796-D	May 29	Uncompahgre, Colo.	Structural steel for bridges over outlet and spillway channels at Taylor Park Dam.	Midwest Steel & Iron Works Co.	Minnequa, Colo.	2,160.00	F. o. b. Minnequa, ½ percent discount.	June 6
				Worden-Allen Co.	Milwaukee, Wis.	2,686.00	F. o. b. Almont, Colo., ½ percent discount.	
				Milwaukee Bridge Co.	do.	1,994.00	F. o. b. Milwaukee.	
790-D	May 20	Owyhee, Oreg.	North canal laterals.	Morrison-Knudsen Co.	Boise, Idaho.	16,421.00		June 12
				Otis Williams & Co.	Vale, Oreg.	16,695.00		
				H. J. Adler Co.	Nyssa, Oreg.	18,025.00		
791-D	May 21	do.	North canal lateral structures.	Otis Williams & Co.	Vale, Oreg.	13,551.00		June 12
				Henry L. Horn.	Nyssa, Oreg.	14,535.00		
				Morrison-Knudsen Co.	Boise, Idaho.	14,725.00		
789-D	May 20	Moon Lake, Utah.	Radial gates and gate float-wellintake pipe for spillway.	Valley Iron Works.	Yakima, Wash.	4,200.00	(Item 1), f. o. b. Yakima, 5 percent discount.	June 2
				Lakeside Bridge & Steel Co.	Milwaukee, Wis.	5,650.00	(Item 1), f. o. b. Milwaukee, ½ percent discount.	
				S. Morgan Smith Co.	York, Pa.	5,615.00	(Item 1), f. o. b. York.	
				Berkeley Steel Construction Co., Ltd.	Berkeley, Calif.	160.00	(Item 2), f. o. b. Berkeley.	Do.
				Western Pipe & Steel Co. of California.	South San Francisco, Calif.	186.00	(Item 2), f. o. b. South San Francisco.	
				California Steel Products Co.	San Francisco, Calif.	248.00	(Item 2), f. o. b. Heber, Utah.	
794-D	May 23	do.	Sand for Moon Lake Dam.	Provo Sand & Gravel Co.	Provo, Utah.	32,250.00	Item 1.	
				Joseph Massey and Joseph Sannes.	Vernal, Utah.	36,000.00	do.	
				Reynolds-Ely Construction Co.	Springville, Utah	42,500.00	do.	
				Provo Sand & Gravel Co.	Provo, Utah.	12,000.00	Item 2.	

Notes for Contractors—Continued

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
793-D....	May 21	Yakima-Roza, Wash.	Sand and gravel.....	Woodworth & Cornell, Inc.	Tacoma, Wash...	113,050.00	Schedule 1, f. o. b. Pomo-	June 22
				L. Romano Engineering Corporation.	Seattle, Wash....	114,900.00	na, Wash.	
				Pioneer Sand & Gravel Co.	do.....	35,700.00	do.....	
				Woodworth & Cornell, Inc.	Tacoma, Wash...	71,400.00	Schedule 2, f. o. b. Pioneer Pit, Wash.	
				L. Romano Engineering Corporation.	Seattle, Wash....	114,900.00	Schedule 2, f. o. b. Baker's Spur, Wash.	
				Do.....	do.....	83,600.00	Schedule 2, f. o. b. Pomo-	
				Yakima Sand & Gravel Co.	Yakima, Wash...	73,200.00	na, Wash.	
				L. Romano Engineering Corporation.	Seattle, Wash...	78,500.00	Schedule 3, f. o. b. Pomo-	
				Do.....	do.....	78,500.00	na, Wash.	
				Pioneer Sand & Gravel Co.	do.....	24,300.00	Schedule 4, f. o. b. Pomo-	
				Western Gravel Co.....	Maple Valley, Wash.	37,260.00	na, Wash.	
				L. Romano Engineering Corporation.	Seattle, Wash....	57,000.00	Schedule 5, f. o. b. Pioneer Pit, Wash.	
				Yakima Sand & Gravel Co.	Yakima, Wash...	61,050.00	Schedule 5, f. o. b. Pioneer Pit, Wash.	June 22
				Woodworth & Cornell, Inc.	Tacoma, Wash...	7,770.00	Schedule 6, f. o. b. Pomo-	
				L. Romano Engineering Corporation.	Seattle, Wash....	11,760.00	na, Wash.	June 22
				Pioneer Sand & Gravel Co.	do.....	1,260.00	Schedule 7, f. o. b. Easton, Wash.	
685....	June 8	Owyhee, Oreg.	Drains, earthwork, and structures.	Western Gravel Co.....	Maple Valley, Wash.	2,016.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	
				L. Romano Engineering Corporation.	Seattle, Wash....	4,200.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	
				Woodworth & Cornell, Inc.	Tacoma, Wash...	6,720.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	
797-D...	June 1	do...	Structures for north canal laterals.	J. A. Terteling & Sons....	Boise, Idaho....	44,786.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	June 22
				Geo. B. Henly Construction Co.	Nyssa, Oreg.....	45,305.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	
676.....	Apr. 6	Boulder Canyon, Ariz.-Nev.	Structural steel supports, grating, and handrails for tunnel outlets	Morrison-Knudsen Co., Inc.	Boise, Idaho....	52,699.00	Schedule 8, f. o. b. Pioneer Pit, Wash.	
				Kanrich & Corliss	Ontario, Oreg....	14,214.25	Schedule 8, f. o. b. Pioneer Pit, Wash.	
801-D....	June 18	Salt River, Ariz.	Service road to Bartlett dam site.	Otis Williams & Co	Vale, Oreg.....	14,226.25	Schedule 8, f. o. b. Pioneer Pit, Wash.	June 12
				Fife & Co.	Nyssa, Oreg....	14,267.50	Schedule 8, f. o. b. Pioneer Pit, Wash.	
686....	June 22	All-American Canal, Ariz.-Calif.	Earthwork, station 3325 to station 3538-50 and central main canal detour around structure sites.	Blaw-Knox Co.	Pittsburgh, Pa...	13,383.00	Item 2, f. o. b. Boulder City, 1 percent discount.	
				Barrett, Hilp & Maccó Corporation.	Clearwater, Calif	9,960.00		
				R. E. Canion.	Phoenix, Ariz ..	10,366.00		
				Arizona Engineering & Construction Co.	Clifton, Ariz....	14,185.00		
686....	June 22	All-American Canal, Ariz.-Calif.	Earthwork, station 3325 to station 3538-50 and central main canal detour around structure sites.	Peterson Construction Co	Minneapolis, Minn.	54,862.00		
				Boyce & Igoe.....	Baton Rouge, La	58,867.00		
				Lewis Chambers Construction Co.	New Orleans, La	63,505.00		

Transmission Lines

A. E. Wishon, president of the San Joaquin Light & Power Corporation, and P. M. Downing, vice president and general manager of the Pacific Gas & Electric Co., have announced plans for the construction of two high-voltage transmission lines to carry to San Joaquin Valley users surplus power from the Southern California Edison Co.'s Boulder Dam supply.

One of the new transmission lines is to be built from the Edison Co. generating plant at Big Creek to Herndon and the other from the Edison Co.'s Magunden substation in Kern County to the San Joaquin system in the Bakersfield area.

Application was made to the California Railroad Commission for authority to proceed with the undertaking, which, if and when completed, will join the two power systems by means of high-voltage transmission lines.

The first interconnection would be in the vicinity of Bakersfield to tie in the Edison Co.'s substation at Magunden and the San Joaquin Light & Power Co.'s system in the Bakersfield area. The connection will have a capacity of 80,000 horsepower and will permit delivery of surplus Edison power into the southern end of the San Joaquin system, releasing a similar amount of power from the Pacific Gas & Electric Co.'s northern supply.

A second high-tension 220,000-volt line would be constructed between the Edison Co.'s Big Creek no. 3 plant on the San Joaquin River and Herndon, 11 miles north of Fresno, and the present southern terminus of the Pacific Gas & Electric Co.'s own 220,000-volt line. The new connection, 38 miles in length, will permit transfer of 280,000 horsepower of electric energy.

The completion of the connections, set tentatively for July 1937, would provide a central and northern California outlet for surplus power created in southern California through the Edison Co.'s contract for use of part of the Boulder Dam production.—*Southwest Builder and Contractor.*

Wool Grower

(Continued from p. 160)

result of the coming of irrigated farming in their midst. Speaking for the wool grower, Mr. Bishop adds:

"He will welcome reclamation."

TOWNS on the Belle Fourche project, including Belle Fourche, show considerable building activity along the lines of commercial structures and small cottages for tenantry which are necessary to catch up with housing demands.

Progress of Investigations of Projects

Grand Lake-Big Thompson transmountain diversion, Colorado.—In the Loveland area, control surveys and topography were completed along the power-conduit line and the river in Big Thompson Canyon by nine planetable parties, and geological reports and a map were made on several tunnel, reservoir sites, dam sites, and canal lines. The field office was moved from Loveland, Colo., to Grand Lake, and all but three planetable parties were moved into the Grand Lake area, with three parties remaining in the Big Thompson Canyon to complete the survey there. A reconnaissance survey of two canal routes was started, extending from Williams River, at elevation 8,500, to the Granby Reservoir site, and geological examinations were made of several tunnel sites and canal lines from Carter Lake to St. Vrain River. Seven planetable parties will be concentrated in the Grand Lake area in June in order that the survey there may be completed as soon as possible. Work was started in the field office on the preparation of a relief map of the Grand Lake area.

Blue River Transmountain diversion, Colorado.—The project being investigated contemplates the transmountain diversion by means of a tunnel through the Continental Divide of waters from the Blue River near Dillon to the South Platte watershed above Denver. One vertical and three horizontal control parties were in the field during the latter part of May locating control on the Green Mountain replacement reservoir sites on the Blue River near Kremmling. These parties will be working in the Williams and Blue River areas during the month of June. A geological map on tunnel lines from the Blue to South Platte drainage was prepared during the month.

Western Slope, Colorado.—Investigations in progress as follows:

Fruitland project (north fork of the Gunnison).—Reconnaissance surveys were made on five tributaries entering the river above Paonia to locate possible storage sites. One field party is now engaged in level control surveys and taking reservoir topography at the various alternative reservoir sites. Daily gage readings are being secured at stations on four contributing streams.

Mancos Valley project, Colorado.—A planetable survey of the Weber Reservoir site has been completed. A preliminary location of the main inlet ditch, from Middle Mancos Creek, with a short extension to Horse Creek approximately 8,800 feet long, has been surveyed with transit and stadia to the present reservoir.

A survey was made of the present inlet ditch, 10,500 feet in length, from the headgate on Middle Mancos Creek to the reservoir, obtaining grades and average cross-section. Mapping of the irrigation district on a scale of 1 inch to 500 feet with 5-foot contour intervals in the vicinity of the river has been in progress.

Rio Grande Basin, Colo.-N. Mex.—The following surveys and investigations are in progress:

(a) *Wagon Wheel Gap Dam site.*—Topographic surveys of the dam site were continued and were sufficiently completed for studies in the determination of the location of the proposed diamond-drill holes. Since the site is quite long, there are several possible choices in locating the axis of the dam, and this, together with the difficulty in scaling the almost vertical cliffs on the side of the canyon, has required more time for the survey than had originally been contemplated. Topography on the spillway site and checking of the reservoir topography is all of the surveying remaining to be done at this site. Test pits have been dug in the spillway site to determine the suitability of the rock for the spillway.

(b) *Vega-Sylvestre Dam site.*—Exploration by digging additional test pits was continued.

(c) *Conejos Dam site.*—A preliminary geological report has been prepared.

(d) *San Juan-South Fork diversion.*—Paper location studies and reconnaissance surveys have been made on the proposal to divert portions of the San Juan River or its tributaries into the South Fork of the Rio Grande.

(e) *San Juan-Chama diversion.*—Surveying, leveling, and reconnaissance on the long diversion canals proposed to divert the west and east forks of the San Juan River, the Blanca River, and the Navajo River (all tributaries of the San Juan River) over the Continental Divide near Chama into the Rio Grande watershed, are in progress. The diversion scheme involves the construction of reservoirs in the upper reaches of each of the above-named streams, about 104 miles of canal to pick up water from the various streams and convey it over the mountains and the construction of a terminal reservoir at Stinking Lake in New Mexico, the outlet of which is a tributary of the Chama River. All reservoir sites have been examined and two prospective routes for the canals have been reconnoitered. On the upper line, 22 miles of canals were surveyed and about 48 miles of levels run to establish benchmarks upon which to base transit

lines. On the lower line, 14 miles of canal were surveyed during the latter part of the month and another field party was started on this line May 28 working out from Pagosa Springs.

Boise (Boise-Weiser-Payette), Idaho.—Investigations were resumed and explorations and preliminary plans and estimates for reservoirs in the Payette Basin for the benefit of old rights below Black Canyon Dam; special examination of the Garden Valley Dam site; examination of alternative possibilities for diversion of Salmon River waters to the Payette and Boise River Basin; and survey of means of bringing Payette River waters into the Boise Valley. Former reports were reviewed. Snow at the higher elevations made auto roads impassible and limited reconnaissance surveys to the lower areas.

Gallatin Valley, Mont.—Field survey work consisted of running a branch canal line westerly from the High Line to cover the lands south and west of Manhattan. Some test pit work was done along the east abutment of the Lower Basin Dam site; and at the end of the month, pits were being dug in sand and gravel deposits along the river bottom above the dam site. Samples of these deposits will be sent to the Denver office during the first part of June. Land classification and an economic survey of the irrigable areas in the Gallatin Valley were begun and by the end of the month 56,000 acres had been classified.

Saco Divide, Milk River project, Mont.—Investigation was continued of the cost and the feasibility of irrigating about 8,000 acres on the Saco Divide between the Nelson Reservoir canal and Milk River, by pumping from that canal. Detail topography of three pump sites and delivery lines was completed. The general topography will be completed early in June and the land classification immediately undertaken.

Madison River diversion, Montana-Idaho.—An investigation of the feasibility of diverting water from Hebgen Lake, Mont., through an 8-mile tunnel to Henrys Lake, Idaho, was continued. On April 30 a conference was held in Helena, Mont., for the purpose of discussing the Madison River diversion. Those who attended the conference were Gov. C. Ben Ross and R. W. Faris, State commissioner of reclamation, of the State of Idaho; and Gov. Elmer Holt, State Engineer J. S. James, and the water conservation board, of the State of Montana; and other interested parties. Officials of both States concurred in a plan to request an extensive investigation of the entire Missouri River situation.

Meadow Valley, southern Nevada.—Early in May the field organization began the classification of the lands lying within the proposed Meadow Valley project in Lincoln County, near the towns of Caliente and Panaca, Nev. An area of approximately 22½ square miles, or 14,400 acres, was covered during the month of May; and with an estimated total area of 29½ square miles, it is planned to complete the classification and make alkali tests of soil samples taken of the area during the first week of June.

Deschutes, Oreg.—Final reports are in preparation covering: (a) Comprehensive investigation of all reservoir sites in Deschutes Basin above Bend, Oreg., (b) investigation of north unit, and (c) storage on Crooked River. At the close of the month, the Crooked River report was completed.

Black Hills, S. Dak.—Weather conditions have been drier and warmer than normal, thereby permitting the completion of the Brennan Reservoir topography and the making of several reconnaissance trips over the various features of the project, the principal trips being:

(a) Over the Inyan Kara Creek, a tributary of the Belle Fourche River on the northwest side of the hills, in search of storage for the Johnson lateral lands of the Belle Fourche project; (b) over the Rapid Creek and Angostura projects; (c) inspecting one of the Angostura project dam sites on the Cheyenne River; (d) over the various irrigable areas of the Angostura project.

Stream and canal measurements were continued during the month at the recently established gaging stations on Rapid Creek and canals diverting therefrom, and it is anticipated that the investigations of the Rapid Creek-Castle Creek projects will be completed by the middle of July.

Dixie project, Utah.—Additional field work was in progress, and soil borings were made to substantiate the land classification. The water supply and silt investigations were continued during the month.

Salt Lake Basin, Utah.—On the Gooseberry project investigations, a small amount of work was accomplished in the field office on water supply studies for the years 1933 to 1935, which studies are about completed. It is intended that a brief report be made on the water supply available for the project, as revised, to include the last 3 or 4 years of low run-off as soon as some information can be obtained from the Price River water commissioner and the State engineer's office.

Colorado River Basin.—Throughout the winter land classification and irri-

gated area surveys have been conducted with a small force principally near Rifle, Grand Junction, and Glenwood Springs, Colo. During April and May as weather conditions became more favorable for field work the force employed on this work was greatly increased and now consists of six field parties working in Colorado. A total of 67,400 acres were covered with irrigated area surveys and 28,900 acres with land classification surveys during the month.

Hawaii water supply studies, Hawaii.—Continued rains throughout the months of March and April made survey work almost impossible, limiting the activities to reconnaissance, the cutting of trails and establishing triangulation stations in the field and making computations in the office. Trails are being cut into various watersheds; and, as each is completed, the stream flow is analysed and compared with previous records. Nineteen triangulation stations were made accessible by several miles of trails and the area around them has been cleared and the monuments marked.

Elephant Butte Lake Popular



Continued increase in the number of visitors at Elephant Butte Lake has prompted National Park Service officials to arrange for guest cabins in future development plans for recreational areas around the lake.

When the Civilian Conservation Corps company moves from its present camp into another section of the reservation, probably late in the summer, cottages now occupied by enrollees are to be

rebuilt into a more permanent type of construction, and made available to tourists. The present camp site will be dismantled. The plan is to move the cottages around into different sections of the reservation, some of them along the lake shore; some on the higher hillsides, overlooking the lake. They will be furnished and made available to the public at nominal rentals.

The resort is becoming increasingly popular to residents of New Mexico and Texas. Many now bring camping equipment and spend the week end, particularly El Pasoans. During the present early season the number of visitors has already been in excess of those who came throughout last year, mainly because of the completion, by Civilian Conservation Corps labor, of a system of wide roads that make the area easily and safely accessible. It was anticipated there would be several thousand visitors during the first week end of June, in connection with the outboard motorboat regatta.

Other plans the National Park Service is considering call for remodeling of the lodge building constructed by the United States Bureau of Reclamation at the time the Rio Grande was dammed to create the lake as an irrigation project. This building now is being used as head-

quarters and for recreation purposes by the Civilian Conservation Corps. It would be remade into small apartments for rental to tourists.—*Daily Current-Argus, Carlsbad.*

THE National Dairy Association has placed 9 Yakima Valley dairies, all members of the Yakima Herd Improvement Association, on the national honor roll for high production during 1935.

Rye Patch Dam Completed

The completion of Rye Patch Dam on the Humboldt River in Nevada, the third important storage dam constructed and placed in service by the Bureau of Reclamation since its emergency program was launched, was reported by Acting Commissioner John C. Page to Secretary of the Interior Harold L. Ickes on June 10.

Rye Patch Dam, like Hyrum Dam in Utah and the Agency Valley Dam in Oregon, was begun in 1934 with funds allotted to the Bureau of Reclamation by the Public Works Administration. Hyrum and Agency Valley Dams were completed earlier this year. Upon completion of Rye Patch Dam Acting Commissioner Page said:

"These dams, although they are not large and their construction was not dramatic, are vital to the people of the projects they serve and the States in which they are located. The importance of this type of construction in the arid West is illustrated by Rye Patch Dam. It will conserve the waters of the Humboldt River, one of the very few streams in Nevada. The Humboldt River rises in mountains in the northern part of the State and curves toward central Nevada until it finally disappears without a trace in the desert.

"Nevada has about 71,000,000 acres of land, yet only 487,000 acres are irrigated in the State, and without irrigation none of it can be farmed. It is as though in all New England with New York State added, no agricultural land could be found except in Rhode Island, and only half of Rhode Island could be farmed. Despite this fact, until Rye Patch Dam



Close up of spillway.

was completed on June 10, the waters of the Humboldt River were not completely conserved. Quite a large quantity was wasted in the desert."

Rye Patch Dam is an earth-fill structure 75 feet high. It has created a reservoir with a capacity of 80,000 acre-feet of water. At present 4,000 acre-feet have been caught and saved and by the close of this season it is expected that the storage may be increased to 25,000 acre-feet.

The Humboldt River has an exceptionally erratic record for water production. It produced 522,609 acre-feet in 1907 and only 7,350 in 1920. Storage of the surplus waters in the wet years under these conditions becomes essential to safe irrigation. The Rye Patch Dam will

store water for 33,000 acres in the narrow valley of the Humboldt. All this land is at present farmed, but with an indefinite water supply. The water rights held by an acreage equally as large, but of sub-marginal character, were purchased and this land retired. The cost of Rye Patch Dam was approximately \$1,250,000.

The Agency Valley Dam is an earth-and rock-fill structure 90 feet high on the north fork of the Malheur River in Oregon. It stores 60,000 acre-feet of water to supplement the supply of the new Vale reclamation project which has an area of 30,000 acres. Its cost was about \$1,060,000.

Hyrum Dam is an earth- and rock-fill structure 100 feet high and stores 18,000 acre-feet of water for use in supplementing the water supply of lands in the vicinity of Logan, Utah. It will provide a safe supply for 6,000 acres now irrigated and will provide an irrigation supply for 4,000 acres now being farmed by dry-farming methods. The cost of Hyrum Dam and three canals of a total length of 20 miles approximated \$930,000.

Benchmarks

(Continued from p. 162)

a franked envelope will be furnished for this purpose.

The cooperation which individuals and organizations may extend to this office in preserving the benchmarks will be a service not only to this bureau and other government surveying organizations but to anyone who may have occasion to use the marks.—*Engineering News-Record*, February 20, 1936.



Rye Patch Dam and spillway.

Emergency Conservation Work Safety Program

By Alfred R. Golzé, Assistant to Supervising Engineer, E. C. W.

THE safety program for Emergency Conservation Work is under the general jurisdiction of the safety engineer in the Office of the Director of Emergency Conservation Work. The Bureau of Reclamation cooperates to the fullest extent with the safety engineer in the extension of his safety program to the E. C. W. camps under the direction of this Bureau.

A representative of the Washington office attends meetings of the E. C. W. safety council held monthly by the safety engineer. All instructions relative to safety matters are promptly forwarded to the field. Field control of the Bureau of Reclamation E. C. W. camps is maintained by a number of regional directors, who are in charge of from one to six camps, dependent on their location. In nearly every case the regional directors are either reclamation project superintendents or construction engineers engaged in the regular activities of the Bureau. On the regional directors is placed the responsibility of enforcing all E. C. W. safety regulations, and the camps under their direction benefit by the experience obtained in their dual capacities.

In each E. C. W. camp a member of the supervisory personnel is designated as safety assistant to the camp superintendent. On this individual rests the responsibility of checking all activities on the work projects for compliance with the safety regulations, issued by the Office of the Director, E. C. W. The safety assistant reports regularly to the camp superintendent and necessary changes are effected by the superintendent. The safety assistant examines all work projects for the hazards involved, regularly checks all tools and equipment, and the possible fire hazards in the work area and in that portion of the E. C. W.

camp under the jurisdiction of the technical agency.

Reports of accidents occurring to the E. C. W. enrollees while at work under the supervision of the Bureau are reported to the Washington office monthly on standard accident report forms. The accidents are summarized by States and for the Bureau as a whole, the summaries being forwarded to the safety engineer, E. C. W., for his information. Careful studies are made of the individual camp accident reports, and when believed necessary special efforts are made to improve conditions at any camp having a poor record. In cases of serious or fatal accidents occurring under the supervision of this Bureau, investigations are made to determine the responsibility and causes, recommendations for disciplinary action being made when warranted.

Safety regulations prescribed by the safety engineer, E. C. W., relating to approved types of safety equipment are enforced throughout the E. C. W. camps assigned to the Bureau of Reclamation. For example, approved types of governors, set for a maximum speed of 35 miles per hour, are required on all trucks used for E. C. W. purposes. When working in dust areas, or on work where particles of materials are thrown into the atmosphere, goggles are required to be worn by the E. C. W. men, and also respirators if the air conditions are sufficiently bad.

Matters of general health, sanitation, food supply, recreation, and similar items pertinent to the welfare of the E. C. W. enrollees in the camps are not the direct concern of this Bureau, as the Army is charged with those responsibilities. However, full cooperation in these matters is extended to the Army by the Bureau whenever requested, chiefly to furnish transportation for recreation trips.

Excerpts From May Project Reports

Carlsbad.—Crops generally were in excellent condition at the close of the month. Stands of cotton were unusually good over the entire project.

Provo River.—Crops are looking exceptionally good for this time of the year, and in localities where water is available it is expected that the yields will be very high. The market was exceptionally good for strawberries, which were ripening fast by the end of the month.

Hyrum.—A marked increase in the growth of alfalfa on the old dry farm land of the conservation district was

obtained by irrigation. Alfalfa, sugar beets, peas, beans, and truck crops in general are in good condition.

Cattle and sheep are now on summer range in the adjacent hills and are in good condition.

Vale.—All crops are in good growing condition. All cattle and sheep are now on the range, which is exceptionally good this year.

Owyhee.—Crops generally are in very good condition, especially early potatoes. The quality of the first cutting of alfalfa on an average is considerably better than for some years past.

Rio Grande.—Cotton planting was completed during the month. Cotton so far is of a very good and uniform stand, with a very small amount of replanting necessary. The first cutting of alfalfa was completed during the first part of the month, the growers reporting above average yields.

Yuma auxiliary.—Picking and packing of the season's grapefruit crop was completed about the middle of the month. The grade and quality of the crop remained good. The demand was better than during the past month, which resulted in an average advance in price of 25 cents per box.

Shoshone.—Livestock is in excellent condition. The lamb crop was good and the lambs are making excellent growth. Most flocks were sheared during the month and heavy yields of wool were obtained. The Powell wool clip, aggregating about 100,000 pounds, was sold locally for 25½ cents per pound. The ranges are in better condition than they have been for a number of years. The demand for range lands is greater than the lands available.

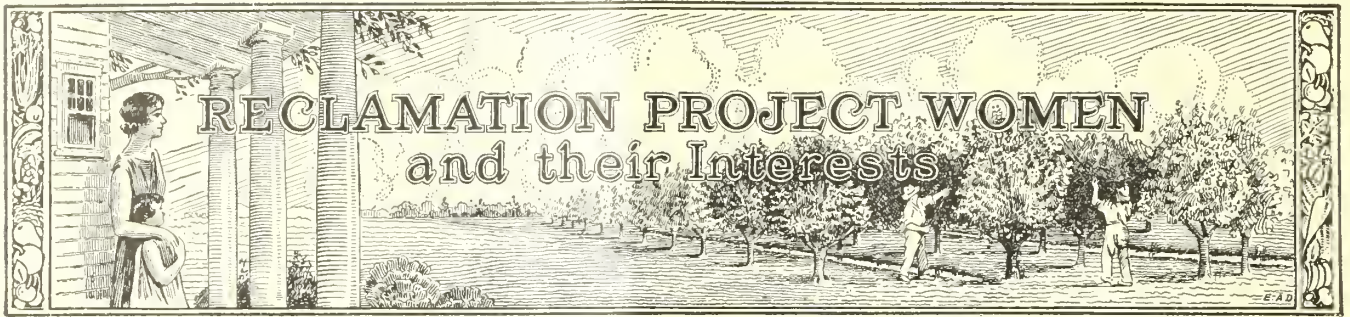
Frenchtown.—The livestock industry is in good condition and range is also excellent. Prices received for farm products are satisfactory.

Klamath.—All livestock is in excellent shape. Rains during the last week in May were general, and the range is in fine condition. There was a sudden rise in the price of potatoes early in May, and odd lots approximating 10 cars were shipped from the project. The outlook for the sheepmen is bright, with most of the wool clip sold at 27 to 30½ cents per pound, and lambs contracted for July 15 to September 1.

Yakima.—The 1935 onion crop for the Yakima Valley amounted to 15,585 tons, for which aggregate returns were \$300,790. Growers received \$8 to \$26 per ton. This season the White Rose variety of potato is being introduced in the valley, as experiments last year showed it to be of excellent quality and size. Eleven cars of the seed potatoes were brought to the valley and distributed among farmers. This tonnage is sufficient to plant 400 acres.

Shipments of apples for the month of May, amounting to 668 cars, were more than double that for May 1935.

Humboldt.—All crops are in fine condition and good growing weather has prevailed throughout the month. There will be 3,000 acres of wheat, 1,000 of barley, 1,000 of new alfalfa, and 10,000 of old alfalfa irrigated in the district during the 1936 season.



A Game Bird Refuge

By O. G. Luehrs, Ontario, Oreg.

FROM earliest childhood I have always been a great lover of all game birds and animals. Through all my boyhood I lived in one of the greatest game bird States in the Union. As a hunter I have become intimately acquainted with all the game birds' habits from the midget sand piper's to the lordly trumpeter swan's.

As the advancing years saw an alarming decline of nearly all species, the resolve gradually shaped itself to do what I could in my small way to stem the disappearance of these wonderful game birds, and in February 1935 I bought the first tract of land located 3 miles due west of Ontario, Oreg., a tract of 80 acres lying on both sides of the Malheur River. I then added more land until the refuge now contains 290 acres and controls both banks of the river through the entire center of the section. As the river winds and bends, there is actually $1\frac{1}{4}$ miles of the Malheur River within the refuge.

The land is what is generally known as "dry land"; that is, it has no irrigation water on it and it must therefore depend on the scant rainfall we have here. This land had been very closely pastured for years with the result that vegetation was practically obliterated. So, in order to get a cover for the ground, as well as for the birds, the following seed was planted on the snow within a few days after the first tract was acquired: Sweet-clover, ryegrass, orchard grass, alfalfa, redtop, millet, sudan grass. The result was a very satisfactory stand, especially that which was planted near the river and in low spots. This spring all the foregoing seed was planted, together with timothy, Reed canary grass, crested wheatgrass, buckwheat, bulbous bluegrass. I planted about 70 to 80 acres in wheat with a mixture of the above seed. The land was disked, planted, and smoothed with a heavy float. This was done in the clearing of the sage brush which was allowed to remain in order

that the birds might not be deprived of anything that they could use for cover.

After the seed was planted last year the whole refuge was fenced, and 1,300 posts and 6 miles of barbwire were used.

Then the river bottom was planted with the following aquatic plants: Wild celery tubers, duck potato tubers, sago pondweed tubers, wild duck millet seed, wildrice seed, Wampee duck corn seed, American lotus seed, and early this spring I planted Mushgrass seed spores and brownleaf pondweed seed.

This spring I will add to the above redhead grass roots, duckmeat plants,



Luehrs' Bird Refuge.

coontail plants, white lily tubers, chufa tubers, duckwheat seed, and Reed grass roots.

This, together with bull rushes and cattails, completes the list of the various plants and seed used for feed and cover for the game and song birds on my bird refuge.

A brief history of the dams constructed for the conservation of water and the creation of ponds and lagoons for the migratory waterfowl follows:

The first dam was constructed near the east end of the refuge. Large concrete blocks, old furnaces, heavy iron parts from automobiles, iron barrels cut open lengthwise and filled with gravel, logs anchored to the bottom of the river—in fact, anything that had weight entered into the construction of the dam. The whole was filled and covered with gravel.

Two 10-foot wasteways, one at each end of the dam, were made. This dam then made a pond of about 10 acres, by damming up one end of the pond with an exclusive gravel dam. This pond was also planted with the same aquatic plants as the river had been. As the soil is mostly gravel it is doubtful if anything worth while will grow in this pond except where the soil is good. This dam also was forced to make a lagoon and another pond an acre in size.

Then two other dams were made toward the west end of the reserve. One entirely of gravel and the other concrete as well as gravel entered into its construction.

The spring of 1936 saw water over 20 feet high on the reserve. The result showed that the first dam constructed of concrete blocks and iron held while the others were flattened and washed out.

However, I am constructing another dam at the west end of the refuge and figure it will make a pond of 20 to 25 acres on good rich soil on which any of the aquatic plants will grow fine.

A good many willows were planted and grew well, also, black locust, mulberry, green ash, and yellow pine, but because of the drought, squirrels, and jack rabbits, very few lived through the season. However, as we killed more than 2,500 jack rabbits and poisoned thousands of ground squirrels, the trees stand a better chance to live, and this season I am planting more.

Last fall it was estimated nearly 15,000 ducks stayed on the refuge until the river froze solid. The varieties were mallard, pintail, teal, baldpate, goldeneye, a few ruddy ducks, gadwalls, a few redheads and a very few canvasbacks. A number of mergansers stayed all winter.

Forty to fifty pairs of mallards, teal, golden-eyes, pintails, and baldpates will possibly nest on the refuge this year. Last year five or six pairs nested. Pheasants numerous enough to scratch up the wheat that was planted this spring, also several pairs of Hungarian partridges, and a number of pairs of Gambel partridges

will no doubt nest on the place this year. The State game commission released 100 Gambel partridges last year on the place but they scattered up and down the valley, although some remained.

Predatory birds and animals were and are still a constant menace to the game birds, especially during nesting season. A number of skunks, five coyotes, a badger, and three weasels were killed during the time I have had the place. Two golden eagles (by special permit from the State game commission), possibly 30 horned owls, over 100 crows and ravens, sharp-shinned hawks, duck hawks, marsh hawks, goshawks, Coopers hawks, were shot. We took a few hawks that are supposed to be beneficial to farmers, such as the rough-leg hawk, red-tail, buzzard; the common prairie owl and the sparrow hawk have not been disturbed as they feed principally on mice and squirrels. The magpie is one of the worst predatory birds flying, destroying mainly eggs and young game birds. Of these we have killed over 350 the past year.

The carp is a destroyer of aquatic plants that migratory birds feed on; and of these we have seined over 200 that weighed from 5 to 16 pounds each. Last year over 50 avocets and 75 sandpipers hatched on the refuge.

It requires plenty of work and constant vigilance on man, bird, and animal.

Progress on All-American Canal

Forty-four and one-half miles of the 80-mile All-American Canal have been excavated in the construction of the Nation's greatest irrigation ditch.

A total of 34,994,900 cubic yards of earth and rock has been moved in the 17 months since construction began. The dirt has been flying at a rate sufficient to dig a hole each day big enough to hold an 18-story building.

The All-American Canal will replace the present main canal serving the Imperial Valley of California and traversing 50 miles of Mexican territory. A canal entirely upon American soil has been the hope of the 60,000 inhabitants of the Imperial Valley since settlement began there in 1901. The canal will tap the Colorado River at a point about 15 miles north of Yuma, Ariz., and will cross the desert of the east side mesa on a line paralleling and only a few hundred feet from the international boundary.

While a dozen contractors are at work on various sections and structures of the canal, the largest volume of excavation to date has been done by the W. E. Callahan Construction Co. and Gunther

Nature Lends A Helping Hand

By Seth H. Dibble, Assistant Clerk, Milk River Project

Aeons ago ice floes from the north, with their boulder-forming action, transformed the then tropical verdure covered West into what it is today, a semiarid country. As the floes receded, their accumulation of soil and gravel was deposited in irregular masses or left level, as the case might be. With this topographic change came a climatic change. Rainfall was scant and a new vegetation came into being—short curly grass that hugged the ground for protection, with little leaf surface for evaporation, and a root system that drew from that virgin soil a strength that made, in later times, the American bison the "Monarch of the Plains."

During this transformation nature was preparing for the advance of civilization; the carbon of huge forests was converted into coal; other life became petroleum; vast pockets of gas were rock-sealed for future heat and power; deep snows from high mountain peaks carved wide water courses to the sea, and as their volume decreased, fertile valleys were formed by their rich alluvial deposit. But nature had done even more. Her irregular glacial deposits had formed huge hill-lipped basins, into which the engineers of today guide the spring run-off from the distant mountains against the time it will be needed to water the productive plains below.

Such a basin is Nelson Reservoir, some few miles northwest of Saco, Mont., and a part of the Milk River project. With

a capacity of 66,800 acre-feet, this artificial lake serves an irrigable area of 13,000 acres. Pike, whitefish, cat, buffalo, goldeye, ling, and carp abound in its waters. Summer week ends find its shores dotted with fishermen; the crisp air of fall resounds with the duck hunter's gun; and winter sees men seining through the ice for buffalo, goldeye, ling, and carp, which are shipped in carload lots to eastern markets.

The canal that carries these impounded waters to the hay meadows, the sugar-beet and alfalfa fields on the lower levels, skirts the rolling edge of a still higher mesa. With the event of the Chain of Lakes Storage unit (and entirely contingent upon its construction) thousands of the fertile acres of this higher plane are susceptible of irrigation. But the water must be pumped.

Beneath these very lands, natural gas, with titanic force, is hissing its way through huge pipes to the surface, where it is harnessed for the use of man. It is proposed to pipe this gas directly to the combustion chambers of pump engines that will lift water from the main canal to another canal system above.

Thus the circle is completed. Preice-age vegetation fed the life of that day only to be crushed by creeping glaciers, and now that same prehistoric life will furnish power to lift water from the glacier-made water course to feed life of today. Surely nature lends a helping hand.

& Shirley, who are digging the canal through a range of sand hills which lie along the Colorado River. The holders of this contract have excavated a total of 26,565,400 cubic yards of earth and have completed 68 percent of their work. Here three drag-line excavators each capable of moving 12 yards of earth a minute are in operation.

The excavation of the canal through the irrigated section of the Imperial Valley was done by Government forces, as many as 300 men and teams recruited from the nearby farms were at work on this section. With the completion of 17½ miles of canal in this fashion, the force account work has been completed.

R. B. Williams, construction engineer in charge of the canal, and the Imperial Diversion Dam at its head, reported that a total of 279 carloads of materials have been received from 12 States to date in the construction of the canal. These materials include 124 cars of lumber, 51 cars of reinforcement steel, 39 cars of cement, 14 cars of sheet piling, 5 cars of structural

steel, 3 cars of nails, 7 cars of fittings, 2 cars of automobiles, 5 cars of poles, 3 cars of pipe, 1 car of machinery, 2 cars of brick, 1 car of wall board, 1 car of roofing, 1 car of transformers, 2 of coal tar, 12 of road oil, and 6 of asphalt.

These shipments originated as follows: 115 cars in California, 119 cars in Oregon, 5 cars in Missouri, 2 cars in Idaho, 2 cars in Pennsylvania, 3 cars in Washington, 3 cars in New York, 2 cars in Illinois, 4 cars in Ohio, 2 cars in Wisconsin, 7 cars in Colorado, and 15 cars in Indiana.

INTEREST in settlement opportunities continues on the Riverton project, Wyoming, where 22 farm units are still available for entry.

LABOR on the Belle Fourche project is generally well employed, with farm work and field construction taking care of those who need work.

Articles on Irrigation and Related Subjects

Arizona Suit: Colorado River water (long description of history of suit), Eng. News-Record, June 4, 1936, v. 116, p. 824.

Bartlett Dam: Record Multiple Arch dam to be built in Arizona, illus., Western Cons. News, May 1936, v. 11, pp. 137.

Boulder Power Plant: 287 Kv Boulder Dam disconnecting switches, illus., by A. J. Bowie and C. P. Garman. Electrical Engineering, June 1935, v. 55, no. 6, pp. 582-589.

Check Dams: Function and design of check dams, illus., Paul Baumann, Civil Engineering, June 1936, v. 6, p. 355-358.

Conchas Dam: Bids to be called on Conchas Dam (brief description). Eng. News-Record, May 28, 1936, v. 116, p. 792.

Columbia Basin Project: Results of electric heating at Mason City, illus., Electrical West, May 1936, v. 76, no. 5, pp. 17-18. (Includes tables of electrical consumption by months for 1935—not rates or costs.)

Comparative heat loss tests on insulated buildings in the electrified Mason City at Grand Coulee Dam site. H. J. Dana and R. E. Lyle, Wash. Eng. Exp. Sta. Bull. No. 45, 26 pp. 1935.

Hoyt, J. C.: Droughts of 1930-1934. Water Supply Paper #680, Geological Survey, 1936, 106 pp. (With numer-

ous tables and charts including precipitation table by States of U. S., 1881-1934.)

Grand Coulee Dam: Half-million yards of concrete poured at Grand Coulee, with cover illus., Pacific Builder and Engineer, June 6, 1936, v. 42, p. 30.

Grand Coulee operations accelerated to rapid pace, illus., Western Construction News, May 1936, v. 11, pp. 164-165.

Lewis, A. D., Director: Report Director of Irrigation, April 1, 1934 to March 31 1935, Union of So. Africa, Pretoria, 1936, 51 pages.

Los Angeles Aqueduct: Colorado River Aqueduct, illus., F. E. Weymouth, Ch. Engr., and Julian Hinds, Asst. Ch. Engr., 2nd Edition, March 1936, 65 pp.

Mexico, Irrigation: Irrigation program in Mexico, Eng. News-Record, June 4, 1936, v. 116, p. 824.

Oregon Settlement: Vale and Owyhee project lands opened for homesteading, Eng. News-Record, May 14, 1936, v. 116, p. 702.

O'Shaughnessy Dam: Cableway installation of unique design used in raising O'Shaughnessy Dam, illus., Western Construction News, May 1936, v. 11, pp. 138-140.

Taylor, Hon. Edward T., M. C.: Elwood Mead, a tribute to. Cong. Record, June 19, 1936, v. 80, pp. 10368-10370.

Conservation

The addresses of President Roosevelt, Frederick A. Delano, Chairman, National Capital Park and Planning Commission, and the Secretary of the Interior, Harold L. Ickes, at the laying of the cornerstone of the new Interior Department building, on April 16, 1936, have been issued in an illustrated pamphlet of 20 pages.

The addresses emphasize the need for conservation of our natural resources, trace briefly the history of the growth of the Interior Department, describe the architectural plan of the building for service and give an account of the activities of the Department in the disposal of the public lands, construction of dams, and other public works, and the investigation of the resources and their uses for the benefit of mankind.

This pamphlet is available for free distribution as long as copies are available.

Settler's Banquet

By Mary M. Hunt, Nyssa, Oreg.

The second settler's banquet was given by the Nyssa Commercial Club at the high-school gym, Friday, April 10. It was a very lovely affair for both newcomers and the old-timers. Last year when the first unit of land was sold, a similar banquet was held and expressions were unanimous that a good time was had by all. One hundred and sixty guests were present and it was a great pleasure to meet and enjoy these friends who have come to live in our midst.

When another unit of lands was sold we knew a larger building would be required, so this year's party was held in the large gym of the local high school. Three hundred people enjoyed the banquet, speeches, and music. Many of the past year's settlers were with us again, as well as a large number of newcomers. Having watched the construction of the Owyhee project for the past 6 years it was an inspiration to look over the fine group of intelligent people who have recently taken up their homes in our great country.

THE opening of 27 public land units to homestead entry on the Vale project, Oregon, on May 15, attracted the attention of homeseekers from New York to California, it is apparent from applications received by the project office during a 20-day period immediately following the opening date.

A 90-day preference period for filing is accorded ex-war veterans over other citizens. The period expires August 13, 1936.

THE new Powell Band shell was dedicated on May 2. This building was constructed of logs and was an E. R. A. project. A band of approximately 216 pieces, which was made up from school bands from practically every

town in the Big Horn Basin, participated in the dedication.

THERE is a local shortage of skilled and semiskilled labor on the Burnt River project, Oregon.



Peach orchard on Grand Valley project, Colorado.

Reclamation Organization Activities and Project Visitors

R. F. Walter, chief engineer, visited a number of the Federal reclamation projects during the month of May and inspected the engineering works in progress.

W. J. Burke, district counsel at Billings, Mont., spent some time in the Washington office during the month of June.

Harold S. Williams, engineer, and George B. Ralph, assistant engineer, were transferred from the Denver office to the Central Valley project, California, effective May 1 and 11, respectively. Both of these employees are carried on the emergency, non-civil-service rolls.

B. E. Stoutemyer, district counsel, with headquarters at Portland, Oreg., attended the meeting at Walla Walla, Wash., on June 25-27, of the Western Regional Conference of the American Farm Bureau Federation, and presented the subject "Reclamation, Its Place in Western Agriculture."

B. L. Mendenhall, since 1934 employed on the Hyrum project, Utah, as inspector during the period of construction of the dam and appurtenant works, and later assistant in cost keeping and general work in the office as well as in work connected with the construction and operation of the dam and canal system, has been appointed superintendent of the South Cache Water Users' Association of Utah and his appointment has been approved by the Secretary of the Interior.

The office has learned with regret of the accidental death on May 31 of Arnold Jensen, chairman on the Ogden River project. Mr. Jensen leaves a widow and four children.

C. Christopoulos, Director at the Department of Agriculture of Greece, visited the Orland project early in May. Mr. Christopoulos was much interested in all phases of reclamation, economic as well as engineering.

Ben C. Bellamy was appointed to the position of associate engineer on the Shoshone project, effective May 21.

B. D. Glaha, photographer on the Central Valley project, accompanied by P. H. Van Etten, hydraulic engineer of the California division of water resources, left Sacramento on May 11 for a photographic survey of Friant and Contra Costa divisions, completing the survey and returning to project headquarters on May 19. Mr. Glaha then left on May 25 to make a similar survey of the Sacramento River and Kennett division, accompanied by T. B. Waddell, supervising hydraulic engineer of the State division of water resources.

Byram W. Steele, Senior Engineer, Resigns

B. W. Steele, designing engineer on dams in the Denver office for the past several years, resigned from the Bureau of Reclamation on May 8 to accept the position of chief designing engineer for the Tennessee Valley Authority.

A camera was presented to Mr. Steele as a token of remembrance and best wishes from the Denver office employees. With it went the following thought from the pen of J. P. August of the Denver office:

This little gift of friendliness
We offer you today,
With wishes of much happiness
For you in T. V. A.

If sometimes you get tired and blue
With all the work and fuss,
Remember that we're all for you:
As you have been for us.

And though our footsteps stray apart
As down life's way we wind,
A joyful note is in our heart
For having called you "Friend."

W. I. Swanton, engineer in the Washington office of the Bureau of Reclamation, left Washington on June 28, accompanied by his daughters, Misses Lucy and Edith Swanton. The party will travel by motor to Denver and points west, visiting a number of the Federal Reclamation projects and National Parks, and returning to Washington the latter part of July.

Transfer of George E. Chambers, senior clerk, from the Boulder Canyon project, Nevada, to the Moon Lake project, Utah, was approved as of May 27, 1936. Mr. Chambers will succeed Mr. Claude W. Kellogg, whose new assignment will be with the Social Security Board.

Sims Fly, City Manager of Boulder City, Nevada, headquarters of the Boulder Canyon project, was called to Washington by Acting Commissioner of Reclamation John C. Page, arriving on June 19. During Mr. Fly's stay in Washington plans for the future operation of the Boulder City area will be considered.

Frank T. Crowe, who was general superintendent for Six Companies, Inc., during the construction of Boulder Dam, has been appointed superintendent by the same organization at Parker Dam, now under construction on the Colorado River about 150 miles below Black Canyon. Henry J. Kaiser, chairman of the executive committee of Six Companies, notified E. A. Moritz, Bureau of Reclamation construction engineer in charge at Parker Dam, of the appointment of Mr. Crowe June 3.

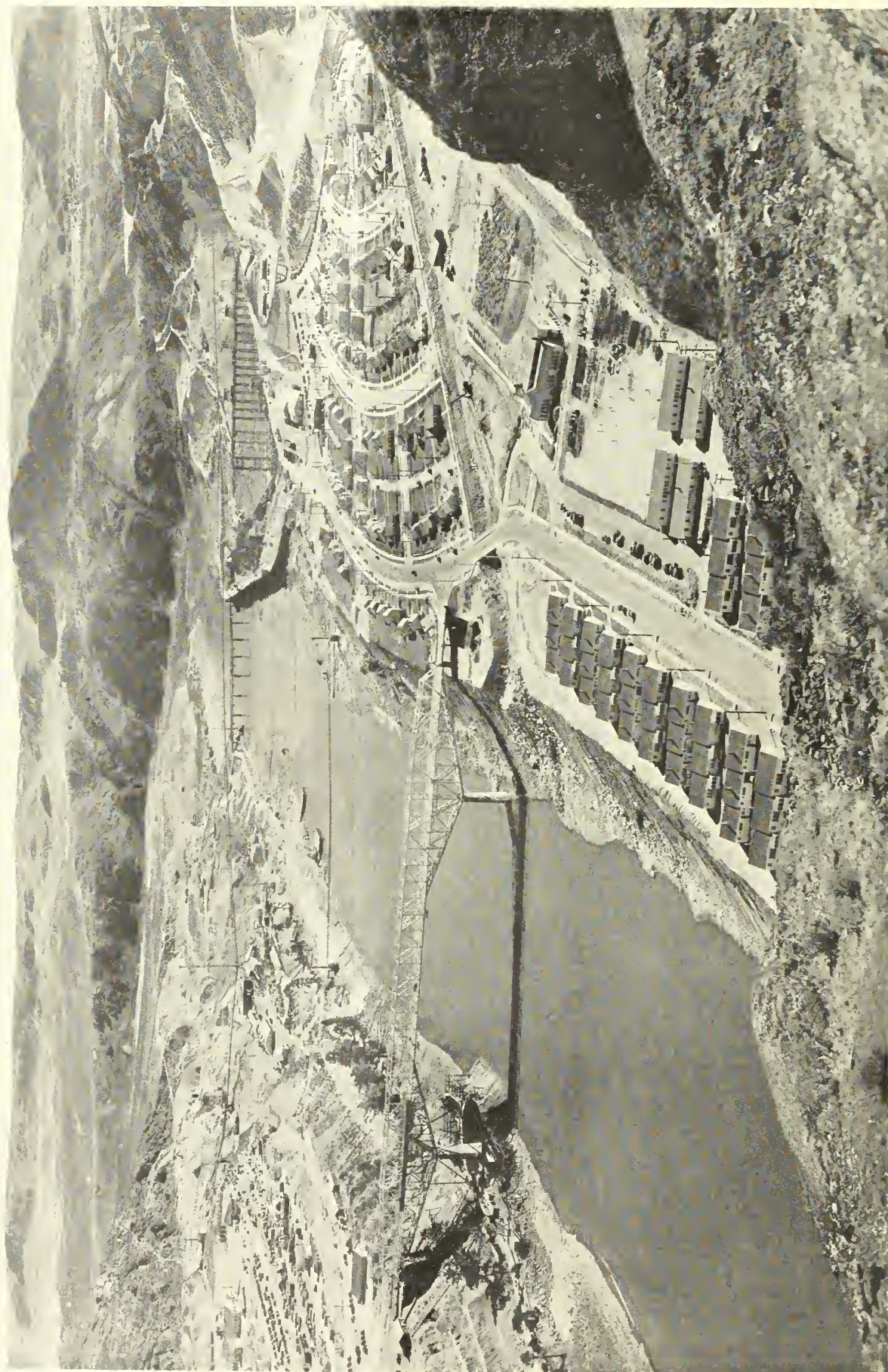
Yakima Loses Valued Employee by Death

Henry C. Bishop, clerk, passed away at Sunnyside, Wash., May 21, 1936, having been in failing health for some time. Mr. Bishop was transferred from Yakima to the office of the irrigation manager at Sunnyside, Wash., on April 1, to fill the position left vacant by the retirement of Mrs. Ella S. Tuttle, who was retired on March 31.

Mr. Bishop was born at Dubuque, Iowa, on July 8, 1874, and following the completion of his school work he was engaged in a clerical capacity with various industrial concerns, the Panama Canal Service, Culebra, Canal Zone, the Lehigh Valley Railroad Co., and the Bureau of Naturalization in New York City.

His connection with the Government started in 1919 with the position of junior clerk on the Huntley project; in 1924, after an interrupted period of 4 years during which he was privately employed, he returned to the Government service and was appointed to a position at King Hill, Idaho, from which he was transferred in January 1925 to the Yakima project. He was continuously employed on the Yakima project from that date until the day of his death.

Charles G. Anderson, engineer in the Denver office, has been transferred to the Casper-Alcova project, Wyoming.



COLUMBIA BASIN PROJECT, WASHINGTON.

Looking upstream (south) at Grand Coulee dam site on the Columbia River. In the foreground to the right is Coulee City, the permanent Government camp.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page**, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Deblor, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thraillkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.	B. E. Stoutemyer	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do	E. W. Shepard	B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	do	Wilfred W. Baker	Engineer	do	do	do
Casper Alegra	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voven	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.	do	W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.	do	R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	E. A. Peek	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do	do
Hyrum	Hyrum, Utah	D. J. Paul	Resident engr.	H. W. Johnson	do	do
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do	do	do	do	do	do
Minidoka	Burley, Idaho	E. B. Darlington	do	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guerney, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	D. R. Jakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. J. Larson	do	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	L. R. Fiock	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Rio Grande	El Paso, Tex.	S. F. Creelcius	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	H. D. Comstock	Constr. engr.	do	do	do
Riverton	Riverton, Wyo.	E. C. Koppen	Engineer	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. O. Larson	do	Geo. H. Bolt	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	L. J. Windle	Superintendent	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	Walter F. Kemp	Constr. engr.	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	R. J. Newell	do	Robert B. Smith	do	do
Stanfield	Ontario, Oreg.	A. W. Walker	Superintendent	do	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	L. J. Foster	Constr. engr.	do	W. J. Burke	Billings, Mont.
Truckee River Storage	Lovelock, Nev.	C. L. Tice	Reservoir supt.	do	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	A. A. Whitmore	Constr. engr.	Ewalt P. Anderson	B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	C. B. Elliott	Engineer	do	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	H. A. Parker	Constr. engr.	Emmanuel V. Hillius	do	do
Upper Snake River Storage	Ashton, Idaho	C. C. Ketchum	Superintendent	do	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	J. S. Moore	do	do	do	do
Yakima	Yakima, Wash.	Chas. E. Crownever	Constr. engr.	do	do	do
Roza div.	do	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.
Yuma	Yuma, Ariz.	do	do	do	do	do

¹ Acting.

² Non Federal

³ Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation district	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do	Chas. A. Revell	Bonanza.
Klamath, Horsely	Horsely irrigation district	do	Henry Schmor, Jr.	President	Dorothy Evers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do	Fort Belknap irrigation district	do	H. B. Bonebright	do	L. V. Bogy	do.
do	Haulem irrigation district	Harlem, Mont.	Thos. M. Everett	do	Geo. H. Tout	Harlem.
do	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich.
do	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do	H. W. Emery	Fallon.
North Platte: Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do	Flora K. Schroeder	Mitchell.
Fort Laramie div.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
do	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do	Mary Harrach	Torrington.
Northport div.	Northport irrigation district	Northport, Nebr.	Mark Iddings	do	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
do	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do	H. P. Wangen	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do	Enos D. Martin	Hermiston.
West div.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Thompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Engineer.
Grand Lake-Big Thompson Transmountain Diversion	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Weiser-Payette	Boise, Idaho	J. A. Keimig	do.

SALLIE A. B. COE, Editor.

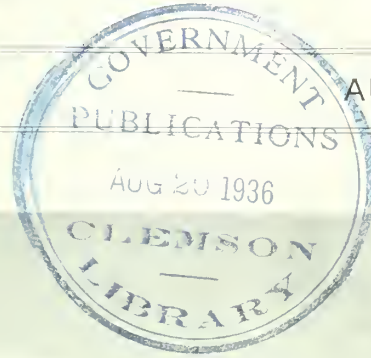


BOULDER CANYON PROJECT, ARIZONA-NEVADA

ON ITS WAY TO THE POWER HOUSE AT BOULDER DAM, A BOX CAR OF MACHINERY IS PHOTOGRAPHED ABOVE THE SPRAY FROM THE GREAT WATERFALL ISSUING FROM THE ARIZONA CANYON WALL OUTLET.

THE RECLAMATION ERA

VOL. 26, NO. 8

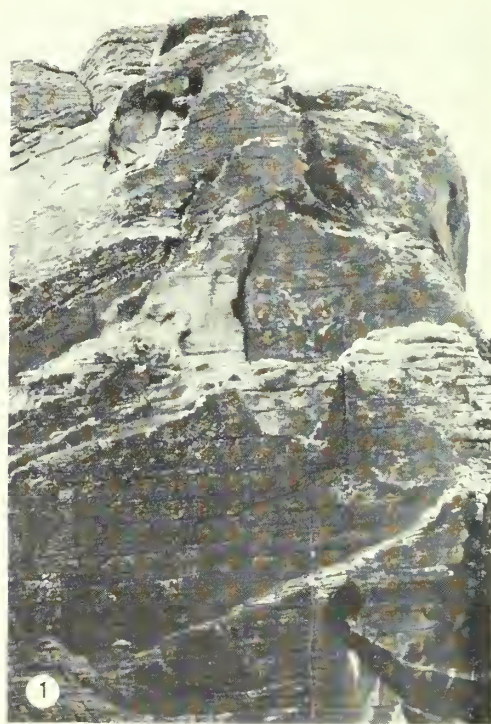


AUGUST 1936



MAKING FURROWS FOR IRRIGATION.

1. Ancient Indian petroglyphs at Atlatl Rock, Valley of Fire, near St. Thomas.
 2. Ruins of House No. 47 of Lost City. This ruin is said by authorities to be the oldest known human habitation on the North American Continent. Note fingerprints of builder on lower tiers of bricks. 3. Reconstructed pueblo at Lost City near St. Thomas. 4. Ancient Indian petroglyphs at Atlatl Rock, Valley of Fire, near St. Thomas. 5. Reconstructed kiva or ceremonial chamber at Lost City.



THE RECLAMATION ERA

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HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

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AUGUST 1936



Lake Mead Disturbs the Ancient Indian

By Junior Engineer E. H. Heinemann

(See illustrations on opposite page)

ON THE shores of rising Lake Mead, archaeologists are racing against time, against the time when the pent up waters of the Colorado will inundate the burial grounds of ancient hunters who lived and fought 3,000 years before North America became intimate with so-called civilization. The scene of the most concentrated activity is the Moapa Valley, through which the Muddy River flows, none too steadily, to join the Virgin, whose waters meet the Colorado at the eastern entrance to Boulder Canyon, 30 miles upstream from Boulder Dam. (See fig. 1.) The remains of other dwellings are being investigated at Pierce's Ferry and in the vicinity of Eldorado Canyon, 10 miles below Boulder Dam.

Fifty thousand years ago, the Southwest was the setting for a lake more vast than any to be constructed by the puny efforts of man. Climatic conditions changed and the lake dried up. Between 12,000 B. C. and 3,000 B. C. (these dates are only approximate) this region was settled by three distinct groups of cavemen. These first comers were, successively, the Tule Spring people, the Gypsum Cave people, and the Pinto Basin people. (See fig. 2). Evidences of this primitive civilization have been found in the dry lake beds of southern Nevada along with the fossilized remains of prehistoric mammoths and camels. Time elapsed and art progressed, and the cavemen moved into dugouts sheltered by rudely thatched roofs, where basket-making, arrowhead-making, and the construction of rude tools were developed.

The basketmakers evolved through three stages until about 500 A. D. they had begun to make pottery and their dwellings had been moved to the surface of the ground, the beginning of the pueblo as we know it today. There were six stages of the pueblo builder, ending with the modern Indian living on Government reservations in the Southwest.

The traces of early Indian civilization found in the Lake Mead region are those of the second and third basket makers, and the early, or second pueblo builder. The first of the pueblo ruins was discovered by Fay Perkins, of Overton, Nev., and John Perkins of St. Thomas, Nev., and was first opened by them in 1924. When this was brought to the interested attention of Hon. J. G. Scrugham, then Governor of Nevada, he enlisted the aid of the Museum of the American Indian, Heye Foundation, in New York, which sent out an expedition under M. R. Harrington, spending two seasons exploring the ruins, with the State of Nevada in cooperation. This excavation later became known as the "Pueblo Grande de Nevada" or more popularly, "The Lost City."

The fact that these were actually pueblo ruins is of great archaeological importance because it is farthest west of all large pueblo settlements, and is at the same time the most extensive on record for the early pueblo (pueblo 2) cultural stage. Before its discovery it was a common belief that there were no pueblo remains worthy of attention west of the Colorado River.

The work attracted widespread attention and during the two seasons of 1924 and 1925, while the investigations were in progress, a pageant was presented at the "Lost City" depicting the rise and fall of Indian culture in the region with the Paiutes of Nevada and the Zunis of New Mexico as participants. Each pageant was witnessed by at least 10,000 people. It seems the Paiutes were not so easily "signed" for the first perform-

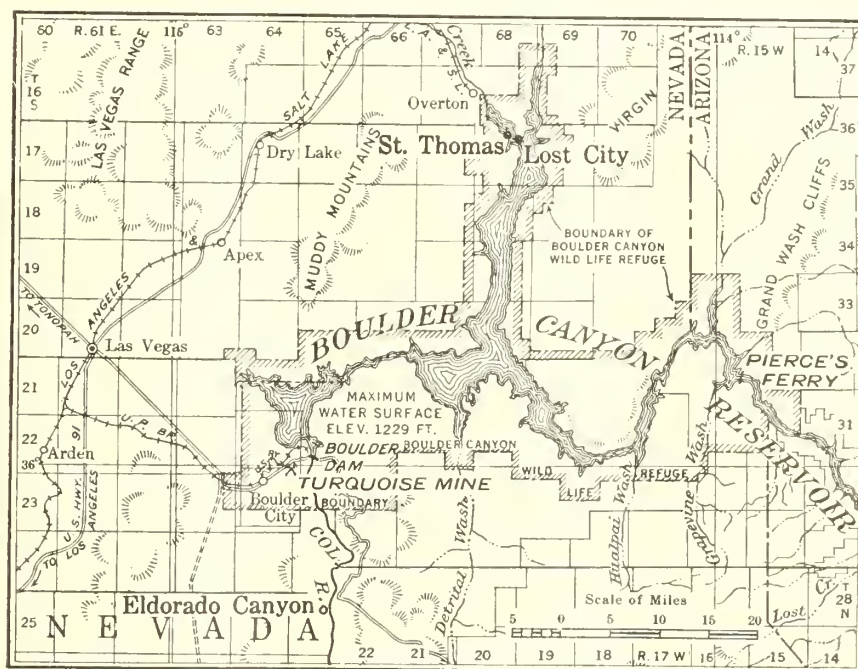


FIG. 1. BOULDER CANYON RESERVOIR OFFICIALLY NAMED LAKE MEAD, FEB. 1, 1936.

ance. Taking their cue from the more illustrious actors of the Pacific coast, they struck for higher wages and a great deal of diplomatic argument was necessary before the performance could go on.

In 1929 Mr. Harrington continued his work for one season, this time as representative of the Southwest Museum. At the end of this work, the ruins became the prey of vandals who did considerable damage. Finally, in the fall of 1933, an E. C. W. project was arranged by Colonel Scrugham, now Congressman, under the auspices of the State Park Division of the National Park Service, with the Southwest Museum of Los Angeles in cooperation, to rescue what remained before the area was inundated by the waters of Lake Mead. This work was continued for 2 seasons, with a company of C. C. C. boys furnishing the labor. Starting in January 1934 the boys constructed the Boulder Dam State Park Museum, finishing it in June 1935.

In this building is preserved the large collection of ancient pottery, implements, ornaments, and other objects obtained from the ruins during the 2 seasons of excavation, and from certain dry caves in the region. A representative collection was assigned, however, to the Southwest Museum, in return for its cooperation. The museum is now open to the public, the cases arranged and labeled so as to tell the story of the ancient inhabitants of the region, and all specimens are cataloged. The building, constructed of adobe, stands on a bluff about a mile south of the small town of Overton overlooking what will be an arm of Lake Mead extending up the Muddy

River. In front is constructed a pit dwelling of the second basketmaker era as it probably looked when occupied, with the original floor and fireplace. To the rear is a small adobe and stone ruin of the Lost City pueblo period and some distance away is a reconstructed building of the same type. In this way the visitor can see the original appearance of the ancient dwellings of the region, and entering the museum can see the story of their inhabitants told by the relics they left behind.

C. C. C. AIDS EXPLORERS

Since Mr. Harrington is back at the Southwest Museum at the present time, the work is going ahead under the direction of Fay Perkins, one of the discoverers of the Lost City, working in the Overton and St. Thomas areas, and Willis Evans, investigating early Indian workings of a turquoise mine located midway between Boulder City and the dam. A large collection of stone hammers has been made, and some specimens of pottery and arrowheads have been found. These all indicate that the same tribe of Indians that worked this mine also lived in the Moapa Valley. The same crew has also excavated along the Colorado River about 10 miles below the dam. There, in a sand deposit, evidence has been found of Indian camping grounds to a depth of 9 feet. They are now working in the vicinity of Pierces Ferry, about 50 feet in elevation above the present water surface. Within a short time they will necessarily be driven to other workings. Both Mr. Perkins and Mr. Evans have 25 C. C. C. boys working with them, stub camps of the main camp at Boulder City.

Possibly nobody could be better suited to explore the buried houses in the Moapa Valley than Mr. Perkins, although he is not a college-trained archaeologist. Born at Overton, he has lived in the valley all his life, and since his discovery of the Lost City in 1924 has worked steadily with Mr. Harrington unearthing more ruins. (Incidentally, he has a son working for the Bureau of Reclamation.) It is quite improper to call the "Lost City" just that, for it probably extended for miles up and down the valley. It is more of a metropolitan district. The crew stationed at Overton is now working on the one hundred and second house to come to light since the first in 1924. In this particular house, one of the larger pit-dwellings of the second basketmaker era, there were 94 separate burials. When a person died, if he was of enough importance, he was buried with his belongings beneath the floor of the house, and the house was burned. It was believed that the spirits of his possessions in life

would aid him in his life after death. All were not so fortunate, however. If a person was killed or died away from home, he was brought back and buried in the ash deposit or refuse heap outside the house. Some of the burials were intrusive burials; that is, after the house had been burned, and the walls caved in, the dead were buried within the ruins of the adobe walls. One of these is particularly interesting, in that the skeleton, stretched full length, was found upon its face and the skeleton of a dog was lying across its thighs.

The culture of the second basketmaker and the early pueblo builder was amazing in its versatility. The basketmaker's house was an oval-shaped pit dug in the ground, sheltered by a dome-shaped roof constructed of screw-bean, tule, and willow wood, plastered with adobe, supported on the circumference by six forked tree branches and in the center by two wooden posts. Charred remains of these posts are still in the uncovered floors. The floor was of adobe plaster with a fireplace in the center. The entrance was by means of a ladder from an opening in the top, this opening also serving as an escape for smoke and foul air. Within the ruins of these have been found the fruits of the inhabitant's art, woven sandals, baskets, pendants of shell and turquoise, necklaces made of thousands of small bone disks and sometimes fresh water shells, arrowheads, spearheads, pipes of clay (some of these still containing the charred remains of ancient "tobacco"), pottery, woven fabrics, and evidences of the art of sewing. The pueblo was a development of the pit dwelling, similar in many ways except it was constructed entirely above ground. The walls were of adobe and the entrance was from above as in the case of the pit houses.

The art of picture writing was developed in these two periods. Their "petroglyphs" can still be seen on the rock walls of the Valley of Fire, a dry wash running into the Muddy River Valley. The pueblo 2 dweller perfected pottery making, and the vessels he fabricated differed from those of the basketmaker in that the interior surfaces were quite finished and the outer surfaces artfully corrugated. Wood and bone working was also highly developed in this period. Many of the water bottles found were in the form of water fowl. It seems that great religious importance was attached to birds of all kinds. For food, these people hunted the wild ram and jack-rabbit. Skeletons of these are still to be found. They also ate mescal, pinion nuts, mesquite, and wild grass to balance their diet.

Most surprising of all is the fact that these aborigines carried on an extensive

WHITES	1776 A. D.
PAIUTES	800 A. D.
EARLY PUEBLO	
LOST CITY	500 A. D.
3D BASKETMAKER	1 A. D.
2D BASKETMAKER	1500 A. D.
1ST BASKETMAKER	3000 B. C.
PINTO BASIN	
GYPSUM CAVE	
TULE SPRING	12000 B. C.

THE
FIRST COMERS

FIGURE 2.

trade with other tribes, and at long distances. Abalone shells from the Pacific coast, polychrome pottery from eastern New Mexico, early glaze pottery from western New Mexico, clam shells from the Gulf of California, pottery from the Colorado River tribes, bone hair ornaments from the southern Pacific coast, and beads of olivella shells from the northern Pacific coast have been found among the ruins in the Moapa Valley. In return, they traded salt from the many salt deposits in the valley, articles of turquoise, pottery, and woven fabrics.

Arrow- and spear-head making reached a degree of perfection during these times, although the quality and workmanship was exceeded by those of the Paiutes who came and merged with the pueblo tribes around 800 A. D. Incidentally, this was the only art in which the Paiutes excelled. The last remnants of the Paiutes are still living in the region, on a small reservation 2 miles west of the little town of Moapa. Ansidian, a dark, glasslike substance, was preferred in the making of arrowheads, but if this was not available, flint, agate, and even limestone were used. A queer story is still told of Kit

Carson in connection with ansidian. He was riding one day (we did not catch the reason) and suddenly perceiving an antelope a few rods away (he thought) he decided to take a pot shot at the animal, which he did. All he heard was the tinkle of shattered glass. As it turned out, the poor beast, or lucky beast, was not a few rods away, but a few miles away, on the other side of a mountain of ansidian. Much to Mr. Carson's disgust.

ARRIVAL OF FIRST WHITES

Besides the archaeological story told in the museum at Overton, the history of the first whites arriving in the region is interesting. The old Spanish Trail from Santa Fe to San Gabriel, which later became known as the Mormon Road, ran within a mile of the museum, on the other side of the valley. Jedediah Smith passed by on one of his trips, and Fremont, Carson, and Cody went that way, returning from California in 1844. Mormon colonization began in the 1850's. In the sixties a group was sent by Brigham Young to the Moapa Valley especially to raise cotton. Moreover, the

region is intimately connected with steamboat navigation on the Colorado River and Brigham Young's attempt to find an outlet to the sea, via Fort Callville on the Colorado. In the valley today is a wealth of historical material—documents, pictures, handmade tools—relics of pioneer days in the hands of Mormon families living there today. The region is very rich in different kinds of minerals, also; and mineralogy could be developed for an attractive and instructive museum exhibit.

Since the ruins were first discovered in 1924, more than 5,500 separate artifacts, subsequently labeled and cataloged, have been unearthed in the Moapa Valley and the other points of exploration. The archaeologists are hurrying to rescue what they can from what will be the bed of Lake Mead in a few short months, so that not only the museum at Overton and the Southwest Museum at Los Angeles may be amply supplied with these relics, but also that there may be an abundant stock from which schools and colleges throughout the country may draw.

Excerpts from June Project Reports

Yuma.—Conditions during the month as related to alfalfa were more favorable for the largest crop on the project during the past 15 years. Prospects are also favorable for remunerative prices. The warm June weather has been very favorable for the growth of cotton. Heavy shipments of cantaloups continued throughout the month. Indications pointed to completion of the harvesting of this crop early in July. The average yield of cantaloups was 100 crates per acre.

Orland.—In spite of good yields, the price of alfalfa hay raised \$5 per ton during the month. The increased demand was probably due to purchases by sheepmen who will hold the hay for winter feeding. The price of butterfat increased to 34 cents, an advance of 4 cents since the first of the month. Case eggs increased 2 cents a dozen to 19 cents for the largest size.

Klamath.—There is a material increase in the acreage planted to potatoes, and the project acreage is now estimated at 15,560. At the close of the month cutting of the first crop of alfalfa was well under way and reports indicate that yields are running 10 to 15 percent above average. With pasture and ranges excellent, livestock is about 30 days ahead of normal condition.

Provo River.—All major crops of the project, including alfalfa, grain, fruits, and vegetables, are better than they

have been for several years. This is due to the increased water supply available this year, more than average rainfall for the month, and favorable weather conditions. Prices were particularly good for berries and vegetables.

Vale.—All crops are in good condition. The first cutting of hay has been completed on both the Vale and Warm Springs projects. A heavy cutting was made on the Vale project. All cattle and sheep are now on the range, which is exceptionally good this year. A number of lambs have been shipped to market.

Sanpete.—The main crops of the project, alfalfa, grain, and peas, are considerably better as an average than they have been for several years. This is due to the better water supply. Numerous herds of sheep and cattle are being moved to the higher areas on the mountains for summer grazing. The extensive grazing area adjacent to the project is in good condition and shows improvement over past years. Prices for dairy and poultry products remained good.

Moon Lake.—The hay and grain crops, which are the major project crops, are better than for the past several years.

Burnt River.—By reason of frequent rains during the month, crop conditions are above normal. Because of the best range conditions in years, the livestock, of which 90 percent is on the open range, are in excellent shape.

Carlsbad.—Conditions were ideal for the growth of crops. Two crops of alfalfa had been harvested at the close of the month with good yields reported. A small acreage is being left for seed. Cotton was advanced to the blooming stage at the close of the month. Prospects were excellent for better than the average crop.

Frenchtown.—The rainfall during June was above normal and prospects for grain crops are the best for many years. Sugar beets on irrigated lands around the project are in excellent condition. The livestock industry is in good condition. The range is the best for many years. Livestock is being shipped from the drought-stricken area of eastern Montana to Missoula County for range and feed.

Shoshone.—Crops in general good.

Minidoka.—All crops made an exceptionally good growth. The first cutting of alfalfa was completed and most of it was stacked. The yield was heavy. Wheat is beginning to ripen and early potatoes will be ready for digging soon. Sugar beets also look well.

Rio Grande.—All crops have made very satisfactory progress during the month. The beet seed crop was cut and shocked and an unusually large yield is anticipated.

(Continued on p. 186)

The Reclamation Era

Issued monthly by the Bureau of Reclamation,
Department of the Interior.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

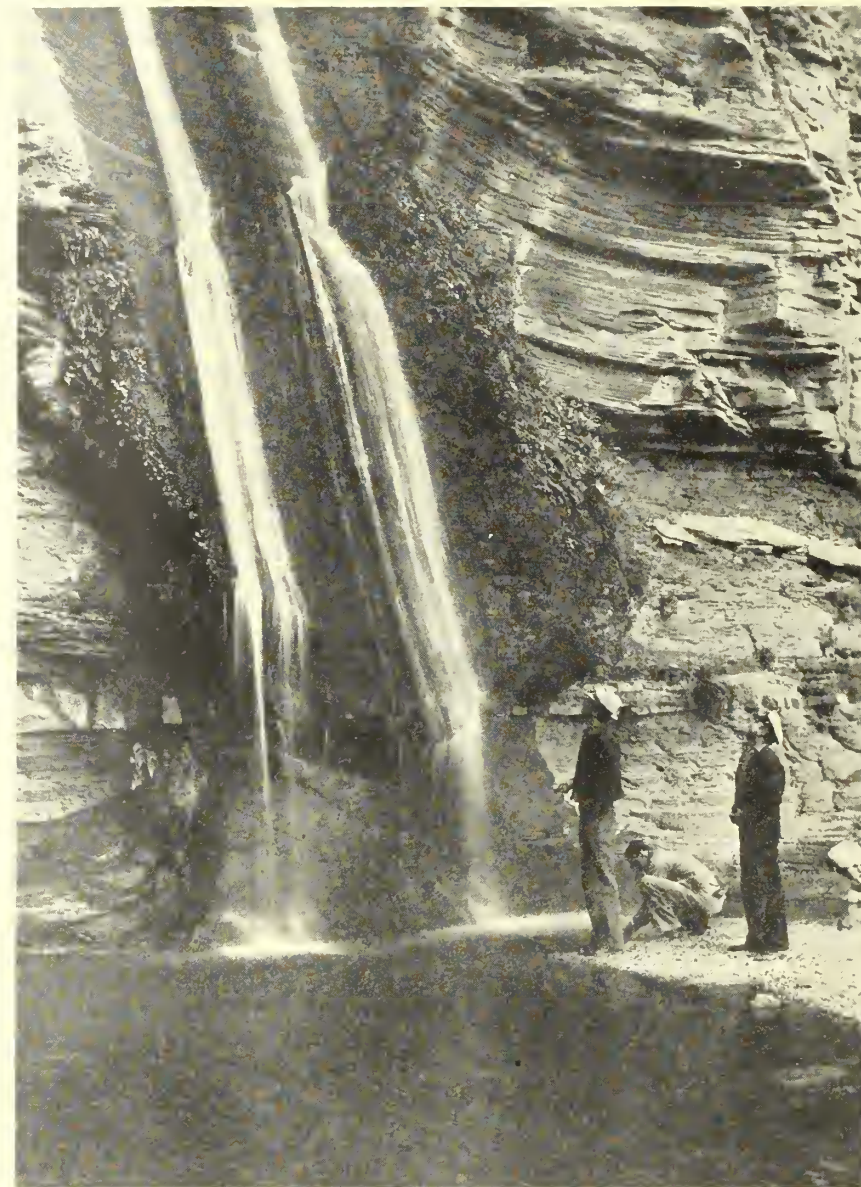
AUGUST 1936

Boulder Dam Tourist Mecca

Early in 1931 the site in Black Canyon on the Colorado River where this mammoth structure would rise was visited by contractors interested in bidding on this work. The railroad terminus was Las Vegas, 7 miles from this site, and the trip from that town to the river was made by automobile on a road winding through typical Arizona desert country. A trip to the canyon rim afforded a fine view up and down stream. Seen through the eyes of these contractors and their staff of engineers, estimating on what it would cost to build Boulder Dam, this canyon, inaccessible to the huge machinery which would have to be used in the construction of this dam, was something that needed to be subdued so that accessibility to the river was made possible. Sheer walls 2,000 feet high confronted their eyes. However, bids were submitted, award was made and work went forward with steam shovels and road-building equipment and Black Canyon, so to speak, had its face lifted.

MILESTONES IN CONSTRUCTION

The canyon continued a beehive of activity. September 17, 1931, construction of the diversion tunnels was begun.



Base of falls located in box canyon about 5 miles upstream from Pierce's Ferry at the lower end of Grand Canyon. This falls is as yet unnamed and was not known until recently.

May 23, 1932, excavation was completed. Excavation for the dam was completed June 5, 1933. The first bucket of concrete was poured in the dam on June 6, 1933. Pouring continued night and day when the dam rose to a height that

the gates of the diversion tunnel were closed and Lake Mead began to form February 1935. The final bucket of concrete, of a total of 3,240,871 cubic yards, was poured in Boulder Dam May 29, 1935. President Roosevelt dedicated the

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date) _____

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) _____

(Address) _____

¹ Do not send stamps.

NOTE —30 cents postal charges should be added for foreign subscriptions



1, The painted cliffs hemming in a deep cove near Napoleon's Tomb on the Colorado River; 2, along the steep canyon wall shores of the reservoir suitable boat landings are few and far between. The sheer cliffs drop off immediately into water several hundreds of feet deep.

dam on September 30, 1935, and the Government accepted the dam from the contractor, Six Companies, Inc., March 1, 1936, 2 years, 1 month, and 28 days ahead of schedule.

PUBLIC IS INTERESTED

That this construction is of tremendous interest to the public is evidenced by the statistics which show that in 1935 more than 365,000 persons visited Boulder Dam and Lake Mead, and the 1936 record to date indicates that a great many more visitors will take advantage of the invitation to view this highest dam in the world.

Boulder Dam is now comfortably accessible by rail, automobile, or plane.

A regular commercial airplane service has been inaugurated over the Boulder Dam, Lake Mead, and Grand Canyon area. It affords a combination trip which will take visitors not only over the immediate area surrounding the dam but also to Bryce Canyon and Zion National Park in Utah. The plane service is just another link in the planned recreational development of that region undertaken by the Bureau of Reclamation and the National Park Service.

Wildlife in the Boulder Canyon project area is protected by a wild-life refuge and Lake Mead is stocked with fish. As plans go forward, other features for the comfort and pleasure of the traveling public will be inaugurated. This region is destined to be a very popular attraction for

tourists. The road across the dam permits crossing the Colorado River by automobile from Arizona to Nevada, as the river is the State line at this point. This advantage was recognized by the State of Arizona and its road system has been improved to permit auto travel on good roads to the dam.

Boulder City, the town built by the Government to house the workers for Boulder Dam, is a well-organized town with business enterprises catering during the construction period to the population of the city, made up chiefly of workers. The post-construction period will find the city planned in such a way that by elimination of small homes and dormitories which housed the employees of the contractors it leaves a well-organized operating unit which was part of the original plan, and it is this unit that will cater to the permanent population of Boulder City and the traveling public.

LAKE MEAD

This largest of man-made lakes in the world is a gem. Motorboats operating under official permit take visitors up the canyon, and a trip 100 miles long is possible. It opens vistas seen by very few people.

National Support Deserved

Appropriations made by Congress for Bureau of Reclamation construction during the fiscal year 1937, on the whole, are ample and satisfactory to all concerned.

No major work will be crippled by reductions in the original estimates. No project was lost. The money available will enable the Bureau to carry on substantial and worthwhile construction with no loss of efficiency due to reduction in funds. Some of the work could have proceeded more rapidly if additional funds had been appropriated, of course, but good speed will be made in virtually all cases under present circumstances.

Developments this year, however, have put up to those interested in preserving Federal reclamation a difficult problem. In continuing the construction program in the future, additional dependence must be placed on the reclamation fund. At the close of this year, this fund will all but be exhausted. Collections and accretions this year will not provide nearly enough money to continue the construction next year.

The answer must be found either in increasing the reclamation fund through providing revenue from additional sources or through supplementing the reclamation fund by appropriations from the general treasury as a part of a general public-works program.

Senator Carl Hayden, of Arizona, has proposed that all the Western States devote serious thought to this problem. He has said that a general contribution can be afforded because of the widespread benefits which accrue from development of the West. Reclamation is a national advantage.

In support of this position, Senator Hayden said on the floor of the Senate: "Since 1902, when the Reclamation Act was passed, the Bureau of Reclamation has constructed 40 projects, creating 45,790 farms and providing a livelihood for a population of 752,766 persons in project communities. This has been done through the investment of approximately \$200,000,000 obtained from the sale of public lands, and oil and mineral royalties from public lands in the arid and semiarid States where these projects were constructed. The investment has been increased by approximately \$50,000,000 through reinvestment of moneys once used and repaid by those benefited. These new communities have added to

the taxable wealth of these far Western States a total of more than \$1,000,000,000.

"Not only has Federal reclamation benefited the West—it has been of equal national advantage. The national benefits are of two forms; one brought through integrating the national development, joining the West with the East to make a solidified country, and the other through the creation of markets for the industrial centers.

"Economists of the Bureau of Reclamation whose work has been checked and found conservative, estimate that three-fourths of all the money paid to Reclamation farmers for their produce goes immediately into the purchase of materials, agricultural and manufactured, which originate in the Middle West and East. These materials range from automobiles, household machinery and appliances, farm machinery, down through clothing to ham and other pork products, and flour and grains.

"In the course of 20 years these farms created under the national reclamation policy have produced products of a value

of \$2,000,000,000. Thus, in the same score of years, a market for the East and Middle West worth \$1,500,000,000 was created through the irrigation of our western deserts, on projects that are self-financing.

"Let me remind Senators that not a particle of the vast clouds of dust which they saw pass over Washington last year came from any Federal reclamation project. Irrigated areas are not 'dust bowls.' Instead of wind-blown soil one sees green fields and orchards and shade trees. If it had not been that for over 30 years the Federal Government has been bringing water to arid lands the effects of the great drought would have been even more appalling. But the United States Reclamation Service had provided places where livestock, which would have otherwise died of thirst and starvation, could be fed. Let it also be remembered that not \$1 of the vast sum of \$525,000,000, which was appropriated by Congress for drought relief, was paid to any farmer on any Federal reclamation project."

Colorado River of Texas Project

Under a revised contract between the Government and the Lower Colorado River Authority, dams nos. 1 and 2 of the Colorado River of Texas project will be constructed by the Authority instead of by the Bureau of Reclamation.

In announcing completion of this arrangement, Secretary of the Interior Harold L. Ickes said that as a consequence all bids received by the Bureau of Reclamation for the construction of dam no. 2 (Arnold Dam) on the Colorado River of Texas, had been rejected. In addition, three important contracts made by the Bureau in connection with construction of dam no. 1 (Hamilton Dam) have been turned over to the Authority. These are; one for clearing the reservoir, another for construction of the north dike, and a third for supplying cement.

The Colorado River of Texas project consists of a series of dams with no. 1 near Bluffton, Texas, and others between there and Austin. The no. 1 dam originally was begun by a private utility company but was left incomplete. Plans for the project include completion of this dam as well as construction of no. 2 and others. The project is a flood control, power, navigation, and irrigation plan.

The Lower Colorado River Authority was set up by the Texas legislature. It received a grant of \$4,500,000 and a loan of \$10,500,000 from emergency funds last year through the Public Works Administration for construction of the project. In addition, the Bureau of

Reclamation was allotted \$5,000,000 to be spent on the project as the Government's contribution in return for flood control benefits.

The original contract between the Government and the Authority designated the Bureau of Reclamation as the construction agency for the entire project. The new agreement will permit the Authority to become its own construction agency, except that the Bureau of Reclamation will construct a flood control dam as its part of the project. This dam will be constructed at or near the Marshall Ford site near Austin.

Work had already been started by the Bureau of Reclamation with Government forces on completion of no. 1 dam. In addition, the Bureau has designed and called for bids on no. 2 dam. These bids were opened at the Bureau's office at Austin, Tex., April 15. While these bids have been rejected by the Department of the Interior, they have been turned over to the Lower Colorado River Authority and, if the Authority and bidders agree on terms, an award may be made by the Authority without readvertisement.

The Bureau of Reclamation is making preliminary studies preparatory to commencement of construction of the flood-control dam.

All plans, drawings, specifications, and the like prepared by the Bureau in connection with dams nos. 1 and 2 have been turned over to the Authority.

June Project Reports

(Continued from p. 183)

Grand Valley.—The price of pinto beans raised from \$2 to \$2.50 per hundred-weight with prospects of a further raise during July. With this increased price it is believed that all of the old beans will move.

Humboldt.—All crops are in fine condition, good growing weather prevailed, and 12,717 acre-feet of water was delivered to 15,000 acres of land during the month. The first cutting of alfalfa is now under way and it is estimated that around 2 tons per acre will be produced from this cutting.

Boulder Elevator Service

Visiting hours via the elevator to include evening service at Boulder Dam have been changed. The number of daily and weekly visitors to the dam is steadily increasing and in order to avoid delay in the heat at the top of the dam while waiting for guide service, visitors are taken down to the lower lobby from which the guides take groups about every 15 to 30 minutes.

On July 4, 1,565 persons made the trip, and during the week ending July 4, the total number of visitors was 4,972.

President Roosevelt Appoints Drouth Committee

President Roosevelt appointed on July 22 a committee, to be known as the "Great Plains Drouth Area Committee", to make a study of the most efficient utilization of the natural resources of the Nation's drouth area. The members of the committee appointed are as follows:

Morris L. Cooke, Rural Electrification Administrator, Chairman;

John C. Page, Acting Commissioner, Bureau of Reclamation;

Frederick H. Fowler, National Resources Committee;

Rexford G. Tugwell, Resettlement Administrator;

Harry L. Hopkins, Works Progress Administrator.

The first meeting of the committee to make preliminary plans for the study was held at the call of Chairman Cooke on July 23.

The committee plans to start a 2-week, 2,200-mile trip through the drouth-stricken States on August 15, Chairman Morris L. Cooke announced today.

Starting at Amarillo, Tex., on August 18, the committee has tentatively scheduled overnight stops at Garden City, Kans.; Wray, Colo.; Chadron, Nebr.; Pierre and Aberdeen, S. Dak.; Bismarck, N. Dak.; Miles City, Mont.; Gillette, Wyo.; and Rapid City, S. Dak.

In addition to the States in which overnight stops will be made, the trip will cross the Oklahoma Panhandle, giving the members of the committee an opportunity to study conditions in nine States.

Feminine Experts on All-American Canal Job

THE ladies also have a finger in the construction pie. Of the 1,500 workmen, on the canal only a half dozen women are playing direct parts in the big job.

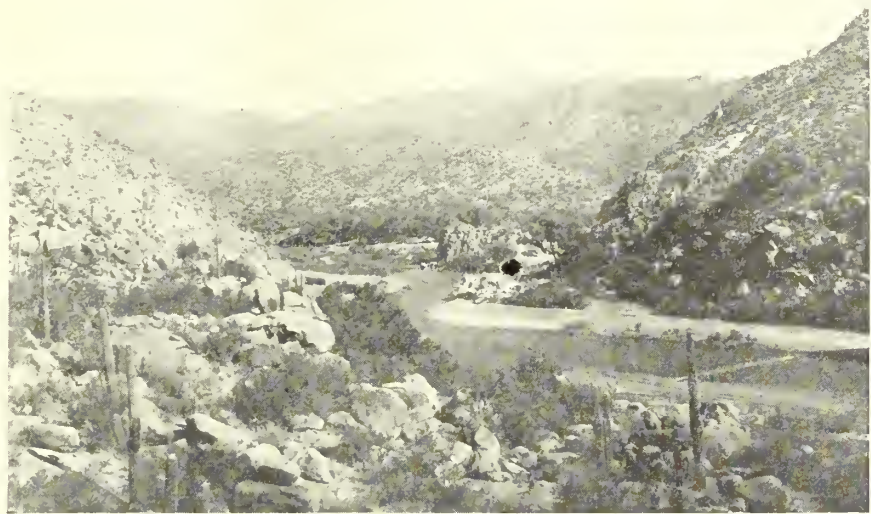
Chief of these may be said to be Mrs. B. M. Irving. She is the secretary of the Lewis-Chalmers Construction Co., an exceedingly capable business woman who does not confine her time exclusively to the company home office in New Orleans. In fact it was Mrs. Irving who, upon starting the local contract, came to Callexico and lined up the material and supply contracts for her firm, which will prevail throughout the job. Regularly, since that time, she makes trips here, one of these trips having kept her here throughout the hot weather last year. She is expected to make another "check-up" visit this month.

Bartlett Dam Contract Awarded

Secretary of the Interior Harold L. Ickes on July 6 announced award of the contract for construction of Bartlett Dam on the Verde River in Arizona, to Barrett and Hilp of San Francisco and Macco Corporation of Clearwater, Calif., on their joint bid of \$2,228,272. The successful bid was the lowest of eight received by the Bureau of Reclamation at its office in Phoenix, Ariz., May 16. Work will start in 30 days and must be completed in 1,000 days.

The dam will have a crest length of 750 feet. It will have 10 reinforced concrete arches, supported by 9 hollow reinforced concrete buttresses spaced 60 feet apart. It will have a short gravity section at each abutment.

A concrete-lined, open-channel spillway controlled by three 50-by-50-foot gates will be located in the right abutment. The outlet works will pass through one of the arches. Among the principal items of work involved in con-



Bartlett dam site.

Bartlett Dam, which will serve the Salt River Federal Reclamation project through storing 200,000 acre-feet of water to supplement the supply of project and Indian lands, will be the highest multiple arch structure in the world, reaching a height of 270 feet. It will be 14 feet higher than the Lake Pleasant Dam on the Agua Fria River, also in Arizona, which is at present the highest multiple arch dam. Outside the United States the 239-foot Tirso Dam in Italy is the highest of this type of construction.

struction of the dam are the following: 337,000 cubic yards of excavation; placement of 163,000 cubic yards of concrete; and installation of 9,200,000 pounds of gates and hoists, valves, trash tracks, pipes, reinforcement bars, and miscellaneous metal work.

Approximately 6,300 acres of land allocated to Indians on the Salt River Indian Reservation will receive water from the reservoir to be created by Bartlett Dam. Otherwise the water will be used on lands already within the Salt River project.

In the Callexico office of the same company is Mrs. Pauline Edwards. This is Mrs. Edwards' first construction company job.

In the field office of the W. E. Callahan Construction Co., all visitors must pass before the scrutiny of Miss Claire Wilmon, secretary to the field superintendent. This is Miss Wilmon's first field job. She came from the company office in Dallas.

In contrast with the hundreds of men connected with the canal construction at the upper end, there are only three women directly connected with the job.

One is Miss Grace McCutcheon, nurse in the company's field hospital. Miss McCutcheon is kept busy attending scratches and minor cases, but for the most part lacks for major patients in view of the comparatively small number of major accidents which have taken place.

Very busy indeed, however, is Majorie Rawles, daughter of Mrs. Barbara L. Rawles, El Centro, Calif. Miss Rawles lived in El Centro until April 1 when she obtained a position as the only feminine employee of the Morrison-Utah-Winston Co. Officially a stenographer, Miss

(Continued on p. 200)

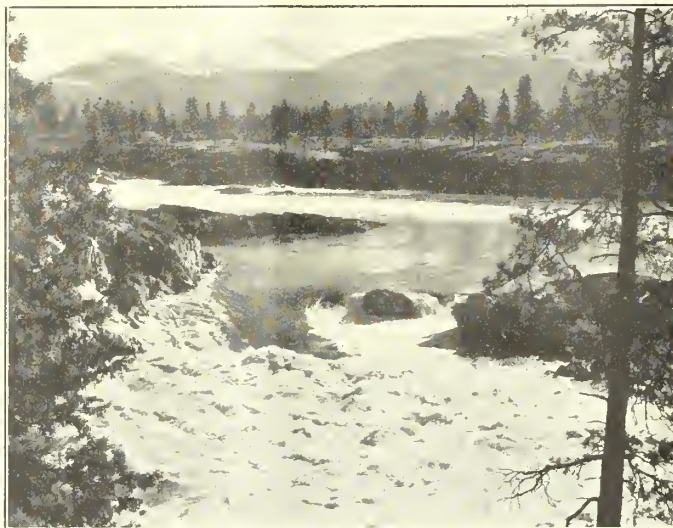
Project Returns Columbia River to Its Ancient Course

To Wipe Out These Heartbreaks and Reclaim The Desert

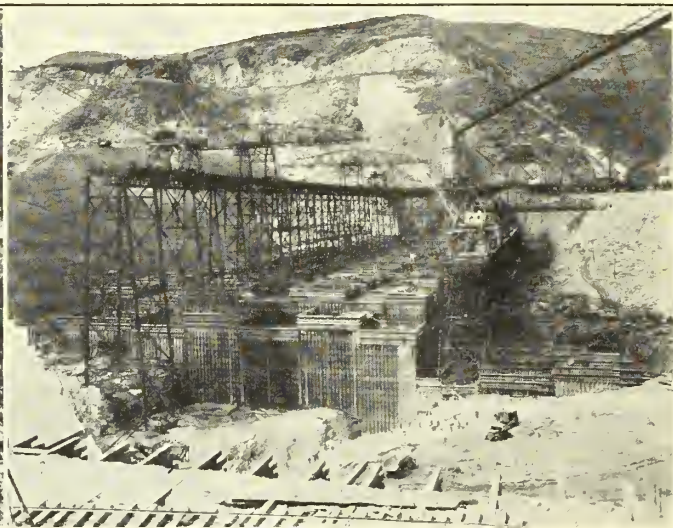
THE Columbia Basin project in eastern Washington has for its ultimate purpose the reclamation of the

est treasures. Water in the Columbia Basin is the primary natural resource. All other resources take their value from

The Grand Coulee, from which the dam takes its name, will become an integral part of the irrigation system



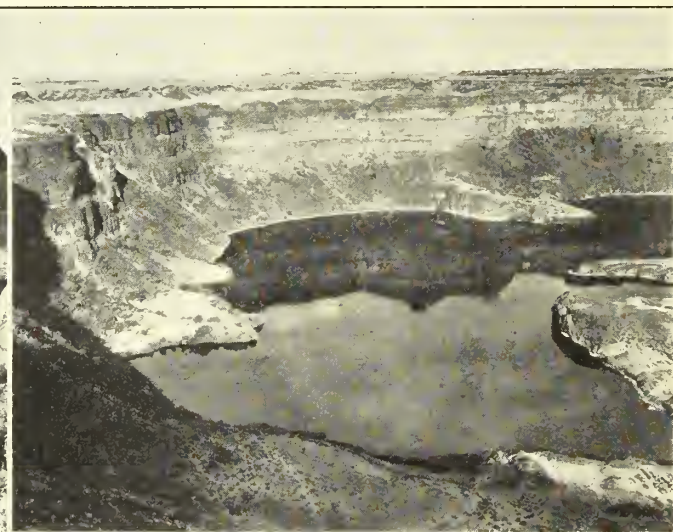
Columbia River.



Grand Coulee Dam.



Bed of the Grand Coulee.



Dry Falls of the Grand Coulee

finest undeveloped tract of land remaining available to the American people.

From earliest days, men with imagination have been looking forward to the time when the Columbia River could be lifted out of its deep channel and its plentiful water used in the irrigation of the lands of its basin, lands insufficiently watered by nature, but rich indeed in promise. Completion of the Columbia Basin project some decades in the future will accomplish this.

The Columbia River is the Nation's second greatest water producer. The fact that it flows through a semiarid region makes it one of the Nation's great-

est treasures. Water in the Columbia Basin is the primary natural resource. All other resources take their value from

Grand Coulee Dam will become the principal engineering feature of the Columbia Basin project when it has been completed to its full height of 500 feet. It not only will place the Columbia River in a harness of power-line cable, but it will control its floods and improve its navigation.

Grand Coulee Dam also will raise the surface of the river to a point from which its waters can be lifted to its high banks, and thence on to the dry lands of the Columbia Basin.

contemplated by the project. This coulee is a section of the bed of the Columbia River during the ice age. It has banks more than 600 feet high and forms a natural reservoir. As such, it will be used in the completed Columbia Basin project. Small earthen dams will cut off a section into a watertight lake.

The Grand Coulee itself is one of nature's marvels. The tremendous dry falls of the coulee, which are 3 miles long, and much higher than Niagara, have attracted wide interest. These falls will be below the end of the reservoir in Grand Coulee.

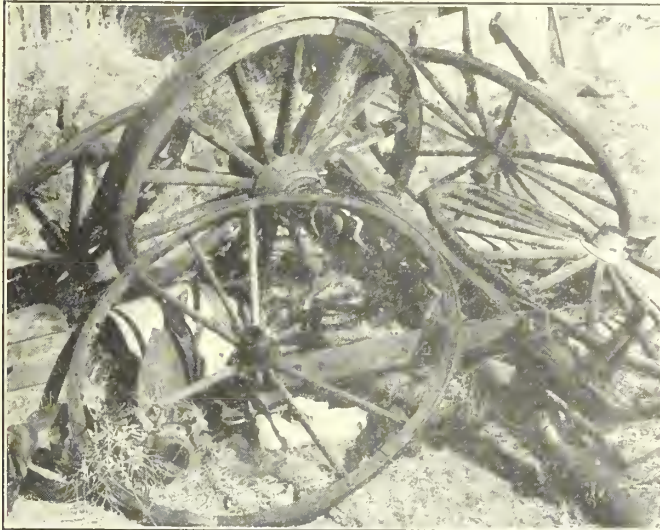
Canals will lead water from the reservoir in the Grand Coulee to the project lands, which consist of wide, gently sloping plains divided at wide intervals by ranges of hills. Altogether there are 1,200,000 irrigable acres in this tract.

This rich, fertile soil has enticed many a homesteader in the past. In years when the rainfall is slightly above normal, crops of grain and a few other products

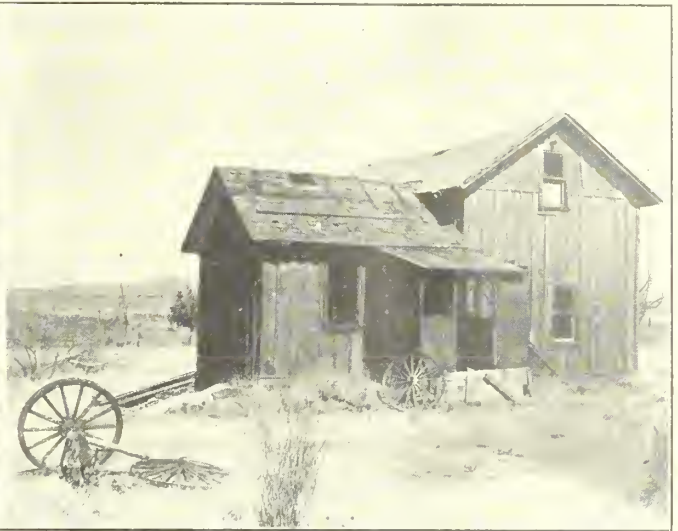
with short growing seasons have been made on these lands by dry-farming methods, but all such dry-farming ventures have ended in disaster for the settler. These lands are dotted with abandoned homesteads left by people whose hopes were raised in years of abnormal rainfall, only to be dashed by the perpetual drought, which is normal for this semiarid territory. Where it has been possible to

irrigate these lands, their productivity has been amazing. Some of the finest communities in the State of Washington, such as the Wenatche and Yakima districts, have been founded by irrigation of such territory.

The Columbia Basin project holds great promise for the growth and development of the Northwest, and the enrichment of the entire Nation.



Wagonwheels.



Dry-farming tragedy.



With water it is fruitful.



Irrigated hops.

LABOR conditions on the Provo River project were greatly improved at the close of the month of June. In addition to a large number of skilled and unskilled workmen being required on the various Government projects, a considerable number were being used in the construction of a steam power plant by the Utah Power & Light Co. at the mouth of Provo Canyon and on other jobs of private industry. A large number of workmen were also being required on increased farming activities.

Electrified Farms on Grand Valley Project

Members of the board of directors of the Grand Valley Water Users Association have initiated a movement with the Rural Electrification Administration to electrify the farm area west of Grand Junction. At the end of June the administration had set aside \$105,000 for this project and the local people are going forward with an organization to contract with the Rural Electrification Adminis-

tration for this development. It is believed this construction will go forward in the near future.

THE work of preparing the Paul Sugar Factory, Paul, Idaho, for operations this fall is going forward rapidly. It is said that more than 100 men are employed on this job and it is expected the plant will be completely modernized by harvest time. The cost of the improvements now under way is estimated at \$300,000.



ENGINEERING



Hydroelectric Power Plants, Boulder and Others

INSTALLATION of machinery and equipment in the power house at Boulder Dam is now in progress and it is expected that this work will be completed and the first units placed in operation in September 1936. Additional generating units will be installed from time to time to suit the requirements of the power contractors, and it may be 8 to 10 years before all the machinery is installed. Other than the generators, which are being erected by the General Electric Co., Westinghouse Electric & Manufacturing Co., and the Allis-Chalmers Manufacturing Co., Government forces, comprising about 250 men, are doing the work of installation.

Not only is the 727-foot Boulder Dam on the Colorado River the highest dam in the world, as well as the largest concrete masonry dam ever built, but the development of power will involve construction of the largest hydroelectric power plant. The rated capacity of the plant will be 1,835,000 horsepower, which is three times the ultimate capacity of either the Wilson plant (610,000) on the Tennessee River in Alabama or the Conowingo plant (594,000) on the Susquehanna River in Pennsylvania. It will have four times the capacity of the Niagara Falls plant on the American side, and 22 percent more capacity than all five plants on the Niagara River—the Niagara, U. S., Queenston, Ontario, C. N. P. Co., and Toronto plants. The initial installation is 515,000 horsepower. The largest hydroplant in this country at the present writing is the one at Niagara Falls, N. Y., with an installed capacity of 452,500 horsepower, while Soviet Russia has completed a 746,000-horsepower plant on the Dnieper River in the Ukraine, which far outranks all others.

The ultimate installation in the Boulder plant provides for fifteen 115,000-horsepower and two 55,000-horsepower vertical-shaft, Francis single-runner, spiral-casing hydraulic turbines; eleven 60-cycle and four 50-cycle main generating units of 82,500 kilovolt-ampere capacity each and two 60-cycle main generating units of 40,000 kilovolt-ampere capacity each; transformers, switching equipment, etc. The turbines operate under a maximum

head of 590 feet and an average head of 530 feet.

General Electric is furnishing four of the large generators for the initial installation. The first two were purchased in 1933 for \$1,240,000 f. o. b. Schenectady and are now being installed. A contract for two additional units was awarded in November 1935, price \$1,342,000, also f. o. b. Schenectady, delivery to be made about December 1937. Two large generators are being manufactured by the Westinghouse Electric & Manufacturing Co. in their East Pittsburgh plant for a contract price of \$1,285,000. One of these 82,500 kilovolt ampere units weighs more than 2,000,000 pounds, is 40 feet in diameter and 32 feet high. The rotor weighs approximately 1,100,000 pounds, and the shaft is 38 inches in diameter and weighs approximately 100,000 pounds. Four of the large turbines were furnished by the Allis-Chalmers Manufacturing Co. of Milwaukee, Wis., and two are now being manufactured by the Pelton Water Wheel Co. of San Francisco, Calif., the prices being \$1,087,600 and \$551,000, respectively, at the Milwaukee and Philadelphia, Pa., plants.

The total weight of one of the large turbines is approximately 1,425,000 pounds, and the heaviest piece is the first section of the scroll case which weighs 75,000 pounds. These turbines have a rated output of 115,000 horsepower at 492.5-foot head and will operate at a speed of 180 revolutions per minute.

A butterfly-type hydraulic rotor-operated, shut-off valve will be installed at the inlet to each main turbine casing, in size 14-foot diameter for the large and 10-foot diameter for the small turbines.

The larger transformers are rated 55,000 kilovolt amperes at 287,000 volts. They are water-cooled and each weighs over 400,000 pounds, and is 32 feet high, 20 feet wide and 13 feet deep. The generator voltage oil circuit breakers are 27 feet in height and weigh 300,000 pounds each.

The power plant is located 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 1,650 feet long, built of steel and reinforced

concrete. Each wing is 650 feet long, 150 feet high above normal tailrace water surface, and 229 feet (nearly 20 stories) above the lowest concrete in the powerhouse footings. There are 10 acres of floors.

FOREIGN PLANTS OF INTEREST

The largest hydroelectric power plant in the world is the Dneprostroy plant on the Dnieper River in Ukraine in the extreme southwestern corner of Soviet Russia. This plant was completed in 1932 and dedication ceremonies were held in August of that year. The capacity of the plant is 746,000 horsepower, practically three times the present installed capacity of the Wilson (Muscle Shoals) plant. Its nine turbines are rated at 83,000 horsepower each, being equalled in capacity only by those at Boulder and the two turbines in the Diablo plant in the State of Washington. At maximum head of 123 feet, each Dneprostroy turbine is expected to produce 100,000 horsepower. The diameter of the runner is 19 feet 10½ inches. The 76,500-kv-a generators in the Dnieper River plant were the largest built prior to Boulder. Each generator weighs approximately 1,760,000 pounds, with the rotor and shaft weighing approximately 980,000 pounds. The maximum diameter is 42 feet, and the over-all height is 40 feet 5 inches. General Electric manufactured five of the generators while Electrosila, a Russian concern, furnished the other four. All of the turbines came from the plant of the Newport News Shipbuilding & Dry Dock Co. at Newport News, Va.

The dam is 200 feet high, and 2,500 feet long with the power plant at the right abutment, the building being 860 feet long, 220 feet wide, and 164 feet high. Press reports stated that 55 percent of the 25,000 workers employed on the project were 23 years of age and under, while 17 percent were women, the latter filling such positions as foreman, inspectors, mechanics, locomotive firemen, concrete tampers, and common laborers. The cost of the project including the navigation feature was \$150,000,000. In the construction of the dam and power

plant 390,000 cubic yards of concrete were placed during the 3 months of September, October, and November 1930, with a single day's record of 6,500 cubic yards for a 24-hour period. The minimum flow of the Dnieper River is 12,000 second-feet, and the maximum of 865,000 second-feet occurred in 1931 when the cofferdams safely withstood the flood.

In addition to its famous Dnieprostroy plant the Russians now have under construction in Uzbek near Tashkent the Niasbek development on the Chirchik River, with four 59,500-horsepower turbines and a station capacity of 238,000 horsepower. Another large plant under construction is the Swir III on the Swir River in the Leningrad district, with a capacity of 150,000 horsepower. This plant has four 37,500-horsepower vertical Kaplan type turbines operating under a 29½-foot head. A third Russian plant worthy of note is the 160,000-horsepower Troizkaia plant now being built on the Chirchik River in Uzbek, on which stream

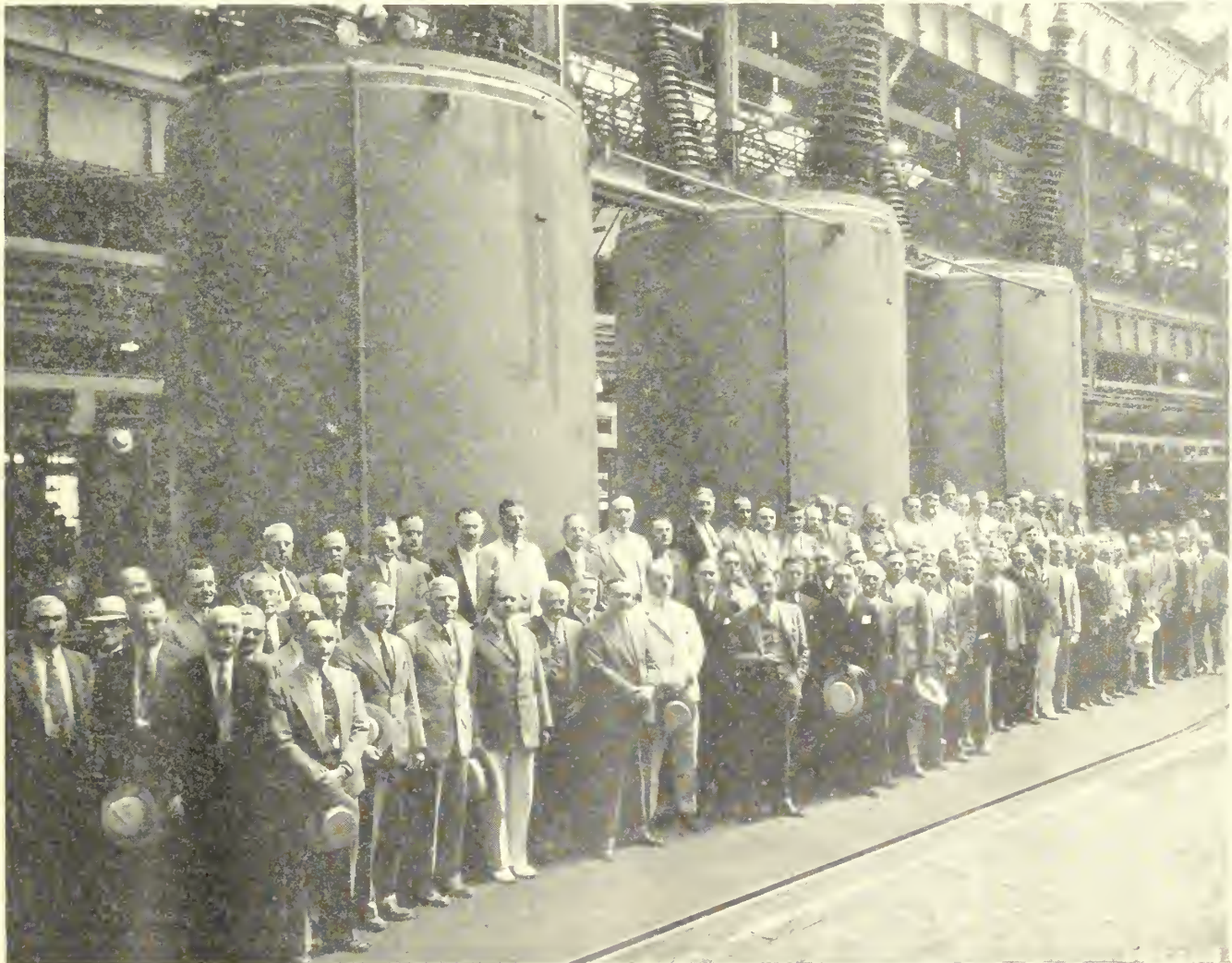
the Niasbek development is also located. At Troizkaia the installation comprises four 40,000-horsepower Francis type turbines with 34,500-kilovolt-ampere generators. The Russian Government has under construction in Soviet Armenia the Lake Sevan hydroelectric power and irrigation project. The project provides for construction of eight power stations along the Zanga River with a total capacity of more than 1,000,000 horsepower, and the irrigation of 320,000 acres in two Armenian deserts.

In France is found one of the most unusual power plants in the world, the 252,000-horsepower Brommat hydroelectric plant in Aveyron in southern France. The installation comprises six 42,000-horsepower vertical Francis waterwheels operating under a head of 813 feet. The plant is located entirely underground, the rooms necessitating the excavation of a space in solid granite 246 feet long, 72 feet wide and 95 feet high. Special tunnels were driven for the purpose of installing machinery and ventilation

equipment. Water from the Bromme reservoir passes through a mile long tunnel to this subterranean station.

The Rhenisch-Westfälische Elektrizitätswerk A. G., operating in the industrial center of West Germany, represents the largest current supply concern in Germany and also in Europe, with an annual energy output of 3,000,000,000 kilowatt-hours. All its power producing plants are connected by means of 220/380,000-volt long-distance lines, with a total length of 1,020 miles. The demand for peak power at short notice has led to the erection of storage pump stations, working solely with a water volume, which is continually pumped back into the reservoir in pendulum fashion. The Herdecke plant on the Ruhr River in Westphalia, Prussia, is a typical plant of this kind. Here water is accumulated in an elevated upper reservoir by means of pumps for the generation of peak load power on the largest possible scale.

Four pumps, each of 515 second-foot capacity, can fill the upper reservoir in



Members of Army Industrial College of Washington, D. C., visiting East Pittsburgh plant of Westinghouse Electric & Manufacturing Company, are shown 287,000-volt circuit breakers.

10 hours, operating with energy chiefly obtained by increasing the night output of the company's steam stations. When the turbines, which are available for 4.2 hours until the reservoir is entirely discharged, are fully utilized, the power generated amounts to 160,000 to 194,000 horsepower. During the pumping operation the turbine discharges are closed by means of flaps. Modern automatic equipment enables the station to be switched over from pumping to turbine operation in 2 minutes.

In Swedish Lapland, 30 miles within the Arctic Circle, is the Porjus dam on the Great Lule River, with a 100,000 horsepower development. Power is transmitted 100 miles to Kiruna and used for the operation of iron mines. Irish Free State has an interesting 220,000-horsepower plant on the Shannon River. The intake building at the power station is fed by a canal $8\frac{1}{2}$ miles long, which is also used for navigation. For the latter purpose there is a double-lift navigation lock at the intake building through which the boats are raised from the tailrace. The tailrace rejoins the main river $1\frac{1}{2}$ miles below the power station. The normal dimensions of the headrace canal are: Top width 352 feet, bottom width 104 feet, depth of water 30 feet, width at water level 262 feet.

HIGH-HEAD PLANTS

The Dixence plant in Canton Valais, Switzerland, constructed by L'Energie de l'Ouest-Suisse on the Dixence River, operates under a normal net head of 5,665 feet, with a range from 5,553 to 5,740, the highest head of any plant in the world. Dixence has five 50,000-horsepower turbines of the horizontal Pelton type. The purpose of this station is to supply power chiefly during the winter, with 8 hours service per day.

The Lake Fully power plant near Martigny, Switzerland, is operated under a head of 5,350 feet, and ranks next to Dixence. The penstock is a pipe varying from 2 feet to 1 foot 8 inches in diameter, and $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches in thickness in proportion to the pressure. The power developed amounts to only 12,000 horsepower with four 3,000-horsepower Pelton water-wheels. Each unit is driven by 7 second-feet of water issuing from a $1\frac{1}{2}$ -inch nozzle at a velocity of 540 feet per second. Outstanding among high-head plants with impulse wheels is the Niederebach in Switzerland with an effective head of 3,260 feet. On the Feather River in California the Great Western Power Co. has the highest head plant in the United States, the Bucks Creek plant with two 35,000-horsepower impulse wheels

operating at a head of 2,557.6 feet.

At the Ardnacrusha plant in the Irish Free State the fourth unit is of the Kaplan type, 29,000 to 38,500 horsepower according to head, which ranges from 85 to 97 feet, normal net 93, ultimate 111. This is said to be the highest head for which a Kaplan turbine has yet been constructed. J. M. Voith, of Heidenheim, Germany, is the manufacturer and the unit went into operation in September 1934. The highest head for Kaplan turbines prior to Ardnacrusha was 75 feet, at the Wettingen plant in Switzerland, which has three 10,640-horsepower wheels. Two 18,400-horsepower turbines of the same type, built for the Greenvallfoss plant in Norway operate under a 75-foot head. At the La Gabelle plant on St. Maurice River are four 30,000-horsepower turbines with 192-inch cast-steel propeller runners of Moody design under an average head of 60 feet.

LARGE FOREIGN PLANTS

The largest water power development in Switzerland is the Waggital owned by the City of Zurich and the Swiss North Eastern Power Company. There are two power houses, Rempen and Sieben, with heads of 853 and 647 feet respectively. The plants have a total capacity of 140,000 horsepower and are operated for 5 months in the year, November to March, inclusive. In single plant capacity the Handeck plant of the Oberhalsi Power Co. in Canton Berne with an installation of four 30,000-horsepower impulse wheels with vertical shaft, operating under a 1,770-foot head, was the largest in Switzerland proper, until exceeded by the 250,000-horsepower Dixence plant. Switzerland exports power to Germany, Italy, Austria, and France. On the Rhine, the Germany-Switzerland boundary, is located the 152,800-horsepower Ryburg-Schwoerstadt station, with four 38,200-horsepower wheels of the Kaplan type, scroll case of reinforced concrete, and an operating head 38 feet. In Germany the Schluchsee development in the State of Baden is the largest, and 1,970 feet of head is being utilized in three stages from the Schluchsee reservoir to the Rhine at Waldshut, with an ultimate development of 500,000 horsepower. The 184,000-horsepower Schluchsee station has four 46,000-horsepower Francis turbines with vertical shaft operating under a head of 594 feet. Another large German plant is the 162,000 horsepower Bringhausen on the Eder River, with four 40,500-horsepower horizontal reaction units under a head of 975 feet.

The 252,000-horsepower Brommat plant of the Societe des Forces Motrices de la Truyere on the Truyere River is

the largest hydroelectric development in France with six 52,000-horsepower Francis type turbines, head 839 feet, and the 216,000-horsepower Kembs plant on the Rhine with six 36,000-horsepower Kaplan turbines, head 39 feet, is second in capacity. Another important French plant is the Sarrans on the Truyere River with three 52,000-horsepower vertical Francis turbines, and an initial plant capacity of 156,000 horsepower. The 269,100-horsepower Carlo Cignana plant on the Nera River exceeds in size all other Italian water power plants, but the ultimate capacity of the Galletto plant on the Isarco River will be 400,000 horsepower. The four 50,000-horsepower turbines now installed in the Galletto plant are among the most powerful vertical Francis turbines outside of the United States; they were manufactured by Escher-Wyss.

The Norwegian Government has built two interesting hydroelectric plants. On the Numedalslaagen River is the Nore I with a present capacity of 146,400 horsepower and ultimate of 292,800 horsepower. The turbines are 36,600-horsepower horizontal Pelton type and the head is 1,125 feet. The Glomfjord plant on the Fyknaaga River will have a capacity of 192,500 horsepower, with six 27,500-horsepower horizontal Pelton turbines of which three are already installed. This plant operates under a 1,465-foot head.

Japan has a 180,000-horsepower plant on the Fusenko River in Chosen, which has four 45,600-horsepower impulse turbines. The head at this plant is 2,181 feet. In Austria the Vermunt plant on the Iller River is the largest, with four 33,250-horsepower impulse wheels, head 2,325 feet. In South America the largest hydro plant is found in Brazil the 116,000-horsepower Ilhados Pambos plant of the Brazilian Hydro-Electric Co. The Serra plant, also in Brazil, has two 50,000-horsepower horizontal double overhung impulse turbines under a 2,230-foot head. This plant of the Sao Paulo Tramway Light & Power Co. also has one 70,000-horsepower turbine on order, and the ultimate capacity will be 800,000 horsepower, exceeding the Dnieprostroy development in Russia.

India's major hydroelectric project is in Mandi State, Punjab. The powerhouse is located at Jogindernaga, 180 miles from Lahore. The Uhl and Rana Rivers flow parallel to each other but at elevations that vary by 3,000 feet. The waters of the Uhl are carried through a 9 foot 3 inch diameter tunnel 2.6 miles long, driven through the Dhauladhar Mountains to the level of the Rana. The powerhouse is a steel-frame build-

(Continued on p. 193)

Notes for Contractors

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
798-D....	June 11	Boulder Canyon, Ariz.-Nev.	Bus structure, lighting arrester supports, disconnecting switch supporting structures for switchyard.	American Bridge Co. Bethlehem Steel Co. International Derrick & Equipment Co.	Denver, Colo. Bethlehem, Pa. Torrance, Calif.	\$6,485.00 6,500.00 7,440.00	F. o. b. Pittsburgh, Pa. F. o. b. Leetsdale, Pa. F. o. b. Torrance, ½ percent discount.	June 18
683.....	June 25	Upper Snake River storage, Idaho.	Diversion dam and canal headworks; earthwork, concrete lining, and structures for Cross Cut Canal.	Otis Williams Co. and Brent Sturgill Co. Myers & Goulter Klug & Brumbach	Vale, Oreg. Seattle, Wash. Easton, Wash.	124,531.00 154,383.00 157,115.00		July 10
676.....	Apr. 6	Boulder Canyon, Ariz.-Nev.	Structural steel supports, gratings, and handrails.	Hansel-Elcock Co.	Chicago, Ill.	16,000.00	(1) f. o. b. Chicago, ½ percent discount.	June 23
673.....	Apr. 15	Colorado River, Tex.	Arnold Dam and power plant.	All bids rejected.				
800-D....	June 18	Central Valley, Calif.	Core drilling and excavation for investigation of Kennett dam site.	L. E. Dixon Co., Bent Bros., Inc., Case Construction Co.	Los Angeles, Calif.	\$7,217.50		July 6
802-D....	June 17	Owyhee project, Oreg.-Idaho.	Structures, north canal laterals.	Geo. Pollock Co. Milton A. Purdy H. J. Adler Co. Fife & Co. Henry L. Horn	Sacramento, Calif. Oakland, Calif. Nyssa, Ore. do. do.	108,502.50 113,165.00 11,555.00 11,990.00 12,262.50		July 2
805-D....	June 29	Boulder Canyon project, Ariz.-Nev.	Furnishing 125-foot steel flagpole for Boulder Dam.	John E. Lingo & Son, Inc. Pole & Tube Works, Inc.	Camden, N. J. Newark, N. J.	2,225.00 1,750.00	F. o. b. Boulder City, Nev. F. o. b. Newark, N. J.	July 14
685.....	June 8	Owyhee, Oreg.-Idaho.	Drains—earthwork and structures.	J. A. Terteling & Sons	Boise, Idaho	41,786.00		July 1
804-D....	July 2	Upper Snake River storage, Idaho.	Relocated roads of the Island Park Reservoir.	Nick Burggraf, Inc., and J. W. Brennan. Max J. Kuney Co. P. R. Knowlton Wheeler and England Barrett and Hilp and Macco Corporation.	Idaho Falls, Idaho. Spokane, Wash. Layton, Utah. Ashton, Idaho. Clearwater, Calif.	26,385.00 31,707.00 33,641.00 45,061.00 2,228,272		July 17
674.....	May 16	Salt River, Ariz.	Construction of Bartlett Dam.	L. E. Dixon Co., Bent Bros., Inc., Case Construction Co. V. R. Dennis Construction Co.	Alhambra, Calif. San Diego, Calif.	712,976.00 723,255.00		July 2
689.....	July 3	do.	Spillways for Horse Mesa Dam.	Westinghouse Electric & Manufacturing Co. S. Morgan Smith Co. Joshua Hendy Iron Works.	Denver, Colo. York, Pa. San Francisco, Calif.	391,040.00 36,000.00 37,226.00	F. o. b. Boulder City, Nev. F. o. b. York F. o. b. Sunnyvale, Calif.	July 9
680.....	May 18	Boulder Canyon, Ariz.-Nev.	Transformers for Boulder power plant.	Hardie-Tynes Manufacturing Co. Otis Williams Co. and Brent Sturgill Co.	Birmingham, Ala. Vale, Oreg.	75,000.00 124,531.00	F. o. b. Birmingham	July 10
687.....	June 15	do.	536-inch sphere valves for station service penstocks.	Virginia Bridge Co. Lakeside Bridge & Steel Co. American Bridge Co. Superior Portland Cement Co., Inc. Spokane Portland Cement Co.	Roanoke, Va. Milwaukee, Wis. Denver, Colo. Seattle, Wash. Irvin, Wash.	3,436.00 3,794.00 4,184.00 2.00 2.60	F. o. b. Memphis, Tenn. F. o. b. Milwaukee, ½ percent discount. F. o. b. Riverton F. o. b. mill, \$0.50 discount and sax. do.	July 11 July 11 July 17
683.....	June 25	Upper Snake River Storage, Idaho.	Diversion dam and canal headworks; earthwork, concrete lining, structures for Cross Cut Canal.	The Olympic Portland Cement Co., Ltd. Harnischfeger Sales Corporation. Link Belt Co. Koehring Co. Bay City Shovels, Inc. Osgood Co. Link Belt Co. Barrett & Hilp and Macco Corporation.	Bellingham, Wash. Milwaukee, Wis. Chicago, Ill. Milwaukee, Wis. Bay City, Mich. Marion, Ohio Chicago, Ill. Clearwater, Calif.	2.47 28,920.00 33,028.00 35,148.00 11,150.00 11,929.00 12,759.00 9,960.00	Item 1, two 1½ yards excavators. do. do. do. Item 2, one-yard excavator. do. do. do.	July 10
807-D....	July 7	Riverton, Wyo.	Structural steel for spillway bridge at Bull Lake Dam.	R. E. Canion All Arizona Engineering & Construction Co. V. R. Dennis Construction Co.	Phoenix, Ariz. Clifton, Ariz. San Diego, Calif.	10,366.00 14,185.00 32,500.00		July 3
A-33, 539-A.	July 2	Yakima-Roza, Wash.	Cement, 16,000 barrels.	George Pollock George Condon Co. Peterson Construction Co.	Sacramento, Calif. Omaha, Nebr. Minneapolis, Minn.	43,000.00 60,000.00 60,000.00		
808-D....	July 8	Uncompahgre, Colo.	Dragline excavators.					
801-D....	June 18	Salt River, Ariz.	Service road to Bartlett Dam site.					
810-D....	July 4	All-American Canal, Ariz.-Nev.	Earthwork, sta. 1161+75 to sta. 1170+25.					
691.....		Casper-Alcove, Wyo.	Turbines, governors, and generators for Seminoe power plant.					
692.....		Chain Lakes Storage, Mont.	Construction of Fresno Dam.					
693.....	Aug. 7	Upper Snake River Storage, Idaho.	Construction of Grassy Lake Dam.					

THE Yakima plant of the Washington Cooperative Chick Association distributed 130,000 chicks this season, as compared with 93,000 last year. The total number hatched by all branches of the concern was 1,600,000, or an increase of 40 percent over the previous season.

Hydroelectric Power Plants

(Continued from p. 192)

ing, reinforced to resist earthquake shocks; while the water wheels, running at 428 revolutions per minute, are said to be the largest ever constructed in Great Britain.

Installed capacity for the first stage is 64,320 horsepower. Started in 1925, the project when completed will cost \$25,000,000 and will help in developing local industries in the Punjab with its 20,000,000 inhabitants.

(Continued in the September issue)

Progress of Investigations of Projects

Grand Lake-Big Thompson Transmountain diversion, Colorado.—Six plane-table parties were in the field at Grand Lake completing the topography on Granby Reservoir site and the North Fork diversion reservoir. Horizontal control was located for a topographic survey of two canal lines from Willow Creek, one of these lines starting at elevation 8,400 and running to the North Fork diversion dam below Grand Lake, and the other starting at elevation 8,265 and running into Granby Reservoir. Two plane-table parties were in the field all month in the Loveland area completing strip topography on the water conduit for the power plants between Estes Park to the mouth of Big Thompson Canyon and completing the topography of the Big Thompson River. Horizontal control for a regulatory reservoir was located on the Williams River about 18 miles southeast of Parshall, Colo. A reconnaissance was made of a canal line for the diversion of Meadow Creek, a tributary of the Fraser, into Strawberry Creek, also a tributary of the Fraser, and a canal from Strawberry Creek into Walden Hollow and a canal from Walden Hollow into Granby Reservoir. The reconnaissance to determine the most feasible route for the diversion of the Williams River to Granby Reservoir was continued.

A geological reconnaissance was made of the following areas to determine as nearly as possible the material that would be encountered in their construction: (a) the proposed North Fork diversion dam site, (b) the proposed upper and lower canal lines from Willow Creek to Granby Reservoir and Shadow Mountain Lake, (c) the proposed canal course from Granby Reservoir pumping plant to North Fork diversion dam, and (d) the spillway and area adjacent to the proposed Granby Reservoir. Final computations have been completed for the length, azimuth, and back azimuth of Longs Peak tunnel, including the geodetic positions of each end. This locates the tunnel according to the latest data, but is subject to minor changes in location. Profiles have been computed and drawn for Windy Gap siphon on the Colorado River and have been submitted to the Denver office for design.

Blue River Transmountain diversion, Colorado.—A further reconnaissance was made of the reservoir site on the Blue River at Dillon and another was started on a canal line from Clear Creek near Golden, to Platte Canyon, south of Denver. Detailed geological plane-table

surveys were made of the Colorado River dam site below Parshall, of the Green Mountain Canyon, and of proposed dam sites on the Blue River in connection with a reservoir to be used for replacement purposes.

Western Slope, Colorado: (a) *Paonia project (formerly reported as the Fruitland project).*—Reconnaissance surveys have been made on several creeks on this project without finding any dam sites worth considering other than the Spring Creek dam site on the East Muddy Creek and the Horse Ranch dam site on the Anthracite Creek. Topography, taken of both dam sites, showed that the Horse Ranch dam site was not feasible. Old topography indicated that the Spring Creek dam site would be more feasible; so reservoir topography, based on a 200-foot water depth, was started during the month of June. Foundation explorations are now in progress on both abutments and have exposed no bad features to date.

(b) *Florida Mesa project.*—On June 1 a field party began the surveys of the project by starting at the lower end of the valley and taking topography upward.

(c) *Mancos Valley project.*—Field work on the topographic mapping of the irrigation district was continued during the month, placing special emphasis on a detailed survey of the Weber Reservoir which was completed.

(d) *Roan Creek project.*—Survey work was started on this project on June 23 with the running of control levels on Kimbral Creek and on the main Roan Creek.

(e) *Silt project.*—Preliminary work was started on this project on June 13. The present work is limited to a lower canal. A stream gage was established on the main Elk Creek at the end of the Box Canyon.

(f) *West Divide Creek project.*—Only preliminary reconnaissance surveys were made on this project, as it is planned to transfer the field party from the Roan Creek project upon the completion of its work there.

(g) *Yampa reservoirs.*—The first part of the month was spent in organization of crew, etc. Triangulation points were laid out on both sides of the Upper Yampa River at reservoir site no 4, and a plane-table survey on a scale of 500 feet to 1 inch was started and almost completed. Since the dam site no. 3 is so close to the end of reservoir site no 4, it was decided to extend the above triangulation net so as to include both sites in one set of coordinates.

Rio Grande Basin, Colorado-New Mexico.—The following surveys and investigations are in progress:

(a) *Wagon Wheel Gap dam site.*—Diamond drilling was begun June 21. By the end of the month hole no. 1 was completed to a depth of 110 feet and drilling was in progress on hole no. 2, but the overburden has not yet been penetrated.

(b) *Conejos dam site.*—Topography on the dam site was completed on June 15, and the topographic sheets on a scale of 50 feet to 1 inch were forwarded to the Denver office to be used in the laying out of a drilling program.

(c) *Vega-Sylvestre dam site.*—The digging of test pit no. 2 was continued throughout the month and was completed at 100 feet on June 30. No greater depth could be obtained owing to the rapid inflow of the water which was encountered at 97 feet. It is intended to sink the hole to the Creede formation as soon as a diamond-drill rig can be released from the Wagon Wheel dam site.

(d) *San Juan-South Fork diversion.*—On June 24, four men established a camp on the West Fork of the San Juan River and began a survey of the proposed ditch line to divert the West Fork into Wolf Creek and from that point by tunnel to the South Fork of the Rio Grande. By the end of the month a profile for prospective dam sites and trial lines to locate the proper diversion point had been completed.

(e) *San Juan-Chama diversion.*—Several field parties continued the work initiated during the previous month; one running transit and stadia on the upper trial line from the Navajo River and reaching the Blanco River diversion at the end of the month; one continuing the plane-table survey along the lower line from Stinking Lake to the Navajo River; one plane-table party surveying the lower line from the West Fork of the San Juan River to the Blanco River and completing same within 1 mile of the Blanco River; and another party completing the topography on the Navajo dam site on a scale of 50 feet to 1 inch.

(f) *Water supply studies.*—In the Denver office, the water supply studies initiated last month to determine the amount of water available for transmountain diversion from the San Juan River watershed were continued throughout the month of June. A new study, based upon the recorded discharges of the San Juan and Piedra Rivers at Arboles and the Navajo River at Edith, was initiated and practically completed.

Boise (Boise-Weiser-Payette), Idaho.—Preparations for field work were completed during the month. The first party, with three to five men, was placed in the field on June 9, at Garden Valley to start the survey of a canal line from the proposed Garden Valley Reservoir site toward the Boise diversion dam. On June 15, a level party started on a control line from the Boise diversion dam toward Horseshoe Bend. On the line of the proposed canal from the dam site of the proposed Garden Valley Reservoir to the Boise diversion dam, because of unusual conditions, the conventional method of location and strip topography was abandoned.

Gallatin Valley, Mont.—Field survey work consisted of the extension of the high-line canal on the west side of the valley to its end near the town of Manhattan and the extension of the Kleinschmidt Canal on the east side of the valley from the East Gallatin River to its end just north of Reese Creek. At the close of the month the survey party was extending the topography in the Gallatin Canyon from dam site no. 2 to damsite no. 3. Field work on the economic survey and checking of the soil survey was completed.

Saco Divide, Milk River project, Mont.—Field work consisted of the completion of the general topography and cross-sections on the Nelson South Canal throughout the upper 17 miles in order to determine the quantities involved in the enlargement. All field work was completed on the 24th and the parties were disbanded, a total area of approximately 16,000 acres having been covered by the topographic survey.

Meadow Valley, Southern Nevada.—The classification of the lands within this area was carried on until completion on June 4, covering a total area of 29½ square miles.

Deschutes, Oreg.—The reports on the comprehensive investigation of all reservoir sites in the Deschutes Basin above Bend, Oreg., and on the investigation of the north unit have been completed.

Black Hills, S. Dak.—The principal accomplishments of the field parties were the establishment of triangulation stations and bench marks on the Pactola site, the completion of the strip topography for the inlet canal to the proposed Brennan reservoir site near Rapid City and the near completion of the Deerfield reservoir site about 40 miles west of Rapid City on Castle Creek, the main tributary of Rapid Creek.

Dixie Project, Utah.—Tabulations have been made of all the water rights as stipulated in four court decrees on adjudication of water rights covering the entire Virgin River system in the State of Utah, together with tabulations of certificates issued by the State Engineer's office, whose applications are now in good standing.

Salt Lake Basin, Utah: (a) Gooseberry project.—Following the receipt of water supply data from the State Engineer and the Price River Water Commissioner during the first part of the month, work was accomplished in bringing the water-supply studies up to date as contained in the report on the Sanpete project dated May 1933.

(b) Blue Bench project.—A brief report was prepared on the present status of the Lower Blue Bench project and the probable extent of investigations necessary to determine the feasibility of irrigating both the upper and lower Blue benches.

Colorado River Basin.—A total of 50,880 acres were covered with irrigated area surveys and 35,300 acres with land classification surveys during the month in the regions of Plateau Creek, Roaring Fork, North Fork, Burns, Piney Creek, Upper Eagle River, and Gunnison.

All-American Canal and Appurtenant Works

Substructures of powerhouses will be constructed concurrently with the construction of the channel of the All-American Canal in California at four points along its course where there are sharp declines suitable for the development of power. This concurrent construction, as authorized by Secretary of the Interior Harold L. Ickes, will result in a saving estimated at \$465,000.

The Bureau of Reclamation is constructing the All-American Canal to replace the present main canal of the Imperial Valley which loops 50 miles through Mexican territory in crossing from the Colorado River to the irrigated section. A branch of this canal also will serve the Coachella Valley; construction of the branch has not been started. Contracts for repayment of the cost of construction of the canal and the branch up to \$38,500,000 have been signed with the Department of the Interior by the Imperial Irrigation District and the Coachella Valley Water Users' Association. These contracts cover repayment of the power drop structures.

Bureau of Reclamation engineers estimated the substructures could be built concurrently with construction of the canal with an increase of \$1,075,000 in the cost of construction of regular canal drops down the four hills involved.

This represents a saving of nearly half a million dollars under the original schedule.

The Imperial Irrigation District petitioned for the concurrent construction of the powerhouse substructures and the canal, and it was joined in its request by virtually every civic and farm organization in the Imperial Valley.

The Bureau of Reclamation will not install power machinery at the drops; it will simply construct the drops on designs suitable for installation of machinery. The District expects eventually to make the installation and to operate the power houses. Construction of the substructures at this time will reduce rather than increase the total investment in the completed canal.

The drops involved are nos. 2, 3, 4, and 5, which will develop heads of 26, 26, 51, and 24 feet, respectively, and will have an installed capacity of 12,000, 12,000, 24,000, and 6,200 kilovolt-amperes, respectively. These drops are between 40 and 64 miles from the head of the canal.

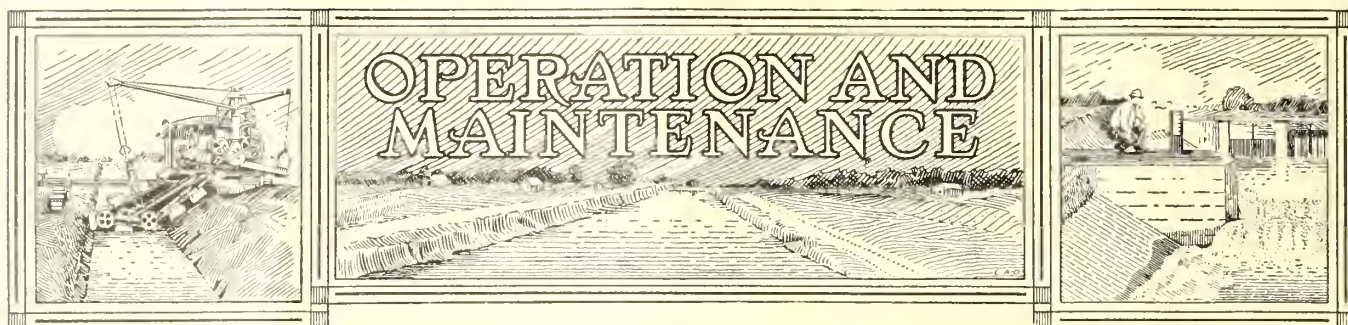
Two other potential power drops along the canal are not being developed at this time. They are drop no. 1 in the canal itself, which provides a head of 12 feet, and the Pilot Knob power drop. The Pilot Knob drop is not in the canal but could be used by diverting water into the All-American Canal and later returning

it to the river at Pilot Knob. Those interested in the water of the Colorado River have protested against the development of the Pilot Knob power drop on the grounds that the diversion into the canal of this water and its return to the river at Pilot Knob on the international boundary might enable Mexican irrigators to establish a right to its continued delivery to Mexico.

President of A. S. C. E. Visits Grand Coulee

En route to the annual meeting of the American Society of Civil Engineers in Portland, Professor Daniel W. Mead, president, and party stopped at the Columbia Basin project and visited Grand Coulee Dam.

The party was made up of President and Mrs. Mead, Vice President and Mrs. H. E. Riggs, Secretary and Mrs. George T. Seabury, Assistant Secretary and Mrs. W. E. Jessup; Field Secretary Franklin Jenks, Mr. and Mrs. L. L. Hiddinger, C. S. Proctor, Mr. and Mrs. C. E. Trout, Miss Harriet Trout, Mr. and Mrs. Sydney Wilmot, and General C. U. Kutz, United States Engineering Department, retired. General Kutz was a member of the Board of Army Engineers which reported upon reclamation projects about 1912.



Description of Home-made Air Coolers

By L. H. Mitchell, Field Supervisor, Bureau of Reclamation

ON THE Salt River project in Arizona more than 1,000 home-made air coolers were installed in homes during 1935. Those who made and used them testify to their effectiveness in increasing the comfort of the living and sleeping quarters in very hot weather.

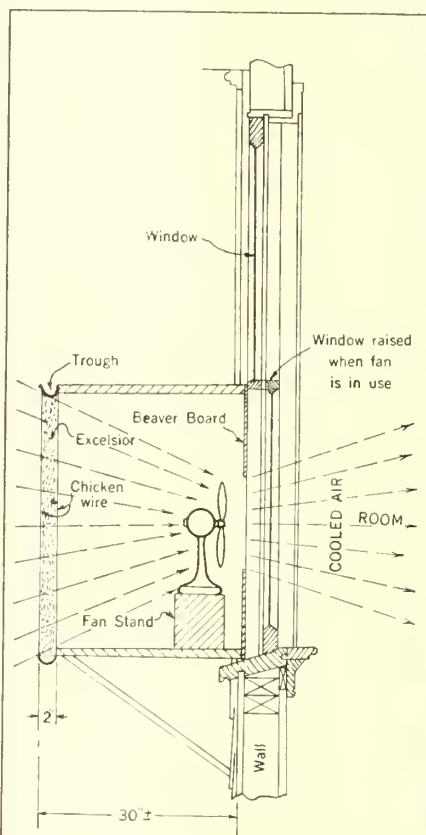
The air coolers are so simple and the materials needed in their construction so easily obtained that many project settlers and residents of project towns will be interested in a description of them.

These coolers will be effective, it is believed, only in a hot climate where the humidity is very low, as is the case throughout the Southwest. They will increase the humidity of the house while cooling the air, but in the dry climate of the Southwest the increase in humidity will cause no discomfort. Proof of this is their popularity in central Arizona.

The only requirement for the installation which may limit their use is that the house must be wired for electricity, since an electric fan is an integral part of the air cooler.

The air cooler is made of a wooden box made to fit tightly in the lower half of a window, a bit of excelsior, a tin trough perforated to spread water through the excelsior, and a good-sized electric fan. The fan draws air through the moistened excelsior and in doing so lowers its temperature. The temperature of a room can be lowered 10 or 15 degrees with one of these home-made air coolers.

The front or window side of the box may be constructed of heaver board or some other thin material. In the center of this is cut a circular opening the size of the fan to be used. (The fan should be a large one, especially if more than one room is to be air cooled.) The back face of the box consists of two chicken wire screens with a 1-inch mesh and spread about 2 or 3 inches apart. The space between these screens is filled with excelsior. At the top of the excelsior is placed a metal trough so that water is



CROSS SECTION

1. Fan should be directly in front of and close to opening cut to force air into room.
2. No air should reach fan without passing thru the wet excelsior.
3. Best results are had by having fan about two feet from excelsior.

and also upon the temperature and moisture content of the air out of doors. The water tank for the cooler can be chosen with a little practical experimenting. Enough water should be applied to keep all the excelsior moist.

With long continued use the excelsior may become sour. It should be changed regularly to avoid tainting the air with unpleasant odors.

The accompanying drawing shows the essential features of this air cooler. The picture is of an air cooler on a drug store in Phoenix. Remember, the box must fit tightly into the window so that all the air entering the room will be drawn through the moistened excelsior. A 15-inch fan generally is used for an ordinary living room.

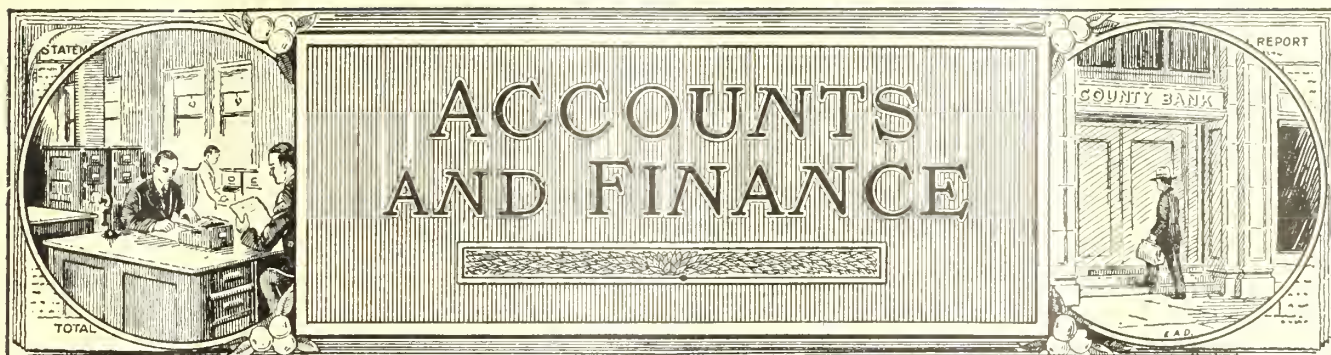
These air coolers became so popular on the Salt River project in 1935 that excelsior was shipped in by the carload.



Air conditioner

evenly distributed to the excelsior. The water is conveyed to the trough through a small rubber hose. The excelsior must be loose enough to permit the fan to draw a big flow of air through the box.

A cooler will use from 25 to 100 gallons of water per day, depending upon its size, the number of rooms to be cooled,



Congress Provides Funds for Construction

But Presents Difficult Future Problem

By William E. Warne

CONTINUATION until June 30, 1937, of the construction program of the Bureau of Reclamation on a substantial scale and without interruption was assured by appropriations totaling \$54,610,000 made by Congress in June.

However, insistence by leaders in the House of Representatives that a large part of this year's appropriation and future appropriations come from the reclamation fund has poised a very serious question for consideration. How can this program be carried on in the future by appropriations from the reclamation fund, when the anticipated income to that fund from present sources is inadequate?

Senator Carl Hayden of Arizona, who managed the Interior Department appropriation bill in the Senate, called this problem forcefully to the attention of Congress. He pointed out that accretions to the reclamation fund had decreased rapidly during recent years due to exhaustion of attractive public land and to operation of the Taylor Grazing Act, which has virtually stopped the sale of public lands, and due to reduction of development of oil resources of the public domain. Previously sale of public lands and oil royalties were the principal sources of revenue entering the reclamation fund.

EFFECT OF MORATORIUMS

"The normal income to the reclamation fund that would have been obtained from repayments by settlers on the projects have not been received because of various acts of Congress that have been passed granting moratoriums," Senator Hayden said. "That type of relief legislation must come to an end. The moratorium this year is only for one-half of the annual construction charges. Senators and Members of the House of

Representatives from the West must be frank with their constituents by advising them that there will be no more general reclamation moratoriums."

This, he said, would result in an income of about \$5,000,000 a year to the reclamation fund, adding that "that in itself will not be sufficient."

"There is nothing for Congress to do but to give very, very serious consideration at its next session to the best means to be adopted to provide an adequate amount of money for the reclamation fund," Senator Hayden insisted. "We, who represent 14 states in the arid region, must devote our time and attention to that subject."

Possible means of augmenting the income to the reclamation fund were suggested as follows:

1. Deposit in the reclamation fund of repayments of construction charges from projects constructed with emergency funds.
2. Deposit royalties from naval oil reserves in the fund.
3. Deposit a portion of the fees collected for public land grazing in the fund.

In addition, it was suggested that bond loan repayments, which must start in two years at the rate of \$2,000,000 a year might be deferred.

"I wish to suggest to the Senate," Senator Hayden said in this regard, "the President has stated in a recent message to Congress that in normal times and under normal conditions the Congress can afford to appropriate about \$500,000,000 a year for public works. With such a total sum of money allocated for internal improvements of various kinds, such as rivers and harbors, flood control, public buildings, and Federal aid for roads, there must be found, within the limits and scope of that \$500,000,000, a reasonable sum of money to be taken out

of the Federal Treasury and added to the reclamation fund each year so as to supplement it to an extent which will permit necessary construction to properly proceed. Congress can afford to do that because of the vast benefit which comes to the Nation as a whole by the development and utilization of the waters of our western streams."

APPROPRIATIONS FOR FISCAL YEAR 1937

The total of \$54,610,000 for continuation of the Bureau of Reclamation construction program was included by Congress in two acts which passed late in the session. All but one item was included in the Interior Department Appropriation Act. That item was \$8,900,000 for continuation of the Central Valley project in California. It was included in the First Deficiency Appropriation Act. Both these acts were approved by President Roosevelt on June 22.

The Interior Department Appropriation Act contains appropriations totaling \$10,860,000 from the reclamation fund for continuation of construction of 14 projects and administrative expenses connected with them. It carries in addition, \$36,850,000 from general funds for the Boulder Dam powerhouse, the All-American Canal, and the Grand Coulee Dam.

Most of the projects included in the appropriations for construction from the reclamation fund were started with money allotted from emergency funds. Two exceptions were the Pine River project in Colorado, which is a new project estimated to cost when completed about \$3,000,000, and the Deschutes project in Oregon, on which construction has not started. Investigations for the Deschutes project are now in progress.

Although full Congressional authorization had been given previously for construction of Grand Coulee Dam and canals and appurtenant works connected with the Columbia Basin project in Washington, Congress provided in appropriating \$20,750,000 for this project, that obligations to be incurred by the Bureau of Reclamation must not exceed \$63,000,000 until additional "appropriations, or contract authorizations, or both" have been granted by Congress. This limitation will not affect the work in any way this year, since the foundation dam, estimated to cost approximately \$60,000,000, will not be completed in the fiscal year 1937.

Senator Hayden said on the floor of the Senate, explaining this limitation:

"It is evident that this restriction cannot in any manner affect the law authorizing the construction of the project. It merely provides that no money shall be appropriated to continue the construction of that dam and incidental works, once it is completed to the height that is now contracted for, unless Congress shall make a specific grant for that purpose. In other words, the basic law authorizing the construction of the Grand Coulee Dam is not changed by this limitation."

CENTRAL VALLEY PROJECT AUTHORIZED

The item in the First Deficiency Act for the Central Valley project in California constituted a full authorization for construction of the entire project, the project to be reimbursable under the reclamation law. However, of the \$6,900,000 appropriated, \$6,000,000 was set aside for the commencement of the construc-

tion of the Friant Dam and the canal system in the San Joaquin Valley part of the project. The remainder of the appropriation and \$8,100,000 of emergency funds allotted by the President for construction of this project are available for expenditure without any limitation. The work will go forward on the project as a whole.

RECLAMATION FUND APPROPRIATIONS

Operation and maintenance.—For the Commissioner's office, \$150,000; for the Chief Engineer's office, \$115,000; for miscellaneous, travel, inspection, etc., \$71,000; for field legal offices, \$48,750.

For Yuma project, Arizona, \$73,000, and \$25,000 of power revenues are available for operation and maintenance of the commercial system; Orland project, California, \$36,000; Boise project, Idaho, \$30,000; Minidoka project, Idaho, \$11,600, plus \$50,000 of power revenues which may be used for operation and maintenance of the commercial system and \$100,000 from the same source which may be used for continuation of the construction of the South Side division; North Platte project, Nebraska-Wyoming, \$60,000 from power revenues for the commercial system and \$6,000 from the same source allocated to the Northport Irrigation District for payment to the Farmers' Irrigation District for carriage of water; Rio Grande project, New Mexico-Texas, \$340,000; Owyhee project, Oregon, \$75,000; Klamath project, Oregon-California, \$50,000; Yakima project, Washington, \$265,000, plus \$25,000 of power revenues which are available for

operation and maintenance of the power system; Riverton project, Wyoming, \$40,000, plus \$25,000 of power revenues which are available for the commercial system; Shoshone project, Willwood division, Wyoming, \$40,000, plus \$25,000 of power revenues for operation and maintenance of the commercial system. For administration of operation and maintenance, \$75,000.

Construction.—For Gila project, Arizona, \$1,250,000; Salt River project, Arizona, \$1,500,000; Grand Valley project, Colorado, \$200,000; Pine River project, Colorado, \$1,000,000; Boise project, Payette division, Idaho, \$1,000,000; Boise project, Idaho (drainage), \$160,000; Carlsbad project, New Mexico, \$900,000; Deschutes project, Oregon, \$450,000; Owyhee project, Oregon, \$200,000; Yakima project, Roza division, Washington, \$1,000,000; Provo River project, Utah, \$500,000; Casper-Alcova project, Wyoming, \$1,000,000; Riverton project, Wyoming, \$250,000; Shoshone project, Heart Mountain division, Wyoming, \$700,000. For administrative expenses connected with these projects, \$750,000.

GENERAL FUND APPROPRIATIONS

Construction.—Grand Coulee Dam, Washington, \$20,750,000; Boulder Canyon project, Boulder Dam and power plant, \$9,600,000, plus \$350,000 of revenues which may be available for operation and maintenance of the dam and power plant, etc.; All-American Canal, \$6,500,000; Central Valley project, California, \$6,900,000, of which \$6,000,000 must be spent on the San Joaquin Valley division

(Continued on p. 200)

Tentative program for reclamation construction

State and project	Ultimate cost	Previously expended	Necessary to complete	Available to June 30, 1937 (including H. R. 10630)	Additional required					Thereafter
					Fiscal year 1938	Fiscal year 1939	Fiscal year 1940	Fiscal year 1941	Fiscal year 1942	
Arizona:										
Gila.....	\$20,500,000		\$20,500,000	\$3,050,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$2,000,000	\$7,450,000
Salt River.....	18,744,000	\$12,744,000	6,000,000	5,000,000	500,000	500,000				
Colorado:										
Grand Valley.....	4,600,000	4,300,000	300,000	200,000	50,000	50,000				
Pine River.....	3,000,000		3,000,000	1,000,000	1,000,000	1,000,000				
Idaho:										
Boise:										
Payette.....	5,800,000	870,000	4,930,000	1,700,000	500,000	500,000	1,000,000	500,000	500,000	230,000
Arrowrock, dam and drainage.....	13,413,000	12,643,000	800,000	800,000						
New Mexico: Carlsbad.....	3,964,650	1,464,650	2,500,000	1,900,000	300,000	150,000	150,000			
Oregon:										
Deschutes.....	6,065,000		6,065,000	515,000	1,300,000	750,000	500,000	500,000	500,000	2,000,000
Owyhee.....	18,000,000	11,500,000	6,500,000	5,300,000	500,000	500,000	200,000			
Washington: Yakima, Roza.....	14,446,600	2,813,000	11,633,600	3,500,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	3,133,600
Utah: Provo River.....	10,000,000		10,000,000	1,500,000	1,500,000	1,000,000	1,000,000	750,000	750,000	3,500,000
Wyoming:										
Casper-Alcova.....	20,000,000		20,000,000	13,300,000	2,000,000	1,500,000	500,000	500,000	500,000	1,700,000
Riverton.....	8,670,000	3,900,000	4,770,000	1,250,000	300,000	300,000	300,000	300,000	300,000	2,020,000
Shoshone, Heart Mountain.....	6,500,000		6,500,000	2,000,000	800,000	800,000	500,000	500,000	500,000	1,400,000
Construction.....	153,733,250	50,234,650	103,498,600	41,015,000	11,750,000	10,050,000	7,150,000	6,050,000	6,050,000	21,433,600
Bond repayment.....						2,000,000	2,000,000	2,000,000	2,000,000	7,000,000
Subtotal required.....					11,750,000	12,050,000	9,150,000	8,050,000	8,050,000	28,433,600
California: Central Valley.....	170,000,000		170,000,000	15,000,000	15,000,000	15,000,000	16,000,000	16,000,000	20,000,000	73,000,000
Washington: Columbia Basin.....	389,000,000		389,000,000	55,750,000	15,000,000	18,000,000	20,000,000	20,000,000	20,000,000	240,250,000
Total.....	712,733,250	50,234,650	662,498,600	111,765,000	41,750,000	45,050,000	45,150,000	44,050,000	48,050,000	341,683,600

Reclamation Organization Activities and Project Visitors

Through the courtesy of the TVA, John C. Page, Acting Commissioner, and J. L. Savage, Chief Designing Engineer and one of the consultants on the work, visited the Tennessee Valley project on July 17 and 18, and viewed the work from an airplane.

B. E. Stoutemyer, district counsel at Portland, Oreg., represented the Bureau of Reclamation at the Western Regional Conference of the American Farm Bureau Federation at Walla Walla, Wash., on June 27. Mr. Stoutemyer delivered an address on the subject, Reclamation—Its Place in Western Agriculture.

George O. Sanford, general supervisor of operation and maintenance, left Washington on July 1 on an inspection tour of the western projects with the exception of Carlsbad, Rio Grande, Salt Lake, and Yuma. Mr. Sanford is expected to return to Washington early in September.

Charles H. Carter, engineer in the Washington office, has been transferred to the Denver office and entered on duty in this new assignment early this month. He was accompanied west by Mrs. Carter and their small son and daughter. Their many friends in Colorado will welcome them, as Mr. Carter was formerly a member of the chief engineer's staff. It is with regret that the Commissioner's force bids him adieu, since he has found a warm spot in the hearts of his new associates in Washington, all of whom wish for him a successful future.

W. E. Warne, the Bureau's press representative left July 1 for a trip over some of the larger projects. He will arrange for more adequate news reports from the projects and by personal contact with the various organizations, plan for future news programs. He is visiting the Denver office, and the Casper-Alcova, Grand Coulee, Central Valley, All-American, and Boulder Canyon projects.

Among the recent appointees in the Washington office assigned to duty in the Accounts Division are the following:

Miss G. M. Conant and Charles W. Dey, of California; M. C. Sedberry, of North Carolina; Fred J. Berberick, of New Jersey, and W. Clayton Jenkins, of Utah.

The following employees have been assigned to work in the Denver office by transfer or new appointment:

On June 16 Kenneth B. Keener was appointed senior engineer in the Denver office, vice Byram W. Steele, whose separation from this bureau was recently effected in order that he might accept employment with the Tennessee Valley Authority.

Mansfield Merriman from the Rio Grande Investigations, Crede, Colo., to the position of assistant engineer, Denver, June 17.

James W. Gwyn, junior engineer on the Boulder Canyon project to the Denver office, June 9.

George H. Bolt, chief clerk on the Salt River project, Phoenix, Ariz., is being transferred to the Denver office.

Merle G. McCleery, assistant engineer, from the All-American Canal project, effective June 24.

The following employees have been transferred from the Denver office to the designated field offices:

Hollis Sanford, assistant engineer, to associate engineer on the Boise and Owyhee projects, with headquarters at Ontario, Oreg., June 16.

Alison Tewksbury, junior engineer, to the position of assistant engineer, Boulder Canyon project, June 17.

Joseph Garrett Turner, assistant engineer, to associate engineer, Boulder Canyon project, June 17.

Everett S. Huntington, associate engineer, to engineer at the Bartlett Dam, Salt River project, May 22.

Charles S. Rippon as assistant engineer at the Seminole dam site and power development, Casper-Alcova project, June 19.

Paul A. Nelson as junior engineer at Friant Dam, Friant, Calif., June 5.

Elmer J. Nemmers to the Bull Lake Dam, Riverton project, as an assistant engineer, effective June 1.

Richard J. Wilson, inspector, to the Colorado River project, Texas, effective June 1.

Daniel Clark to the Boulder Canyon project, as an associate engineer, effective June 4.

Edgar A. Peek was transferred on June 16 from the position of chief clerk on the Grand Valley project to the same position on the Salt River project, vice George H. Bolt, who has been assigned to the Denver office.

Emil T. Ficenece, clerk on the North Platte project, has been transferred as

chief clerk to the Grand Valley project, effective June 17. Mr. Ficenece succeeds Edgar A. Peek, who has been assigned to the position of chief clerk on the Salt River project.

Clemeunt T. Douglass, inspector on the Central Valley project, was transferred on June 15 from the Friant Dam, Friant, Calif., to the Kennett Dam at Redding in that State.

Herman R. Elliott's appointment as engineer, for assignment on the Uncompahgre project, was authorized by the Secretary of the Interior on May 27.

Appointment issued on June 6 to Philo M. Wheeler as chief clerk on the Yakima project, by change in status from principal clerk, same headquarters, succeeding the late Robert K. Cunningham.

Robert F. Skinner, assistant engineer, Taylor Park Dam, Uncompahgre project, was transferred as associate engineer to the Roza Division, Yakima project, effective June 1.

Robert D. Hamilton resigned as clerk at Denver, Colo., effective at the close of June 30, in order to make business connections with the Burroughs Adding Machine Co., at Kansas City, Mo.

Everett T. Giles, formerly office engineer on the Colorado River project at Austin, Texas, has been transferred to the engineering division of the Washington office.

W. I. Swanton, engineer in the Washington office, and family completed in July an automobile tour of 8,600 miles through the West, including visits to the Seminole and Alcova damsites and Yellowstone Park in Wyoming; Grand Coulee Dam and the Yakima project in Washington; Crater Lake Park in Oregon; Red Wood Trail and Los Angeles in California; Boulder Canyon project in Arizona and Nevada; Grand Canyon in Arizona; and the Uncompahgre project in Colorado.

Elmer R. Fronck has been appointed assistant clerk, Yakima, Wash., to fill the position left vacant by the death of Henry C. Bishop.

Visitors to the All-American Canal project who called in connection with the work of the National Planning Board were as follows:

J. C. Stevens, consulting engineer, Portland, Oreg.; Dr. W. Woods, professor mechanical engineering, University of California; Sheldon Baker, consultant, and Claude Myers, representative, State Planning Board, Phoenix, Ariz.; and Prof. Fred Merryfield, Oregon State College, Corvallis.

George V. Hays, deputy archivist, of the office of the survey of Federal Archives, Phoenix, Ariz., with his assistants, Henry Muehlebach and Oliven Nims, field supervisors, visited the All-American Canal project during June to check the files of the office.

Arthur V. Fant, junior engineering draftsman in the Denver office, resigned at the close of June 10, to accept employment with the State highway department of Colorado.

Edward Helgren was appointed an inspector on the All-American Canal project, effective July 1.

The principal visitors to the Alamo-gordo Dam, Carlsbad project, during the month of June were F. F. Smith, senior engineer from Denver, and Andrew Weiss consulting engineer, Mexico City, Mexico.

On June 23 the Orland project was inspected by Messrs. G. J. Daley, George T. Scott, and E. C. Fisk of the Holly Sugar Corporation. Mr. Daley is in charge of all operations in California, Mr. Fisk is the assistant secretary, and Mr. Scott the agriculturist for the corporation. These gentlemen were investigating the possibilities of raising sugar-beet seed on the Orland project and it is possible that something highly desirable for the project may develop from the visit.

C. A. Lyman, inspector for the Bureau, is spending several weeks on the Klamath project, where he is engaged in certain accounting work.

Ethelbert Ward, attorney from the Department of Justice; J. R. Alexander, district counsel of the Bureau of Reclamation; and L. J. Foster, construction engineer, Uncompahgre project, spent several days on the project preparing

evidence to be submitted in connection with the adjudication of storage rights in the Taylor Park Reservoir.

John W. Haw Addresses A. S. C. E.

At the 66th annual convention in Portland, Oreg., on July 15-18 of the American Society of Civil Engineers, John W. Haw, Director of Agricultural Development of the Northern Pacific Railway Company, delivered an address on the "Relation of Reclamation of Arid Land by Irrigation to the National Land Use Program."

Drafting Division Moves

Owing to the requirement of the Post Office Department for more space the Drafting Division of the Bureau of Reclamation, of which Edward A. Dacey is chief, was moved on June 24 to the fifth floor of the Lemon Building at 1729 New York Avenue. Immediately following this move the Chief Clerk of the Bureau, Charles N. McCulloch, was transferred, with the force immediately under his supervision, to the fifth floor of the Post Office Department (Rooms 5433, 5435, 5437), leaving his former space for occupancy of the Philatelic Division of the Post Office Department.

Fossil Remains Found on Roza Division

On June 19 the fossil remains of a large animal, apparently mastodon, were encountered on the Roza division of the Yakima project in the tunnel in sandstone about 8 feet above the basalt. Teeth, bones, and pieces of tusk were carefully removed and sent to the department of geology, Washington State College, for study.

The department contemplates issuing a report on its findings. These remains are particularly interesting because of the fact that they are the first that have been found in the Ellensburg formation.

WITH more than 91,000 acre-feet of water in storage on the Orland project the prospects of a good carry-over for next season are very bright. There is very little snow left on the watershed of Stony Creek, but some natural flow is still available for the project. No shortages in the water supply for northern and central California are expected for this season.

Funds for Construction

(Continued from p. 198)

of the project and \$250,000 for administrative expenses.

North Platte project, \$50,000 from power revenues for construction of an additional power circuit between the Guernsey and Lingle power plants.

RECLAMATION FUND DEPLETED

Appropriations made for construction from the reclamation fund will practically exhaust that fund. The income to the reclamation fund which may reasonably be expected annually from all present sources will average during the next 5 years \$6,500,000. This will be made up as follows: Sale of public lands, \$200,000; oil royalties, \$1,700,000; repayments by reclamation fund projects, \$1,500,000; other, \$100,000.

The amount of money which will be needed during each of the next 5 years to carry on the construction of projects now under way will approximate \$50,000,000. This is without considering the possibility of adding new projects to the present list, although it is apparent that within 5 years the time will arrive when some new construction will be advisable. This estimate does not include the money that will be needed to complete the Boulder Canyon project, since money for this project, including the All-American Canal, is authorized by the Boulder Canyon Project Act of December 21, 1928.

The accompanying table provides a tentative picture of the requirements of the Bureau of Reclamation up to 1942. Requests for appropriations probably will not be made in accordance with figures given here, since definite determination of future needs must await developments. However, the table will give an idea of the requirements.

All-American Canal

(Continued from p. 187)

Rawles' main task is acting as telephone operator at the camp. This is the only telephone going into the dam and desilting-works area and the demands have been so heavy that her company "exchange" now boasts 14 stations.

Although less closely connected with the actual field force, Miss Nina White of the National Commissary Co., has direct dealings with probably more workmen than any other woman. She is in charge of the store for the commissary company, where she supervises sales of drugs, meats, groceries, clothes, and the countless odds and ends of the little community. Miss White formerly lived in Yuma.—*The Post-Press, El Centro, Calif.*

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. IKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation.

John C. Page, Acting Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Deane S. Stuver, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal.....	Yuma, Ariz.....	R. B. Williams.....	Constr. engr.....	J. C. Thraillkill.....	R. J. Coffey.....	Los Angeles, Calif.
Belle Fourche.....	Newell, S. Dak.....	F. C. Younghlut.....	Superintendent.....	J. P. Siebeneicher.....	W. J. Burke.....	Billings, Mont.
Boise.....	Ontario, Oreg.....	R. J. Newell.....	Constr. engr.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
Boulder Dam & power plant.....	Boulder City, Nev.....	Ralph Lowry.....	do.....	Gail H. Baird.....	R. J. Coffey.....	Los Angeles, Calif.
Burnt River.....	Unity, Oreg.....	Clyde H. Spencer.....	do.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
Carlshad.....	Carlshad, N. Mex.....	L. E. Foster.....	Superintendent.....	E. W. Shepard.....	H. J. S. DeVries.....	El Paso, Tex.
Alamogordo Dam.....	do.....	Wilfred W. Baker.....	Engineer.....	.....	do.....	do.
Casper Alcoa.....	Casper, Wyo.....	H. W. Bashore.....	Constr. engr.....	C. M. Voven.....	W. J. Burke.....	Billings, Mont.
Central Valley.....	Sacramento, Calif.....	W. R. Young.....	do.....	E. R. Mills.....	R. J. Coffey.....	Los Angeles, Calif.
Colorado River in Texas.....	Austin, Tex.....	H. P. Bunger.....	do.....	William F. Sha.....	H. J. S. DeVries.....	El Paso, Tex.
Columbia Basin, Grand Coulee Dam.....	Coulee Dam, Wash.....	F. A. Banks.....	do.....	C. B. Funk.....	B. E. Stoutemyer.....	Portland, Oreg.
Frenchtown.....	Missoula, Mont.....	J. W. Taylor.....	Resident engr.....	.....	W. J. Burke.....	Billings, Mont.
Gila Valley.....	Yuma, Ariz.....	R. B. Williams.....	Constr. engr.....	.....	R. J. Coffey.....	Los Angeles, Calif.
Grand Valley.....	Grand Junction, Colo.....	W. J. Chiesman.....	Superintendent.....	E. A. Peek.....	J. R. Alexander.....	Salt Lake City, Utah.
Humboldt.....	Lovelock, Nev.....	L. J. Foster.....	Constr. engr.....	George B. Snow.....	do.....	do.
Klamath.....	Klamath Falls, Oreg.....	B. E. Hayden.....	Superintendent.....	W. I. Tingley.....	B. E. Stoutemyer.....	Portland, Oreg.
Milk River.....	Malta, Mont.....	H. H. Johnson.....	do.....	E. E. Chahot.....	W. J. Burke.....	Billings, Mont.
Chain Lakes Storage.....	do.....	do.....	do.....	do.....	do.....	do.
Minidoka.....	Burley, Idaho.....	E. B. Darlington.....	do.....	G. C. Patterson.....	B. E. Stoutemyer.....	Portland, Oreg.
Moon Lake.....	Duchesne, Utah.....	F. J. Westerhouse.....	Constr. engr.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
North Platte.....	Guernsey, Wyo.....	C. F. Gleason.....	Supt. of power.....	A. T. Stimpff.....	W. J. Burke.....	Billings, Mont.
Ogden River.....	Ogden, Utah.....	J. R. Iakisch.....	Constr. engr.....	H. W. Johnson.....	J. R. Alexander.....	Salt Lake City, Utah.
Orland.....	Orland, Calif.....	D. L. Carmody.....	Superintendent.....	W. D. Funk.....	R. J. Coffey.....	Los Angeles, Calif.
Owyhee.....	Ontario, Oreg.....	R. J. Newell.....	Constr. engr.....	Robert B. Smith.....	B. E. Stoutemyer.....	Portland, Oreg.
Parker Dam ²	Parker Dam, Calif.....	E. A. Moritz.....	do.....	Geo. W. Lyle.....	R. J. Coffey.....	Los Angeles, Calif.
Provo River.....	Salt Lake City, Utah.....	E. O. Larson.....	Engineer.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
Rio Grande.....	El Paso, Tex.....	L. R. Flock.....	Superintendent.....	H. H. Berryhill.....	H. J. S. DeVries.....	El Paso, Tex.
Caballo Dam.....	Caballo, N. Mex.....	S. F. Creelius.....	Constr. engr.....	.....	do.....	do.
Riverton.....	Riverton, Wyo.....	H. D. Comstock.....	do.....	C. B. Wentzel.....	W. J. Burke.....	Billings, Mont.
Salt River.....	Phoenix, Ariz.....	E. C. Koppen.....	Constr. engr.....	Geo. H. Bolt.....	R. J. Coffey.....	Los Angeles, Calif.
Sanpete.....	Salt Lake City, Utah.....	E. O. Larson.....	do.....	Francis J. Farrell.....	J. R. Alexander.....	Salt Lake City, Utah.
Shoshone.....	Powell, Wyo.....	L. J. Windle.....	Superintendent.....	L. J. Windle.....	W. J. Burke.....	Billings, Mont.
Shoshone-Heart Mountain.....	Cody, Wyo.....	Walter F. Kemp.....	Constr. engr.....	do.....	do.....	do.
Stanfield.....	Ontario, Oreg.....	R. J. Newell.....	do.....	Robert B. Smith.....	B. E. Stoutemyer.....	Portland, Oreg.
Sun River, Greenfields div.....	Fairfield, Mont.....	A. W. Walker.....	Superintendent.....	.....	W. J. Burke.....	Billings, Mont.
Truckee River Storage.....	Lovelock, Nev.....	L. J. Foster.....	Constr. engr.....	.....	J. R. Alexander.....	Salt Lake City, Utah.
Umatilla (McKay Dam).....	Pendleton, Oreg.....	C. L. Tice.....	Reservoir supt.....	.....	B. E. Stoutemyer.....	Portland, Oreg.
Uncompahgre: Taylor Park.....	Gunnison, Colo.....	A. A. Whitmore.....	Engineer.....	Ewalt P. Anderson.....	J. R. Alexander.....	Salt Lake City, Utah.
Repairs to canals.....	Montrose, Colo.....	C. B. Elliott.....	Engineer.....	do.....	do.....	do.
Upper Snake River Storage ¹	Ashton, Idaho.....	H. A. Parker.....	Constr. engr.....	Emmanuel V. Hillius.....	B. E. Stoutemyer.....	Portland, Oreg.
Vale.....	Yakima, Oreg.....	C. C. Ketchum.....	Superintendent.....	.....	do.....	do.
Yakima.....	Yakima, Wash.....	J. S. Moore.....	do.....	Philo M. Wheeler.....	do.....	do.
Roza div.....	do.....	Chas. E. Crownover.....	Constr. engr.....	do.....	do.....	do.
Yuma.....	Yuma, Ariz.....	R. C. E. Weber.....	Superintendent.....	Noble O. Anderson.....	R. J. Coffey.....	Los Angeles, Calif.

¹ Acting.

² Non Federal

³ Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division).....	Lower Powder River irrigation dist.....	Baker, Oreg.....	A. J. Ritter.....	President.....	F. A. Phillips.....	Keating.
Bitter Root.....	Bitter Root irrigation district.....	Hamilton, Mont.....	N. W. Blindauer.....	Manager.....	Elsie H. Wagner.....	Hamilton.
Boise.....	Board of Control.....	Boise, Idaho.....	Wm. H. Tuller.....	Project manager.....	F. J. Hanagan.....	Boise.
Grand Valley, Orchard Mesa.....	Orchard Mesa irrigation district.....	Grand Jctn., Colo.....	Charles Tharp.....	Superintendent.....	C. J. McCormick.....	Grand Jctn.
Huntley.....	Huntley irrigation district.....	Ballantine, Mont.....	E. E. Lewis.....	Manager.....	H. S. Elliott.....	Ballantine.
Klamath, Langell Valley.....	Langell Valley irrigation district.....	Bonanza, Oreg.....	Chas. A. Revell.....	do.....	Chas. A. Revell.....	Bonanza.
Klamath, Horsely.....	Horsely irrigation district.....	do.....	Henry Schmor, Jr.....	President.....	Dorothy Evers.....	do.
Lower Yellowstone.....	Board of Control.....	Sidney, Mont.....	Axel Persson.....	Manager.....	O. B. Patterson.....	Sidney.
Milk River: Chinook div.....	Alfalfa Valley irrigation district.....	Chinook, Mont.....	A. L. Benton.....	President.....	R. H. Clarkson.....	Chinook.
do.....	Fort Belknap irrigation district.....	do.....	H. B. Bonbright.....	do.....	L. V. Bogy.....	do.
do.....	Harlem irrigation district.....	Harlem, Mont.....	Thos. M. Everett.....	do.....	Geo. H. Tout.....	Harlem.
do.....	Paradise Valley irrigation district.....	Zurich, Mont.....	D. V. Norton.....	Superintendent.....	J. F. Sharpless.....	Zurich.
do.....	Zurich irrigation district.....	Harlem, Mont.....	J. H. Birdwell.....	Manager.....	H. M. Montgomery.....	do.
Minidoka: Gravity.....	Minidoka irrigation district.....	Rupert, Idaho.....	Frank A. Ballard.....	do.....	W. C. Trathen.....	Rupert.
Pumping.....	Burley irrigation district.....	Burley, Idaho.....	Hugh L. Crawford.....	do.....	Frank O. Redfield.....	Burley.
Gooding.....	Amer. Falls Reserv. Dist. No. 2.....	Gooding, Idaho.....	S. T. Baer.....	do.....	P. T. Sutphen.....	Gooding.
Newlands.....	Truckee-Carson irrigation district.....	Fallon, Nev.....	W. H. Wallace.....	do.....	H. W. Emery.....	Fallon.
North Platte: Interstate div.....	Pathfinder irrigation district.....	Mitchell, Nebr.....	T. W. Parry.....	do.....	Flora K. Schroeder.....	Mitchell.
do.....	Gering-Fort Laramie irrigation dist.....	Gering, Nebr.....	W. O. Fleenor.....	Superintendent.....	C. G. Klingman.....	Gering.
do.....	Goshen irrigation district.....	Torrington, Wyo.....	Bert L. Adams.....	do.....	Mary Harrach.....	Torrington.
do.....	Northport irrigation district.....	Northport, Nebr.....	Mark Iddings.....	do.....	Mahel J. Thompson.....	Bridgeport.
Okanogan.....	Okanogan irrigation district.....	Okanogan, Wash.....	Nelson D. Thorp.....	Manager.....	Nelson D. Thorp.....	Okanogan.
Salt Lake Basin (Echo Res.).....	Weber River Water Users' Assn.....	Ogden, Utah.....	D. D. Harris.....	do.....	D. D. Harris.....	Ogden.
Salt River.....	Salt River Valley W. U. A.....	Phoenix, Ariz.....	H. J. Lawson.....	Superintendent.....	F. C. Henshaw.....	Phoenix.
Shoshone: Garland div.....	Shoshone irrigation district.....	Powell, Wyo.....	F. E. Martin.....	President.....	Geo. W. Atkins.....	Powell.
do.....	Deaver irrigation district.....	Deaver, Wyo.....	Floyd Lucas.....	Manager.....	Lee N. Richards.....	Deaver.
Strawberry Valley.....	Strawberry Water Users' Assn.....	Payson, Utah.....	William Grotegut.....	President.....	E. G. Breeze.....	Payson.
Sun River: Fort Shaw div.....	Fort Shaw irrigation district.....	Fort Shaw, Mont.....	E. J. Gregory.....	Manager.....	E. J. Gregory.....	Fort Shaw.
do.....	Greenfields irrigation district.....	Fairfield, Mont.....	A. W. Walker.....	do.....	H. P. Wangen.....	Fairfield.
Umatilla: East div.....	Hermiston irrigation district.....	Hermiston, Oreg.....	E. D. Martin.....	do.....	Enos D. Martin.....	Hermiston.
do.....	West Extension irrigation district.....	Irrigon, Oreg.....	A. C. Houghton.....	do.....	A. C. Houghton.....	Irrigon.
Uncompahgre.....	Uncompahgre Valley W. U. A.....	Montrose, Colo.....	Jesse R. Tompson.....	Acting supt.....	J. Frank Anderson.....	Montrose.
Yakima, Kittitas div.....	Kittitas reclamation district.....	Ellensburg, Wash.....	W. V. Russell.....	Manager.....	G. L. Sterling.....	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15.....	Denver, Colo.....	P. J. Preston.....	Senior engineer.
Columbia Basin Economic Survey.....	Coulee Dam, Wash.....	F. A. Banks.....	Construction engineer.
Gallatin Valley.....	Bozeman, Mont.....	R. R. Robertson.....	Engineer.
Colorado-Big Thompson.....	Denver, Colo.....	P. J. Preston.....	Senior engineer.
Island of Molokai.....	Honolulu, Hawaii.....	Hugh Howell.....	Engineer.
Weiser-Payette.....	Boise, Idaho.....	J. A. Keimig.....	Do.

SALLIE A. B. COE, Editor.



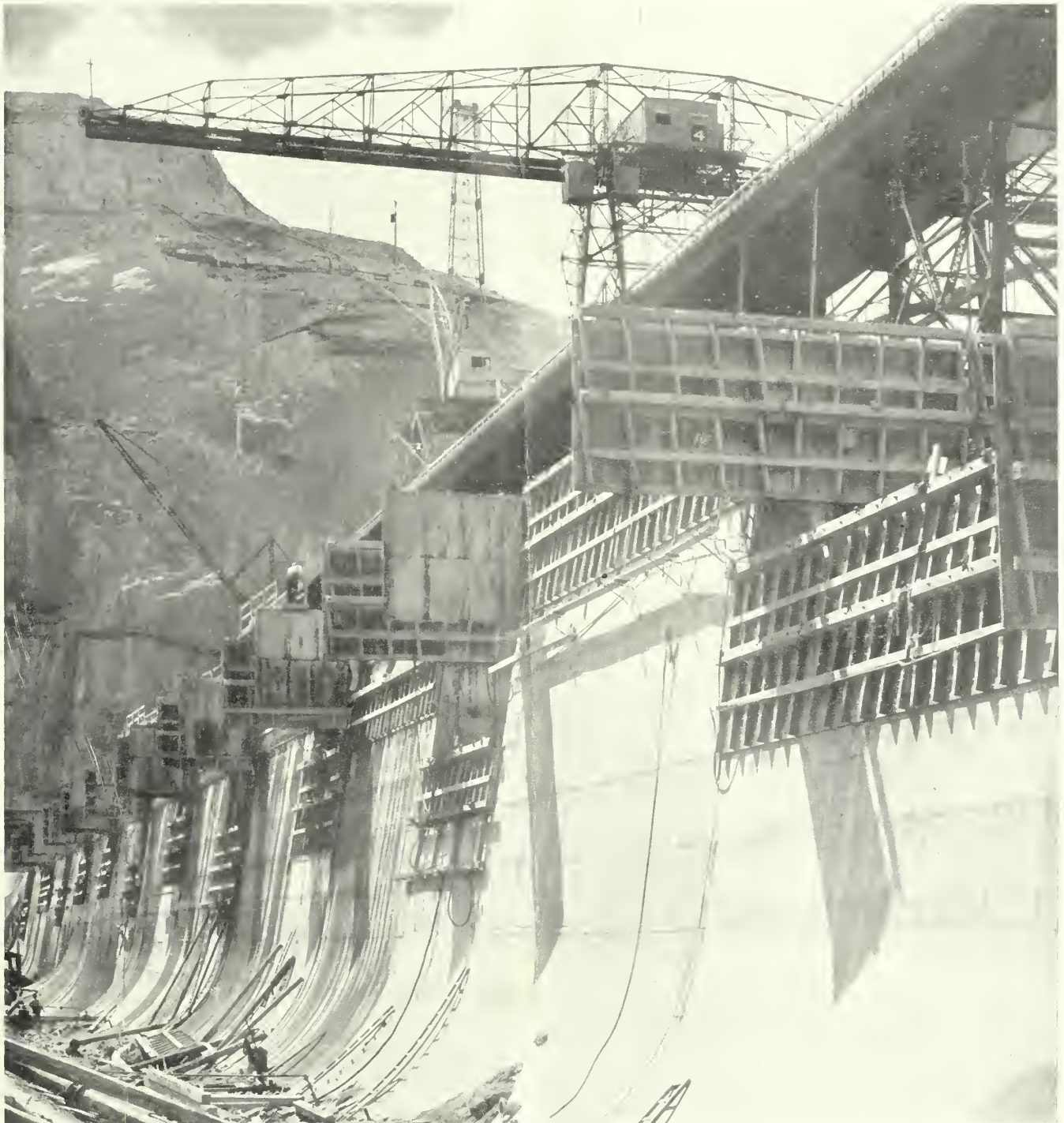
OUTLET WORKS OF THE NEWLY COMPLETED RYE PATCH DAM, NEVADA, THROUGH WHICH THE CONTROLLED WATERS OF THE HUMBOLDT RIVER ARE RELEASED FOR USE BY IRRIGATORS BELOW.

THE RECLAMATION ERA

VOL. 26, NO. 9

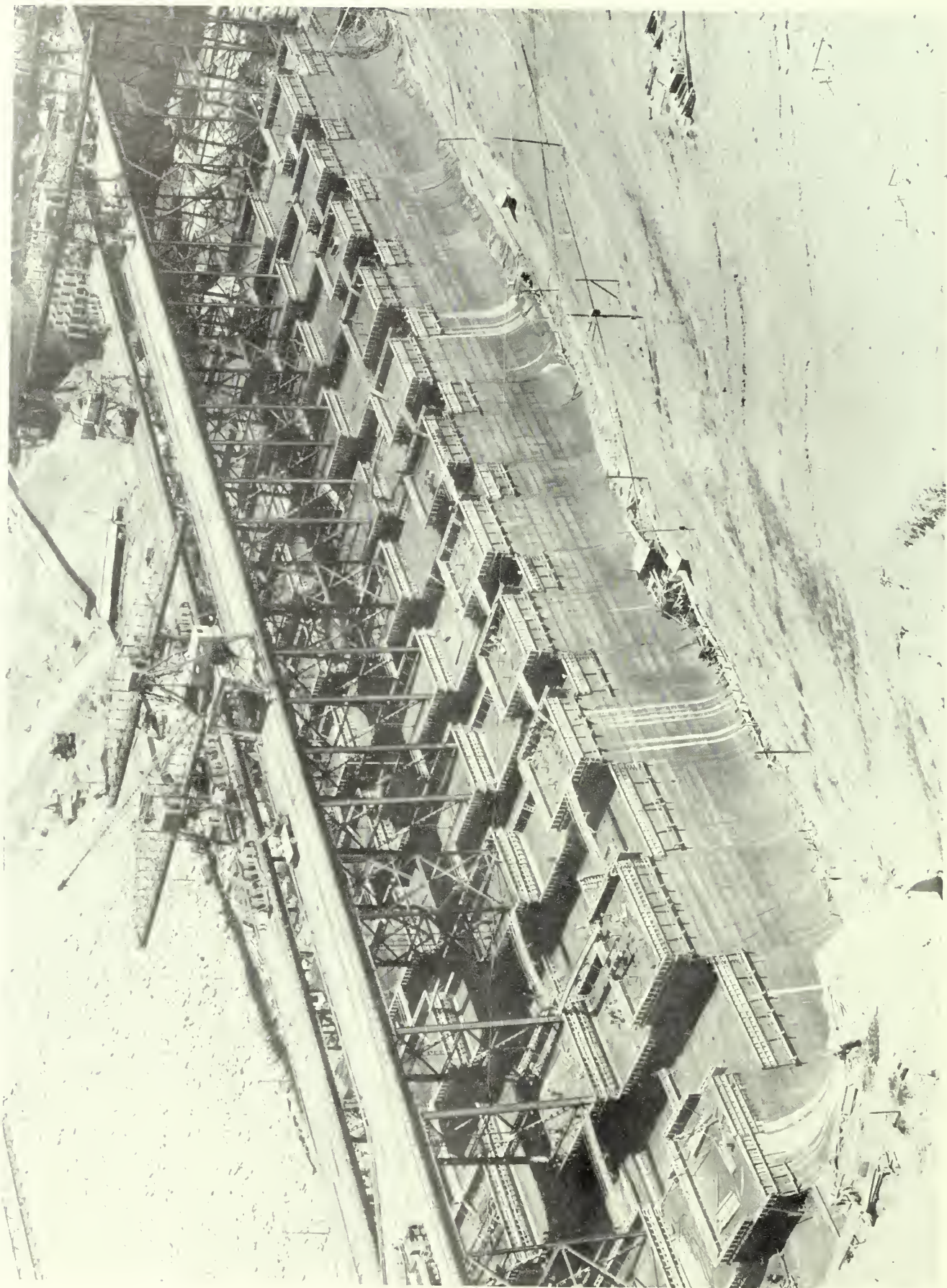


SEPTEMBER 1936



GRAND COULEE DAM. COLUMBIA BASIN PROJECT, WASHINGTON

DETAIL VIEW OF THE UPSTREAM FACE OF THE DAM, SHOWING THE FILLET SECTION AT THE BASE



LOOKING NORTH ACROSS GRAND COULEE DAM, SHOWING THE UPSTREAM FACE
THE MAXIMUM HEIGHT OF CONCRETE POURS IS AT ELEVATION 945

THE RECLAMATION ERA

Issued monthly by the DEPARTMENT OF THE INTERIOR, Bureau of Reclamation, Washington, D. C.

Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 9



SEPTEMBER 1936

Importance of Water Conservation

ON MONDAY, August 5, 1889, Maj. John Wesley Powell, Director of the Geological Survey, stood before the North Dakota Constitutional Convention in some embarrassment, as he confessed, at having to make an address. But the words he spoke when read today, 47 years later, seem to have had a prophetic ring. He read in history what the then young West would face in the future. His address follows:

"Mr. President, and gentlemen of the convention: I am not accustomed to speak on occasions like this. In the first place I never made a political speech in my life and it seems to me that I am almost out of place here. When I was a boy they used to bring to the table the dinner, and the finest things came at the last part of the feast, but somehow in the high falutin' dinners they give now they fill the people with wines and viands of many kinds and then end with a strong cheese and hard crackers. I think that is what your president is doing today. He wants to top off with something very plain.

"I know nothing about the silver question but I have studied somewhat the subject of irrigation. I was a farm boy and have been engaged in farming and have spent a good deal of time studying many of the problems which interest your people. I remember in my childhood my father moving into Illinois. Then I remember when Minnesota and Wisconsin were making States, and now you are making two States of Dakota. All these years I have watched the march of progress across the continent and have seen all the western half of America grow up as it were from a wilderness. Of the questions that practically interest the people who are engaged in farming I have made some study, and in my remarks I will confine myself wholly to some practical questions relating to irrigation, and then I will show what the constitutional convention should have to say about them.

"GEOGRAPHICAL POSITION

"The State of North Dakota has a curious position geographically in relation to agriculture. The eastern portion of the State has sufficient rainfall for agricultural purposes; the western part has insufficient rainfall, and the western



Major John Wesley Powell

portion is practically wholly dependent on irrigation. In the western portion all dependence on rains will ultimately bring disaster to the people. They are unwilling yet, a good many of them, to admit it, but the study of the physical conditions which prevail in this country and the application of the knowledge which has been given to mankind through the study of these same problems in Europe and Asia and Africa all prove this one fact—that in the western portion of this State they will have to forever depend on artificial irrigation for all agriculture. In the eastern portion they may depend upon the storms that come

from the Heavens and there is a middle belt between the two regions which is of very great interest. They will soon learn in the western portion to depend upon irrigation and provide themselves with agencies for the artificial fructifying of the soil with water. In the eastern part they will depend on the rainfall, and in the middle portion they will have a series of years when they will have abundant crops; then for 2 or 3 years they will have less rainfall and there will be failure of crops and disaster will come on thousands of people, who will become discouraged and will leave. Up and down, the temperature of agriculture will rise and fall with the seasons in this manner and the only practical thing to do is to look the thing squarely in the face and remember that in middle Dakota agriculture will always be liable to meet with failure unless you provide against it. That is the history of all those who live on the border between humid and the arid lands. Years will come of abundance and years will come of disaster, and between the two the people will be prosperous and unprosperous, and the thing to do is to look the question squarely in the face and provide for this and for all years.

"UNALTERABLE CLIMATE

"You hug to yourselves the delusion that the climate is changing. This question is 4,000 years old. Nothing that man can do will change the climate. A long succession of years will give you the same amount of rainfall that any other succession of the same length will give you. The settlement of the country, the cultivation of trees, the building of railroads—all these matters will have no influence upon your climate. You may as well not hope for any improvement in this direction. There's almost enough rainfall for your purposes, but one year with another you need a little more than you get. It is flowing past

you in the rivers. Storms come and spread over the land and the water runs off into the rivers and is carried into the waters of the Gulf of Mexico. There are waters rolling by you which are quite ample to redeem your land and you must save these waters. I say it from the standpoint of history of all such lands.

"Civilization was born in arid lands. Taking the world at large, most of the agriculture of the world has depended on irrigation for more than 4,000 years. The largest populations have depended on irrigation, so it is an old problem. And it has been solved time and again so that it may be said that there is nothing to learn. All you have to do is to learn the lessons already taught by history, and that is that in those lands you have to depend on placing the water on the soil, and when you have learned to do that you are in no unfavorable condition. In the humid region the storms come and the fields receive the gentle shower, but frequently just before the harvest comes a great storm devastates it all. In this arid region, if you depend on artificial irrigation, you are independent of storms. The waters that are brought on the lands by irrigation are sources of fertilization beyond all other sources. There are fields in the eastern

world that have been cultivated for 4,000 years—where water was brought on the land to irrigate and all other fertilization is unnecessary. Now in all lands of high culture, where fields are irrigated, they are ceasing to use any other fertilizer. In France, where they are irrigating their lands, they have commenced a system in every county and township—the same in Spain and Germany. They find that they must pour the waters of their streams on their lands.

"CONSERVE YOUR STREAMS

"As members of this convention, that is what I have to say to you. Not being a public man it may be considered a little presumptuous for me to say—in Dakota you are to depend hereafter in a great measure on the running stream—in a small part on your artesian wells, and in part on the storage of the storm waters. The chief source will be the running streams. These waters are to be preserved and stored during the season of nonirrigation. There are, say, 2 months of the year when you need to irrigate, and 10 months when you should store the water. All other wealth falls into insignificance compared with that which is to come from these lands from the pouring on them of the running streams

of this country. Don't let these streams get out of the possession of the people. If you fail in making a constitution in any other respect, fail not in this one. Take lessons from California and Colorado. Fix it in your constitution that no corporation—no body of men—no capital can get possession and right of your waters. Hold the waters in the hands of the people. Think of a condition of affairs in which your agriculture—which you have to depend on largely—depending on irrigation, is at the mercy of 20 companies who own all the water. They would laugh at ownership of land when the value is in the water. You should provide in the constitution which you are making, that the water which falls from the heavens and rolls to the sea, down your great rivers—that water should be under the control of the people, subject always to the will of the people; that property in water should be impossible for individuals to possess. You should forbid the right to acquire property in water. The property should be in the land, and the right to the water should inhere in the land and no company or individual should have property in the running streams. Such a provision will prevent your great agricultural sources falling into the hands of the few."

Early Ginning of Cotton on the Yuma Project

By R. C. E. Weber, Superintendent, Yuma, Arizona

THE first bale of the 1936 cotton crop on the Yuma project was ginned July 21. It is believed that this constitutes the earliest "first bale" in the history of the cotton industry at Yuma, being 8 days ahead of last season's initial bale.

The cotton, which was of the Stoneville variety, was raised in the valley division by Fred Blohm and L. P. Barkley on land which had been idle for a

number of seasons and in connection with which the water-right had been canceled in 1928 and on which Messrs. Blohm and Barkley, who recently acquired ownership, filed a new water-right application early this year.

The first bale was ginned at the gin of the Yuma County Farmers' Cooperative Association, a local cooperative engaged in ginning and marketing cotton, located at Somerton. It was brought to Yuma,

placed on display at the corner of Main and Second Streets, and auctioned off on July 25, at a price of 15.19 cents per pound. It was purchased by L. C. Perkins, local manager for Anderson-Clayton & Co., buyers operating extensively in the purchase of cotton throughout the Southwest. In addition to the price of 15.19 cents per pound, which represented a premium of about

(Continued on p. 218)



Left: Field of cotton with prospects of nearly 2 bales per acre; right: a well developed cotton plant in bloom and bud.

The Yuma County Farmers' Marketing Association

By Henry Frauenfelder, President, Yuma County Water Users' Association

SINCE the beginning of the Yuma project, various cooperative marketing associations have been organized, most of which were comparatively short lived. However, one present cooperative, the Yuma County Farmers' Marketing Association, has functioned satisfactorily and grown consistently ever since its formation 14 years ago. The success of this particular organization is due to sound, intelligent management and to the determination of a group of farmers to stick together in an effort to market some of their products cooperatively.

As set out in the bylaws, the purposes of the association are: "to promote, foster, and encourage the intelligent and orderly marketing of agricultural products through cooperation and to conduct a nonprofit cooperative corporation for the sale of alfalfa seed, Bermuda grass seed, hay, straw, honey, wheat, barley, oats, grains, sorghums, and flax; to clean and store seed; to provide its members with necessary agricultural supplies, machinery and equipment; and to exercise all of the powers conferred upon a cooperative marketing association by the cooperative marketing act of the State of Arizona."

When originally organized, the association was launched under the sponsorship of the Yuma County Farm Bureau and was the direct outgrowth of several previous attempts to form a similar cooperative. In July 1935 it became necessary to reorganize the association and effect a separation from the Farm Bureau in order to make this cooperative association eligible for loans from the Federal Bank for Cooperatives, located at Berkeley, Calif. Ordinary operations of the association, which include making advances to growers on recleaned seed, are financed with money borrowed on liberal terms from a local bank. It is anticipated, however, that it may become necessary in the future to borrow from the Federal Bank for Cooperatives when principal payments on our warehouse and processing plant become due.

BUSINESS OPERATIONS

The business of the association is handled in four departments—marketing, cleaning, storage, and supplies. All agricultural supplies, machinery, and equipment purchased by the association for resale to its members are sold for cash at the current market prices charged by others handling similar commodities in Yuma. Cleaning and storage is charged at current rates. Net earnings or savings

made by the various departments are distributed to member patrons of the respective departments in the form of credits in the revolving fund.

The revolving fund is perhaps the most important feature of our bylaws. As a partial explanation of the revolving fund,

(Continued on p. 217)



1. Threshing seed on J. C. Hunter ranch, Yuma.
2. Yuma County Farmers' Association warehouse.
3. Cutting alfalfa seed.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

SEPTEMBER 1936

Power Plant at Boulder Dam Commences Operations

On September 11 President Roosevelt will throw the switch at the conclusion of an address to the World Power Conference in Washington which will start the generation of power at Boulder Dam, thus adding another historic date to the history of the construction of the Boulder Canyon project. The President's action will be the signal to turn the water into the first turbine to go into operation in the Boulder Dam power house and will open the 12 great needle valves in the canyon wall outlets below the dam, thus creating a spectacular waterfall 13 feet higher than Niagara.

Six streams of water of approximately 5,000 cubic feet a second will issue from either side of the Black Canyon gorge 180 feet above the power house tail-race. These streams of water will meet at mid-stream. Only six of the valves have been in operation previously, and only on one side of the canyon.

It is anticipated that motion and still pictures will be taken on this occasion, and a later issue of the Era will carry a photograph. A national broadcast of

the ceremony will be made to include the President's address at Washington to the delegates to the World Power Conference, which will begin about 3 o'clock eastern standard time, the scene to shift quickly to the Boulder Dam power house to pick up a description of the activities of starting the generators in motion. The broadcast contemplates an interview, during which Ralph Lowry, construction engineer of the Bureau of Reclamation in charge at Boulder Dam, will explain the significance of the commencement of generation of power.

Delegates to the World Power Conference in Washington will experience the word picture to be presented of the activities at Boulder Dam, and an audience at Boulder Dam will hear the President's speech and be given a word picture of activities in Washington in Constitution Hall during a session of the World Power Conference.

It is particularly appropriate that this initial generation of power at Boulder Dam should be timed to take place when delegates to the World Power Conference are in session in the Capital City of our Nation.

President Roosevelt, in extending an invitation to the nations of the world to take part in this conference in the City of Washington September 7 to 12 inclusive, stated:

"The subject chosen for the World Power Conference is one of wide appeal, and because of that I hope there will be a substantial response and a large attendance from all parts of the world. I am sure that we here will participate wholeheartedly.

"Besides study and discussion of the important problem of power in its various aspects, delegates and their families and friends will have an opportunity to become better acquainted with us. I hope those who come will have time in which to see the scenic wonders of our land and view our scientific and industrial achievements.

"The United States, as host for the Third World Power Conference and the

Second Congress of the International Commission on Large Dams, assures its guests of a sincere welcome."

Following the conference at Washington, it is anticipated a number of the group will make a tour of the United States, and, of course, each Reclamation official in the West should act as host to any of the delegates visiting any of our projects. We are happy the Boulder Dam celebration is to play such a prominent part in the convention, and we are glad delegates to the convention are prompted to visit our territory. A welcome awaits them.

Arizonans' Interest in Boulder Dam Power

Arizona citizens have organized a group known as the Boulder Dam Power Transmission Association of Arizona, with the intention of promoting the distribution of Arizona's share of power to be generated at Boulder Dam.

Like the State of Nevada, Arizona was assigned 18 percent of the power generated at the dam, but until this time no serious efforts have been made for the use of this energy by the State.

The new association has headquarters at 402 Professional Building, Phoenix, Ariz.

Albert Stetson, executive secretary of the association, said in a recent letter to the Acting Commissioner, "This association has been formed for the purpose of arousing the people of this State to the great benefits that would result from transmitting Boulder Dam power to every section of the State. We have gone into the matter rather extensively, have sought wise counsel, have gone to authoritative sources for information, and are satisfied that Arizona can and should use this power to build up mining, agriculture, manufacturing, and industry, and speed up the growth of population in all areas."

(Cut along this line)

COMMISSIONER,

Bureau of Reclamation,
Washington, D. C.

(Date) _____

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name) _____

(Address) _____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Reclamation Exhibits Now on Display

The demand for reclamation exhibits has increased until we have at the present time a number of major exhibits installed. These include one at the new National Museum in Washington, D. C., made up of transparencies and bromide enlargements, giving a picture of our construction activities and the results in irrigated-farm development.

The California-Pacific Exposition being held at San Diego, Calif., closes on September 9. The Bureau was represented by typical reclamation scenes made into

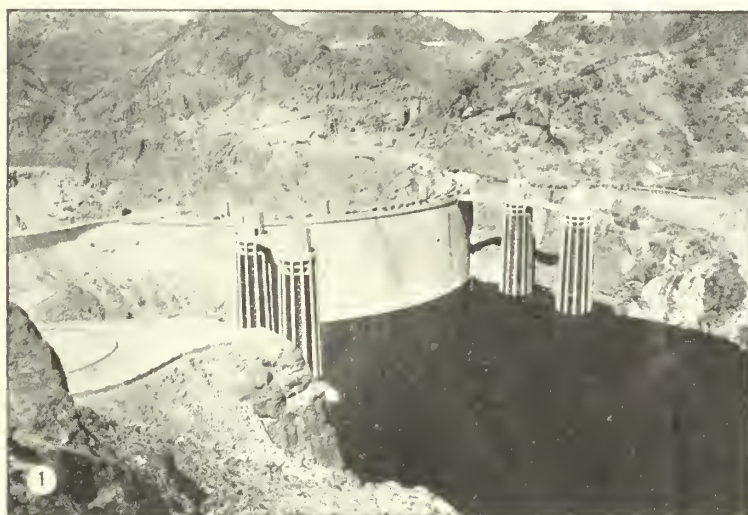
transparencies and attractively mounted in panel form.

Another attractive reclamation exhibit was installed at the Texas Centennial being held at Dallas, Tex., June 6 to November 29.

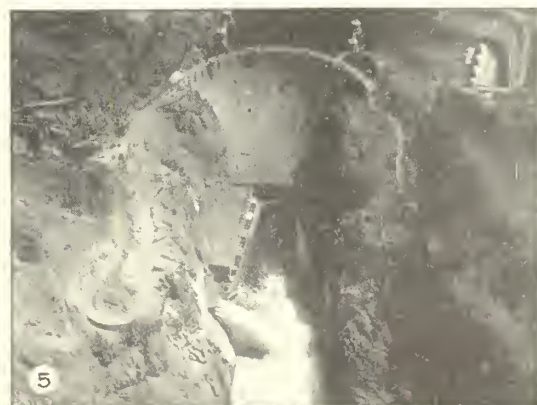
Probably the exhibit which will get a great deal of attention will be on display at the Mayflower Hotel, Washington, D. C., from September 7 to 12, inclusive, on the occasion of the Third World Power Conference and the Second Congress on Large Dams. This exhibit will include models, transparencies, and bromide enlargements. A feature of the exhibit will be a series of panels which, when joined together, will give a running story of

the construction of Boulder Dam. The scenes are created by freehand drawing and then colored in oil. These panels will form a border around the top of the reclamation exhibit booth. A model of the Nevada wing of the Boulder Dam powerhouse and a model made to proper scale of Boulder Dam, the powerhouse, intake towers, the spillways, and tunnels will be another attraction.

From September 22 to 24, inclusive, we will install an engineering exhibit in the Department of Commerce Building during sessions of the Upstream Engineering Conference. This will be educational in the field of Federal reclamation, illustrating construction work on, and benefits of, Federal irrigation projects.



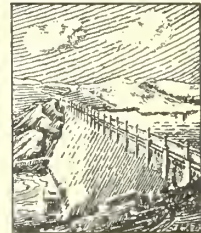
1. Upstream from Arizona rim
2. Downstream. Elevation of lake surface 1020 feet; roof of powerhouse 725 feet
3. Crest of dam seen through cantilever towers on roof of the Nevada wing of powerhouse
4. Air view of completed project
5. Downstream face from 2,000 feet, showing powerhouse, outlet works, and the Nevada spillway



Boulder Dam, Boulder Canyon Project, Arizona-Nevada.



ENGINEERING



Hydroelectric Power Plants—Boulder and Others

(Continued from the August issue)

Canadian plants.—Canada has several large power plants, 14, each with an ultimate capacity of over 200,000 horsepower. It is interesting to note that the United States has 24 plants over 200,000 horsepower, each, including Boulder and Grand Coulee. However, considering installed capacity Canada has 10, while we have 8 plants in which the machinery now installed is rated at 200,000 horsepower or over.

The Niagara-Queenston plant of the Hydro-Electric Power Commission of Ontario, on the Niagara River, has an installed capacity of 560,000 horsepower and is the largest in Canada. The equipment comprises ten 52,500 to 58,000-horsepower Francis type vertical turbines and ten 45,000 to 55,000 kilovolt-ampere standard-type generators. The intake is located 2 miles above Niagara Falls and water is conveyed to the powerhouse through 12¾ miles of canal, of which the first 4¼ miles utilizes the lower part of the Welland River and the remaining 8½ miles is excavated canal, of which 7 miles is in rock. The penstock is a 16-foot diameter steel pipe, 385 feet long, encased in concrete. On the St. Lawrence River, the Beauharnois 530,000-horsepower plant now has five of ten 53,000-horsepower units installed, and has awarded contracts for the remaining five. The diameter of one of the generators is 40 feet and of the turbine runner 19 feet. When the entire stream flow is utilized it is estimated that 2,000,000 horsepower can be developed at this site. Water is conveyed to the Beauharnois plant through a combined ship and power canal 3,000 feet wide, which provides for 27-foot navigation to the powerhouse near Melocheville, on Lake St. Louis, and is a part of the proposed Great Lakes-to-the-Sea Waterway.

In British Columbia a 540,000-horsepower plant is being constructed on the Bridge River by the British Columbia Power Corporation, Ltd. The Isle Maligne plant of the Duke-Price power interests on the Saguenay River in Quebec now has 11 generating units installed with a total capacity of 495,000

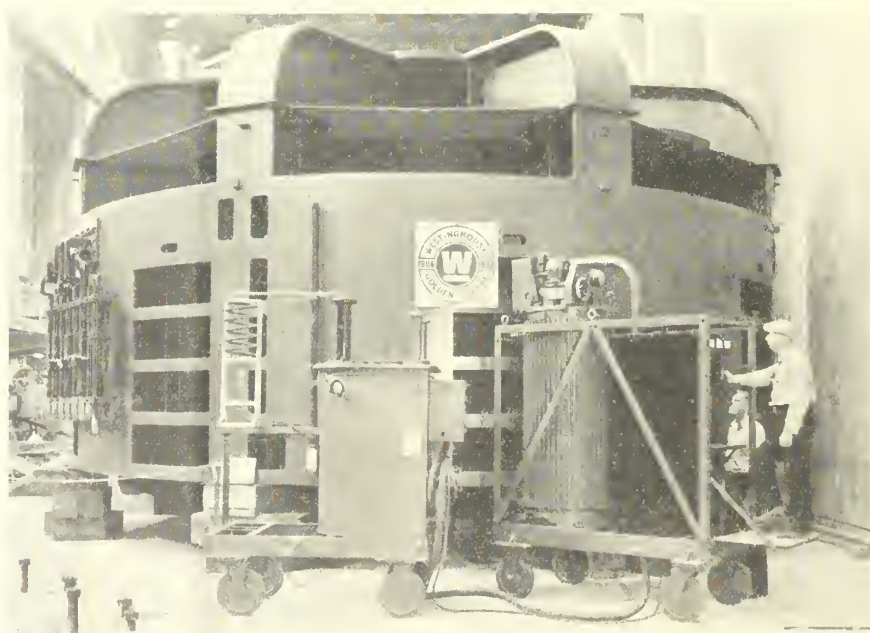
horsepower, and an additional unit is provided for which will bring the ultimate capacity to 540,000 horsepower.

The Canyon plant on the Abitibi River in Ontario boasts the largest turbines in Canada, 66,000-horsepower, and will eventually have five of these units. The Chute, a Caron plant in Quebec, on the Saguenay River, has 56,250 kilovolt-ampere generators. Ultimate development on the Saguenay, is 1,260,000 horsepower and includes a canal 2 miles long from the Chute a Caron dam to the Shipshaw station where 640,000 horsepower will be developed, or a total of 900,000 horsepower for the two stations.

On the Gatineau River in Quebec, the Gatineau Power Co. has three major plants—Paugan Falls 238,000 horsepower, Chelsea 170,000 horsepower, and Farmers Rapids 120,000 horsepower. From Paugan Falls power is transmitted over a 220,000-volt line a distance of 230 miles to Toronto.

American plants.—Outstanding among the power plants in the United States is the Wilson plant, familiarly known as

Muscle Shoals, on the Tennessee River near Florence, Ala. Only 8 of the 18 units planned are now installed giving a present capacity of 260,000 horsepower (4—30,000 and 4—35,000) compared with ultimate capacity of 610,000 horsepower (4—30,000 and 14—35,000). The Federal Government in 1918 began construction of the Wilson Dam to provide adequate power for the production of ammonium nitrate, used in making explosives, so that in case of prolonged warfare, the supply of coal could be conserved. With the signing of the armistice, the nitrate plants in the vicinity of Muscle Shoals were closed, but completion of the dam and power plant was authorized by Congress as an economic measure, and also a safeguard for the national defense. The cost of the entire project with present power installation is \$47,000,000 of which \$37,000,000 is chargeable to power and \$10,000,000 to navigation. With the creation of the Tennessee Valley Authority in May 1933, the Wilson plant was turned over to the Authority for operation.



Westinghouse 82,500 Kv. a stator shown with generator testing set used to put artificial load on coils.

The largest plant in this country is that of the Niagara Falls Power Co. on the Niagara River, which has an installation of 19 units with a capacity of 452,500 horsepower. Three of the turbines are rated at 70,000 horsepower. The city of Seattle, Wash., has installed in its Diablo plant on the Skagit River, two 83,000-horsepower turbines manufactured by the S. Morgan Smith Co. of York, Pa., and two 67,000 kilovolt-ampere, Westinghouse generators. Prior to Boulder these units were the largest manufactured to date for an American plant, and the turbines were also the largest in the world equaling in capacity the wheels in the Dnieprostroy plant in Russia.

The Big Creek-San Joaquin River development of the Southern California Edison Co. cost \$375,000,000 and the entire project develops 1,407,000 horsepower. The system has 18 powerhouses, with 86 tunnels, one of which (Florence Lake) is 15 by 15 feet in section and 13 miles long, driven under the Sierras and mostly through solid granite. Big Creek 2-A plant has a normal net head of 2,290 feet. The Balch plant of the San Joaquin Light & Power Corporation near Fresno, Calif., has a head of 2,243 feet. The penstock is 4,882 feet long, with diameters decreasing in 4-inch steps from 60 inches at the top to 40 inches near the powerhouse. Banded pipe, consisting of forge-welded core on which steel bands were shrunk on, was used for the first time in this country.

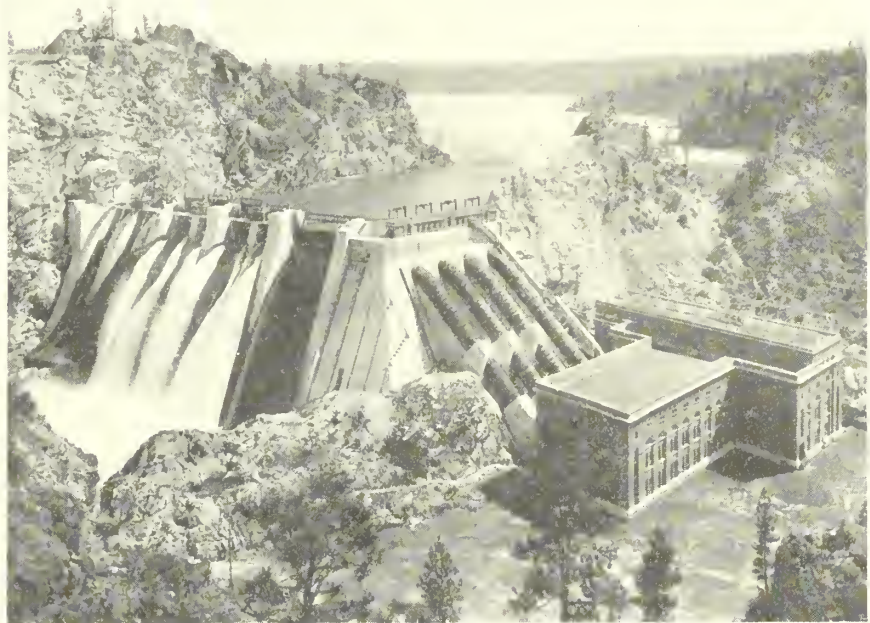
On the lower 30-mile section of the Susquehanna River, before the stream enters into Chesapeake Bay, are to be found three large power plants—the 378,000-horsepower (ultimate 594,000) Conowingo plant in Maryland; 135,000-horsepower McCalls Ferry (Holtwood) and 255,000-horsepower (ultimate 510,000) Safe Harbor plants, both in Pennsylvania. These three plants utilize 225 feet of fall in the river between Columbia, Pa., and the mouth of the Susquehanna at Havre de Grace, Md. Power is distributed to Philadelphia, Baltimore, Washington, and other places, while some is used for Pennsylvania Railroad electrification. The Conowingo generators are 37 feet in diameter. However, these are exceeded in size by those in the Ariel plant of the Inland Power & Light Co. in Washington, which have a diameter of 42 feet.

PROGRESS IN INDUSTRY

The hydroelectric industry is 45 years old and the first plant with transmission was built at Lauffon, Germany, in 1891. The first installation of large units in this country was at Niagara Falls in 1895, when three 5,000-horsepower units were installed. Twenty-nine years later, in

1924, 70,000-horsepower units were installed in the same plant. In 1932 two turbines were manufactured by the S. Morgan Smith Co. for the Diablo plant in Washington rated at 83,000 horsepower under 310-foot head. The guaranteed performance of these wheels at maximum head of 327 feet was 90,700 horsepower. Today 115,000-horsepower units are being installed in the Boulder plant and 140,000-horsepower units are planned for Grand Coulee. Thus today we are manufacturing turbines with 23 times the capacity of those built in 1895. General Electric has manufactured generators ranging from 30 kilovolt-

six 42,500-horsepower Kaplan adjusted-blade propeller-type turbines, under a 55-foot head, which are the highest-powered units of this type in the world. Three were manufactured by the S. Morgan Smith Co. of York, Pa., and three by the I. P. Morris division of the Baldwin-Southwark Corporation. The Smith-Kaplan turbines are described as propeller-type wheels with blades adjusted automatically as the load changes, to maintain high efficiency over a wide range of load. The runners of the Safe Harbor wheels are 18 feet 4 inches in diameter and discharge about 9,000 second-feet at full gate and normal head.



Long Lake power dam of the Washington Water Power Company, Spokane River, Washington, 25 miles northwest of Spokane.

ampere to the 82,500 kilovolt-ampere machines for the Boulder plant. The first Niagara Falls power was transmitted a few miles at 11,000 volts. Today the city of Los Angeles is constructing two transmission circuits 265 miles in length from the Boulder Dam to Los Angeles to operate at 287,500 volts, the highest transmission voltage in the United States.

LARGE UNITS OF VARIOUS TYPES

In the Ariel plant of the Inland Light & Water Co. on the Lewis River in Washington is found one of the largest overhung-type generators. It is a 56,250 kilovolt-ampere unit, 60-pole, 120 revolutions per minute, 3-phase, 60-cycle, 13,800-volt, 42 feet in diameter, and was manufactured by the General Electric Co.

The Safe Harbor plant on the Susquehanna River in Pennsylvania has

The largest Kaplan turbines in Europe are 35,800-horsepower wheels in the Ryburg-Schwoerstadt plant on the Rhine in Germany. The plant has four turbines of this type manufactured by Voith, with a total capacity of 143,200 horsepower. These turbines were designed for 44,000 horsepower at full gate and 37.7 feet head. The runners are 23 feet in diameter.

In a description of plants in Power it was stated that the largest impulse units are the two 56,000-horsepower machines in the Big Creek 2-A plant of the Southern California Edison Co. that operate under an effective head of 2,290 feet. These wheels on test developed 70,000 horsepower and are of the double-runner overhung type, with one nozzle per wheel. The largest impulse wheels in Europe are said to be those in the Mese plant on the Truzzo River, in Italy, five

35,000-horsepower units operating under a 2,500-foot head. The same publication lists 1,152 feet as the highest head for a Francis type turbine, which is the head under which two 5,000-horsepower units of the Zappello plant in Italy operate. The four 40,500-horsepower turbines in the Bringhausen plant in Germany, which operate under an effective head of 975 feet, are outstanding among wheels of the Francis reaction type. The four 50,000-horsepower turbines now installed in the Galletto plant are the most powerful vertical Francis turbines outside of the United States; they were manufactured by Escher-Wyss. In the Oak Grove plant of the Portland Pacific Northwest Public Service Co. in Oregon are two 40,000-horsepower Francis type units, which operate under a head of 850 feet, highest in the United States for this type

of wheel. The Waterville hydroelectric development on the Big Pigeon River in North Carolina has a head of 755 feet.

The two Francis type turbines manufactured by the S. Morgan Smith Co. for the Diablo plant of the city of Seattle are each guaranteed to develop 90,700 horsepower under a 327-foot head. They were at the time the most powerful turbines yet manufactured for an American plant, and are only surpassed by the 115,000-horsepower units of the Boulder plant. The ratio of total length of penstock to operating head at the Diablo plant is high, about 10 to 1, and, in order to insure close regulation without excessive pressure surges, it was necessary to install automatically operated relief valves and a surge tank. The relief valve functions to relieve the pressure rise when load is thrown off and the

surge tank functions to supply make-up water for a load on demand until the velocity of the water in the long penstock reaches the rate of turbine demand and equilibrium is again established. The turbine spiral casing or scroll is 11 feet 6 inches in diameter at its inlet and is composed of 11 cast-steel sections suitably flanged for bolting together. This casing weighs approximately 375,000 pounds.

Other than the two 83,000-horsepower turbines manufactured for the Diablo plant and the three 70,000-horsepower turbines installed in the Niagara Falls plant in 1924, the Spier Falls plant of the New York Power & Light Corporation on the Hudson River, 12 miles north of Glens Falls, claims one of the largest wheels in this country. The wheel is a Francis-type, vertical-shaft turbine rated

Hydroelectric Power Plants

Plant	Location	River	Owner	Capacity in horsepower	
				Ultimate	Present
Grand Coulee	Washington	Columbia	U. S. Government	2,550,000	1,420,000
Boulder	Arizona-Nevada	Colorado	do.	1,835,000	1,515,000
Wilson	Alabama	Tennessee	do.	610,000	260,000
Conowingo	Maryland	Susquehanna	Susquehanna Electric Co.	594,000	378,000
Safe Harbor	Pennsylvania	do.	Safe Harbor Water Power Corporation	510,000	255,000
Niagara (U. S.)	New York	Niagara	Niagara Falls Power Co.	452,500	452,500
Fort Peck	Montana	Missouri	U. S. Government	400,000	
Wheeler	Alabama	Tennessee	do.	360,000	45,000
Bonneville	Oregon	Columbia	do.	360,000	120,000
Diablo	Washington	Skagit	City of Seattle	332,000	166,000
Saluda	South Carolina	Saluda	Lexington Water Power Co.	330,000	220,000
Keokuk	Iowa	Mississippi	Mississippi River Power Co.	330,000	150,000
Gorge	Washington	Skagit	City of Seattle	320,000	78,000
Pickwick Landing	Tennessee	Tennessee	U. S. Government	288,000	
Bagnell (Osage)	Missouri	Osage	Union Electric Light & Power Co.	268,000	201,000
Santee-Cooper	South Carolina	Cooper	South Carolina Public Service Authority	267,000	
Ariel	Washington	Lewis	Inland Power & Light Co.	246,400	61,600
Flathead	Montana	Flathead	Montana Power Co.	234,000	
F. D. Comerford	New Hampshire	Connecticut	Connecticut River Power Co.	216,000	216,000
Rock Island	Washington	Columbia	Puget Sound Power & Light Co.	216,000	84,000
Jordan	Alabama	Coosa	Alabama Power Co.	216,000	144,000
Chickamauga	Tennessee	Tennessee	U. S. Government	214,000	
Big Creek No. 3	California	Big Creek	Southern California Edison Co., Ltd.	210,000	131,000
Big Creek Nos. 2 and 2A	do.	do.	do.	202,000	202,000
Beauharnois	Canada (Quebec)	St. Lawrence	Beauharnois Light, Heat & Power Co.	2,000,000	265,000
Chute à Caron	do.	Saguenay	Alcoa Power Co., Ltd.	1,260,000	260,000
Niagara (Queenston)	Canada (Ontario)	Niagara	Hydro-Electric Power Commission of Ontario	560,000	560,000
Isle Maligne	Canada (Quebec)	Saguenay	Duke-Price Power Co., Ltd.	540,000	495,000
Bridge River	Canada (British Columbia)	Bridge	British Columbia Power Co., Ltd.	540,000	160,000
Paugan Falls	Canada (Quebec)	Gatineau	Gatineau Power Co.	476,000	238,000
Abitibi Canyon	Canada (Ontario)	Abitibi	Ontario Power Service Corporation	330,000	132,000
Chats Falls	do.	Ottawa	Hydro-Electric Power Commission of Ontario	280,000	224,000
Shawinigan Falls No. 2	Canada (Quebec)	St. Maurice	Shawinigan Water & Power Co.	278,500	278,500
Rapide Blanc	do.	do.	do.	240,000	160,000
Seven Sisters	Canada (Manitoba)	Winnipeg	Northwestern Power Co.	225,000	112,500
Niagara (Ontario)	Canada (Ontario)	Niagara	Hydro-Electric Power Commission of Ontario	208,200	208,200
Grand Mere	Canada (Quebec)	St. Maurice	Laurentide Power Co., Ltd.	200,500	200,500
Cedar Rapids	do.	St. Lawrence	Cedar Rapids Manufacturing & Power Co.	200,000	200,000
Serra	Brazil	Tiete-Parana	Sao Paulo Tramway Ltd. & Power Co. Ltd.	800,000	100,000
Dnieprostroy	Russia	Dnieper	Soviet Russia (U. S. S. R.)	746,000	746,000
Dura	Norway	Sunnaldalfjord	do.	550,000	550,000
Galletto (Nera Velino)	Italy	Nera	Soc. per l'Industria e l'Elettricit	400,000	200,000
Gumush	Russia (Armenia)	Zanga	Soviet Russia	352,000	352,000
Esla	Spain	Esla	Salto del Duero S. A.	300,000	200,000
Nore I.	Norway	Numedalslaagen	Norwegian Government	292,500	146,400
Carlo Cigogna (Cardano)	Italy	Isarco	Soc. Idroel. dell'Isarco	269,100	269,100
Brommat	France	Bromme	Soc. des Forces Motrices de la Truyere	252,000	252,000
Dixence	Switzerland	Dixence	L'Energie de l'Ouest-Suisse	250,000	125,000
Niasbek	Russia	Chirchik	Soviet Russia (U. S. S. R.)	238,000	123,000
S. Francesco-Mese	Italy	Liro-Mera	Soc. Elettr. Interreg. Cisalpina	231,900	189,000
Ardnacrusha	Irish Free State	Shannon	Electricity Supply Board	220,000	155,000
Timpa Grande	Italy	Arvo	do.	220,000	107,000
Kemhs	France	Rhine	Energie Electrique du Rhin	216,000	183,000
Inatira	Finland	Vuoksen	do.	216,000	108,000
Marezes	France	Dordogne	do.	210,000	120,000
Ihadios Pambos (Parahyba)	Brazil	Parahyba	Brazilian Hydro-Electric Co. Ltd.	204,000	116,000
Sarrans	France	Truyere	Soc. des Forces Motrices de la Truyere	200,000	156,000
Tröolhattan	Sweden	Goatelf	do.	200,000	164,000
Arapuni	New Zealand	Waikato	do.	200,000	100,000

¹ Installation in progress, project under construction or authorized for construction.

at 57,000 horsepower, operating under a head of 81 feet. The scroll case is of steel-plate construction with a diameter of 26 feet at its junction with the concrete penstock, and the diameter of the wheel at the throat is 19 feet 2 inches. The generator is rated at 47,000 kilovolt-ampere and is of the umbrella type, 3-phase, 60-cycle, 13,800-voltage. The outside diameter of the rotor is 31 feet 4 inches and it weight 440,000 pounds. The outside diameter of the stator is 37 feet. This ninth generating unit was installed in 1931, increasing the capacity of the plant to 101,000 horsepower, with provision made for one additional unit. Completion of the Sacandago Reservoir

has regulated the flow of the Hudson River so that eventually the river may be utilized for short-term peak power by installation of several power plants with an ultimate capacity of possibly 1,000,000 horsepower.

Forty-two percent of the water-power resources of the world are in Africa. On the Congo River in Belgian Congo in Central Africa, according to United States authorities, there can be developed over 100,000,000 horsepower on two stretches of the main river. For comparison the St. Lawrence River is estimated to be capable of developing 5,000,000 horsepower, the Niagara 6,500,000, the Colorado River 6,000,000, and the Columbia 8,000,000 horsepower.

PLANTS AUTHORIZED OR UNDER CONSTRUCTION

The ultimate Columbia Basin project in the State of Washington, comprises a power plant of 2,550,000 horsepower capacity at Grand Coulee Dam on the Columbia River, with 18 main generating units of 140,000 horsepower capacity each. A larger plant than Boulder with even larger units is planned. There will be two power houses, one on each side of the river. Average annual gross head with power capacity fully utilized will be about 340 feet. At present the only construction work for which funds are available is a structure 177 feet in height, designed as a base for a future high dam, and there is no power development.

At the Wheeler project on the Tennessee River in Alabama the Tennessee Valley Authority is providing for a plant of 360,000 horsepower with eight 45,000-horsepower units, and an initial installation of one unit. The Authority plans for a future installation of six 48,000-horsepower units at the Pickwick Landing Dam on the Tennessee River in Hardin County, Tenn., and space is provided at the Chickamauga project, also in Tennessee, for a 214,000-horsepower installation. The Army Engineers, building the Bonneville power and navigation dam on the Columbia River near Portland, Oreg., are installing two 60,000-horsepower units. Provision will be made in the foundation of the power house for four additional units of the same size, and space will be left for a total of 10 and possibly 12 units. An important non-Federal project planned for early construction is the Santee-Cooper navigation and power project in South Carolina, which includes a 267,000-horsepower capacity plant on the Cooper River.

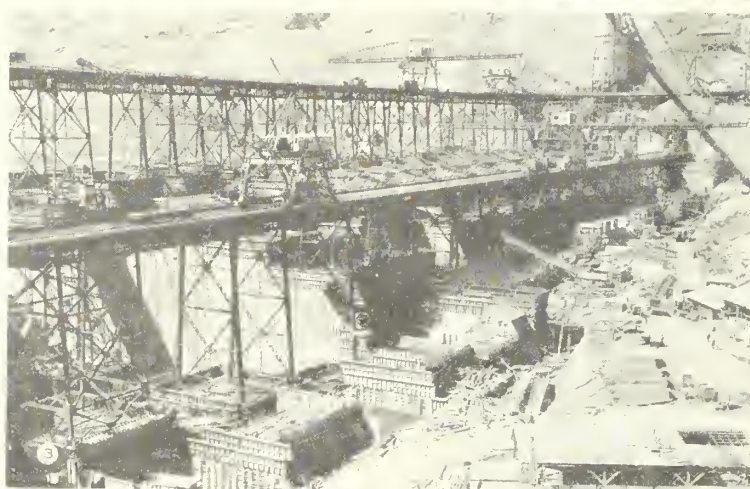
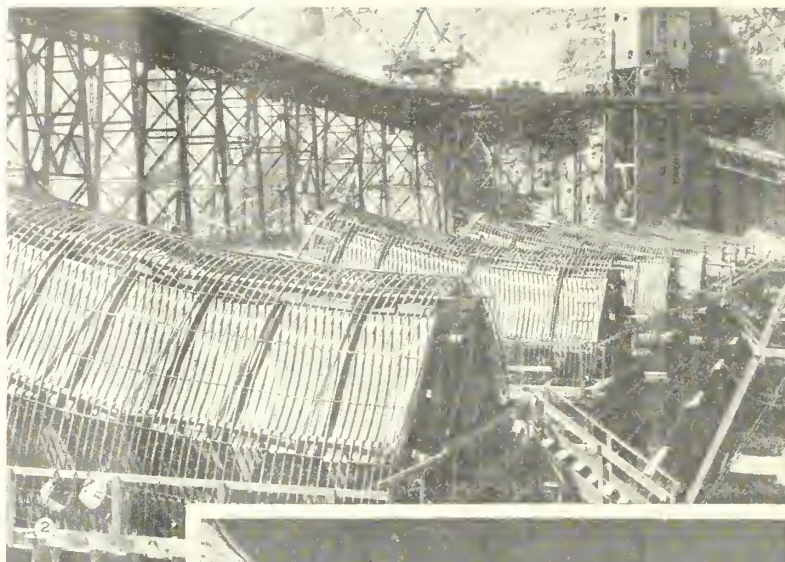
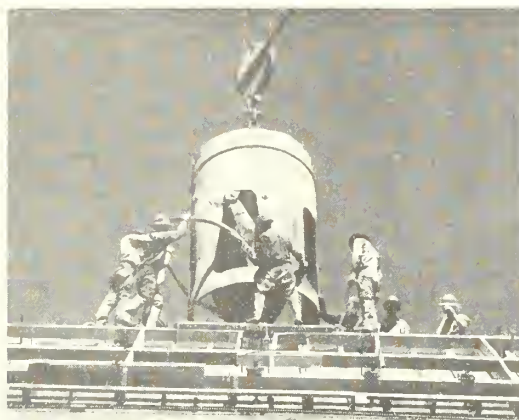
A FEW sales of farm tracts on the Willow Creek, Vale project, Oregon, were reported in July. At the close of the month, under public notice opening 27 farm units to entry, 30 applications had been received, 12 had filed, and it was expected that all units opened would be entered by August 13, the date set for the remaining units to be thrown open to the public.

A PACKING plant for head lettuce is being constructed at Vale, Oreg.

PRACTICALLY all labor on the Vale project is employed. The building of a union high school at Vale, ranch work, road, and canal work, has continued to keep all extra hands employed.



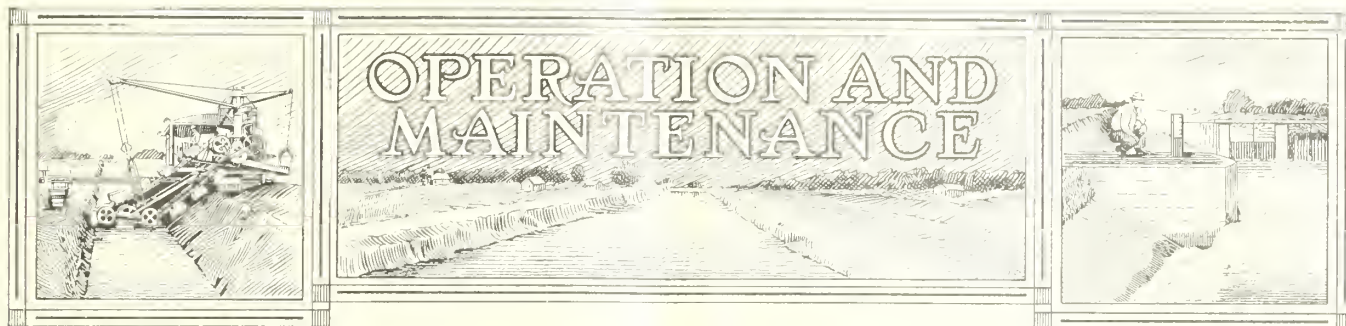
A 500-ton rotating field of one of the largest generators in the world is lowered into place by means of two traveling cranes, each with a capacity of 300 tons.



GRAND COULEE DAM, COLUMBIA BASIN PROJECT, WASHINGTON

1. Concrete bucket in position, ready for dumping.
2. Forms and reinforcing steel for penstock tunnels.
3. Concrete placing.

4. Drillers excavating for pumping plant.
5. Looking across upstream section toward west abutment.
6. Reinforcing steel in place for penstock tunnels.



Owyhee Field Inspection Tour

ON July 29 Malheur County farmers were invited on a tour of lands that have been irrigated for many years but are now coming under the Owyhee project and being served with gravity water rather than by pumping from the Snake River. The purpose of the field tour was to introduce several crops new to the district that will show profit quickly. The trip was sponsored by R. G. Larsen, county agent, and officials of the Amalgamated Sugar Co., who are interested in a new sugar beet producing area.

Cucumbers.—The caravan started near Ontario, Oreg., and visited a field of cucumbers being raised for seed. The owner, A. N. Andrews of Ontario, expressed his opinion on the profit in the crop and answered questions regarding yields and harvesting. The work of separation of seed from pulp held the group in earnest discussion for a short time, but the process was described as simple though its explanation sounded somewhat difficult.

Flax.—The next field considered was one of flax and the county agent gave reasons for adding it to the crop rotation as a ready market commodity. Sale of flax is assured at the present time when it is placed on the train and fair prices are paid. The market for flax is Portland, Oreg., and at present all of the crop grown locally goes to that point.

Lima beans and crested wheat grass.—Shortly after starting, the convoy began to grow as late arrivals dropped into line. By the time a stop was made for consideration of a field of lima beans the caravan had grown to some 80 persons representing a wide area. The next crop was an unusual but profitable one. A new grass seed is finding a ready market at 50 cents per pound. It is known as crested wheat grass, a very hardy variety, similar to mountain bunch grass. The seed is used for reestablishment of grazing lands where the natural feed has been killed out.

Sugar beets.—Sugar beets became the topic of most importance from the first field visited. Mr. Tullman, representative of the Amalgamated Sugar Co., was present and discussion was turned over to him. He gave his opinions as to productivity of the soil and answered all questions from field to field until lunch time. A picnic was held under the shade trees of the Gerrit Groot ranch, the food furnished by courtesy of the Amalgamated Sugar Co. and served by the Ladies Civic Club of Nyssa.

The program continued after lunch with speeches and general discussion. Professor Rinehart, of the department of animal husbandry, of the University of Idaho, gave a lecture on the food value in sugar beet tops. He described methods of feeding to cattle and sheep and the best ways of getting the most good from the discarded tops when the beets are harvested. The opinion was expressed that a valuable system of feeding for market would follow the introduction of the sugar beets as a regularly rotated crop for the district. Estimated values for the beet tops would represent an increased revenue either for direct sale or in additional weight on feeder stock. Mr. Tullman was called upon to answer questions and to tell of his company's requirements. He stated that a production of 50,000 tons of sugar beets for the district would assure a factory in the vicinity, and he urged that the crop be studied with intention to place it among the rotated production, thereby keeping up fertility of the soil and introducing a new crop of steady annual yield for the district. He offered to help interested farmers in plowing and in laying out fields, to give full possible cooperation at any time. The meeting was closed and discussion reopened at the nearest beet field.

Several fields were inspected, tonnage was estimated, and advice was given on the general condition of the crop. The

ranches visited in the afternoon were of high tonnage in sugar beets and the members of the tour obtained a good idea of what to expect throughout various stages of growth. Conditions of damage to beets were also under discussion and considered carefully. From the largest field of the district, which promised in excess of 25 tons per acre, the tour ended by looking over production on new land recently in sagebrush.

New lands will grow excellent beet crops but the soil lacks for high tonnage yield. It was not advised that the new lands be given to beets until after a few years build-up with other crops that will benefit the soil. In the planting of the new lands in various crops that will do well on recently reclaimed land the production of the area will tend to be very large in a few crops unless the older lands change to other production. The purpose of the tour was to introduce new, paying crops that will grow to advantage in the fertile, built-up lands for many years past under cultivation, and leave to the newer land the production of crops that will grow to advantage there. As the reclaimed desert lands gradually come into producing fields the older lands will be in rotation with a variety of crops and as years go by there will be no difference between the two. The area will produce sufficient to meet the demand, each ranch producing to best advantage throughout its own rotation system, and the average yield will be annually the same.

THE Vale-Owyhee Land Settlement Board reports a continuous influx of landseekers on the Vale and Owyhee projects.

EMPLOYMENT conditions have improved on the Owyhee project and any able-bodied man can find work if he really desires to do so.

Sanpete County Cooperative Sawmill Association

By M. S. Ross, Assistant Engineer, Bureau of Reclamation

A SELF-HELP cooperative sawmill association has been organized in Sanpete County, Utah, the primary purpose of which is to take men off relief and provide them with a self-sustaining industry which will give them profitable employment. Spring City, one of the divisions of the Sanpete reclamation project, was chosen for the sawmill site.

ORGANIZATION AND ADMINISTRATION

The cooperative was made possible by an act of the State legislature in March 1935. Funds for financing were set aside by the department of public welfare. At the same time an administrative board was created to approve plans of organization, operation, production, distribution, and financing of the cooperative. The board also supervises the distribution of goods and services for all cooperative self-help associations which are organized on a nonstock, nonprofit basis, and lends every assistance possible to encourage the associations in their endeavor to make their members self-sustaining.

Legal service in connection with the work of the board is rendered by the attorney general. A report of the official activities of the board is submitted to the Governor at least every 2 weeks. Supervisory help is also obtained from every State, county, town, and municipal officer, department, and committee.

The membership of the sawmill cooperative extends into seven Sanpete County towns. Members in each town are organized in individual units which represent the cooperative. Two of these units are organized in Ephraim and Spring City, the two areas which comprise the Sanpete project. Groups from other towns may organize as a cooperative and enter the sawmill association at any time. An individual membership is obtained by payment of \$100, which may be paid to the association in cash or commodities, or an equivalent amount is pledged to be paid off by performing personal service in erecting or operating the mill.

EXCHANGE SYSTEM

A central office and commissary functions as a means of distributing the products and services of the various cooperatives in the State. The exchange system embodies a central office, commissary, and warehouses for storing commodities. Products of the association that are not consumed within the individual cooperative or sold by it are stored to be exchanged for the professional services and com-

modities of other cooperatives. In this manner practically every necessity of life is made available to members. Ultimate development of the plan includes the organizing of every profession and producer of commodities desirous of being so organized within the State.

A cooperative farm is operated in Mount Pleasant and an adobe plant in Manti. Units of the sawmill cooperative are in both of these towns.

FINANCED BY STATE

The sawmill is equipped with machinery purchased at a cost of \$8,500. This initial investment was borrowed by the cooperative from the State, together with sufficient funds to obtain enough fuel and lubricating oil to get the mill into operation. Labor required in erecting the plant was performed by members pledging personal services in payment of their membership fee, and work required in excess thereof was paid for by issuing credit to be paid after the mill is producing lumber. Until the proceeds from production are sufficient to meet the cost of erection, overhead, and wages, the members are given credit to be paid from future production.

Wages paid the various members are determined by the value of the lumber produced by the sawmill. A unit rate per hour is set for each labor classification. The unit rate of each man employed is multiplied by the number of hours he works in the production of, say, 1,000 board-feet of lumber. To the total of unit-hours thus determined is added a number of unit-hours for overhead. Thus the value in dollars of a unit-hour is derived. For example, a superintendent

is given a unit rate of \$1.40, a man with team gathering timber a unit rate of \$0.80. With all labor required, it is found that 26 unit-hours are required to produce 1,000 board feet of lumber. Overhead deductions added may be itemized as 7 percent for industrial insurance, 10 percent for development, 5 percent for reserve, and 10 percent for retirement of obligation. This amounts to 9 unit-hours, making a total of 35 unit-hours required. If 1,000 board-feet of lumber is worth \$20, then the unit-hour rate of earning is \$0.57, and the superintendent receives \$0.80 per hour and the man with team \$0.46 per hour. Overhead deductions would amount to \$5.13 per 1,000 M. B. M.

The item of "retirement of obligation" in the above example is to be used to repay the investment loan made by the State to the cooperative. The item of "development" could be reflected by an increase in labor and material account. Current earnings may not be large enough for development when most needed. When the obligation is retired, or when any other item in the "overhead deduction" is decreased, the hourly earning rate of the members is increased.

The products of the mill may be used by the members for the construction of homes, barns, or for other purposes. Lumber may be sold by the cooperative to the retail trade for cash. The lumber received by the members may represent payment of wages in part or in whole. The cash received from the sale of lumber to the retail trade is distributed in the various accounts requiring cash, and may be used for part payment of wages. The

(Continued on p. 219)



Standing timber.

Progress of Investigations of Projects

Colorado-Big Thompson, Colorado.—The seven planetable parties continuing their work during July completed the survey of the transmountain project, including also the survey for a diversion from Willow Creek to Granby Reservoir. Horizontal and vertical survey was partially completed for the survey of a reservoir site at the mouth of Ranch Creek, east of Tabernash, Colo., and a canal line from this reservoir to the Granby Reservoir through Fraser Canyon. One level party was in the field all month in the Grand Lake area, locating vertical control for the survey of canal from Willow Creek to Granby Reservoir. A reconnaissance survey has been made for a canal line coming out of the Fraser River, just below the town of Fraser, starting at about 8,500 feet elevation and extending into a reservoir site on the lower end of Ranch Creek, immediately east of Tabernash, Colo. Detailed planetable geological surveys have been completed on the Ute Park dam site on Williams Fork and of the main fault zone on the Grand Lake-Big Thompson tunnel course in the vicinity of Bear Lake and Prospect Canyon. A relief map of the Grand Lake area and a working model of an automatic radial gate spillway were completed.

Blue River Transmountain, Colorado.—Field parties have been working at the Green Mountain Reservoir site and on a preliminary survey to determine the feasibility of a canal line from Clear Creek west of Golden, Colo., to the mouth of the Platte Canyon at the head of the High Line Canal. The planetable surveys of the Green Mountain Canyon and the proposed dam sites on the Blue River have been completed.

Western Slope, Colorado: (a) *Paonia project.*—Topography was completed on the Overland Reservoir for a study of increasing the amount of storage, the proposed reservoir on the Smith Fork, and the Spring Creek Reservoir site on the East Muddy Creek.

(b) *Florida Mesa project.*—Two planetable parties continued the taking of topography of the valley; maps are being worked upon in the field office; and it is anticipated that the results of the reservoir surveys will be available in a very short time.

(c) *Mancos Valley project.*—The field work of mapping the irrigation district and the survey of the Weber Reservoir site has been completed. The total area of the district is 13,600 acres, of which 8,500 acres are under cultivation. The classification of the undeveloped lands bordering the Mancos Valley district

was carried on until completion, with only the undeveloped lands lying adjacent to the irrigated areas within the district remaining to be classified. The land classification and irrigated area survey will also be continued in the Montezuma Valley during August.

(d) *Roan Creek project.*—Three reservoir sites on the Kimball Creek have been surveyed and topography taken on the proposed dam sites. Detail topography is now being taken on the Carr Creek dam site with indications of a good location.

(e) *Silt project.*—Control levels have been completed and topography started on the area between the West Elk and the Main Elk creeks in order to determine the tunnel, canal, and pipe-line possibilities in connection with bringing water from the Main Elk to the West Elk Creek and Harvey Gap Reservoir.

(f) *West Divide Creek project.*—Topography has been taken by the United States Geological Survey at the Owen Creek dam site on the Buzzard Creek, indicating a good reservoir capacity.

(g) *Yampa reservoirs.*—The field work on the topographic sheets at reservoir site no. 4, and the detail topographic sheet across the dam site were completed. Triangulation base lines have been completed and checked in the region of reservoir site no. 3, and about one-third of the topography has been taken.

Rio Grande Basin, Colorado-New Mexico.—The following surveys and investigations are in progress:

Wagon Wheel Gap dam site.—Diamond drilling on the dam site was virtually completed during the month, with 853 additional feet of hole being drilled. The design of the dam has begun.

Vega-Sylvestre dam site.—At test pit no. 2, located in glacial till on the right abutment, which had been dug to a depth of 97 feet, the diamond drill rig was set up and continued the drilling to a total depth of 197 feet without encountering any marked change in material.

Concejos dam site.—One churn-drill hole has been put down on each side of the river bed through river-washed gravel to a depth of 90 and 95 feet. On the right abutment a test pit has been dug to a depth of 42 feet.

San Juan-South Fork Transmountain diversion. Triangulation surveys have been completed for the proposed tunnels and surveys are now in progress for prospective reservoir and dam sites on the West Fork of the San Juan River and on Beaver Creek.

San Juan-Chama diversion.—Both of the trial lines for the diversion of the San Juan waters to the Chama River at an elevation of 7,900 and 7,500 were completed and estimated during the month, the upper line being 94 miles long and the lower being 80.6 miles long.

Blanco River damsite.—Upon the completion of the San Juan-South Fork triangulation survey, a field party was moved to the Blanco River damsite and by the end of the month all field topography on the site had been obtained, and three test pits were put down.

(Continued on page 219)



All-American Canal. Placing compacted lining.

Notes for Contractors

Spec. no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
684	July 23 (4 bidders).	All-American Canal, Calif.	Overchute wash crossings, drainage inlets and turnouts.	Peterson Construction Co.	Minneapolis, Minn.	\$339,452.00		Aug. 14
				V. R. Dennis Construction Co.	San Diego, Calif.	384,934.00		
				David H. Ryan	do.	445,066.00		
811 D	July 17 (16 bidders).	Casper-Alcova, Wyo.	Oil circuit breaker, disconnecting switches, potential and current transformers.	Condit Electrical Mfg. Corp.	Boston, Mass.	5,715.00	It. 1, oil circuit breaker, f. o. b. Casper.	
				Pacific Electric Mfg. Co.	San Francisco, Calif.	5,850.00	do.	
				Kelman Electric & Mfg. Co.	Los Angeles, Calif.	5,951.00	do.	
				The High Tension Co., Inc.	Phillipsburg, N. J.	451.20	It. 2, disconnecting switches f. o. b. Casper.	
				Royal Electric Mfg. Co.	Chicago, Ill.	468.00	do.	
				Johnson Mfg. Co.	Atlanta, Ga.	505.56	do.	
				Royal Electric Mfg. Co.	Chicago, Ill.	796.00	It. 3, airbrake switches, f. o. b. Casper.	
				Johnson Mfg. Co.	Atlanta, Ga.	931.76	do.	
				Condit Electrical Mfg. Corp.	Boston, Mass.	2,224.00	It. 4, potential transformers, f. o. b. Casper.	
				General Electric Co.	Schenectady, N. Y.	2,358.00	do.	
				Westinghouse El. & Mfg. Co.	Denver, Colo.	2,420.00	do.	
				Condit Electrical Mfg. Corp.	Boston, Mass.	1,188.00	It. 5, current transformers f. o. b. Casper.	
				General Electric Co.	Schenectady, N. Y.	1,266.00	do.	
				Westinghouse El. & Mfg. Co.	Denver, Colo.	1,272.00	do.	
				Condit Electrical Mfg. Corp.	Boston, Mass.	675.00	It. 6, outdoor meter, relay cabinet, f. o. b. Casper.	
				Pacific Electric Mfg. Co.	San Francisco, Calif.	680.00	do.	
				General Electric Co.	Schenectady, N. Y.	690.00	do.	
				Condit Electrical Mfg. Corp.	Boston, Mass.	11,593.00	All items f. o. b. Casper.	
812-D	July 20 (9 bidders).	Ogden River, Utah.	Structural steel control gates and appurtenances, and cast-iron gates for division works.	California Steel Products Co.	San Francisco, Calif.	1,498.00	It. 1, structural steel, f. o. h. San Francisco.	July 25
				Spuck Iron & Foundry Co.	St. Louis, Mo.	1,690.00	It. 1, structural steel, f. o. h. St. Louis, ½ percent discount.	
				Worden Allen Co.	Milwaukee, Wis.	1,847.00	It. 1, structural steel, f. o. h. Milwaukee, ½ percent discount.	
				California Steel Products Co.	San Francisco, Calif.	2,339.00	It. 2, control gates, f. o. b. San Francisco.	Do.
				Valley Iron Works	Yakima, Wash.	2,458.00	It. 2, control gates, f. o. b. Yakima, 5 percent discount.	
				Joshua Hendy Iron Works	San Francisco, Calif.	2,974.00	It. 2, control gates, f. o. h. Sunnyvale.	
				General Iron & Steel Works.	Portland, Oreg.	385.00	It. 3, cast-iron gates, f. o. h. Portland.	Do.
				Beall Pipe & Tank Corp.	do.	446.40	do.	
				Pekrul Iron Works	Denver, Colo.	535.00	It. 3, cast-iron gates, f. o. b. Denver.	
22337-A	July 20 (9 bidders).	Casper-Alcova, Wyo.	Steel reinforcement bars, 786,517 pounds.	Colorado Fuel & Iron Corp.	Minnequa, Colo.	21,743.96	F. o. b. Casper, Wyo.	Aug. 3
				Carnegie-Illinois Steel Corp.	Duquesne, Pa.	22,845.10	do.	
				Concrete Engineering Co.	Chicago, Ill.	22,845.10	do.	
				Tennessee Coal, Iron & R. R. Co.	Fairfield, Ala.	22,845.10	do.	
				Inland Steel Co.	Indiana Harbor, Ind.	22,845.10	do.	
				Bethlehem Steel Co.	Lackawanna, N. Y.	22,845.10	do.	
				Sheffield Steel Corp.	Kansas City, Mo.	22,845.10	do.	
				Republic Steel Corp.	Buffalo, N. Y.	22,845.10	do.	
				Laclede Steel Co.	Madison, Ill.	22,845.10	do.	
688	July 27 (5 bidders).	Boise-Payette, Idaho.	Tunnels, canal earthwork and structures.	J. A. Terteling & Sons.	Boise, Idaho	292,796.00	Schedules 1 and 2.	Aug. 19
				Klug and Brumbach.	Easton, Wash.	323,775.00	do.	
				Utah Construction Co.	Ogden, Utah	334,867.00	do.	
813-D	July 22 (14 bidders).	Boulder Canyon, Ariz.-Calif.-Nev.	Miscellaneous electrical equipment.	Westinghouse El. & Mfg. Co.	Denver, Colo.	8,023.60	It. 1, oscillographs, f. o. b. Boulder City.	
				General Electric Co.	Schenectady, N. Y.	11,819.60	It. 1, oscillographs, f. o. b. Schenectady.	
				Westinghouse El. & Mfg. Co.	Denver, Colo.	1,540.50	It. 2, oscillographs, f. o. h. Boulder City.	
				General Electric Co.	Schenectady, N. Y.	3,409.80	It. 2, oscillographs, f. o. b. Schenectady.	
				do.	do.	1,268.38	It. 3, testing apparatus.	
				Graybar Electric Co.	Denver, Colo.	1,463.38	It. 3, testing apparatus f. o. h. Newark.	
				Westinghouse El. & Mfg. Co.	do.	299.99	It. 4, watt-hr. meters f. o. h. Boulder City.	
				General Electric Co.	Schenectady, N. Y.	300.00	do.	
				Graybar Electric Co.	Denver, Colo.	429.00	It. 5, phase shifter f. o. b. Hartford.	
				do.	do.	556.50	It. 6, phase shifter f. o. b. Hartford.	
				Gray Instrument Co.	Philadelphia, Pa.	905.52	It. 7, potentiometers, etc., f. o. b. Washington.	
				Leeds & Northrup Co.	do.	1,095.00	It. 7, potentiometers, f. o. b. Philadelphia.	
				Rubicon Co.	do.	1,189.00	It. 7, potentiometers, f. o. b. Washington.	
				Gray Instrument Co.	do.	949.62	It. 8, potentiometers, f. o. b. Washington.	
				Leeds & Northrup Co.	do.	1,030.00	It. 8, potentiometers, f. o. b. Philadelphia.	

Notes for Contractors—Continued

Spec. no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
813-D	July 22 (14 bidders).	Boulder Canyon, Ariz.-Calif.-Nev.	Miscellaneous electrical equipment.	Rubicon Co.	Philadelphia, Pa.	\$1,189.00	It. 8, potentiometers, f. o. b. Washington.	
				Beck Bros.	do.	95.04	It. 9, rheostats f. o. b. Boulder City.	
				Ward Leonard Electric Co.	Mt. Vernon, N. Y.	118.50	do.	
				Rubicon Co.	Philadelphia, Pa.	120.04	do.	
				General Electric Co.	Schenectady, N. Y.	130.00	It. 10, resistor boxes f. o. b. Boulder City.	
				do.	do.	111.50	It. 11, ammeter f. o. b. Boulder City.	
				Wolfe & Mann Mfg. Co.	Baltimore, Md.	621.00	It. 14, switchboard, f. o. b. Baltimore.	
				Le Page McKenny Co.	Seattle, Wash.	728.14	It. 14, switchboard, f. o. b. Seattle.	
				Square D Co.	Los Angeles, Calif.	827.00	It. 14, switchboard, f. o. b. Boulder City.	
				Standard Electric Time Co.	San Francisco, Calif.	210.36	It. 15, electric clocks, f. o. b. Boulder City.	
				do.	do.	176.00	It. 16, electric stop clock, f. o. b. Boulder City.	
				International Business Mach. Corp.	Denver, Colo.	370.50	It. 17, electric time stamps, f. o. b. Endicott, N. Y.	
809-D	July 14 (5 bidders).	Central Valley, Calif.	Core drilling and excavation for investigation of Baird and Table Mountain dam sites.	Lynch Bros., Inc.	Seattle, Wash.	47,242.75	Sch. 1	Aug. 8
				J. H. Pomeroy & Co., Inc.	San Francisco, Calif.	49,041.00	do.	
				Henry J. Kaiser Co.	Oakland, Calif.	49,518.75	do.	
				do.	do.	34,125.00	Sch. 2	(1)
				L. E. Dixon Co., Bent Bros., Inc., Case Construction Co., Inc.	Los Angeles, Calif.	47,998.75	do.	
				J. H. Pomeroy & Co., Inc.	San Francisco, Calif.	67,677.75	do.	
808-D	July 8	Uncompahgre, Colo.	Dragline excavators.	Harnischfeger Sales Corp.	Milwaukee, Wis.	28,290.00	Item 1	Aug. 10
810-D	July 14	All-American Canal, Calif.	Earthwork sta. 1161+75 to sta. 1170+25.	Bay City Shovels, Inc.	Bay City, Mich.	11,150.00	Item 2	Do.
689	July 3	Salt River	Spillways for Horse Mesa Dam.	V. R. Dennis Construction Co.	San Diego, Calif.	32,500.00		July 28
				L. E. Dixon Co., Bent Bros., Inc., Case Construction Co.	Alhambra, Calif.	712,976.00		July 24
693	Aug. 7 (5 bidders).	Upper Snake River storage, Idaho-Wyo.	Construction of Grassy Lake Dam.	S. J. Groves & Sons Co.	Minneapolis, Minn.	488,477.00		
				Myers & Goulter	Seattle, Wash.	518,465.00		
				George W. Condon Co.	Omaha, Nebr.	541,475.00		
690	Aug. 3 (7 bidders).	All-American Canal, Ariz.-Calif.	Sludge disposal piping and misc. metal work for desilting basins at Imperial Dam.	National Tube Co.	Pittsburgh, Pa.	67,231.25	It. 1, discount 2 percent f. o. b. McKeesport, Pa.	
				Southwest Welding & Mfg. Co.	Los Angeles, Calif.	69,250.00	It. 1, discount ½ percent f. o. b. Los Angeles.	
				Grimes Pipe & Supply Co.	Denver, Colo.	7,014.18	It. 2, f. o. b. Birmingham and Bradford, Pa.	
				United States Pipe & Foundry Co.	Chicago, Ill.	9,088.83	It. 2, f. o. b. Potholes, Calif.	Aug. 10
				Alhambra Foundry Co., Ltd.	Alhambra, Calif.	7,772.89	It. 2, discount ½ percent f. o. b. Bessemer, Ala.	
				Beuhler Tank & Welding Works.	Los Angeles, Calif.	2,820.00	It. 3, f. o. b. Los Angeles.	Aug. 10
783-D	Apr. 9 (4 bidders).	Columbia Basin, Wash.	Railroad track scale.	Winslow Govt. Std. Scale Works, Inc.	Terre Haute, Ind.	3,120.00	do.	
				Fairbanks, Morse & Co.	Chicago, Ill.	4,492.00	It. 1, discount 2 percent, f. o. b. Odair, Wash.	(1)
				Howe Scale Co.	Denver, Colo.	5,025.00	It. 1, f. o. b. Odair.	
				Winslow Govt. Std. Scale Works, Inc.	Terre Haute, Ind.	5,042.00	do.	
				Fairbanks, Morse & Co.	Chicago, Ill.	6,309.00	It. 2, discount 2 percent, f. o. b. Odair, Wash.	(1)
				Howe Scale Co.	Denver, Colo.	7,632.00	It. 2, f. o. b. Odair.	
814-D	Aug. 3 (3 bidders).	Casper-Alcova, Wyo.	Preparation of concrete aggregates.	Mountain States Co.	Billings, Mont.	7,504.00	Sch. 1-5 incl.	Aug. 19
				Sharrock and Pursel.	Casper, Wyo.	25,040.00	do.	
816-D	Aug. 14 (8 bidders).	Yakima, Wash.	Structural steel for bridges over spillway channel at Kachess Dam.	A. H. Read Co.	Cheyenne, Wyo.	29,600.00	do.	
				Spuck Iron & Foundry Co.	St. Louis, Mo.	39,095.00	Disc. ½ percent f. o. b. St. Louis.	
				Virginia Bridge Co.	Roanoke, Va.	800.00	F. o. b. Memphis.	
				Isaacson Iron Works.	Seattle, Wash.	810.00	Disc. ½ percent f. o. b. Seattle.	
817-D	Aug. 24 (13 bidders).	Columbia Basin, Wash.	Cast-iron bulkheads for Grand Coulee power plant.	Crawford & Doberity Fdry. Co.	Portland, Oreg.	1,059.00	F. o. b. Portland.	
				Stacy Schmidt Mfg. Co.	York, Pa.	800.00	F. o. b. York.	
				St. Paul Foundry Co.	St. Paul, Minn.	875.00	F. o. b. St. Paul.	
819-D	Aug. 21 (4 bidders).	Owyhee, Oreg.-Idaho.	Pumping units for Payette-Oregon slope pumping plant.	Fairbanks-Morse & Co.	Kansas City, Mo.	32,354.00	F. o. b. Beloit, Wis.	
				Bingham Pump Co.	Portland, Oreg.	39,541.00	F. o. b. Ontario, Oreg.	
				Allis-Chalmers Mfg. Co.	Milwaukee, Wis.	41,600.00	F. o. b. Milwaukee.	
694	Aug. 24 (5 bidders).	Salt River, Ariz.	Office building, dormitory, residences.	Del E. Webb Construction Co.	Phoenix, Ariz.	39,233.04		
				H. P. Adams	do.	40,166.75		

1 All bids rejected



Turkey Raising

By Mrs. Almo H. Newton, Merrill, on Klamath Project, Oregon

TURKEY raising, which is rapidly becoming one of the important industries of the Klamath reclamation project, received its first impetus from the pioneering work of a woman, Mrs. John Liskey. The Crater Lake Mountain Turkey Co. of Malin, Oreg., has this year an up-to-date and in every way scientifically equipped brooding ranch for the hatching of more than 100,000 turks. Mrs. Liskey started her venture in 1927 with 150 hens and 11 toms, and pointed the way to the establishment of such modern plants as the one at Malin.

Facing the greatest obstacles in the way of make-shift equipment, insect pests, disease, coyotes, and cold, Mrs. Liskey took turkey raising in the Klamath area out of the infant class and put it into that of big business. She hatched most of her turkeys under hens, borrowed from farmers in the valley, and unable to find enough hens for this purpose, she built a brooder room, with thick walls, and bought a 540-egg incubator which was designed for chicken eggs. Since it takes but three weeks to hatch chickens, she had to work out the management of the incubator for the extra week needed to incubate turkey eggs.

The incubator and brooder having worked out wonderfully well, she had a

house built to protect the little turks from the cold spring winds, and then had them moved into a more open pen room by the time of the second hatching.

Unable to get any bulletins or instructions from any source that were much help on the feeding of baby turks, Mrs. Liskey worked out unaided a formula of mash, ground grains, trits, cottage cheese mixed with chopped young onions, including tops, and seasoned with black pepper.

These brooder turks were later turned outside and allowed to run with the broods mothered by chicken hens. These latter, in the meantime, were being housed in coops and fed grain and mash, but not such a variety as the others, as their mothers foraged for them.

When all were active and strong, the whole band of 3,100 turks was turned into the grain fields where valuable work was done by eating hordes of grass hoppers.

COYOTES DESTROY TURKEYS

Mrs. Liskey hired a man on horseback, who with a well-trained dog, patrolled the fields for varmints, but in spite of such vigilance, 600 turks were destroyed by coyotes, before Mrs. Liskey obtained the aid of the Government trapper, who

killed eight of the animals and Mrs. Liskey herself shot seven of the marauders with a rifle.

Roosts were erected near the farm barns where the birds learned to spend the nights as soon as they became too old for brooder houses and coops.

After the coyotes were exterminated, another disaster overtook the growing turks. One of the farm hands decided the stock needed salt, and being ignorant of the fact that it is poisonous to turkeys scattered it liberally around the feed racks of both horses and cattle. More than 300 turkeys died in 24 hours from the deadly dose.

Prices were high in 1927, and Mrs. Liskey realized a net profit of \$3 each on 2,140 turkeys, or the sum of \$6,420, after holding several hundred to sell the following spring.

Following Mrs. Liskey's success other raisers started on larger scales than they ever had before, culminating in the formation of the large Crater Lake Mountain Turkey Co., which consists of Henry Nicol, manager, with Oscar Kittredge and Dan and Dave Liskey, as partners. Mrs. Liskey, who is a sister-in-law of the two last-mentioned partners, hopes again to raise turkeys on a large scale.

A Project Woman's Version of Her Own Efforts

By Mrs. Hypatia K. McKendree, Merrill, Oreg.

MY VIEWPOINT may not be strictly feminine for I have long been a "widow-woman farmer." By necessity in years past, I wielded a shovel irrigating fields and pastures, and found pleasure for my pains in seeing the vegetation come out of the thirsty earth, perhaps knowing my onions best while their roots were still in the earth. Some of our present ways of farm living are a great improvement over the good old days. Even farmers progress. The everpresent crying wolf is a prayer for

betterment. Some times I think the better we live the louder we wail.

In midwinter and hog-butcher time, little getting ready of scalding vats and calling in the neighbors is done. Most farmers here load the fat porkers into the truck and to the well-equipped plant in the nearest town they go, not to sell but to have them returned either eured meat or cut up ready for euring, lard rendered and sausage seasoned, all for a sum less than the extra labor would have cost, not to mention no mess and no

extra work for the farm women, and no greasy jumpers and overalls to wash.

Next biggest new innovation is a refrigeration room full of locked cells of sufficient size to meet individual needs, and attached to a creamery. The rent is nominal. Into these go excess eured meat which we wish to keep sweet past the hot summer, fresh sausage for haying breakfasts next summer, dressed fowls, beef, and mutton. This is in our biggest nearby town where business or shopping

takes most of us often so it is no extra expense to transport some of this stored stuff home for immediate use or to store in our smaller electric refrigerators until needed. Electric refrigerators have become the rule rather than exception in our farm homes and mean much in food economy and housekeeping delight.

We do not have to wait for the Tennessee nor the Grand Coulee for our farmers began to enjoy electricity 30

years ago. With that start and this same will to howl, we are well electrified as to bathrooms, cooking ranges, and small household devices. Outside I can also see run by motor, wood saw, potato sorter, sickle grinder, grain grinder and, most appreciated of all, the pressure pump which supplies the running water to house, barn, feedlots, lawn, etc. These and many more are in general farm use. All we have to complain of

is the cost of the juice. This one just keeps us from getting self satisfied.

Individually we have an electric device that has added much to the peace of the household, an electrically run lawnmower, not out of reach in price for we purchased a small motor from one of our popular mail-order houses and put it on our old lawnmower. Getting it to run was practically a free course in electricity, but now it works with more show of pleasure than anything else on the place.

Yuma County Marketing Association

(Continued from p. 203)

it might be stated that this fund is being created to provide the necessary capital for the purchase of land, buildings, equipment, machinery, and supplies and to conduct the business of the association. In addition to the contributions mentioned in the preceding paragraph, accruals to the revolving fund are provided by paying into it so much of the 5-percent deduction from the sale price of commodities marketed that is not required to pay overhead costs and incidental marketing expenses. The amounts so paid in to the fund are credited to the member patrons of the marketing department in proportion to the volume of their business with that department. When the revolving fund reaches an amount sufficient to meet all the requirements for which it was created, current contributions to it are used to repay those previously contributing.

The marketing agreements specifically designate the crop or crops to be marketed. A grower may, at his option, sign up for any one or all of his crops to be handled by the association. Unless the grower exercises his right to withdraw at a specified time each year, all such agreements run for an indefinite period.

Patronage of nonmembers in the cleaning, storage, and supplies departments is solicited on a competitive basis with establishments in Yuma, engaged in similar activities. Profits or earnings on such business are credited to members according to the volume of business contributed by each to the various departments.

All seed belonging to members is pooled and loses its identity, after having previously been graded. Substantial advances are made on members' seed as soon as delivered to warehouse and re-cleaned. Thereafter, distributions are made from time to time as the marketing of seed progresses.

PLANT ENLARGED

A little more than a year ago the Yuma County Farmers' Marketing Association

moved to its present quarters, which are much larger and better suited to its requirements than any previously occupied. The plant consists of a reinforced concrete warehouse with 15,000 square feet of floor space and an adjoining building, which is utilized for housing the recleaning machinery. The main building is located in Yuma at the intersection of United States Highway 80 with one of the main roads leading into the Valley Division of Yuma project, and constitutes one of the busiest and best commercial corners in the city.

A general manager conducts the business of the association and is directly responsible to a board of directors. These directors, of which there are seven, represent the districts of which they are residents and for which they have been elected to serve. At the close of each fiscal year, an annual meeting is held at which the manager renders a statement covering the year's business. It has been customary, in order to stimulate attendance at these annual meetings, to serve a banquet at the general expense of the association. These meetings have been growing consistently in interest and popularity. At the annual meeting held in July of this year a record number attended to hear the manager's report, indicating that the Yuma County Farmers' Marketing Association had just completed the most successful year in its history.

Producers have very encouraging prospects for the current marketing season just beginning. No doubt some demand for alfalfa and Bermuda seed will be created by the Government's soil conservation program, which calls for the planting of additional areas to hay and pasture. The drought in some of the large seed-producing sections of the country has reduced production below normal. In such a situation, a distinct advantage accrues to the irrigation farmer on a project with an assured water supply, in which fortunate classification the Yuma project may be appropriately placed since the completion of Boulder Dam and the beginning of storage operations in Mead Lake.

Central Valley Dam Site Investigations

Secretary of the Interior Harold I. Ickes has announced award of contract for drilling and excavation of the Baird dam site on the Pitt River in California, a possible location of one of the dams of the Central Valley project, to Lynch Bros., Inc., of Seattle, on their bid of \$47,242.75. The successful bid was lowest of five proposals submitted to the Bureau of Reclamation at its Sacramento, Calif., office on July 15.

At the same time all three bids submitted for doing similar work at the Table Mountain dam site on the Sacramento River were rejected. Engineers of the Bureau of Reclamation considered these bids too high.

The Table Mountain dam site will be investigated by force account labor under the direction of reclamation engineers.

The Kennett dam site on the Sacramento River, which lies between the Baird and Table Mountain sites, already is being investigated. Because broken rock was found on the west abutment at the Kennett site, the Bureau of Reclamation decided to make careful investigations of the Baird and Table Mountain sites in order that a construction program might be launched without undue delay.

The contractor will be expected to commence work at the Baird dam site within 10 days after being notified of the award. The force account work at Table Mountain will be begun as soon as equipment can be transported to the site.

DURING July Klamath County, Oreg., and Siskiyou County, Calif., conducted a joint tour of potato fields for the study of potato diseases, fertilizer trials, time of plant, and irrigation methods. The tour was in charge of G. R. Hyslop, of the Oregon State College, and H. H. Poulsen, of the California Department of Agriculture, and was attended by 65 potato growers.

Excerpts from July Project Reports

Boise.—Most crops looking good. Most of the early potatoes have been dug.

* *Yuma.*—The first bale of the 1936 cotton crop was ginned July 21. This cotton, which was of the Stoneville variety, was raised in the valley division on land which had been idle for a number of seasons.

Minidoka.—The second cutting of hay is completed and most of the wheat has been harvested. Beets, beans, and potatoes made an unusually heavy growth during the month, and give promise of large yields.

The fifth lamb pool of the season was shipped July 21 by the Minidoka County Lamb Pool. It contained 1,082 lambs and 5 bucks. The lambs averaged 81 pounds each and sold for \$8.50 per hundred-weight, the total receipts from the sale amounting to \$7,513. Lamb sales made by the pool so far this season have totaled \$38,976.

Frenchtown.—The excessive heat has caused a shrinkage in the spring wheat crop. Harvest is now underway and yields are expected to be about average. Sugar beets are in good condition. Seed peas are reported to be yielding as high as 40 bushels per acre. The range is in good condition and the livestock industry is about normal.

Humboldt.—Several thousand tons of alfalfa have been contracted for \$7 per ton in the stack. This price is net to the producer and is about \$1.50 per ton above the 1935 price. The first cutting of alfalfa has been completed on all except the larger ranches. The yield has been exceptional and will average between 2 and 2½ tons per acre for the first cutting. All turkeys on the project are in fine condition.

Burnt River.—Hay and grain harvest was in progress throughout the month. The crop is above normal owing to above normal precipitation during the growing season. Range conditions continue good and as a result, livestock are in excellent condition.

Vale.—All crops are in good condition. Some excellent fields of barley, wheat, and oats are yet to be harvested. A total of 1,000 acres of head lettuce will be planted this year, mostly in potato ground. The company, a packing concern, furnishes the seed and plants the acreage for \$8 per acre. The farmer furnishes the water and cultivates and harvests the crop. If the crop fails, the company stands the loss. A number of settlers have taken advantage of the offer.

Klamath.—All crops made an unusually rapid growth during July. Harvesting of the first cutting of alfalfa was completed early in the month, with the

second cutting just starting at the close of the month. The tonnage is heavy and quality excellent, and, with the hay crop at least 10 days earlier than usual, it is expected that about 50 percent of the acreage will yield an excellent third cutting. With the heavy production it is estimated that there will be 15,000 to 20,000 tons of hay on the project in excess of local requirements. Recent estimates indicate the potato acreage will exceed 16,000 acres and, with conditions better than average, shipments are expected to exceed all previous records. Grains made an excellent growth. The acreage in small seeds is nearly double that of 1935, most of the increase being alsike clover and bluegrass.

Owyhee.—The condition of crops on the old lands of the project is the best in years. Grain crops are especially good, although rust is apparent in some wheat fields. On the new lands of the project crops generally are in good condition. Several carloads of cattle from the drought-stricken areas have arrived on the project and more are expected to come.

Prices for all farm products are very good, with potatoes outstanding. Livestock prices continue good.

Provo River.—The grains and second-crop alfalfa have been harvested and were found to be excellent in yield. Other crops appear to be in good condition. Prices remained good for berries, vegetables, and fruits, and also for beef cattle, dairy, and poultry products.

Yakima.—Crop conditions in general are satisfactory. Harvesting of cherries was completed early in the month. The apricot harvest was practically completed. The potato crop in the Kennewick district, estimated to be worth \$300,000, was the best in several years.

A heavy fall planting of alfalfa on the Sunnyside division appears certain. Better market prospects for hay, increased feeding activity, and an increase in dairy farming are factors affecting the increase in plantings.

The first lamb shipment of the season was made early in July, when 30 carloads, representing almost 8,000 lambs, were shipped to eastern and coast markets. The lambs are reported to be in unusually fine condition this season.

Shoshone.—Crops are looking exceptionally good. Most of the second crop of alfalfa has been cut, and it appears that three cuttings will be obtained this year. Sugar beets are making excellent growth. Beans are making good progress, and the yield of this crop will be high if there is not an early frost.

Yuma Ginning

(Continued from p. 202)

3 cents over the market, premiums aggregating about \$40 in value were donated the growers by various Yuma merchants.

Local well-informed growers express the belief that the Yuma cotton was the earliest bale of planted cotton produced this season in Arizona, a previous bale grown on the Salt River project near Phoenix having been a volunteer crop.

The value of the 1936 cotton crop for Yuma County has been reliably estimated in excess of \$1,000,000. The estimate is premised on a yield of 14,000 bales from the 15,000 acres planted to cotton in the county and also on prices of 12 cents per pound for cotton lint and \$25 per ton for cottonseed. The major portion of the cotton produced in Yuma County is raised on the Yuma project. A preliminary census indicates a cotton acreage of 13,500 acres on the project this year as compared with 11,766 acres in 1935, during which year the crop census reports a value of approximately \$763,000 for lint and seed.

L. C. Perkins, local manager for Anderson-Clayton & Co., estimates that the harvest payroll in Yuma County during the 5½ months of the cotton growing and picking season will total approximately \$225,000, and in addition the gin payrolls will amount to \$25,000. Seven gins are operating this season in the near vicinity of Yuma, of which five are located on the Yuma project. Four of the seven gins are owned and operated by the Yuma County Farmers' Cooperative Association, and the remaining three by the California Cotton Oil Co. Ginning operations generally started during the first week in August, during which the combined output of all 7 Yuma County gins varied from 150 to 200 bales per week.

ON JULY 22 the annual Naches Heights-Tieton-Cowieche intercommunity picnic was at Eschbach Park on the Yakima project. Games and sports were provided to entertain the large crowd.

ONE OF the home-made air coolers, a description of which was given in the August issue of the "Era", has been installed in the office of the Bureau of Reclamation at Orland, Calif. On August 3, with an outside temperature of 104 degrees and humidity of 26, the inside temperature was 86 degrees and the humidity 50.

Project Investigations

(Continued from p. 213)

West Fork of the San Juan.—Topographic surveys on the damsite and the digging of four test pits were started at the end of the month.

Boulder Lake Terminal reservoir.—A survey is now under way on the Boulder Lake to determine its capacity and feasibility for a terminal reservoir of the San Juan-Chama diversion canal.

Boise (Boise-Weiser-Payette), Idaho.—A planetable party continued its work of taking topography down the South Fork of the Payette River from the proposed Garden Valley reservoir toward the Boise diversion dam. The topography at the point of crossing Deer Creek, the only stream entering the South Fork of the Payette River from the south between Garden Valley and the Banks, indicates a comparatively easy crossing of the creek. Further reconnaissance surveys were made on the possibility of a diversion from the North Fork of the Payette River into the Garden Valley Reservoir site.

Gallatin Valley, Mont.—The field work on the Gallatin Canyon topography was completed in the middle of July.

Deschutes, Oreg.—The Deschutes storage and north unit formal reports have been completed and are now being reviewed before being distributed to the various interested parties. Planetable parties have completed a preliminary survey, including line topography, on an alternate north unit main canal line, diverting from the Deschutes River in the vicinity of Cline Falls. A preliminary survey was begun on a diversion canal from Waldo Lake, on the west slope of the Cascade summit, tunneling through the divide into Odell Lake. This canal will be about 9 to 10 miles in length. A field reconnaissance was made of a plan to provide water for the north unit by means of a pumping plant located on the Crooked River at or near Opal Springs in lieu of a location at the Metolius damsite west of Round Butte.

Black Hills, S. Dak.—Topographic surveys have been completed on the Deerfield Reservoir site on Castle Creek and the Crow Creek Reservoir site on the Belle Fourche watershed and one-third completed on the Pactola site on Rapid Creek about 20 miles above Rapid City.

Dixie project, Utah.—Silt samples are being taken from the Virgin River at regular intervals and oftener during flood flows. At such times as the water is deficient below Virgin, Utah, it is regulated between the La Verkin Canal, the Hurricane Canal, and the St. George-Washington Canal.

Salt Lake Metropolitan Water District Aqueduct, Utah.—Triangulation surveys were made over the mountain area be-

Sawmill Association

(Continued from p. 212)

remaining output of lumber is exchanged with other cooperatives for commodities and services produced by them.

In the event the membership becomes too large for the mill to provide full-time employment to all members desiring work, each man will be allowed a limited number of days each month so as to proportion the work among all members.

SAWMILL EQUIPMENT AND PRODUCTS

The sawmill is considerably better equipped and more modern than any mill in the State. It has sufficient capacity to produce daily 20 M. B. M. of finished lumber. The lumber goes from the big saw to an edger that sizes the boards to comply with commercial tolerances. From there it is conveyed to a trimmer that squares the ends and cuts it to accurate board lengths. A planer then finishes the piece. There is also a lath and molding unit, and an automatic shingle saw. The equipment is set up over a shaft pit, which arrangement eliminates overhead belts and pulleys. All the units, together with the conveying carriages, are driven by a 90-horsepower oil engine.

All kinds of building lumber are produced. Framing, sheeting, and siding are made from Ingelman spruce, white balsam, and Douglas fir. Black balsam and aspen are made into floor stringers and rafters. Shingles are to be made of spruce and aspen. It is intended to manufacture interior finish material and flooring from aspen. However, the use of aspen will be experimental as this native timber has never been used in Utah except in rare instances for shingles.

tween Draper and Alpine for the purpose of ascertaining the length of tunnels on several locations and at several elevations and a stadia traverse survey was made from Draper north to Little Cottonwood, to determine the most feasible location for the aqueduct. A reconnaissance survey along the 5,200-foot contour was made along the north side of Provo Canyon from the North Fork down to the Olmsted power plant.

Colorado River Basin.—All of the survey work in the areas immediately tributary to the Colorado River above Grand Junction have been completed, but it is possible that certain lands in the vicinity of Grand Junction will have to be surveyed. The North Fork areas are practically completed as far west as the juncture of that stream with the main Gunnison River. A total of 43,980

The logs are gathered from the nearby mountains. The most prolific growth of timber is in the head drainage of Black Canyon, approximately 11 miles distant from the mill. This area also forms the watershed which is to supply water to be conveyed through the Spring City tunnel of the Sanpete project. Most of the timber in this area is Ingelman spruce. On the slopes nearer the mill is a very good growth of aspen, some trees having grown to a diameter of 3 feet.

Arrangements have been made with the Forest Service for free stumpage for timber used by cooperative members. A nominal stumpage fee is charged for lumber sold to the retail trade.

The adobe cooperative operating in Manti, a nearby town, enables members to build a complete house on the self-help cooperative plan.

A Bibliography on Dams

Alvan W. Clark, librarian, Engineer School Library of The Engineer School, Fort Belvoir, Va., has compiled a comprehensive bibliography relating to dams from articles appearing in various periodicals and publications from January 1924 through March 1936. This bibliography in loose-leaf form consists of 256 pages and includes reference to articles appearing regarding dams in this country and in many countries abroad and includes an author index. The bibliography is for sale by the book department of The Engineer School, Fort Belvoir, Va., price 75 cents and cover for same, 30 cents extra.

ABOUT 25 new potato cellars, having a total capacity of 500 carloads, are now under construction on the Klamath project.

acres were covered with irrigated area surveys and 32,560 acres with land classification surveys during the month.

Hawaii water supply studies, Hawaii.—Weather conditions continued unusually bad during the month of May, but moderated somewhat during June, there being only 5 clear working days in the former and 16 days in the latter. Very little instrument work was done at times due to the heavy rains and high winds, limiting the activities to the cutting of trails along contours, the establishment of triangulation stations and the marking of these stations for use in the aerial survey. Arrangements were made for the temporary use of a power boat for taking men and supplies to the Pelekunu Valley where a start has been made in getting trails up the main streams for the inspection of the geological formation.

Reclamation Organization Activities and Project Visitors

John C. Page, acting commissioner, left Washington on August 15 with the Great Plains Drought Area Committee to make a study of conditions in the drought area. When the committee has been dismissed Mr. Page will begin an extensive inspection trip of Bureau of Reclamation projects in the West.

Projects and areas in North and South Dakota and Montana will be visited by Mr. Page immediately at the close of the Drought Area Committee's tour.

Mr. Page will begin his inspection tour from Denver, Colo., where the engineering offices of the Bureau are located, September 4. He will travel by automobile. He plans to attend a meeting of officials of the National Reclamation Association September 10 in Salt Lake City, and to be present when touring members of the Third World Power Conference and the Second International Conference on Large Dams visit Boulder Dam and power plant September 29.

Mr. Page expects to visit the Casper-Alcova, Riverton, and Shoshone projects in Wyoming; the Minidoka and Boise projects in Idaho; the Grand Coulee and Yakima projects in Washington; the Owyhee, Vale, Deschutes, and Klamath projects in Oregon; the Central Valley, Orland, and All-American Canal projects in California; the Yuma, Salt River, and Boulder Canyon projects in Arizona and Nevada; and the Uncompahgre and Grand Valley projects in Colorado. His tentative plans call for his return to Washington about mid-October.

R. F. Walter, chief engineer, who has been designated by Secretary of the Interior Harold L. Ickes as acting commissioner during the absence of Acting Commissioner Page, arrived in Washington on August 15.

Effective July 16, Alex S. Harker was appointed chief clerk on the Roza division, Yakima project, Washington.

On July 10, approval was given for the transfer of John A. Keimig, assistant engineer, North Platte project, to that of associate engineer in the Denver office.

Wilbur A. Dexheimer, assistant engineer, Boulder Canyon project, Nevada, was transferred to the position of associate engineer, Salt River project, Arizona, effective July 11.

R. G. Tugwell, Under Secretary of Agriculture, visited the Milk River project the latter part of July, as the western terminus of an inspection trip over the drought-stricken areas of the Middle West. During his stay on the project he made a brief inspection of the resettlement work in progress.

At the meeting in Portland on July 15-16 of the American Society of Civil Engineers, F. E. Banks, construction engineer, discussed a paper dealing with the equipment used in the construction of Grand Coulee Dam, prepared by C. D. Riddle, chief engineer for the Mason-Walsh-Atkinson-Kier Contracting Co., and delivered an illustrated address on Grand Coulee Dam and the Columbia Basin project.

R. F. Walter, chief engineer; J. L. Savage, chief designing engineer; and H. R. McBirney, designing engineer, briefly considered matters relating to rehabilitation and drainage on the Uncompahgre project while on a recent visit to the project.

Visitors to the North Platte project during July included George O. Sanford, general supervisor of operation; L. H. Mitchell, field supervisor of district No. 4; E. W. Burritt, State engineer of Wyoming; Floyd M. Roush, water commissioner; and E. O. Daggett, manager of the Farmer's Irrigation District.

Orin E. Metcalfe has been appointed right-of-way engineer, Marshall Ford Dam and Reservoir, Colorado River project, Texas, effective as of August 1. Mr. Metcalfe entered on duty under field agreement on June 29.

Stanford P. McCasland resigned as assistant engineer, Denver office, at the close of July 20 to accept employment with the city of San Francisco, Calif.

Mrs. May Moy resigned as clerk, All-American Canal project, effective at the close of June 2, on account of ill health.

Miss Gertrude Denkers, junior clerk, Ogden River project, Utah, was married on June 18 to Thomas H. Dieu. Mrs. Dieu retains her position with the Bureau, which extends congratulations.

A board of engineers, composed of Messrs. J. L. Savage, chief designing engineer, W. E. Blomgren, R. F. Blanks, engineers from the Denver office, and Dr. Charles P. Berkey, consulting geologist, visited the Colorado River project in Texas from July 7 to 11 for the purpose of investigating and studying the proposed Marshall Ford Dam, a flood control structure near Austin, Tex., on the Colorado River.

Postmaster Wilson and Capt. Arthur W. Parker visited the Central Valley project early in July. Captain Parker is to have charge of construction of the Army air base at Sacramento, for which \$7,000 has been made available.

J. W. Newsom, inventor of a modified core drill which he is using in mining shafts to depths up to 1,100 feet, called at the Central Valley project to discuss the applicability of his invention to Bureau exploratory work.

George O. Sanford, general supervisor of operation and maintenance of all field forces, and B. E. Hayden, superintendent of the Klamath project, visited the Central Valley project on a recent date.

John C. Thompson, formerly office engineer at Hamilton Dam, Colorado River project in Texas, has been assigned to the vacancy created on the Colorado River project by the transfer of Everett T. Giles to the Washington engineering staff.

The following employees have been transferred from the Denver office to the designated field offices:

Chester C. Fisher, engineer in charge of the Deschutes project to Bend, Oreg.

Kenneth F. Vernon, junior engineer, to the Central Valley project, California, effective July 1.

Donald R. Burnett, junior engineer, to the Burnt River project, Unity, Oreg., effective July 1.

Leslie E. Thompson, junior engineer, to Seminole Dam, Casper-Alcova project, effective July 16.

August D. Kalal to Parker Dam, Parker Dam project, as an inspector, effective July 16.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation.

John C. Page, Acting Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; John C. Page, Chief Engineering Division; Alfred R. Golze, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBriney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thraillkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do.	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Ft. Snmner, N. Mex.	Wilfred W. Baker	Engineer	do.	do.	do.
Casper Alcoa	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voven	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do.	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficene	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Lovelock, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do.	do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do.	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do.	do.	do.	do.	do.	do.
Minidoka	Burley, Idaho	Dana Templin	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpflg	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do.	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Rio Grande	El Paso, Tex.	L. R. Fick	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Creelius	Constr. engr.	do.	do.	do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do.	do.	do.
Stanfield	Ontario, Oreg.	R. J. Newell	do.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent	do.	W. J. Burke	Billings, Mont.
Truckee River Storage	Lovelock, Nev.	L. J. Foster	Constr. engr.	do.	J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.	do.	B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do.	do.	do.
Upper Snake River Storage	Ashton, Idaho	H. A. Parker	do.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent	do.	do.	do.
Yakima	Yakima, Wash.	J. S. Moore	do.	Philo M. Wheeler	do.	do.
Roza div.	do.	Chas. E. Crownover	Constr. engr.	Alex S. Harker	do.	do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non Federal

³ Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do.	Chas. A. Revell	Bonanza.
Klamath, Horseshoe	Horseshoe irrigation district	do.	Henry Schmor, Jr.	President	Dorothy Evers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do.	Fort 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.
do.	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich.
do.	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do.	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do.	H. W. Emery	Fallon.
North Platte: Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do.	Flora K. Schroeder	Mitchell.
do.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mary Harrach	Torrington.
Northport div.	Northport irrigation district	Northport, Nebr.	Mark Iddins	do.	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
do.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
do.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	H. P. Wanger	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	Enos D. Martin	Hermiston.
do.	West extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Thompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise	Boise, Idaho	Lester C. Walker	do.
Rio Grande	Denver, Colo.	Wm. C. Sloan	do.
Western Slope	Grand Junction, Colo.	Frank C. Merriell	do.

SALLIE A. B. COE, Editor.



MODEL FOR THE MEMORIAL TABLET WHICH WILL BE PLACED AT BOULDER DAM IN MEMORY OF THE WORKMEN WHO DIED IN ITS CONSTRUCTION. THE TABLET WAS DESIGNED BY OSKAR J. W. HANSEN, CHICAGO SCULPTOR. PREPARATIONS ARE BEING MADE TO CAST AND PLACE IT ON THE ARIZONA SIDE OF BLACK CANYON ON THE COLORADO RIVER AT THE DAMSITE. THIS PANEL IS 11 FEET, 3 INCHES WIDE. THE INSCRIPTION ON THE FACE IS "THEY DIED TO MAKE THE DESERT BLOOM."

7.5; 1936

THE RECLAMATION ERA



VOL. 26, NO. 10



OCTOBER 1936



BOULDER DAM. SEPTEMBER 11, 1936

Eastern Industry Profits by Western Reclamation

The intensive farming largely practiced in the Yakima Valley, with the production of tree fruits, vegetables, poultry, and dairy products and other specialties involving large amounts of labor in spraying, cleaning, sorting, packing, processing, byproduct plants, lumber plants for local building and for packaging of crops, supports a large population, with purchasing power substantially above the average for the Nation.

Of the \$50,000,000 of new wealth produced annually in the Yakima Valley, more than half is expended for the products of eastern industries. These industries by principal classifications are automobiles and accessories, general merchandise, building material and equipment, apparel, manufactured foods, house furnishings, drugs and cosmetics, tobacco, farm machinery, radio and music, books and magazines, jewelry, office equipment and supplies, and notions.

These industries, with their supplies of raw materials, touch every industrial and agricultural center east of the Rocky Mountains.

The expenditures of Yakima Valley money each year for the items above referred to compare favorably with the total the United States exports to all of Central America or to such countries as Sweden, Norway, Brazil, or Argentina.

From the very beginning of construction of an irrigation project eastern industry profits, as witness the broad distribution of construction outlay incurred by the Government and the contractor at Coulee Dam. Of the first \$23,000,000 expended by the contractor, \$6,500,000 went directly to States east of the Rocky Mountains for equipment, machinery, and supplies.

Thus the Yakima Valley, and doubtless every other irrigated section in the West, contributes substantially to the national well-being by producing new wealth and by spending it for the products of eastern industry and even of eastern agriculture.—Excerpts from Report of the Washington State Planning Commission on Reclamation.

THE RECLAMATION ERA

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HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

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OCTOBER 1936



World Power Conference Broadcast—Boulder Dam Portion

12:25 TO 12:45 P. M. PACIFIC STANDARD
TIME (RED), FRIDAY, SEPTEMBER 11,
1936

00:00. KEATING. The turbine starts as the first water strikes its blades!

(Sound effect of turbine.)

00:20. KEATING. The needle valves open, slightly. The first water begins to fall to the canyon floor.

00:40. KEATING. This is Laurence Keating speaking to you from the upstream end of the Nevada wing of the Boulder Dam power-house, at the bottom of Black Canyon, on the Colorado River. I am looking downstream to where, some four blocks away, four of the needle valves already are permitting four gigantic jets of water to burst out over the canyon. They leap from a great concrete building—the valve house—which clings close to the volcanic cliffs that form Black Canyon. They spurt out from outlets 7 feet in diameter from a height of 177 feet above the level of the tailrace, which is the level of the Colorado River. Thirteen feet higher than the fall of Niagara is the fall of those jets of water; and they feather gracefully downward, and almost across the 300-foot wide canyon. It will take 20 minutes for all 12 to be opened fully—with only the four partially turned on now, there is already a definite murmuring roar of falling water—hear it?

(Five seconds or so of light roar.)

We told you that each of those jets of water is 7 feet in diameter where it leaves the valve house outlet. Yet, from here, they look no larger than the stream from a large fire hose. So high are these volcanic cliffs; so immense is the dam itself sloping straight up behind us; so enormous are the power-house buildings, that all—dam, power-house, water jets, and age-old mountains—appears to be one of a piece, and all designed by the same architectural hand.

We shall not fill you with facts and figures; but a few may be of interest.

The power-house building itself is in the shape of a U, with the bottom of the U, at one corner of which we are standing, resting at the base of the dam proper, and the two legs, each two city blocks long, extending downstream from the dam on each side of the canyon. The total length of this U is 1,650 feet. And—and this is the most amazing thing about it—the power-house, in height from foundation, is equivalent to that of a 20-story building. Yet, from the top of the dam, which is 560 feet above where we are standing, this power-house looks like a bungalow!

One more set of pertinent facts: Boulder Dam is the largest and highest in the world, 727 feet above bedrock; 4,400,000 cubic yards of concrete masonry are in the dam, power-house, and appurtenant works. This power-house is designed to have a rated horsepower capacity of 1,835,000, by far the largest in the world. When completely installed there will be fifteen 115,000-horsepower vertical hydraulic turbines, and 255,000-horsepower installations of the same type. This Boulder Dam and power-house is the hugest, most gigantic, and most awe-inspiring project of its type ever brought to completion by man. And, withal, it is beautiful; beautiful not only to the eye of a trained engineer but to the lay public as well.

A word or two about the general setting and location; here at Black Canyon, we are about 25 miles, air line southeast, from Las Vegas, Nev. Black Canyon is the dividing line between the States of Arizona and Nevada. Boulder Dam joins the two; and the power-house wings—the legs of that U—lie one in Nevada and the other in Arizona. Los Angeles is a little over 300 miles south and west, while Salt Lake City is four hundred and some miles north and east.

Looking downstream again, we note that small jets of water are beginning to leap from all 12 of the needle-valve out-

lets now; and while those valves are slowly being opened, I'm going to ask a few questions of Mr. Ralph Lowry, construction engineer, United States Bureau of Reclamation, who is in charge of this Boulder Dam project. Following our interview with Mr. Lowry, we are going to switch up into the air for a bird's-eye-view description of this project; but now, here's Mr. Lowry, and—well, let's start at the beginning, Mr. Lowry. Why was Boulder Dam built?

04:00. LOWRY. First, for river regulation, improvement of navigation, and flood control; second, for irrigation and domestic uses; and, third, for power development.

KEATING.—Then all this power you can generate here is but one of several reasons for the dam?

LOWRY. Yes, and probably important in the order named.

KEATING. How large is the reservoir the dam creates?

LOWRY. When full, it will be 115 miles long, and will hold about 30,500,000 acre-feet—an acre-foot is enough water to cover 1 acre to a depth of 1 foot. Perhaps you can get a better idea of how much that is if I tell you that this reservoir, which is named Lake Mead in honor of the late Dr. Elwood Mead, formerly Commissioner of the Bureau of Reclamation, will contain enough water to cover the State of New York to a depth of 1 foot. There are 9,500,000 acre-feet in the lake now, and if that were spread over the District of Columbia, Washington would be under 240 feet of water.

KEATING. How high will the water be on the dam?

LOWRY. That's a hard question to answer, definitely, because the water surface in the reservoir will fluctuate due to the fact that it will be necessary to release water as needed for power and irrigation demands. Perhaps it will answer what you have in mind, to

say that the dam will raise the old river level a maximum of about 585 feet.

KEATING. I see. And the difference between the 585 feet of water and the 727 feet of dam is because the dam was sunk in bedrock, and, also, of course, rises a few feet above the surface of the lake.

LOWRY. That's it.

KEATING. Now, Mr. Lowry, about this power-house. I've already spoken of the 15 115,000-horsepower turbines, and the 2 55,000-horsepower ones, totaling 1,835,000 horsepower; how does that maximum capacity compare with other plants?

LOWRY. Based upon installed capacity, it is about three times as large as Muscle Shoals on the Tennessee River; more than three times as large as the Conowingo plant on the Susquehanna River in Pennsylvania, and it has 22 percent more capacity than all the water-power plants on the Niagara River near Niagara Falls.

KEATING. Well, that's the maximum capacity. How large is the present installation of power machinery here at Boulder Dam?

LOWRY. Five hundred and fifteen thousand horsepower. We have four units of 115,000 horsepower each and one of 55,000 horsepower.

KEATING. When will the remaining units of the power plant be installed?

LOWRY. When needed; the additional units will be put in from time to time to meet the requirements of those who have made contracts with the Government for the purchase of the power. It may take 8 or 10 years to install all the machinery.

KEATING. Well, the next question is obvious. What's the Government going to do with all that power?

LOWRY. Sell it. In fact, it has been sold!

KEATING. Huh? The President pressed the key today to start generating power, and it's sold already? Who bought it?

LOWRY. Contracted for way in advance, Mr. Keating. Most of it has been sold to the Metropolitan Water District of Southern California; the city of Los Angeles; the cities of Burbank, Glendale, and Pasadena, all in southern California; and to the Southern California Edison Co., the Los Angeles Gas and Electric Corporation, and the Southern Sierras Power Co. Some of it has been sold to the State of Nevada, and the State of Arizona has the privilege of buying part of the power heretofore sold to the city of Los Angeles and the Edison Co. The Metropolitan Water District of Southern California has the first call on the secondary power, and if it doesn't take all that secondary power, what's left is available to the city of Los Angeles and the private utility companies.

KEATING. I guess it is sold, but what is this secondary power of which you spoke, Mr. Lowry?

LOWRY. All power in excess of 4,240,000,000 kilowatt-hours generated in any one year.

KEATING. How long is this power sold for?

LOWRY. For a period of 50 years.

KEATING. How much will the Government charge for this power?

LOWRY. Well, the power is sold in terms of falling water—what we call "firm" or constant power—power we know we can deliver at any season of the year. For that the Government will



CONSTRUCTION ENGINEER LOWRY
BROADCASTS.

charge 1.63 mills per kilowatt-hour, and one-half mill for the excess, or secondary power. In addition, the contractors have to repay the Government for the generating equipment installed in the power-house. Altogether, the charge for power will be about $2\frac{1}{4}$ mills per kilowatt-hour—at the power-house, here.

KEATING. Oh, delivered here! How do they get it to where they are going to use it?

LOWRY. Their own transmission lines; the city of Los Angeles already has two 266-mile lines built; I believe they are the highest voltage transmission lines in the United States, for they will carry 287,000 volts.

KEATING. Mr. Lowry, under whose direction was this Boulder Dam project constructed?

LOWRY. The dam and related works were built by the Department of the Interior through its Bureau of Reclamation. Intensive investigations and designing have been in progress since 1920, when Boulder and Black Canyons were thoroughly explored by diamond drilling. Over 10,000 separate detailed drawings

have been prepared by the office of the Chief Engineer of the Bureau of Reclamation in Denver.

KEATING. Mr. Lowry, a generator is turning over; the needle valves are open partially; Lake Mead is one-third full; the construction contractors have completed their job 2 years ahead of time, and have departed; the Colorado River, tamed and harnessed, is flowing through man-made tunnels and spouting out of that cliff below us; have any of the main purposes of the project been realized?

LOWRY. Indeed, they have; water has been stored here since February 1, 1935. The spring floods of the past 2 years have been safely held in check, accomplishing the primary purpose of the dam—flood control. You probably have noticed that the water at this whole lower end of the lake is crystal clear; the silt settles out at the upper end. For 2 years water has been delivered as needed to the lower valleys, eliminating forever the threat of floods and ultimately saving the farmers millions of dollars in repairs to levees and canals, and, in addition furnishing an ample and dependable water supply, so today for the first time the Colorado River goes to work, turning generators to light the Southwest; and, with that going to work, the resulting power to be generated and already sold will repay the entire cost of the project, including interest charge and amortization, in about 50 years.

KEATING. In short, Mr. Lowry, the United States built Boulder Dam for control of the Colorado; as a byproduct, we almost might say, we get power; and from the sale of power, the whole project is paid for in 50 years. Sounds like a good business proposition.

LOWRY. It is, for both the Government and the whole Southwest.

KEATING. Thank you very much, Mr. Lowry; and now I imagine that you will be going to see that the milling thousands of people who are here today, lining the top of the dam, surging into the power-houses, and all over the canyon road ways to view this spectacle, are getting along all right?

LOWRY. One more thing I would like to say before I go, Mr. Keating. The Department and the Bureau are pleased to announce that power is now being generated at Boulder Dam and to thank all those who have had a hand in making this event possible.

KEATING. And thank you again, Mr. Lowry.

Just before we introduced Mr. Lowry, I told you that we were going "up in the air" to look at this country. Now's the time. Cliff Engle is flying over Boulder Dam and Lake Mead in one of the West-

ern Air Express-United Airline coast-to-coast planes that regularly fly over here, and I'm going to switch controls to him. Take it, Cliff Engle!

12:00. ENGLE. And this is Cliff Engle, speaking to you from our Western Air Express-United Airline Transport plane flying over Lake Mead toward Boulder Dam at an elevation of 5,000 feet. Boulder Dam is too big to comprehend, all of it at once; and Lake Mead, the largest man-made lake in the world, is of such immense size that we had to come up here to see all its turquoise waters, placidly lapping against the red-, chocolate-, amber-, sulphur-, and iron-colored mountains. And there in the distance is the gray buttress of masonry that is Boulder Dam itself, with the blue lane of the lake reaching halfway down Black Canyon toward it. From here, high in the air, we can appreciate just what this Boulder Dam project will mean to all this southwestern country. This is the very heart of what the old maps marked as "the Great American Desert." Everywhere we look—north, south, east, and west—we can see what countless centuries of devastating floods have done to this country in the way of erosion. Off to our east, and plainly visible, is the mighty Grand Canyon of the Colorado, winding its exquisitely narrow gash through 8,000 feet high plateaus. The Grand Canyon is the result of erosion. Boulder Canyon, right behind us, 20 miles above the dam, was cut by the river, just as was Black Canyon, where Boulder Dam is built. Now, Lake Mead, placid, quiet, stores that water, halts these floods, in this great basin. Right now, the basin is one-third full. Already the still water of the Lake is 97 miles long, and reaches up—still water, mind you—23 miles into the very Grand Canyon itself. As Mr. Lowry told you a few minutes ago, there are right now 9,500,000 acre-feet of water below me in what was once a land as parched as the Sahara, as desolate as outer Mongolia—a land where, up until the Bureau of Reclamation surveyors came in 1920, only a handful of men, red or white, ever had been. Stretching southwest we can see the city of Los Angeles power lines reaching straight to the distant San Gabriel Mountains, clear across the Mojave Desert, and, along with them, the glittering rails of the United Pacific main line. Southward, the ribbon of the Colorado, placid after its leap from the needle-valve openings, winds its way to Needles, and the Yuma and Imperial Valley irrigation districts and the All-American Canal. All this country, nearly, will reap a direct benefit from the limpid, turquoise waters of this lake below us—a lake made by Boulder Dam.

And on that lake man has been quick to relax and play; below us now motor-boats are carving their symmetrical wake across its deep-blue surface; we can see the bottom, clearly—why, there's even someone down there aquaplaning behind a power boat. Just think—aquaplaning on the "Great American Desert", the very heart of the desert. Now wheeling northward we see that Bangs Peak, with its 7,000-foot crest, hides our view of Zion National Park, but eastward the whole kaleidoscope of colored carved canyons that lead into the Grand Canyon of the Colorado is spread before our eyes. This is the country of Lake Mead and Boulder Dam.



CROWDS WITNESSED THE SPECTACLE FROM THE PAVEMENT OF THE NEVADA POWER HOUSE.

Boathouses and swimmers; water storage to the tune of 30,500,000 acre-feet, when full; absolute flood control of all the force of the angry, tricky, notorious Colorado River; sure, certain power for the lighting and industrial purposes of all the great Southwest—Mead Lake provides all these in this hitherto desolate land. And Boulder Dam made Mead Lake. And perhaps the greatest tribute we can pay the architects, the contractors, and the dam itself, is to say that, from here, at 5,000 feet, Boulder Dam looks as though it belonged in this country. It fits the country; it matches, in size, symmetry, grandeur, and beauty, some of the wildest, barrenest, most colorful, and most awe-inspiring country on the face of the earth. May I repeat, Boulder Dam seems to blend in with it all, as though Nature had put it there.

And power pays for it all. All the 12 valves should be open now, and the generator going full. So, back down we go and the next sound you will hear will be that of the twelve 7-foot streams, leaping

from the 12 needle valves, 177 feet down to the floor of Black Canyon. The voice of the Colorado River!

16:00. Twenty seconds full roar of 12 needle-valve streams.

16:20. KEATING. Twelve 7-foot streams of water bursting from the valve houses, 177 feet above the Colorado River. Gleaming and glittering in the brilliant desert sunlight, they meet in midair over midstream, to burst against each other. They fill the whole Black Canyon with throbbing, thundering spray and mist that the sunlight breaks into a million rainbows. The roar is so deafening that I hardly can hear my own voice, and I am nearly four city blocks away from those "higher than Niagara" waterfalls. All Mead Lake—all the present pressure of 385 feet of water held back by Boulder Dam—is trying to get out of those twelve 7-foot openings.

It is thrilling, inexpressibly thrilling, to stand here, in safety and shelter, and watch the terrific impact of those streams, and to almost feel the pounding mass of water bursting downward to the bed of the river. This is a sight few men will see; for but rarely will all 12 of these needle valves be open at one and the same time. For that matter, none of the valves will be open when all the power-house units are in operation. Then all the water will be going through the turbines to reach the river down below the power-house, into the tailrace. Even the four streams which flow regularly, discharging the Colorado River to its duties down below, will be visible for only the next few months, or until the four units now installed go into regular operation.

It is thrilling, too, to stand here and realize that but three or four men—men like you and me—control this roaring, shattering, bursting force of water; and that with slow, gentle turns of their hands these men can regulate, curtail, and entirely shut off those giant waterfalls until not a trickle comes down the face of the canyon wall. The 12 Boulder Dam needle valves are open.

(Three-second pause.)

And inside the power-house the generator is turning at full force—the first power is being generated at Boulder Dam. Listen to the impact of the water on the turbine blades, and possibly you will hear the whine of the generator itself.

18:20. Twenty seconds turbine and generator whine.

18:40. KEATING. The Boulder Dam project is a fact! The Colorado River flows through man-made tunnels, confined by man-made pipe, harnessed to do man's will and man's work. Power—the

(Continued on p. 227)

He Started the First Generator at Boulder Dam Power House



PRESIDENT ROOSEVELT PRESSED THE GOLDEN KEY.

PRESIDENT Franklin Delano Roosevelt pressed a golden key on the platform at Constitution Hall in Washington September 11 and started the first generator in the Boulder Dam power-house.

Dramatically closing his address to the delegates to the Third World Power Conference and the Second Congress of the International Commission on Large Dams, the President said: "Boulder Dam, in the name of the people of the United States, to whom you are a symbol of greater things in the future, in the honored presence of guests from many nations, I call you to life!"

The signal the President gave energized the master relay on the generator-control cubicle in the power-house, thus starting a 3,500 horsepower station service unit in the same sequence as it would have been started if an operator had pressed the starter button at the generator.

Millions heard the Nation-wide broadcast of this ceremony, half of which originated in Washington and consisted of the President's speech, and half of which originated at Boulder Dam where the hum of the first turbine and the roar of falling water gave audible point to the President's assertion that he was calling Boulder Dam to life.

Construction Engineer Ralph Lowry and a commentator of the National Broadcasting Co. gave to the radio audience, to the thousands gathered at Boulder Dam, and to the World Power Conference delegates who also were tuned in on the broadcast in Constitution Hall, a graphic description of Boulder Dam and the power-house, their purposes, and their services.

The President's address came first. His was an earnest charge to the delegates of the responsibility they share toward a social and economic adjustment

of the effects of power made possible through dams. At the close of his address he turned from the audience to a small table on which the golden key of a telegraph transmitter awaited his hand to send his message 3,000 miles to Boulder Dam.

BUREAU ENGINEERS PARTICIPATED

This was the dramatic climax of a week during which the eminent engineers of 52 nations had discussed problems and plans in which electric energy has a part. The Bureau of Reclamation took part in the proceedings of the joint convention of the World Power Conference and the International Commission on Large Dams by contributing papers and sending engineers for discussions. Nearly 1,000 foreign delegates and 2,000 from the United States joined in this great round table discussion, which this year placed special emphasis on the economic problems evolving from and revolving around the use of electric energy.

Before the conference, four groups of delegates made study tours of power plants, industrial establishments, and dams throughout the East. Following the conference, these tours were duplicated, and a fifth and grand tour made. This was a transcontinental tour which visited Grand Coulee Dam and Boulder Dam. Two hundred delegates, representing all the principal nations of the world, traveled in a special train in this 3-weeks' tour.

The President's address before the convention was reserved for its next to the last day.

In part the President said:

"One who considers the matter with forthright vision cannot convince himself that public policy for promotion of availability of electric energy can really harm the electric industry that exists today. It would give opportunity for that industry to add to achievements already great. The more integrated its sources of energy, the less it would require of excess capacity and the lower would be its costs. The broader the base of consumers of a product that is now classed as a necessity, the lower would be its costs and the greater its stability. Years ago Steinmetz observed that 'electricity is expensive because it is not widely used, and it is not widely used because it is expensive.' Notwithstanding reductions in rates and increase of consumption since his day—which, by the way, have demonstrated the truth of his words—that observation still holds true. There is a vicious circle which must

be broken, and wise public policy will help to break it.

"I still hold to the belief of 2 years ago, when I spoke as follows:

"We are going to see, I believe, with our own eyes electricity and power made so cheap that they will become a standard article of use, not only for agriculture and manufacturing, but also for every home within reach of an electric-light line.

"The experience of those sections of the world that have cheap power proves very conclusively that the cheaper the power the more of it is used."

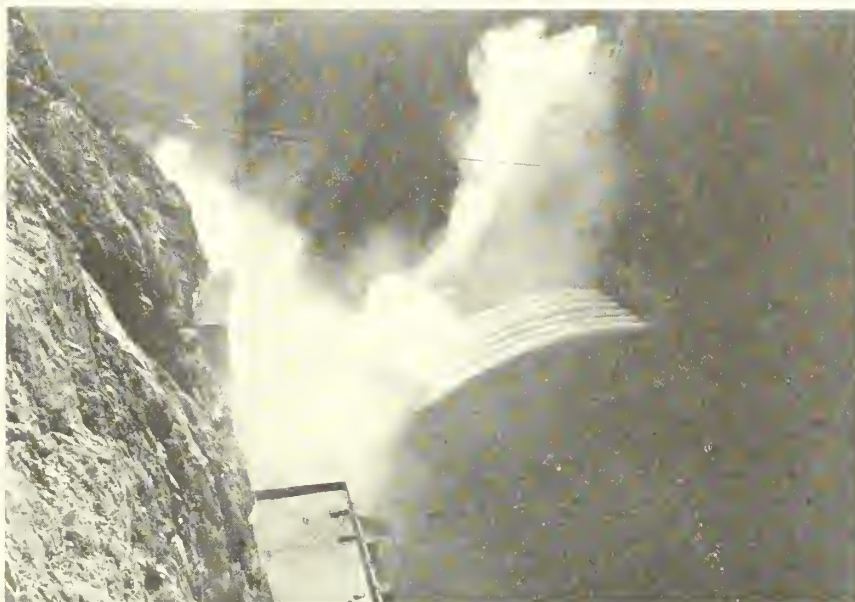
"These words were spoken at Grand Coulee. The Government of the United States has promoted the construction of several great reservoirs, which you will inspect on your grand tour, primarily for navigation or reclamation, but with incidental values for flood control and the regulation of stream flow. Among other incidental values is the generation of electric power. This may prove to be the force that breaks the vicious circle to which I have referred. If these are not sufficient, the influence of additional meritorious projects awaiting development can be added.

"Two great dams of the Tennessee Valley Authority have been completed and are making their contribution to the public weal. Grand Coulee is far enough along to enlist your interest, as also is Bonneville. At Boulder Dam on the mighty Colorado the gates were closed months ago; a great lake has come into being behind the dam; generating equipment has been installed in the power plant; and at this moment the powerful turbines are awaiting the relatively tiny impulse of electric current which will flow from the touch of my hand on the button which you see before me on the desk, to stir them to life and creative activity."

A part of the first electricity generated at Boulder Dam was used to energize the broadcast which brought back to Constitution Hall the sounds of the turbine and the generator.

In addition to starting the generator, the President's finger gave the signal for the opening of the 12 great 84-inch needle valves in the Arizona and Nevada canyon wall outlets to form a mighty waterfall 177 feet high.

Probably never again will the 12 valves be released simultaneously. But the first turbine, started so ceremoniously, continues to generate power which before long will be supplemented by power from the additional 18 turbines, power already contracted for to be transmitted as far as the Pacific coast and which will in 50 years repay to the Nation the total cost of Boulder Dam.



DURING A TEST OF THE NEEDLE VALVES AT BOULDER DAM, FOR THE FIRST AND PERHAPS THE LAST TIME WATER IS RELEASED SIMULTANEOUSLY FROM ALL TWELVE, CREATING A GIANT WATERFALL ON EACH SIDE OF THE CANYON.

WHAT HAPPENED AT THE DAM

Coincidental with the World Power Conference in Washington, at least 8,000 persons were gathered on the roadway at the top of the dam where the program was broadcast over a public-address system. Five hundred more, among whom were the Governor, two Senators, and Congressmen of Nevada, and officials and representatives from all the power companies and municipalities to benefit from the Boulder power plant, heard the speakers in the power-house. The line of private automobiles extended halfway up the 7-mile road from the dam to Boulder City.

The first power to be generated at Boulder Dam is not to be confused with the first power to be sold, for that will go to the city of Los Angeles at 287,500 volts in the late fall, when the first 82,500 kilovolt-ampere General Electric generator motivated by a 115,000-horsepower turbine will go into operation.

As the swish of water was heard and the generator, a 3,000-kilovolt-ampere unit to supply the dam and Boulder City and to excite the major units, began to hum, the crowd assembled in the power-house hurried to the outside to see eight streams of water added to the four already in operation. Amidst the roar of the two Niagaras meeting each other in midstream and the buzz of the generator, a 20-minute program was broadcast with all sound effects, describing the dam and its purposes with the spotlight on power generation, the lake, and surrounding desert lands.

After the broadcast between Construction Engineer Lowry and the announcer, Lake Mead and the arid peaks, plateaus, and valleys surrounding were described to radio listeners by the Western Air Express-United Air Lines plane. Back at the dam again, the broadcast went to the Government cableway, where, in midstream, immediately above the valve houses, hung a "skip" carrying newsreel photographers and radio men who picked up and transmitted the voice of the Colorado. The program was concluded at 12:45 p. m. at the starting point. At 1 o'clock the river was silenced—spectators looked up to see not a trickle of water coming from the great valves. For 15 minutes there was no Colorado, and then suddenly the river spoke again—12 valves again poured water to where, moments before, was only a placid pool. Thus was tangible evidence given to the throng of onlookers that the Colorado can be turned on and shut off at man's will.

ABOUT 7,000 persons attended the ceremonies on the Boulder Canyon project on September 11, among whom were Gov. Richard Kirman, of Nevada; Senators McCarran and Pittman; Representative J. T. Scrugham; and many other distinguished guests.

THE Federal highway leading northwest from Belle Fourche into Montana is to be graveled immediately to the State line at a cost of \$21,709.

History of Irrigation Development in Arizona¹

By R. H. Forbes, Former Director Arizona Agricultural Experiment Station

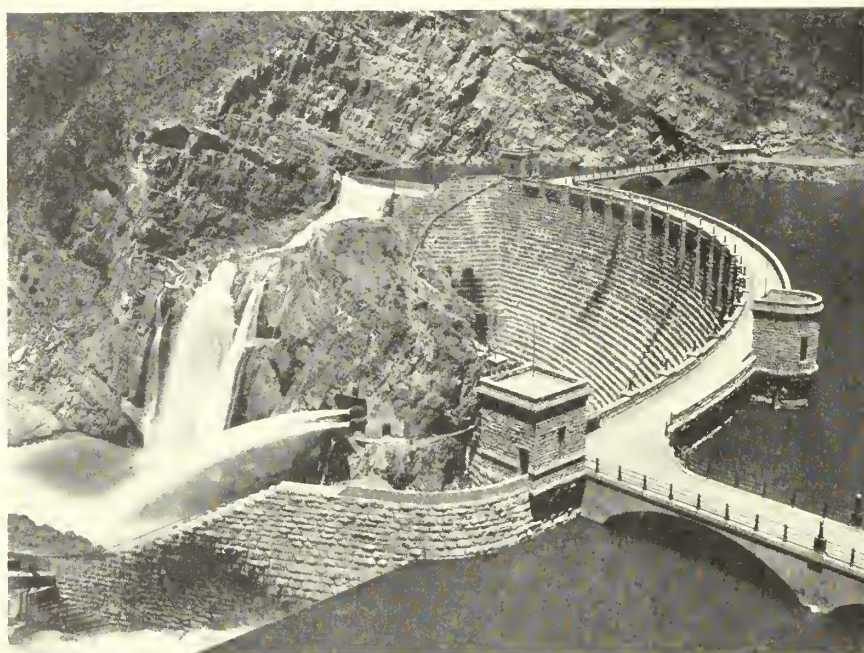
IRRIGATION, which for the most part is a prerequisite to agriculture in Arizona, was first practiced in this region by ancient peoples. In the valleys of the Little Colorado, Salt, and Gila Rivers, and along the Verde River and smaller tributaries are found unmistakable remains of ditches and reservoirs, together with ruins of the cliff dwellings and the communal houses of tribes which had been scattered long before the advent of the Spanish explorers. The character of these remains indicates that these ancient Indians possessed considerable skill in the

people, have continued to water and till the soil. The Pimas particularly are good irrigating farmers. They are a sedentary tribe which, since modern records began, has maintained itself in the Salt and Gila River Valleys in south-central Arizona. Their nomadic relatives, the Papagos, taking advantage of the uncertain rains which chance upon them utilize the run-off from summer storms, soak their soil, and plant quick-growing crops of corn, beans, squashes, and melons. The several tribes along the Colorado River—the Mohaves,

1732. It was not until the more prosperous period from about 1768 to 1822, however, that there was any considerable development of irrigation at favorable points along the Santa Cruz River, near the missions and the Spanish presidios of Tubac and Tucson. During the chaotic period of Mexican rule which followed *acacias* were maintained, orchards were planted, and annual crops of barley, wheat, corn, tobacco, beans, melons, squashes, and peppers—both native and introduced crops—were cultivated. Although from an engineering standpoint the head works and canals of this period were of the simplest construction and of small extent, the Mexican people were skillful in the management of water and possessed an agricultural aptitude well expressed by them in their phrase "*el mano por sembrar*"—the planting hand. They also adopted certain ideas in equity and customs relating to the distribution and use of water, which are approved in the best irrigation practice of the present time. Among these was the rule that water is appurtenant to the land.

The Americans in Arizona received their first instruction in irrigation from the Mexicans. The third, or modern, stage of agricultural development may be said to date from the Gadsden purchase in 1854, after which increasing numbers of Americans—military followers, stragglers from the immigrant stream to California, and pioneers by instinct—began to make permanent homes in the land.

Irrigation in the Salt River Valley began soon after the close of the Civil War, when military occupation of the region was resumed and the Army posts offered the settlers both safety and remunerative prices for their products. Canal construction was rapid, beginning with the old Swilling Ditch in 1867, and 20 years later about as much land had been reclaimed as could be irrigated from Salt River in seasons of scant flow. Nevertheless, during a series of wet years that followed, additional areas were put under cultivation until more ground was nominally reclaimed than could be irrigated by the "critical minimum" water supply. The inevitable hardships which resulted from this condition during ensuing dry years, especially 1898-1904, led to anxious discussion of remedial measures and prepared the way for the construction under United States Reclamation Service auspices of the Roosevelt Storage Dam, which was completed in March 1911.



ROOSEVELT DAM, ARIZ.

art of irrigating. Their ditches and reservoirs were finished with hard linings of tamped or burnt clay, and one instance is known where a main canal was cut for a considerable distance through solid rock. Sometimes a smaller ditch was sunk in the bottom of a large canal to facilitate the carriage of small runs of water, and thus seepage and evaporation were diminished in times of scant flow. The ancient canals in the Salt River Valley aggregated a length of at least 150 miles and were sufficient for the irrigation of 250,000 acres of land, although it is not likely that the whole of this area was ever watered at any one time. In the ruins of the houses of grouted clay are found relics of cotton and corn; beans, squashes, and tobacco were also grown.

The Pimas and Papagos, who were probably descendants of this prehistoric

Chemehuevis, Yumas, and Cocopahs—grow crops in that fertile valley after a peculiar method necessitated by the behavior of the river. Their main crop season begins immediately after the subsidence of the annual flood in July. Millets are sown in the mud flats exposed by the falling waters, much after the fashion of Egyptian irrigators under the old basin system used along the Nile. Other crops, such as corn, squashes, and melons are planted, as soon as the bottom lands are dry enough, in pits sometimes 2 feet deep, from which the plants issue quickly in profuse growth. Sufficient moisture is brought within reach of the plant roots by this method of deep planting to insure a crop without further irrigation.

The first European irrigators in Arizona were, without doubt, the Jesuits, who first established themselves at the old missions of Guevavi and San Xavier in

¹ From Bulletin 63, Arizona Agricultural Experiment Station.

The second largest irrigated district in Arizona (1911) is in Graham County on the upper Gila River. It was settled by Mexican colonists in 1874 and later by the Mormons in 1879.

The Colorado River Valley, although the most extensive and potentially the richest and best watered of the agricultural regions, is the last to be developed through irrigation, principally because of the unmanageable character of this eccentric stream and the large expense of the permanent irrigation works required for its control. Although a few small enterprises near Yuma have achieved temporary successes during the past 15 years, it was not until the United States Reclamation Service undertook the construction of the Laguna Barrage that the irrigation of considerable areas was assured.

The continuation of a development which has increased the irrigated area from 2,000 to 228,000 acres in the 55 years of American occupation (1854-1909) is worthy of study. With the whole of the minimum surface flow of the territory now in use and only flood waters escaping, it is evident that any further expansion of agricultural industry must depend upon the storage of flood waters, the development of underground supplies, and improved cultural methods.

Arizona has an area of 113,956 square miles, of which all but about 116 square miles, or over 99.9 percent, is land surface. The territory is situated in the midst of the semiarid, subtropical region of the southwestern part of the United States and northwestern Mexico. Its

remoteness from communications by land or sea and the heretofore more attractive domains of Texas and California on either side, have left it to be one of the last of the Commonwealths to be developed.

H. C. Schwalen, associate agricultural engineer, reports: "Many different areas within the State of Arizona have been proposed for future development at various times. At present those areas which are being actively pushed for development are as follows: Gila Valley project, 585,000 acres net; the Parker project, 90,000 acres net; Mohave Valley

project, 13,000 acres gravity, 5,300 acres pump.

"The 1930 census report gives the total acreage under irrigation in the State as 576,000. During the depression this acreage decreased, but at the present time the figure of 576,000 would be very close to that actually under irrigation."

The crop summary for 1934, excluding irrigated acreage in pasturage, was as follows: Alfalfa, 146,000; cotton, 136,000; wheat, 50,000; barley, 27,000; grain sorghums, 34,000; corn, 35,000; truck, 40,000; trees, vines, etc., 25,000; total, 493,000.



IRRIGATING AN ORANGE GROVE ON THE SALT RIVER PROJECT, ARIZONA.

Boulder Broadcast

(Continued from p. 223)

first from Boulder Dam is being generated right now.

Now, here's a surprise. The roar of the needle-valve jets was brought to you by means of an ultra high-frequency pack transmitter, located on the Government cableway skip hanging right by the waterfalls, down in the canyon. That short-wave signal was received right here by a short-wave radio receiver. That receiver, ladies and gentlemen, was powered by the electricity from this Boulder Dam generator. In other words, the very first power generated at Boulder Dam was used to bring you a portion of this broadcast.

This Boulder Dam program came to you in connection with the Third World Power Conference and the second World Congress on Large Dams. It was brought to you directly from the Boulder Dam power-house in Black Canyon, and a

Drought Committee Report

The Great Plains drought area committee, of which John C. Page, Acting Commissioner of Reclamation, is a member, submitted a report to the President on August 27 on the essentials of a long-time program looking toward the betterment of economic conditions in the Great Plains drought area.

The report consists of 17 pages and contains numerous charts regarding rainfall, wind erosion, crop acreage, yields, cattle, size of farms, and farm tenancy.

Copies may be obtained as long as available from the chairman of the committee, Mr. Morris L. Cooke, Administrator, Rural Electrification Administration, Washington, D. C.

Western Air Express-United Airlines plane, as a presentation of the red network of the National Broadcasting Co.

The Highest and the Largest

It is only to be expected that irrigation engineers from foreign lands would look to the United States for examples as we continue to be leaders in building the highest and the largest dams, and by a succession of such projects and extensive research new methods are evolved.

We point with pride to having built the highest dam in the world, Boulder Dam on the Colorado River, and having created the largest artificial lake in the world, Lake Mead behind Boulder Dam. We also have under construction the largest dam in the world, Grand Coulee on the Columbia River in the State of Washington. Because of its wide gorge the Grand Coulee high dam will use three times the concrete poured in Boulder Dam.

Each project completed is another link in the chain of water conservation and development of watersheds.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users organizations for mass subscriptions on Federal irrigation projects.

OCTOBER 1936

Dr. Mead Honored

In a previous issue of the Reclamation Era announcement was made of the action of the Board of Geographic Names in naming the lake formed by Boulder Dam Lake Mead.

On September 29 a memorial plaque will be unveiled at Lookout Point above Lake Mead and the inscription on this plaque will be—

Dr. Elwood Mead
Commissioner, Bureau of Reclamation
Department of the Interior
1924-1936

whose lifetime work culminated in the construction of the Boulder Canyon project, creating Lake Mead, named in his honor.

The bronze plaque will bear a likeness of Dr. Mead and was designed by Oscar J. W. Hansen, sculptor of other decorations at Boulder Dam.

Dr. Mead was vice president of the International Commission on Large Dams and a member of the executive committee of the Third World Power Conference. It is, therefore, appropriate that this plaque should be unveiled when approximately 200 delegates of the Third World

Power Conference and the Second Congress of the International Commission on Large Dams reach Boulder Dam September 29 on their transcontinental tour.

Much thought was given as to an appropriate place to install the plaque. The spot chosen is high on the wall of Black Canyon, a few hundred yards from

Boulder Dam and overlooking a vast portion of Lake Mead. The lake is almost 100 miles long, extending into the lower end of the gorge of Grand Canyon. This lake now is the largest artificial lake in the world. The point selected is a favorite among the thousands of tourists who visit the dam and lake each week because of its fine vantage point.

(Cut along this line)

COMMISSIONER,
Bureau of Reclamation,
Washington, D. C.

(Date)_____

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Name)_____

(Address)_____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.



A BRONZE MEMORIAL PLAQUE TO DR. ELWOOD MEAD.

Bureau's Exhibit

The Bureau of Reclamation depicted its work in murals and photographs in an exhibit prepared by the Public Relations Division and placed in the spacious corridor of the headquarters hotel of the Third World Power Conference during its meeting in Washington. A 42-foot mural stretched the length of the exhibit, which told in oils the progressive story from the emigrants' arrival in the arid West to the building of Boulder Dam and the growth of prosperous communities.

In a cabinet, lantern slides of project scenes were displayed, forming a bright mosaic of colored glass. On either side photographs were grouped to show the major activities of the Bureau—that of putting water on the land, that of constructing storage and diversion dams and power plants, that of building Boulder Dam, and the installation of equipment in the Boulder power plant.

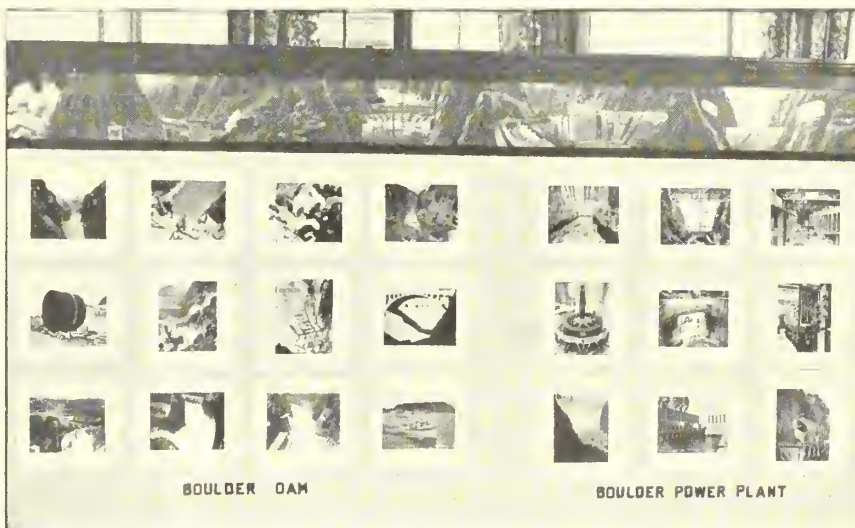
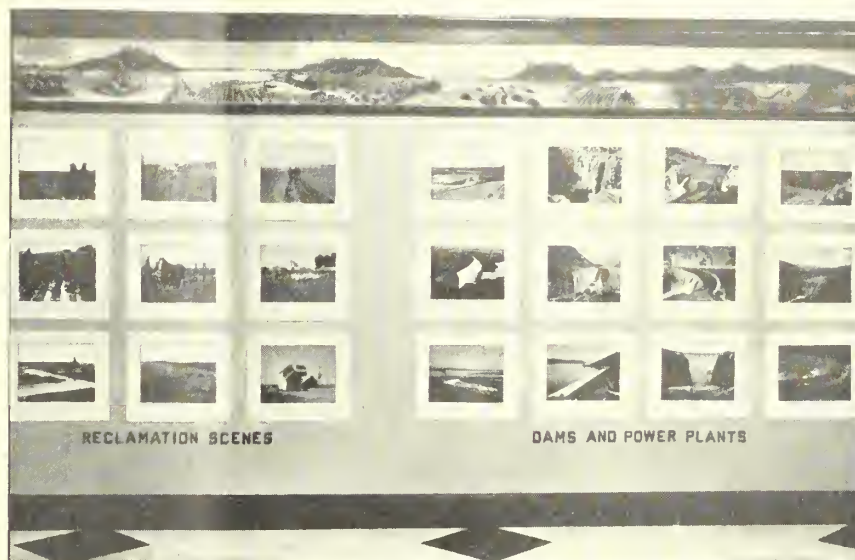
Engineers of the Washington office of the Bureau officiated at the desk beside the exhibit where printed material concerning reclamation was distributed. The delegates, 3,000 from 52 nations, passed the exhibit frequently and expressed a keen interest in the Bureau's work which it portrayed. Many, including Dr. Durand, chairman of the conference, complimented the Bureau on an outstanding presentation.

Neighbors

During the second week in September the officials of the Bureau of Reclamation had the delightful experience of personal calls from engineers from many foreign lands, sent as delegates to the Third World Power Conference and the Second Congress on Large Dams in session in Washington, D. C. An exchange of ideas took place, much valuable material as to activities in foreign lands was left in the Bureau, and the whole experience can be voted a goodwill tour. At the close of the conference in Washington a group of approximately 200 engineers will enjoy a transcontinental tour, and we are delighted to be their hosts on any projects they visit.

The common tie of irrigation development brings irrigation engineers to our office, and, of course, an exchange of experience in a specialized field is always advantageous.

One engineer, from the Argentine, outstanding in his profession, came to observe methods of operation and maintenance, drainage by pumping, silt control, etc. The visit of this engineer, Mr.



Rodolfo E. Ballester, brings to mind the visit 6 years ago of Mr. S. E. Fitz-Simon, civil engineer, from the Argentine, who made a western tour, visiting many of our projects, and since his return has completed the Rio Tecero dam and power-house. These friendly contacts with engineers of foreign countries are very often followed up by correspondence and exchange of interesting material and photographs.

THE Washington Cooperative Egg and Poultry Association on the Yakima project, held its first annual turkey tour late in August. The tour was attended by growers from all over the State and by some from nearby States. Local flocks were visited, educational talks given, and a picnic was held in the Sunnyside Park. The turkey industry in this section is growing rapidly.

Problems of the West

FEW people living in the West realize how little the mass of the country's population east of the Rocky Mountains knows about the problems of the States on this side of the Great Divide. The magnificent distances of the West cannot be comprehended or appreciated except by those who have lived in or traveled through it. Many people in Washington and New York imagine that Boulder Dam is in Los Angeles' back yard and that Portland and Seattle are our neighbors instead of being a thousand miles or more away. So it is really not to be expected that they should understand either the transportation, land, or water problems of the West with its great arid and semiarid regions and extensive areas owned by the Federal Government upon which the States cannot levy taxes but across which they must provide and maintain roads to travel.

For a long time Federal assistance for reclamation projects in the West was obtained in the face of much opposition and sometimes only by a scant margin of votes in Congress, but conditions have arisen which promise to make it even more difficult unless the people in the East can be induced to give serious thought to the problems of the States in the Pacific region. Believing that the West is facing a real crisis in land and water development, J. W. Haw, director of agricultural development for the Northern Pacific Railway, sounded a note of alarm at the recent summer meeting of the American Society of Civil Engineers at Portland, Oreg.; when he appealed to that organization for help in overcoming by presentation of facts and sound argument the distrust with which the people east of the one-hundredth meridian regard those who advocate continued development of the land and water resources of the West.

Mr. Haw cited as a basis for his alarm the scant margin by which both the recent major political party conventions defeated a resolution which read: "We oppose the use of Federal funds for new irrigation and drainage projects which compete with cultivated farm lands while a surplus of farm products exists." This proposal was sponsored, Mr. Haw stated, by leaders of several national farm organizations and was backed by some political and industrial leaders in the Midwest and East. He pointed out that the movement was the outcome of the opposition to reclamation projects in the last session of Congress and declared those advocating the proposal had not made a thorough study of the complex question of a national farm land use

program and the place which reclamation should have in it.

That there are any farm surpluses which would be increased by reclamation in the West was denied by Mr. Haw, who asserted that agricultural imports greatly exceed agricultural exports; that corn and other farm staples can be brought to the west coast at less cost than they can be hauled overland from the Midwest, and that shipments of farm products from the West to other parts of the United States and to foreign countries consist chiefly of specialty crops, such as fruits, nuts, berries, and garden truck.

Referring particularly to reclamation projects in the North, Mr. Haw stated the Casper-Alcova project, under construction in Wyoming, and the Buffalo Rapids project in Montana, now under investigation, would provide feed insurance for stock against summer drought and severe winters over a large area. "To say that funds should be withheld from construction of Casper-Alcova project because there is a production beyond the domestic consumption of cotton or of wheat is a form of logic that may be understood in Congress," he said, "but does not make sense west of the one-hundredth meridian. The use of western land has no more relation to surplus production of corn, cotton, lard, and wheat than it has to the production of coffee in Brazil.

"The integrating of new irrigated land into a land-usage program," Mr. Haw continued, "cannot conceivably be based upon the need or lack of need either in the region or the Nation, of products of that land today. Regional and national food requirements 20 to 25 years hence must be considered. For instance, on the Columbia Basin development, if completely authorized today and funds appropriated at once, irrigation water for the first 50,000-acre unit could not be made available before 1940. The first unit would not be completely settled before 1945 and would not be making substantial contributions of farm products into avenues of commerce beyond project borders before 1950. Whether there is need today for the use of land of the first unit of the Columbia Basin project is not the question. Rather it is whether there will be compelling reasons regionally and nationally for the products of these lands in 1950."

In conclusion Mr. Haw declared: "I hold the view that with consumption at low ebb, with a steadily increasing population, with a steadily increasing consumption per capita, with land now in

Bureau Officials Participated

Several members of the Denver office engineering organization took advantage of their vacation leave to attend the conferences of the Third World Power Conference and Second Congress on Large Dams held at Washington, D. C., September 7-12.

Those of the Bureau attending and participating in the meetings were—

Dr. W. F. Durand, consulting engineer, chairman, and an official delegate of the United States.

R. F. Walter, chief engineer and acting commissioner, also one of the official delegates for the United States, appointed by order of the President.

L. N. McClellan, chief electrical engineer.

Arthur Ruettgers, senior engineer.

R. F. Blanks, engineer.

J. H. A. Brahtz, engineer.

Mr. and Mrs. C. P. Vetter.

Mr. and Mrs. Clarence Rawhouser.

Mr. and Mrs. W. H. Hamilton.

A comprehensive paper was submitted to the Congress on Large Dams by Chief Designing Engineer J. L. Savage, on the subject of Special Cements for Mass Concrete. This paper contains 230 printed pages and is a summary of recent investigations of special cements and experience with their uses throughout the United States. The paper is issued as a Bureau of Reclamation bulletin, and is available for sale to the public at 75 cents per volume as long as the supply lasts.

Papers on Proposed Methods of Calculating the Stability of Earth Dams and Pressures Due to Percolating Water and Its Influence on the Stresses in Hydraulic Structures were also presented by J. H. A. Brahtz, engineer of the Denver office.

In the executive session of the International Committee on Special Cement, Mr. Savage, who is the United States member of the committee, but who was unable to attend, was represented by Messrs. Ruettgers and Blanks, of the Denver office.

Dr. Durand was elected president of the conferences for the next session, the time and place of which will be announced later. The next meeting place will probably be some large city in Europe and the time not later than 1940.

The Bureau presented excellent displays of its activities at the official headquarters and at the National Museum, which received favorable comments from the several thousand delegates and visitors, many of whom will visit various projects of the Bureau in the West, including Boulder and Grand Coulee Dams, before returning home.

A Job Well Done

THE faucets by which man can turn on or off the mighty Colorado River at Boulder Dam have been completed. All construction has been finished and final settlement is being negotiated between the Bureau of Reclamation, and the Babcock and Wilcox Company in connection with the contract for manufacture and installation of the giant penstocks.

The taps or penstocks make up the world's largest plumbing job, with four header pipes of 30 feet diameter and a combined length of 4,700 feet. Three of these pipes feed four of the 82,500 kv dam generators through 13 foot branch pipes. The fourth feeds three of the large generators and two smaller ones in the powerhouse at the toe of the dam.

These 30 foot diameter pipes are the largest ever attempted and tests made after their completion under an 800-foot head or under pressure of one and one-half times that of maximum operating conditions have proved their practicality beyond doubt.

There are four separate systems leading from the four intake towers in Lake Mead above the dam. Each system ends in its own outlet works so that, individually, they may by-pass surplus water. These outlets are controlled by emergency slide gates and needle valves. In this way, the flow of the river is controlled, even though no water is going through the turbines.

Two of the four diversion tunnels driven in 1931-32 are being utilized to carry the pipes and two additional systems, 200 feet above and parallel to the inner diversion tunnels, were completed

to carry the remaining pair of penstocks. These latter two end in outlets which discharge from the Arizona and Nevada canyon walls, 180 feet above the

river, forming a waterfall 13 feet higher than Niagara.

The contract for fabrication and installation of the pen stocks was awarded July 9, 1932, and work began on the following August 11. The completion date of the contract was July 7, 1938, but, as in the case of the main labor contract with Six Companies, Inc., for construction of Boulder Dam, work was completed far ahead of schedule. The Babcock and Wilcox bid was \$10,908,000. Gross earnings, increased by special orders by the Bureau of Reclamation for changes and additional work, will exceed the original contract price by approximately \$1,000,000.

Because of the enormous weight and bulk of the 25-foot sections of the 30-foot pipe, it was necessary for the contractor to construct a manufacturing plant near the dam site. The fabricated sections were too large to be handled by rail—ranging in weight up to 180 tons and exceeding the height and the clearance allowed in tunnels and railroad cuts between existing fabricating plants and



A 30-FOOT DIAMETER PIPE BEING LOWERED TO PENSTOCK TUNNEL ENTRANCE.



THE BABCOCK & WILCOX CO. PLANT AT BOULDER CITY.

(Continued on p. 233)

Western Agriculture Limited

The 11 Western States, roughly those west of the one hundredth meridian, so important to the rest of the Nation as suppliers of raw material and consumers of manufactured products, can never be agriculturally self-sustaining.

With 760,400,000 acres of land area, they have only 54,300,000, or 7.1 percent, that are actually or potentially arable. This is only slightly more than the area of Nebraska. Compared to the probable future population of these States when all their varied resources—forest, mineral, recreational, and commerce—are brought to full fruition, this area is pitifully small.

These 11 States have slightly more than 9 percent of the population of the United States and less than 4 percent of the farmed and cropped area.

Of the 54,300,000 acres now and potentially arable, 24,300,000 acres are nonirrigated. The greater portion of this nonirrigable land has less than 20 inches annual rainfall and can be used only for the production of wheat by so-called dry-farming methods. A considerable percentage is submarginal even for that. In Washington alone at least 1,000,000, and probably 2,000,000 acres, should be diverted from wheat growing to range, forage, or timber use. Another considerable portion consists of cut-over forest land, quite a percentage of which is submarginal for agriculture and should be returned to forest or other uses.

Of the 20,000,000 acres of irrigated land, a part lies at low altitudes, with mild, sunny climate and long growing season and is adapted to the production

of certain specialty crops for which there is a Nation-wide demand, such as citrus fruits, apples, and other deciduous fruits; raisin, table and wine grapes, early vegetables, etc. To the extent of the market demand these lands will be devoted to such specialties. The balance, along with irrigated lands at higher altitudes and having shorter growing season, must produce forage for the range stock and for dairy and other farm herds and other staple crops, including potatoes and sugar beets to supply the food needs of the region. The area available in the Western States for this latter type of crops is not sufficient to supply the demand.

The 10,000,000 acres listed as irrigable in the Western States but not yet irrigated is the estimate of the late Dr. Elwood Mead of land that will justify the cost of irrigation and for which there is dependable and sufficient water supply. It is to the conservation and the timely and orderly reclamation of these 10,000,000 acres that a sound national reclamation policy and program should be directed. A careful and competent study made in 1927 indicates that the production of this additional area is likely to be required within the Western States themselves during the next generation. If these acres are developed according to an orderly plan and program, there will be no aggravation of national crop surpluses.—*Excerpt from Report of the Washington State Planning Commission on Reclamation.*

A River Labors and Brings Forth Life

By Seth H. Dibble, Bureau of Reclamation, Malta, Mont.

Truly, Milk River, with Montana for a parent and Canada claiming kinship, deserves an agricultural *croix de guerre*. From its very beginning, it has fought a stubborn battle. As it pioneered its way from beneath some mighty glacier, it wandered here and there like a palsied finger pointing toward the sea. No granite-walled gorge led it tumbling, eddying, and racing on again in pristine clearness—it had to creep and puddle and charge itself with glacial silt. No limestone canyon spilled it into rainbow mists—its battle front, pregnant with ooze, crawled beneath huge boulders, undermining them until they sank beneath its bed. No firs, no pines, no beeches shaded its surface from the moisture-hungry sun. In their stead, pulpy cottonwoods and strangling wil-

lows, like leeches, fastened themselves to its erosion-built bends, sucking its life and hindering its progress. Neither mother granite nor crustacean-built limestone formed a bed to ease its passage.

Milk River needs must permeate the newly made soil to great depths, push its burden of mud over faults of shale, and gradually silt back to a previous barrier only to find its hard-won upper reaches dammed by some glacial slide and mile after mile to be won again. Concrete evidence of this latter trial is a series of depressions, known to Reclamation as the Chain of Lakes, which lie south of and parallel to the present bed for some 10 miles in northeastern Montana. These depressions were primarily proposed as a storage reservoir for the spring run-off, which was to be spilled

back into the river at their lower axis as necessity demanded. Dam-site investigations proved this to be impracticable, owing to lack of a substantial foundation; and the present proposed Milk River Storage, commonly known as Chain of Lakes, has no connection whatever with this old river channel.

Years and years after the thundering hoof of the bison was stilled and the original American was confined to a parcel of land, civilization's tide, forced into this semiarid land, found irrigation necessary to sustain life, and, reinforced by its ally, man, the Milk charges on with renewed courage. It sends its forces through the trenches of the vast project canal system, tears down the battlements of its enemy, drought, and transforms the semiarid lands into verdant gardens, sun-colored grains, sugar filled beets, and lush alfalfa. And now, with each returning spring, after its period of incubation, it travails again and brings forth new life.

Western Problems

(Continued from p. 230)

production declining in fertility and millions of acres lost annually through operation of natural forces impossible to combat, with important new industrial uses for agricultural products just around the corner, and with the possibility of recapture of American markets for American farmers, it is a tragic mistake in national policies to lay the heavy hand of curtailment upon our entire agricultural industry. In the use of western rivers now running to waste and western fertile arid land now baking in the sun, lies the ultimate attainment of a closely knit, self-contained Nation."—*Southwest Builder and Contractor*, August 7.

New Maps Available

The Bureau of Reclamation has just issued three maps which may be obtained upon application to the Bureau at the prices indicated, payment to be made in advance by check or money order drawn to the Bureau of Reclamation. The maps are as follows:

Map no. 27390, Sun River project, Montana, size 8 by 10 inches; price 5 cents (1935).

Map no. 27390-A, Sun River project, Montana, size 14 by 21 inches; price 10 cents (1935).

Map no. 24830, Casper-Alcova project, Wyoming, size 10½ by 17 inches; price 10 cents (1935).

Irrigation Produces No Surplus

Staple agricultural crops of which troublesome national surpluses are more or less regularly produced are corn, cotton, wheat, and tobacco. Of these four crops, the Yakima Valley produces only a negligible value (about 4 percent of its production) of cereals—far less than enough to meet the purely local demands for milling and feed for poultry, dairy, and other livestock.

The State of Washington shows a deficiency of a number of farm crops and products to the growing of which the irrigated areas are especially adapted. These include, among other items, dressed meats, with an annual shortage for the State of Washington alone of \$15,000,000 in value (these figures are averages for the years 1927 to 1931, inclusive). More than \$2,000,000 worth of corn is imported through the port of Seattle yearly from Argentina. Other crop shortages exist in dried beans, cauliflower, celery, tomatoes, sweet-potatoes, cucumbers, and watermelons, all of which may be profitably produced in the Yakima Valley or other irrigated sections of Washington.—*Excerpt from Report of the Washington State Planning Commission on Reclamation.*

Boulder Penstocks Completed

(Continued from p. 231)

Boulder Dam. Plate steel, some as thick as $2\frac{3}{4}$ inches, was shipped on flat-cars to the plant erected in Black Canyon and there was rolled into shape and electrically welded.

To relieve the stresses within the metal, caused by mechanical rolling, each section was put into a large annealing furnace. After this process each was X-rayed to detect any structural fault, and those not to be encased in concrete were coated with red lead, of which a total of 1,000 gallons was used.

Completed sections were transported to the Nevada rim of Black Canyon on a specially constructed trailer, capable of handling loads up to 200 tons. A specially designed highway was provided for this trailer between the fabricating plant and the top of the dam. From the rim of the canyon the permanent Government cableway lowered the pipe sections to the tunnels where they were being installed. The sections were joined by heating one end and placing it over the end of the next section and allowing it to shrink into place. Rivet holes were reamed to a proper size, and pins machined from one to three one-thousandths



FEDERAL IRRIGATION PROJECTS CONTRIBUTE MANY SPECIAL CROPS. HERE ARE SOME OF THE 40,000 SACKS OF SEED PEAS HANDLED AT A SINGLE WAREHOUSE AT ELLensburg, WASH. THE PEAS ARE GRADED, CLEANED, AND SORTED DURING THE WINTER MONTHS READY FOR THE PLANTERS IN THE SPRING.

of an inch oversize were forced into place cold.

Thus 44,363 tons of steel were placed in the pen stocks at Boulder Dam.

The exterior surfaces of the pipe, of which there were 727,478 square feet, were coated with 5,190 gallons of aluminum paint. The interior surfaces were coated with coal-tar enamel; 730 tons of enamel were used to cover 882,665 square feet.

The first section of pipe was transported to its tunnel on July 10, 1934, the last in January of this year. The first water was released through the Arizona canyon wall outlet on February 10, 1936. The final section of the last pen stock has just been fitted and painted and all four are now ready for use.

A party of 24 fruit growers and county agents from Utah, accompanied by F. M. Coe, head of the horticultural department of the Utah Agricultural College, and Dr. Arvil Stark, extension horticulturist, recently visited the Yakima Valley and inspected the fruit orchards.

The Yakima project reports a continued influx of refugees from the drought-stricken area in the Middle West. Superintendent Moore states that although many of these people are transients, a number are settling in the valley and others are finding temporary work during the harvest season.

Grand Coulee Guides

Two informants who will explain the Columbia Basin project to sightseers have been appointed by the Bureau of Reclamation. After several weeks of schooling, the men will be stationed at the vista points to handle the crowds. Those appointed are superintendents of schools Bachus, of Coulee City, and Shearer, of Wilbur. The grandstand is not yet completed on the west shore.

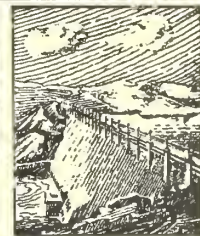
Rock blasted loose from the side of the granite precipice, which will serve as the base for the pumping plant, is being dumped on the slide area. A road has been built part way down the slide slope, which will be lengthened as the rock is dumped. The entire slope of the circular slide incline is to be blanketed with gravel to prevent continued surface slipping.—*Wenatchee Daily World, Wenatchee, Wash.*

Immediate construction on the Yakima project of a modern beet-sugar factory with a capacity of 1,500 tons per day on its property near Toppenish, was recently announced by the Utah-Idaho Sugar Co. Electrical equipment will be installed throughout.

Vale, Oreg., was host early in September to the Oregon Reclamation Congress. Judge Robert W. Sawyer, publisher of the Bend Bulletin and president of the congress, headed the State delegation.



ENGINEERING



Methods at Seminole Dam Site

By N. T. Olson, Engineer, U. S. Bureau of Reclamation

THE Seminole dam site of the Casper-Alcova project is situated 38 miles northeast of Parco, Wyo., in the canyon which the North Platte River has cut through the Seminole Mountains. The canyon is about 6 miles long and, at its maximum, approximately 1,200 feet deep. The side walls of the canyon are in some places steep talus slopes; in other places rock cliffs extend to the river bed. Travel through the canyon was practically impossible until a trail had been blasted out.

The dam site is located about 2 miles from the south end of the canyon, just below where the river crosses the contact between the sedimentaries and the granite core of the mountain range.

Plane-table topography to a scale of 20 feet to the inch with 5-foot contour intervals was desired. Using this large scale meant that plotting on a plane table in the field would complicate matters by permitting only a limited area to be taken at a time. The work was to

be carried on during the winter months and plane-table work under such conditions would be difficult. If stadia methods were used, the very large vertical angles involved would be a continual source of possible error; in addition, many of the spots under overhanging cliffs could not be reached.

Because of weather conditions, scale of map required, and general lay-out the following method of taking the topography was determined upon:

The actual contours to be plotted were run out with a level; points on these contours were spotted by intersections from two transits and the notes plotted in the office. By this method interpolations were required and accuracy was secured.

A base line was established and transit stations were set, both on the base line and at other advantageous positions on both sides of the canyon. These transit stations were selected so that they commanded a good view of the area to be covered, the object being always to ob-

tain a good intersection angle from some combination of two stations to any particular portion of the area. Monuments were established at each station and were carefully tied to the base line by triangulation.

The field party included two transitmen, one levelman, one plotter, two rodmen, one rope tender, one handy man, all under the direction of the writer. Operations were carried on in the following manner: Each transitman occupied a previously chosen observation station where, after orientation, he was ready for work. The plotter, located in the office a thousand feet away, prepared his sheet by laying on the base line and plotting the transit stations being occupied. Over each of the points representing the transit station, he oriented a 14-inch full circle protractor, using the same orientation as that being used by the transits. These protractors had their centers cut out to facilitate close plotting. Transit readings were recorded as azimuths and all transit orientations were frequently checked.

The office in which the plotting was done was close enough to permit the establishment of a telephone system between the transitmen and the plotter in the office. It was a very simple arrangement, but it proved effective.

To start field operations levels were run and a point was located on a definite contour in the area to be covered. When this was accomplished the levelman waved "O. K." and the rodman held his rod in position for the spotting shot and waved a flag. The two transitmen "shot the spot", recorded the azimuth, and telephoned in their readings to the plotter. The rodman then proceeded along the contour giving "shots" as often as the topography required. At each point the transitmen observed and phoned in the observations. This particular contour was followed to its end within the limits of the drawing and without changing the set-up of the transits, while still obtaining a good angle of intersection for the plotted point. To indicate the end of the con-



A MAJOR BLAST AT SEMINOLE DAM SITE, CASPER-ALCOVA PROJECT, WYOMING.

tour as run out and to eliminate duplication, a spot was painted on the face of the cliff with the elevation of the contour. The levelman then took a turn and moved to the next higher contour, or with a different rod reading started the next contour above. The transit stations were so located that they were often occupied for several days at a time.

The plotting of the notes in the office proceeded as follows:

With a pin marking the center of each protractor and using two steel straight edges the plotter rapidly laid off the azimuths phoned in, and plotted the point on his sheet at their intersections. This point was directly on the contour and did not require interpolation. The next point plotted was also on the same contour and the plotter merely drew a line connecting the plotted points in proper sequence. As the work continued the actual contour was run out on the ground and immediately plotted.

When new transit stations were occupied, the ends of the contours as painted on the rocks were checked to see that orientations, both of transits and protractors, were satisfactory before continuing the work.

Elevation of points under overhangs were often obtained by using a short rod. In some cases a hand level and pointer were used to locate the spot.

Three head phones from an old radio set were used. They were hooked up to a metallic circuit of no. 14 gage insulated wire. Each head phone was used as both transmitter and receiver. The insulated wire was merely stretched along the ground except at places where it crossed the stream; there short poles were used for support. Each head phone had two terminals with a few feet of flexible wire and these terminals were hooked to the metallic circuit, one terminal to each wire. All these phones were on the same circuit. No batteries were used, but conversation was carried on over the line without difficulty, except that it was necessary to use the same phone for transmitting and receiving. Ordinarily the transitmen used their phones as transmitters only, while the plotter wore his headphone and, listening in all the time, received and recorded the information sent to him. An electric buzzer operated with a C battery was installed in the office. This could be connected to the telephone line and when cut in caused a hum in the phones which could be heard several feet away. This signal was only used by the plotter when he wished to talk to the men at the transits. To avoid confusion on the phone the order of phoning in the readings was predetermined. Instrumentman no. 1 phoned his reading before recording it

and instrumentman no. 2 after recording it.

The rodman, equipped with a safety belt and "hard-boiled" hat, hanging on the face of the cliff, had the most hazardous part of the work. At intervals along the top of the cliffs holes had been drilled and steel pins set. To these pins three-quarter-inch steel core rope was attached and allowed to hang down the face of the cliff. The rodmen supported themselves on these ropes with a turn about the safety belt; with their hands, feet, and knees they worked along the face of the rock walls, keeping on the contour and passing from one rope to another as occasion required. One man was always above looking after the ropes and changing them from one place to another when necessary. A handy man carried a brush and can of paint to mark the end of the contours. He also assisted at many other tasks as necessity arose.

Transit observation stations were selected with the idea of commanding a good view of the opposite canyon walls. Such locations were frequently hard to

reach and at most of them a place had to be leveled for both instrument and observer. Often this required blasting solid rock. Due to wind conditions in the canyon it was necessary to lash the transit legs to eye bolts set in the rock.

If accurate topography in a difficult country is required, the method here outlined will produce it.

THE new union high school under construction at Vale, Oreg., on the Vale project, will be a handsome structure of light tan brick, containing, among other features, a \$10,000 auditorium. It is being erected in an area comprising two city blocks, thus affording an opportunity for surrounding the building with spacious, landscaped grounds.

Considerable interest in farm properties on the Klamath project, is marked. During the past few weeks a number of prospective settlers from the drought-stricken area have called at the project office to make inquiries concerning opportunities on the project.



A DRAGLINE AT WORK IN A DEEP CUT ON THE ALL-AMERICAN CANAL WHERE THIS GREAT IRRIGATION DITCH PENETRATES THE DESERT DUNES ALONG THE INTERNATIONAL BOUNDARY WEST OF THE COLORADO RIVER.

Notes for Contractors

Notes for Contractors - Continued

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Can bid awarded
				Name	Address			
	Aug. 27 (12 bidders) - Cont'd.	Boulder Canyon, Ariz.-Nev. - Con.	Radial drill (Item 3)	The Salt Lake Hardware Co.	Salt Lake City, Utah	5,162.00	F. o. b. Cincinnati, Ohio	
				The American Tool Works Co.	Cincinnati, Ohio	5,211.00	do	
				The Mine & Smelter Supply Co.,	Denver, Colo.	5,245.00	F. o. b. Oakley, Ohio	
			Mill machinery (Item 4).	do	do	5,185.80	F. o. b. Milwaukee	
				Smith Booth Usher Co.	Los Angeles, Calif.	5,585.00	F. o. b. Sidney, Ohio, 2 percent discount	
				Moore Machine Co.	San Francisco, Calif.	5,722.00	F. o. b. Milwaukee, Wis., 1 percent discount	
			Grinder (Item 5)	The Mine & Smelter Supply Co.	Denver, Colo.	4,187.50	F. o. b. Benton Harbor, Mich.	
				Gallmeyer & Livingston Co.	Grand Rapids, Mich.	4,505.00	F. o. b. Grand Rapids	
				Smith Booth Usher Co.	Los Angeles, Calif.	4,735.00	F. o. b. Benton Harbor, Mich., 2 percent discount	
				The Mine & Smelter Supply Co.	Denver, Colo.	15,850.00	Items 1, 3, 4, and 5	
				do	do	13,963.00	Items 1, 3, and 4	
				The American Tool Works Co.	Cincinnati, Ohio	3,978.00	Items 1 and 2	
811-D.....	July 17	Casper-Alcoy, Wyo.	150,000-volt oil circuit breaker (Item 1).	Condit Electrical Manufacturing Corporation	Boston, Mass.	5,145.00		Aug. '36
			6 60,000-volt discon- necting switches (Item 2).	The High Tension Co., Inc.	Phillipsburg, N. J.	451.20		Aug. '36
			2 60,000-volt air break switches (Item 3)	Royal Electric Manu- facturing Co.	Chicago, Ill.	196.00		Do
			2 60,000-volt potential transformers (Item 4)	Condit Electrical Manu- facturing Corpora- tion.	Boston, Mass.	2,274.00		Aug. '36
			2 60,000-volt current transformers (Item 5).	do	do	1,188.00		Do
			Outdoor meter and re- lay cabinet (Item 6).	do	do	675.00		Do
813-D.....	July 22	Boulder Canyon, Ariz.-Nev.	Automatic oscillo- graphs (Item 1).	General Electric Co.	Schenectady, N. Y.	11,810.60	F. o. b. Schenectady	Sept. 22
			Laboratory type oscil- lographs (Item 2).	Westinghouse Electric & Manufacturing Co.	Denver, Colo.	1,640.50	F. o. b. Boulder City	
			Electrical testing ap- paratus (Item 3)	General Electric Co.	Schenectady, N. Y.	1,208.38	do	Do
			3 portable standard watt hour meters (Item 4).	do	do	300.00	do	Do
			Phase shifter and sin- gle-phase phantom load (Item 5).					(1)
			Phase shifter and polyphase phantom load (Item 6).					(1)
			Potentiometers, gal- vanometers, volt box, etc. (Item 7).	Gray Instrument Co.	Philadelphia, Pa.	921.00	F. o. b. Washington, D. C., 2 percent dis- count	
			Potentiometers, gal- vanometers, volt box, etc. (Item 8).	do	do	960.00	do	
			8 slide wire rheostats (Item 9).	Beck Bros.	do	96.00	F. o. b. Boulder City, 1 percent discount.	
			3 resistor boxes (Item 10).	General Electric Co.	Schenectady, N. Y.	130.00	F. o. b. Boulder City	Sept. 22
			1 surge crest ammeter (Item 11).	do	do	111.34	do	Do
			1 5-kilovolt-amperes motor generator set (Item 12).	(No bids)				
			1 10-kilovolt-amperes motor generator set (Item 13).	do				
			1 laboratory switch board (Item 14).					(1)
			816-D.....	Aug. 14	Yuklim, Wash.	Electric clocks (Item 15).		
1 electric stop clock (Item 16).								(1)
3 electric time stamps (Item 17).	International Business Machine Corporation.	Denver, Colo.				370.50	F. o. b. Endicott, N. Y.	
Structural steel for bridges over spill- way at Kachess Dam.	Bethlehem Fabricators, Inc.	Bethlehem, Pa.				\$1,127.00	F. o. b. Easton, Wash.	Aug. 19
834-D.....	Sept. 11 (2 bidders).	Ogden River, Utah	Installing control gates for diversion works and pressure-control works, Ogden Can- yon conduit.	Ora Bundy	Ogden, Utah	6,596.00		
			Union Construction Co.	do	7,551.00			
A-42, 081-A	Sept. 8 (3 bidders).	All American Canal Ariz.-Calif.	Bolts, structural steel, wall plates, sills, and bearing anchorages.	Consolidated Steel Cor- poration, Ltd.	Los Angeles, Calif.	6,583.00	Item 1, f. o. b. Los Angeles	Sept. 22
				John W. Beaman	Denver, Colo.	9,690.00	Item 1, f. o. b. Chicago	
				Consolidated Steel Cor- poration, Ltd.	Los Angeles, Calif.	7,254.00	Item 2, f. o. b. Los Angeles	Do
				California Steel Prod- ucts Co.	San Francisco, Calif.	7,345.00	Item 2, f. o. b. San Fran- cisco	
				John W. Beaman	Denver, Colo.	8,990.00	Item 2, f. o. b. Denver	Sept. 19
824-D.....	Sept. 4 (4 bidders).	Owyhee, Oreg.- Idaho.	Earthwork, South Canal, lateral 5.7, station 107+00 to 1033+00.	Geo. B. Hardy Con- struction Co.	Ontario, Oreg.	10,640.00		
				Morrison Knudsen Co., Inc.	Boise, Idaho	11,915.00		
				Joseph P. Brumback	Nysa, Oreg.	13,630.00		

1 All bids rejected.

Notes for Contractors—Continued

Specifica- tion no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
818-D.....	Aug. 17 (2 bidders).	Burnt River, Oreg.	Sand and gravel.....	Chester T. Lackey.....	Ontario, Oreg.	13,300.00 9,300.00 16,587.50 21,000.00 15,500.00 22,500.00 3,453.00	Schedule 1..... Schedule 2..... Alternate (Sch. 1 and 2)..... Schedule 1..... Schedule 2..... Alternate (Sch. 1 and 2)..... Item 1, f. o. b. Coulee, Wash.	Sept. 22
825-D.....	Sept. 8 (25 bidders).	Columbia Basin, Wash.	Transformers and air- break switches.	Maloney Electric Co.....	St. Louis, Mo.	3,622.00	Item 1, f. o. b. Emeryville, ½ percent discount.	Sept. 17
				R. E. Uptegraff Manu- facturing Co.	Pittsburgh, Pa.	3,465.00	Item 2, f. o. b. Coulee, Wash.	
				Gardner Electric Manu- facturing Co.	Emeryville, Calif.	590.96	do.	Sept. 17
				General Electric Co.	Schenectady, N. Y.	591.26	do.	
				Pacific Electric Manu- facturing Corporation.	San Francisco, Calif.	591.26	do.	
				Bowie Switch Co.	do.	597.00	do.	
				Royal Electric Manu- facturing Co.	Chicago, Ill.		do.	
827-D.....	Sept. 14 (2 bidders).	Salt River, Ariz.	Air-cooling, heating, and ventilating equipment.	Air-Conditioning Engi- neers, Inc.	Phoenix, Ariz.	5,626.00		Sept. 24
698.....	Oct. 12.....	Owyhee, Oreg.- Idaho.	Earthwork and struc- tures for Dead Ox Flat pump canal and Crystal feeder canal.	Parker Manufacturing Co.	Los Angeles, Calif.	8,943.00		
699.....	Oct. 22.....	Salt River, Ariz.	Gate, 40 foot by 44.5 foot, and hoist for Horse Mesa spill- way.					
700.....		All-American Canal, Calif.	Drains along canal, closed station 3552 to station 3713 and open station 3713 to station 3800.					
38,305-A.....	Aug. 27 (10 bidders).	Columbia Basin, Wash.	Thin-wall steel tubing	The M. B. Austin Co.....	Chicago, Ill.	17,580.80	F. o. b. Moundsville, W. Va.	Sept. 25
				Triangle Conduit & Cable Co.	Brooklyn, N. Y.	17,580.80	do.	
				General Electric Supply Corporation.	Denver, Colo.	23,635.65	F. o. b. Odair, Wash., 5 percent discount.	
830-D.....	Sept. 15 (2 bidders).	Boulder Canyon, Ariz.-Nev.	Gasoline locomotive.	Davenport-Besler Corporation.	Davenport, Iowa.	12,363.33	F. o. b. Davenport.	
				The Fate-Root-Heath Co.	Plymouth, Ohio	12,400.00	F. o. b. Plymouth, ½ percent discount.	
				Pelton Water Wheel Co.	San Francisco, Calif.	94,490.00	F. o. b. San Francisco.	
			Two 15,000-horsepower turbines (sch. 1).	Newport News S. & D. Co.	New York, N. Y.	97,405.00	F. o. b. Newport News, Va.	
				S. Morgan Smith Co.	York, Pa.	100,684.00	F. o. b. York.	
691.....	Sept. 14 (7 bidders).	Casper-Alcova, Wyo.	Two governors (sch. 2) erators (sch. 3).	Pelton Water Wheel Co.	San Francisco, Calif.	18,944.00	F. o. b. Rockford, Ill.	
				S. Morgan Smith Co.	York, Pa.	18,944.00	do.	
				Woodward Governor Co.	Rockford, Ill.	18,944.00	do.	
				Allis-Chalmers Mfg Co.	West Allis, Wis.	186,500.00	F. o. b. West Allis.	
				Westinghouse El. & Mfg. Co.	East Pittsburgh, Pa.	188,350.00	F. o. b. East Pittsburgh.	
			Two 12,000 k.v.a. gen- erators.	General Electric Co.	Schenectady, N. Y.	189,270.00	F. o. b. Schenectady.	
			Aluminum metal- sash windows (item 1).	Newman Bros, Inc.	Cincinnati, Ohio	2,595.00	F. o. b. Cincinnati.	Sept. 22
			do.	General Bronze Corpora- tion.	Long Island City, N. Y.	2,980.00	F. o. b. Long Island City.	
826-D.....	Sept. 10 (6 bidders).	All-American Canal, Ariz.-Calif.	do.	The Kanneer Co.	Niles, Mich.	3,180.00	F. o. b. Niles.	
			Aluminum doors (item 2).	Geo. W. Johnson Mfg. Co.	Kansas City, Mo.	1,680.00	F. o. b. Yuma, Ariz.	Sept. 22
			do.	The Kinnear Mfg. Co.	Columbus, Ohio	1,680.00	do.	
			do.	Cornell Iron Works, Inc.	Long Island City, N. Y.	1,680.00	do.	
832-D.....	Sept. 10.....	Colorado-Big Thompson.	Seismic survey.....	Heiland Research Cor- poration.	Denver, Colo.			Sept. 15
				Colorado Portland Cement Co.	Denver, Colo.	2 2.40	F. o. b. Portland, Colo. (50 cents tax and discount).	
45,093-A.....	Sept. 14 (3 bidders).	Uncompahgre.....	Portland cement, 8,000 bbls.	United States Portland Cement Co.	do.	2 2.40	do.	
				Colorado Portland Cement Co.	do.	2 3.60	F. o. b. Almont, Colo. (50 cents tax and discount).	
				United States Portland Cement Co.	do.	2 3.60	do.	
				Monolith Portland Mid-west Co.	do.	2 2.15	F. o. b. Laramie, Wyo. (50 cents tax and discount).	
				Pomona Pump Co.	Pomona, Calif.	1,512.00		
831-D.....	Sept. 17 (9 bidders).	Klamath.....	Pumping units.....	Fairbanks, Morse & Co.	Kansas City, Mo.	1,670.00		
				Sterling Pump Corpora- tion.	Stockton, Calif.	1,735.00	Discount 3 percent.	
				Idaho Portland Cement Co.	Inkom, Idaho.	2 3.00	F. o. b. Chester, Idaho (50 cents tax and discount).	
10,654-A.....	Sept. 14 (5 bidders).	Upper Snake River Storage, Idaho- Wyo.	Portland cement, 4,900 bbls.	do.	do.	2 2.45	F. o. b. Inkom (50 cents tax and discount).	
				Union Portland Cement Co.	Devils Slide, Utah.	2 2.25	F. o. b. Devils Slide (50 cents tax and discount).	
701.....	Nov. 2.....	Columbia Basin, Wash.	Twenty 102-inch Para- dox service gates and twenty 102-inch ring- follower gates.					
702.....	Oct. 20.....	Colorado River, Tex.	Construction of Mar- shall Ford Dam.					
703.....		Boulder Canyon.....	23,000-volt bus struc- ture, generator neu- tral reactor, and gen- erator voltage oil circuit breakers for power plant.					

Progress of Investigations of Projects

Colorado-Big Thompson transmountain diversion, Colorado.—Seven topographic parties and one level party were in the Grand Lake area completing the topography on the canal line from Willow Creek to Granby Reservoir and a plane-table traverse of a canal line extending from Meadow Creek, a tributary of the Fraser, to Strawberry Creek, also a tributary of Fraser, and from there to Granby reservoir. A diamond drill outfit arrived from Cody, Wyo., on August 24 and started drilling along the diversion tunnel for the proposed Granby Reservoir. One party was put in the field in the Estes Park area to determine the center line of the main tunnel from Grand Lake to Wind River.

Blue River transmountain diversion, Colorado.—Two plane-table parties have been making a traverse of a canal line from Clear Creek, west of Golden, Colo., to Platte Canyon station, about 17 miles southwest of Denver for the purpose of making a cost estimate to take water from Clear Creek to the head of the Highline Canal, which diverts water from the South Platte at the mouth of the canyon about 18 miles southwest of Denver and irrigates 40,000 acres lying south and east of the city of Denver. Five plane-table parties were in the field taking topography of the Green Mountain site on the Blue River. This reservoir is to be used for replacement purposes, i. e., water from this reservoir stored during high run-off will replace Colorado River water users on the western slope, during the low-water period, any water diverted to the eastern slope that they might have used.

Western slope, Colorado: (a) Paoia project.—Explorations of dam foundations at Spring Creek site were continued during the month and preparations are being made for exploration of foundations at two other sites. Topography has been taken on a reservoir site and a dam site on Minnesota Creek and a subdivision was made of the irrigation on the area served by the Overland Canal, Fire Mountain Canal, and the Le Roux Creek relative to the redistribution from these systems.

(b) Florida Mesa project.—A plane table party finished the topograph of dam sites nos. 1 and 2 and is now working on the survey of site no. 4. Each of the proposed reservoirs has approximately the same storage capacity—about 9,500 acre-feet for a depth of 100 feet and 20,000 acre-feet for a depth of 150 feet.

(c) La Plata project.—Plane table parties have been placed on the survey of the Long Hollow Reservoir site during the latter part of the month and it is antici-

pated that the topography will be taken to the level of the top of the ridge at the dam site, which elevation is about 30 feet higher than that previously taken by parties working under the Works Progress Administration.

(d) Mancos Valley project.—Preliminary surveys have been made of a reservoir site near the head of the West Mancos Creek in order to ascertain its approximate capacity, but indications are that it will not hold sufficient storage to justify its recommendation.

(e) Roan Creek project.—Exploration of the dam foundations and the topography of the reservoir site and dam site were taken on a location on the Dry Fork of the Roan and the mapping was completed on the Carr Creek dam site. Classification of the lands in this area shows only 515 acres being irrigated at the present time with an additional 640 acres that could be irrigated.

(f) Silt project.—Topographic surveys were continued over the rough area between West Elk and the Main Elk Creeks with preliminary tunnel lines marked out to aid the geologists in their study of the types of soils encountered in construction.

(g) West Divide Creek project.—Preliminary canal locations have been started between the Owen dam site on Buzzard Creek and the West Divide area while reconnaissance surveys were being made for a canal between Plateau Creek and Buzzard Creek which would supplement the water supply for storage at the Owen site. Preliminary indications show that approximately 8 square miles of excellent watershed may be utilized by the construction of a canal about 3,000 feet in length. Dam foundation explorations have been started on the Owen Dam site.

(h) Yampa reservoirs.—Despite considerable wet weather, surveys at dam site no. 1 progressed with very little delay, control points having been established in preparing for the taking of topography of the reservoir site. Data obtained from the county records at Steamboat Springs, showing ownerships, classifications, etc., have been tabulated and compiled. Further data relative to water rights, ownerships, and location of lands and their classifications and the areas irrigated in the Troublesome area have been obtained from the county records at Hot Sulphur Springs.

Rio Grande Basin, Colorado-New Mexico.—The following surveys and investigations are in progress:

(a) Wagon Wheel Gap dam site.—All field work on this dam site was completed during the first part of the month and the two diamond drill rigs have been removed to the Conejos dam site.

(b) Conejos dam site.—Diamond drilling was begun on the two river bed holes which had previously been bored by the churn drill rig to depths of 95 and 90 feet, respectively. No. 1 hole encountered bedrock at 157 feet and penetrated the same to a depth of 30 feet. In view of this extreme depth to bedrock, no further drilling was done. Excavation was carried to 48 feet in the test pit on the right abutment and then continued to 187 feet with the diamond rig. River sands and gravels were found to underly the landslide material in the abutment at 110 feet from the surface and continued for at least 40 feet additional, at which point the drilling was stopped.

(c) San Juan-South Fork transmountain diversion.—Survey of reservoirs and dam sites on the West Fork of the San Juan and on Beaver Creek were completed during the month and the data submitted to the field office for computations.

(d) Animas-Rio Grande diversion.—Surveys were initiated and completed on the proposed Howardsville reservoir site, and the information is now in the field office for computations.

(e) San Juan-Chama diversion.—Survey of the lower line for the diversion of the San Juan waters to the Chama River from the point of diversion on the West Fork of the San Juan southward for a distance of 20 miles, with the parties taking strip topography, was continued during the month. Topographic surveys of the West Fork of the San Juan dam site were completed and six test pits were started, two completed, and work was in progress on the remaining four at the end of the month. Surveys of the Boulder Lake reservoir site were continued until August 10, at which time the parties were moved to Silverton to complete the Howardsville reservoir survey before the advent of cold weather.

Boise (Boise-Weiser-Payette), Idaho.—The plane-table party continued its work of taking topography down the south bank of the Payette River from the proposed Garden Valley reservoir toward the Boise diversion dam, and by the middle of the month had completed the survey to Banks, after which the party was moved to Smith's Ferry on the North Fork of the Payette River. At the location of the proposed diversion by tunnel from the North Fork of the Payette to the Middle Fork, which is about 3 miles below the ferry, topography was taken for about 9,000 feet along the river. Dam-site topography is completed and reservoir topography 50 percent completed at the Upper Payette Lake site.

Gallatin Valley, Mont.—Work on these investigations has been confined to the office where water supply studies are being made and miscellaneous data on canals in the valley are being compiled.

Madison River diversion, Montana-Idaho.—A field party completed the canal line from the Cherry Creek Reservoir to the South Bench and ran a base line up the Madison River from the Cherry Creek dam site to the Madison no. 2 plant of the Montana Power Co. for use in taking topography of the Cherry Creek Reservoir.

Buffalo Rapids, Mont.—The following units of land classification were completed during the past month: Sadie Flats, Ft. Keogh (Tongue River), Hathaway, Orinocco. It is anticipated that the classification on the remaining three units, North Sanders, Hysham, and the Big-horn-Tullock, will be completed by the middle of September.

Saco Divide, Milk River project, Montana.—During the month of September it is anticipated that the land classification will be completed and the final report assembled.

Deschutes, Ore.—Surveys have been continued for a low diversion dam in the Deschutes River a short distance above Cline Falls to supply water through the North Unit Canal. Topographic surveys are completed at the location of the proposed pumping site at Opal Springs on Crooked River for the purpose of studying the relative locations of the pump site and the top of the lift. Plan no. 1 contemplates a single high lift to an elevation necessary to connect with

the gravity canal survey at the foot of the first drop on the project and plan no. 2, a single low lift to connect with the foot of the second drop on the gravity canal.

Black Hills, S. Dak.—Topography has now been completed on the Pactola Reservoir and Dam site and the leveling and triangulation network is completed for a reservoir near Moorcroft, Wyo., on the Belle Fourche River and the Horse Camp Draw Reservoir on the Cheyenne River near Hot Springs, S. Dak. Area-capacity curves have been prepared for each of the surveyed reservoirs, and water supply and operation studies have been made for the Horse Camp Draw project.

Dixie project, Utah.—During the latter part of July and the first part of August summer rains continued quite regularly causing a wide fluctuation in the discharge of the Virgin River and the deposit of a large amount of silt. At a conference with the State engineer and the bureau engineer at Salt Lake City, it was decided to continue the silt investigations until September, or until the heavy rains ceased, placing special emphasis on the study of the silt in the Santa Clara Creek. It was also decided to roughly map out the watersheds that are subject to excessive erosion.

Salt Lake Basin, Utah: (a) *Salt Lake Metropolitan Water District Aqueduct.*—Field work was continued on the preliminary surveys for the aqueduct with one field party working between Salt Lake City and the mouth of the Provo Canyon and another working in the

canyon. The preliminary location of the aqueduct from the outlet portal of a proposed tunnel near Draper to Little Cottonwood Creek was extended to the Thirtieth South Reservoir, a distance of about 10 miles. An alternate location of the aqueduct on a more direct route involving considerable pressure line was made from Draper to Salt Lake City, a distance of about 15 miles. A preliminary location was also made from Alpine (the inlet portal of the proposed tunnel) southeast to the mouth of Provo Canyon, a distance of 12 miles.

(b) *Blue Bench project.*—Data are being assembled preparatory to making surveys in the field to determine the feasibility of the upper and lower Blue Bench projects and it is intended to begin this work in the near future or as soon as a survey party is available from the Salt Lake aqueduct survey.

Colorado River Basin.—During the first part of the month 6 square miles of lands lying adjacent to the present irrigated areas in the Montezuma Valley were classified, after which the classifiers moved to Mancos, Colo., where 48 square miles of the lands lying within the present Mancos Valley irrigation district were classified. A total of 39 square miles of irrigated lands in the Montezuma Valley was also mapped. It is planned to continue the mapping of the irrigated areas and the classification of the lands lying adjacent to such areas in the Montezuma Valley during the month of September.

Excerpts from August Reports

Belle Fourche.—Threshing of small grain is completed; yields about 50 percent of normal with quality good. Two cuttings of alfalfa are in stack and in a few cases a third will be harvested. Returns should be up to normal, with prices quoted at \$12 to \$15 in stack, although tonnage will be below average because of water shortage. Corn is making satisfactory progress; the yield will be low, but the crop will make good winter feed and fall pasture.

Carlsbad.—Crops are in excellent condition. Harvest of the last alfalfa crop of the season was unusually good. Threshing of alfalfa seed began after the 10th of August; fairly good yields were reported, and the price ranged from 15 to 17 cents per pound.

Grand Valley.—At the end of August all grain and potatoes had been harvested with average yields reported. The Palisade peach crop was harvested, with a yield larger than estimated. About 2,000 carloads were shipped. The Resettle-

ment Administration announced authorization of immediate construction of 50 units, comprising the necessary living quarters and outbuildings, on the Grand Valley project. This is the first rural resettlement project in Colorado.

Klamath.—All crops made an excellent growth this month. The second cutting of alfalfa was practically completed, and a fair third crop is expected from about 50 percent of the acreage. The first field of alsike clover seed was threshed and yielded 900 pounds of seed per acre. Prices for all farm products showed a good increase. About 300 tons of alfalfa hay is being shipped each week at prices of from \$10.25 to \$10.75 per ton baled f. o. b. cars. Practically the entire crop of brewing barley, estimated at over 900,000 bushels, has been sold or contracted for at \$1.05 per bushel.

Milk River.—Sugar beets and alfalfa made excellent growth this month, and the crops are expected to be ahead of last year. Harvesting of beets will

begin the latter part of September and cutting of the third crop of alfalfa early that month.

Minidoka.—All crops made good gains, and officials of the Amalgamated Sugar Co. expect an average yield of 16 tons per acre from the sugar-beet crop. About 22,500 acres are planted, in this area, indicating a total yield of some 360,000 tons.

North Platte.—Crops made good growth. No damaging storms, and cooler weather reduced irrigation water losses. Moderate rainfall early in the month helped crops materially and conserved the irrigation supply of water.

Orland.—Harvesting of the almond crop was completed. Due to a late spring frost the crop was low, on several orchards not over 30 percent. Picking of prunes began late in the month, and the crop is expected to be fairly satisfactory. Citrus estimates place the expected yield at 50 percent of normal. A

(Continued on p. 248)

Considerations on the Design and Choice of Gates for Large Hydraulic Conduits

By B. A. Halliday, Assistant Engineer, Bureau of Reclamation

THE selection of a type of gate for the control of water discharged from a given installation is not purely a matter of chance. Careful consideration must be given to a large number of important factors and that type of gate chosen that will best satisfy all these conditions. This discussion will be confined to installations for closed conduits and no attempt will be made to consider spillway regulating gates, although many of the points discussed will apply equally well to these.

Every installation has its inherent water characteristics. Some streams carry a large amount of finely divided silt, others practically none. In some cases, notably in the well-wooded country, a large amount of trash may be transported downstream during the flood season. Ice is another very important consideration. In severe climates it may be necessary to install heating devices in order to operate the gates during the cold season. Some waters are very active chemically, often making it necessary to use large amounts of corrosion-resisting materials and thus greatly increasing the cost of the installation.

The primary consideration in the choice of a gate is its position with relation to the reservoir. For instance, if the gate were placed on the face of the dam, no pressure-resisting housing would be required, which would decrease the cost of the unit. On the other hand, since entrances are generally bell-mouthed in order to reduce entrance losses, the gate would have to be larger than the nominal size of the conduit, with consequent increased cost of the leaf. In the case of power penstocks it is usually possible to put the inlet at a considerably higher elevation than the turbine scroll case, and hence the gate can be much lighter at this location. Also, hydraulic disturbances from the gate would be minimized, thus increasing the hydraulic efficiency of the power unit. When a gate on the face of the dam is used under very great heads, it is generally advisable to use a wire rope hoist as the stems would be very long and would have to be guided at intervals if required to stand any appreciable compressive load. If a rope hoist is used the gate must be self-closing and the ropes should be hauled out of the water to prevent corrosion when not in use.

In many cases, notably earth-fill dams, the inlets are some distance out into the

reservoir, and intake gates are not feasible unless a gate tower is constructed in the reservoir with consequent increase in cost, and wave and ice difficulties. Under these conditions it may be advisable to locate the gates at some point along the conduit. From the standpoint of pressure lining used, the shorter the amount of lining required the more economical the installation. One system that is commonly employed where a diversion tunnel has been driven in one of the abutments is to use this as a pressure tunnel and pour a plug and install the gates at a desirable point. This system usually makes it possible to keep the gate-operating controls fairly close to other operating features of the dam. Generally speaking, slide gates can be used for these installations as the stems for moving the gates are short and will carry large compressive loads. In some cases, especially when water levels are low, the intake may be bulk-headed off, making it possible to inspect and maintain the entire system.

TYPES OF MOVING SURFACES

Gates may be classified by their motion; whether sliding or rolling, or any combination of these two. Sliding motion is the most commonly used and in a great many cases is satisfactory. It has the twin advantages of simplicity and economy. Frictional forces are, of course, large in this type of motion and unless the weight of the structure is greater than those forces, the leaf must be closed by compressive loads, thus eliminating the possibility of using a rope hoist. It has been found that certain special bronzes are best adapted for use on the sliding surfaces. In cases where heads are very high and gates large, it becomes practically impossible to make hoists and connections strong enough for the use of a sliding gate, and some easier form of motion is necessary.

One common method is to use wheels mounted on axes fastened into the side girders of the gate leaf. These wheels have in some cases been used in combination with roller bearings to reduce the friction to a minimum, although ordinarily, plane bearings with some sort of antifriction bushing are used. One difficulty with roller bearings is that if the water pressure is any great amount, it is practically impossible to exclude it by

means of packing glands, and the bearings may be rapidly destroyed by corrosion. At the present time, roller bearings made from corrosion-resistant steels are not entirely satisfactory when considered from all standpoints. It is common design practice to use standard crane wheels and rails wherever possible as they are economical, and suitable for heavy, slow-moving loads. This feature is often used for headgates as the frictional resistance is relatively small which often permits the use of a rope hoist. Wheel gates have the disadvantage that the transfer of load from the gate leaf to the track takes place at a number of localized points. This means that both the gate leaf and the track are subjected to a number of very heavy concentrated loads.

In the case of extremely heavy loads, roller trains have been used since they distribute the load more evenly than the larger wheels, and in addition purely rolling friction is obtained for the heavy loads. The total load which a roller can carry has been found to be proportional to the length, diameter, and Brinell hardness, and inversely proportional to the square root of the modulus of elasticity. The track should be somewhat harder than the roller to withstand the same load.

Since any gate leaf will deflect when loaded, it is advisable to examine the possibility of high concentration of loading on the sliding or rolling surfaces. This effect can be minimized in a number of ways. For instance, the seats can be tilted during the machining operations so that when full load is applied uniform contact pressure results. Often this condition is approached automatically in practice, for as the load becomes too high, local permanent deformation takes place and the load is redistributed. However, where these surfaces also slide under load, local tearing may take place with consequent final destruction of the seats.

If crowned wheels or tracks are used for wheel gates, and a little end play allowed in the wheel assembly, the gate will adjust itself to the requirements without difficulty. Rollers can also be crowned, although this reduces their load capacity somewhat. One solution for this condition is to provide a track which can rotate slightly on a curved surface, and thus accommodate the deflection. Another solution is to provide

a track design that has sufficient strength for the direct compressional load yet does not have sufficient flexural rigidity to prevent the accommodating deflections necessary for minimizing the concentration of load at the ends of the contact surfaces.

HYDRAULIC CHARACTERISTICS

Probably a rectangular leaf is the most common shape in larger sizes of slide gates. There are some inherent advantages to this shape. The leaf is supported throughout its length on both sides, providing better guiding. As there are no overhanging parts the leaf is stronger, and because of its shape easier to analyze. In addition, it is adaptable to both cast and structural design. As the frames are usually rectangular also, recesses need only be provided on the top and the two sides, thus reducing somewhat the flow disturbances and the places where silt, etc., might collect. Since the shape of the discharge area is rectangular, it makes a fair regulating gate in all positions, especially if well air-vented and if the head is not excessive. As there is only one main moving part, and, since the clearances can be kept small, vibratory effects in this type are minimized, making it adaptable for regulating. Rectangular conduit is not as efficient or economical as round and usually transition sections are provided where the conduits are long.

Circular gates, in which the shape of the bottom half of the leaf is essentially the same as the round conduit, are not very satisfactory for regulating. The moon-shaped outlet areas at partial openings and the unsupported surfaces of the leaf make this design objectionable. Also, a recess for the leaf is usually required across the bottom of the conduit which may silt up under unfavorable conditions.

Where velocities are high, or small losses are desired, as in an emergency gate for a needle valve or for a turbine, the ring-follower type of gate can often be used advantageously. In this type of gate a ring the same diameter as the conduit is part of the leaf. When the gate is completely open, this ring lines up with the conduit, presenting a smooth, uniform water passage. An additional recess or bonnet is required for the follower ring when the leaf is in the closed position. This adds considerably to the cost, and serves as a large pocket which may collect silt.

The cylinder-follower gate is another type suitable for the same conditions. This gate contains, instead of a follower ring on the leaf, a hydraulically-operated sleeve in the conduit. When the leaf is

completely raised, this sleeve moves parallel to the center line of the conduit and closes the slot required for the leaf. This gate does not require a bonnet for a follower ring and hence in this respect is cheaper than the other gate, and in addition will not tend to silt up as the slots are covered. On the other hand, the movable cylinder adds to the cost offsetting the decreased size of leaf and bonnets. It is possible to remove the leaf from the housing for inspection while the gate is in operation. Neither of these latter types are desirable as regulating gates.

GATE SEALS

There are various methods of sealing gates. The most common of these is the method employed by most slide or shear gates, in which the guiding surfaces are also the sealing surfaces, and when the gate comes to its final position it is also sealed. This type of seal is generally subjected to quite heavy unit pressures and requires heavy starting loads. Another scheme often used is to separate the sealing and guiding functions. Here the sealing device is held in contact by some inherent, built-in section such as compression of springs, rubber, etc., and may or may not have its action increased by water pressure. These devices generally avoid heavy overloading of the seals, but of course involve more expense, and unless carefully designed are not necessarily more satisfactory.

Another general method used is the inclined seat. Here there is no seal contact until the very last part of the motion. The gate moves down on the guiding tracks until the inclined surfaces of the seat come into contact, at which point the seat rides slightly up on the inclined surfaces. An adjustable stop is usually provided to prevent the gate from riding up too far on the seats, which would make it difficult to raise because of the heavy seal contact pressure and consequent sliding friction. A disadvantage of this type of gate is that as the level in the reservoir raises, the load on the seals increases, and may become so great as to cause the leaf to stick. This tendency may be overcome by using some sort of constant pressure seal. Inclined seat gates have certain inherent advantages with regard to closing forces which will be discussed later.

Various material have been used for seals and the three most common are wood, rubber, and metals. Wood was undoubtedly the first material used, and several types of treatment have been developed to make it more suitable for this use and it is often incorporated in low head designs. The great improvement in

rubber in recent years has led to its adoption as a seal for numerous installations. However, it is still subject to considerable deterioration especially when exposed to direct sunlight. Metallic seals are probably the most satisfactory if adaptable to the conditions. They can be made of noncorrosive materials and should last indefinitely.

There is still another general method that has been used successfully and which eliminates all sliding friction. This gate utilizes two independent sets of roller trains, one set being inclined and interposed between the gate leaf and a movable wedge-shaped piece, the other being interposed between the wedge and the main track. During operation, the wedge is moved first through a relatively small travel which forces the leaf upstream off its seats, after which the main travel takes place moving the gate to its desired position. Other variations of this general method are possible, such as crank-operated eccentric axles for wheels, etc.

Two of these general methods have been combined in another type. In this gate, the supporting wheels are spaced at irregular intervals. In the closed position, there is a dip provided in the track under each wheel. When the wheels register opposite these dips, the load is transferred from the wheels to the sealing seats. In any other position, because of the irregularity of the dips, this is not possible. Obviously, this gate is not suitable for extremely high heads, as at times different wheels are unsupported and additional loads thrown upon the others. This also involves heavier construction of the end girders.

DESIGN FORCES

The forces acting on a gate can be divided into two general classes. First, there are the static forces by which is meant those forces on the gate which are not due to the flow of water; and second, the dynamic forces which are the result of flow of water past the gate.

The first of these static forces is displacement. In this case the effective downward pull of the leaf is reduced by the amount of water displaced. If the skin-plate is on the upstream side so that the top and bottom girders are the only ones subjected to side water load, and the gate is of any size, there will be an appreciable pressure difference between the top and bottom girders. If these areas are equal, this produces an upward force that is of considerable importance where it is desired to use a rope hoist. This force can be overcome by using an inclined seat which gives

more area for the downward pressure to act upon. The second of these forces is friction. This force is usually quite large where sliding motion is employed in the gate. Usually rope hoists cannot be used with slide gates where the heads are high as compressive loads are required to seat the gate. If rollers are used, practically all sliding friction is eliminated and the total frictional force required to move the gate becomes a small item and consequently less hoist capacity is required. If wheels are used, some sliding friction is obtained between the bushing and the axle. This can be overcome by using roller bearings, but, of course, increases the cost of the wheel assemblies.

Dynamic forces often become very important, especially in those cases where the frictional forces have been greatly reduced with consequent decreased hoist capacity. These forces arise from the fact that as flowing water gains velocity head, its pressure head is correspondingly reduced. Consider a gate on the face of the dam. Here, the top girder is subjected to the static head of water available at that level. Correspondingly the bottom girder of the gate is subjected to the static head available at its level as long as no flow past the bottom girder takes place. As soon as this occurs, however, a portion of the available energy in the water is converted to velocity head with a corresponding reduction in pressure head. In cases where the area of opening is small and the discharged quantity large, pressures less than atmospheric may be produced on the bottom girder. The net result is a very considerable pressure differential with consequent heavy downpull. The same general type of action occurs in gates enclosed in housings, except that the problem is complicated by the effects of clearances. It can be seen that the calculation of this force in the case of a ring-follower gate would be quite complex. A series of model tests have been made in which these pressures and forces have been measured. It has been found that admitting air behind the gate leaf reduces the downpull slightly and also reduces to some extent the vibrations of the leaf at partial openings. However, it is not considered that air venting is necessary unless the gates are to be operated for long periods at partial openings.

In the detailed design of the gate there are several general factors to be considered. The type of material to be used must be decided. This will, of course, depend upon the stresses, special physical or chemical properties required, mass, etc. Then the form of the structure must be considered; whether cast or built up of rolled sections. In cases where required sections are very heavy or of complicated shape, castings are generally

more adaptable. For simple regular shapes and relatively light sections rolled structural material may be preferable. In some cases it may be desirable to use both. For instance, the main girders and skin-plate might be of structural steel whereas the more complicated shapes of the side frames for supporting the roller tracks and seals might be of steel castings. Other factors to be considered are: Welded or riveted construction, class of work, allowances for corrosion, paintings, shipping sizes, erection, etc.

HOISTING EQUIPMENT

There are three general types of hoisting equipment. These are screw hoists, hydraulic hoists, and rope hoists. Screw hoists may be either hand or motor operated. Hand-operated hoists are often used on small-sized installations under low heads. However, in the case of the larger-sized gates, such enormous gear reductions are necessary that all the energy may be absorbed in friction in the reduction unit and the gate itself could not be moved. In other cases the movement may be so slow as to be impracticable. Motor-operated screw hoists may be driven either by some form of internal-combustion engine or by an electric motor. Generally speaking, electrical operation is preferable if a power supply is available, as the local control is much more flexible, remote control is possible, and the unit can be put into service without delay. Often double-screw hoists are used as this keeps the gate aligned vertically and the threads can be cut right and left hand so that the stem torques oppose each other.

Hydraulic hoists are in many respects similar to screw hoists, especially in their applications. Hydraulic hoists are valuable in cases where the gate leaf is to be brought up against a rigid stop in seating. Here the pressure merely rises to the limit set by the relief valve giving a heavy seating force, but causing no damage to the system. Hydraulic hoists are quite economical with regard to space requirements, as a tremendous force can be produced with a relatively small cylinder. Furthermore, a number of gates can be operated from one pump making the installation economical. This type is quite simple, and relatively few parts are required. When a gate using a hydraulic hoist is operated at partial openings some sort of gate hanger is necessary to maintain the proper position.

In cases where gates must be lowered great distances, or it is desired to bring the gate up out of the water for inspection and maintenance, a rope hoist is generally the most practical. Obviously, the gate must be of the self-closing type as no compressive loads can be applied by the ropes.

Maintenance of the entire structure is a very important consideration. Inspections of operating works should be made at regular intervals, and the ease and effectiveness with which this can be done greatly affect the operating cost and reliability of the structure.

This article covers the main points of closed conduit gate selection in only a general manner. It can be seen that the final selection is dependent on a great many factors. In general each factor must be considered and weighed. Where two different installations will serve equally well, cost then becomes the paramount consideration.

National Reclamation Association Meets in Salt Lake City

At the joint meeting in Salt Lake City on September 10 of the directors and legislative committee of the National Reclamation Association active support of the association was urged by the committee in securing adequate annual appropriations from Congress to continue the construction now under way and to carry on an active long-term reclamation program.

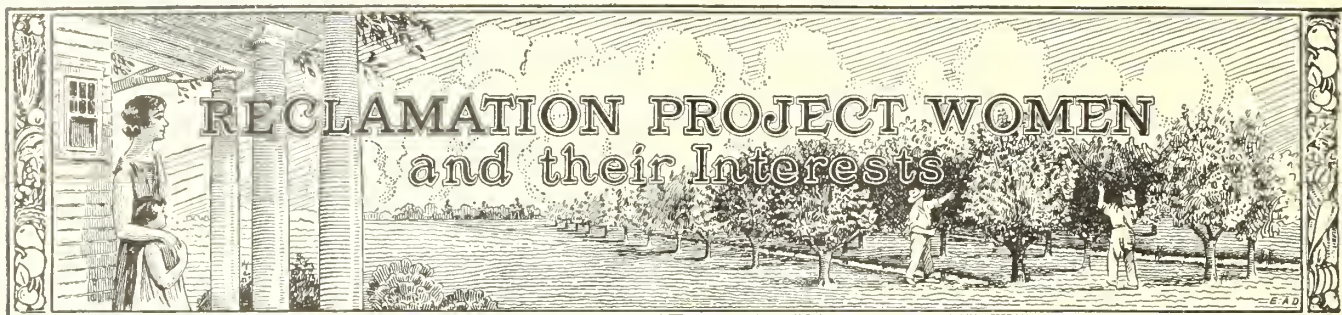
O. S. Warden, president of the association, and L. A. Campbell, secretary-treasurer, have announced that the National Reclamation Congress will be held in Spokane November 23-24.

John C. Page, Acting Commissioner of the Bureau of Reclamation, who was present at the meeting, discussed the present status of reclamation and made certain recommendations for the consideration of the legislative committee.

Yakima Apple Growers

A board of seven permanent grower trustees on the Yakima project was elected at a recent meeting by Washington State Apples, Inc., the organization through which Washington apples will be nationally advertised by growers and shippers in the Yakima and Wenatchee districts. Four trustees were elected from the Yakima Valley and three from the Wenatchee district. Members of the organization represent 95 percent of the shippers and more than 85 percent of the growers. The main office will be in Wenatchee, with a branch office in Yakima.

The J. Walter Thompson Co. has been selected to handle the national advertising campaign featuring Washington boxed apples, which will be financed by a \$200,000 fund raised by an assessment against the growers of 1 cent per box.



One Project Woman's Interests

By Mrs. Ella S. Tuttle, formerly connected with the Sunnyside Division, Yakima project

WHEN Mrs. Mary E. Long came to Prosser, Wash., in 1904, fresh from her graduation from the Spokane College of Music, the music she found there was made by the Chinook winds from the south and cool mountain breezes from the west rustling through sagebrush that covered the rolling hills surrounding their home.

She immediately set to work, shoulder to shoulder with her husband, to create beauty and harmony in this new environment. She has succeeded well. It is a joy simply to drive past her charming home (we say her home, for Mr. Long died 10 years ago), set well back on a lawn shaded by great trees, while upon crossing the threshold one is enveloped in a friendly atmosphere of taste and refinement.

If space permitted, one might tell of Mrs. Long's many musical activities, for her talent for organizing and directing is not merely local, and of her wide influence through years of teaching voice and piano.

But the pride of her heart, the one she calls her "own child", "borned" by herself, is the Saengerfest, which she conceived and developed. This was first presented at the Annual Prosser States Day celebration in 1930, with 110 voices. It was produced again in 1931 with 112 voices.

In 1932, for the Prosser Tenth Annual States Day, Mrs. Long arranged a program of a continuity of song and pictures in celebration of the George Washington Bicentennial. The first number on this program was the first march dedicated to President George Washington, 1783, by Phillip Phile, from which the first American composer, Francis Hopkins, took his theme for "Hail Columbia." The finale consisted of folk songs and dances of the 13 nations locally represented, ending with a living picture of these nations, bearing their flags, and Columbia in the center, with the Stars and Stripes, with outstretched arms,

mothering these alien nations. This gives but a poor description of the beauty and impressiveness of the scene, enacted before an audience of 3,000 people.

In 1933 Mrs. Long presented at the Prosser States Day celebration a program with 130 children's voices. One remarkable feature of this performance was that throughout the long program there was no prompting and not a sheet of music was used.



MRS. MARY E. LONG.

Prosser is a small town, of less than 2,000 inhabitants, but the Methodist Episcopal Church has a large, well-trained, splendidly directed choir, the work of Mrs. Long over a period of years.

Mrs. Long's accomplishments are known and appreciated by the best minds and talents of the State of Washington. When the Adelpian Choral Society of the College of Puget Sound, an outstanding musical organization of the State, toured this part of the country, it was Mrs. Long whom they sought out

and it was to her home they went and rendered some of their choicest numbers for her sole benefit. She was the guest of honor of this society at the commencement exercises of the College of Puget Sound this year.

Besides her musical work Mrs. Long is a member of the Woman's Club of Prosser, whose work is assisting in the maintenance of the Carnegie Library and sponsoring the serving of hot lunches to school children during the winter months; and of the Business Girls' Club, which helps in the work for the Orthopedic Hospital and the sale of seals for the Tuberculosis Society.

She is also a member of Chapter K of the P. E. O. Society, whose chief work is educational. They have sponsored loans from their national educational fund for eight local girls.

In addition to all these activities an occasional poem slips from the pen of Mrs. Long. Up to this time these poems have appeared under a nom de plume, but it is hoped that in the future we may see a volume of these little gems published under her own name, Mrs. Mary E. Long.

The Business and Professional Women's Club of Sunnyside, Wash., recently put on a "Safety-on-the-Highway" campaign. Motorists were asked to sign a pledge which read: "I agree to do my part and you can count on me to prevent accidents," and to place a Safety-on-the-Highway plate on the rear of the car. A charge of 25 cents was made for this plate. With the proceeds from the drive, the club placed an automatic "Stop-and-Go" sign at the one corner in Sunnyside where there was danger of traffic becoming congested.

ENROLLMENT in 4-H clubs in Yakima County totals 337 boys and girls, or 93 percent larger than in 1935. Many of the members belong to more than one club.

Control of Predators in the Yakima Valley

By Fred H. Langford, Chairman Predatory Control Committee, Yakima Valley Conservation League

THE Yakima Valley Conservation League has just completed its third annual boys' predator drive, with highly satisfactory results. While the total number of predators taken falls short of the high mark established in 1935, such a result was to be expected, as the decrease in numbers of predatory birds and animals in the Yakima Valley, since these drives were started, is very noticeable.

The accompanying tabulation shows the total number of each predator taken, in each of the 3 years in which the drive has been held. In the 3 years a total of 314,500 predators have been destroyed, through the efforts of the league.

The Yakima Valley Conservation League is not, primarily, a sportsman's organization. Its membership is made up of business and professional men, farmers, fruit growers, and landowners, banded together for the purpose of conserving the natural resources of the Yakima Valley. The principal objective of the league is the protection of the Yakima Watershed, the source of the life-giving water, without which our valley would be but a barren desert, incapable of supporting human life.

JUNIOR MEMBERS

Among the minor activities of the league is the annual boys' predator drive, instituted first in the spring of 1934, and since continued as an annual event. Each of the 11 chapters of the league puts on its own drive, under a general committee. Only boys under 18 years of age are admitted as contestants. Suitable prizes are secured. The general committee lays down a set of uniform rules and regulations, with certain values given to each bird and animal classed as a predator. Scores are carefully kept by each chapter, and, at the conclusion of the drive, the boy having the greatest number of points in each chapter is awarded the first prize in that chapter; the second highest receives the second prize, and so on down the list. The prize board usually contains from 30 to 50 prizes, ranging from a Scout knife to a shotgun or bicycle. There is also a grand prize, given to the boy having the highest score, in all the chapters.

In placing a point value on the birds and animals classed as predators, emphasis has been placed by the general committee on those most directly inimical to the agricultural industry.

The decision as to which birds and animals should be classed as predators, and destroyed, was given the utmost

attention by the league, and the merits and faults of each carefully considered. After some months of study and consideration nine species of animals and three birds were placed on the predator list. Group meetings were held with the boys of each locality, where qualified speakers explained the reasons why these predators were considered inimical, and the boys instructed in the best way of destroying each species. At the same time the boys were instructed as to the beneficial birds and animals of the community, and urged to protect and foster them.

Of the nine species of animals, the bobcat, coyote, weasel, and skunk were blacklisted because of their activities against ground-nesting birds and the farmer's poultry. Also, the record disclosed that coyotes and bobcats have been responsible for the destruction of many lambs, and even young calves, in this valley. The fact that the coyote, particularly, is a destroyer of the jack rabbit was entered on the credit side of the ledger, but was not sufficient to tip the balance in his favor.

The remaining five animals on the list, the pocket gopher, common barn rat, sage rat or western ground squirrel, woodchuck, and jack rabbit, were placed on the list for the reason that they are directly responsible for a considerable annual loss to the irrigators of the valley.

All feed directly upon the crops of the farmer. We have seen a 10-acre field of grain mowed to the ground by jack rabbits within a few nights. The sage rat and woodchuck likewise take their toll. The activities of the barn rat as a destroyer of grain, young chicks, etc., are so well known as to need no comment.

But the pocket gopher was given the position of public enemy no. 1. It has been stated by men, in a position to know, that the pocket gopher is the greatest single obstacle to successful irrigation in the Yakima Valley. Figures compiled by the league indicate that the average annual loss in production, on diversified farms, due to the activities of the gopher, is as high as 6 percent. The crop actually consumed by the gopher is negligible, but his tunnels, often several hundred feet in length, afford a serious menace to successful irrigation by the furrow method, as practiced in this valley. One has only to glance at the "burnt" areas in an otherwise flourishing field of alfalfa, to appreciate that this rodent is responsible for a considerable decrease in yield. When we add to the indictment, the

destruction of young fruit trees, by the cutting of the roots, and the fact that each gopher is the potential source of a canal break that may cause damage running into thousands of dollars, there can be little wonder that the league is proud of the fact that more than 51,000 of these rodents have been destroyed through its efforts.

CROWS, MAGPIES, AND SPARROWS

Only three species of birds were placed on the predator lists, and these include neither hawks nor owls. While it is well recognized that three species of hawks common to the valley, namely, the coopers hawk, sharpshin and prairie falcon, and the great horned owl, subsist almost entirely upon game and insectivorous birds, and the farmer's poultry, yet it was felt that the boys would, for the most part, be unable to distinguish these particular species; that should they be placed on the list, large numbers of beneficial hawks and owls would be destroyed. Therefore, the rodent-killing proclivities of the majority of our hawks and owls, served to condone the criminal tendencies of the species above mentioned.

Of the three species of birds listed, not a voice was raised in favor of the crow, and his lesser cousin, the magpie. Their well-known proclivities as destroyers of the eggs and young of game and insectivorous birds left but one possible verdict.

As for the English sparrow, his activity against song and insectivorous birds alone, would merit his destruction, but he is also a source of considerable loss to the poultrymen of the valley. Egg production is a considerable industry in the Yakima Valley, and it is estimated that English sparrows consume in the neighborhood of 30 percent of the grain intended for poultry flocks. The destruction of some 135,000 of these feathered pests has resulted in a marked decrease in feed requirements in certain areas.

It is difficult to measure, in dollars and cents, the economic value to the community that has resulted from this activity on the part of the Yakima Valley Conservation League. We know that it costs the United States Department of Biology about \$9 for each coyote killed in the State of Washington. On this basis, the league has destroyed coyotes to the value of about \$8,500. Gopher control, on the Sunnyside project, costs about 30 cents for each gopher caught. On this basis the league has destroyed \$15,500 worth of gophers in the 3 years

that the work has been carried on. These are only 2 of the list of 12 predators.

Perhaps it would not be going too far to say that this activity has resulted in a

saving of \$50,000 to the irrigationists of the Yakima Valley.

It is the intention of the Yakima Valley Conservation League to continue the

work, in the belief that it is entirely possible to control these predators to the point where they will be comparatively harmless.

Yakima Valley conservation league 1936 predator drive, Mar. 1-June 30

Chapter	Bobcat	Coyote	Weasel	Skunk	Gopher	Woodchuck	Barn rat	Sage rat	Jack rabbit	Old crow	Young crow	Crow eggs	Old magpie	Young magpie	Magpie eggs	English sparrow	Total units
Naches.....																	
Tieton.....		1	46	16	3,911	426	587	261	8	21			112			571	11,078
Yakima.....	1	165	35	31	2,025	224	700	1,700	1,441	1,992	199	49	849	564	1,648	1,264	12,867
Parker.....		7	7	6	139		110	138	101	10		4	29		59	305	915
Wapato.....		9	37	33	2,270	1	588	774	296	65	51	11	318	254	462	2,390	7,559
Toppenish.....		11	30	47	2,168	22	733	676	285	287	108	117	239	121	642	3,559	9,045
Sunnyside.....		23	62	9	5,677	15	690	730	459	33	3	44	197	114	143	6,083	14,282
Mabton.....	1	10	8	3	335	24	316	541	509	174	279	270	109		249	2,516	5,344
Grandview.....		40	45		2,171	2	285	762	121	16		23	47	8		7,350	10,870
Prosser.....		207	7	14	1,471	18	692	218	432	40	99	153	271	394	1,044	6,619	11,679
Benton City.....		16	4	13	425		428	241	311	46	4	51	231	342	374	1,479	4,115
Total 1936.....	2	489	281	172	20,592	732	5,129	6,041	3,963	2,684	710	718	2,402	1,797	4,621	32,136	87,757
1935 total.....	2	339	630	193	19,928	1,625	7,793	16,554	14,812	1,649	1,307	1,830	4,196	3,891	17,314	55,002	147,113
1934 total.....	4	116	201	10	11,235		1,645	12,925		1,595		384	3,016		1,452	47,127	79,710
Grand total to date.....	8	944	1,112	375	51,755	2,357	14,567	35,520	18,775	5,928	2,017	2,932	9,614	5,688	23,387	134,265	314,580

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Reclamation Organization Activities and Project Visitors

Acting Commissioner Page, who is making an inspection tour by automobile of the various reclamation projects, was at Boulder Dam on September 29 and presided at the unveiling of the memorial plaque to Dr. Mead. Mr. Page returns to Washington early in October.

In the absence of Mr. Page, Chief Engineer R. F. Walter is in Washington as Acting Commissioner of the Bureau. He was one of the official delegates appointed by the President for the United States to the Third World Power Conference and the Second Conference on Large Dams.

George O. Sanford, general supervisor of operation and maintenance, returned to Washington headquarters the latter part of September. During his absence Mr. Deane S. Stuver was acting general supervisor.

Deane S. Stuver has been transferred from E. C. W. work in the Washington office to the Operation and Maintenance Division as assistant to George O. Sanford, chief. Alfred R. Golzé, engineer, has assumed the duties of chief (super-vising engineer) of the E. C. W. division, succeeding Mr. Stuver.

Recent visitors at Grand Coulee Dam include the following persons: Hon. W. E. Mattingly, assistant to the Director, Department of the Budget; Hon. Frank T. Bell, Commissioner, Department of Fisheries; Col. Charles March, Chairman, Federal Trade Commission; Mr. Harper Sibley, president, United States Chamber of Commerce; Mr. P. P. Laupman, chief of hydroelectric design, Union of Soviet Socialist Republics, Moscow; Mr. Makijiro Ho, engineer, ministry of communications, Tokyo, Japan; Mr. John C. Parker, committee on arrangements for World Power Conference tour.

The following appointments have been approved by the Secretary: Frederick E. Culvers as junior engineer in the Denver office; R. Wayne Morris as inspector, Salt River project; Willis K. Zook as junior engineer in the Denver office.

Miss Sallie A. B. Coe, editor of the Reclamation Era, returned to Washington the latter part of September from an official trip to the West where she visited many of the reclamation projects.

First Assistant Secretary returns from West

T. A. Walters, First Assistant Secretary, having the Bureau of Reclamation under his supervision, left Washington on August 16 for the West, visiting Denver and the following Federal reclamation projects: Boise, including Arrowrock Reservoir and Black Canyon Dam, now under construction; Owyhee, Oreg.-Idaho; Yakima, Wash., including Cle Elum Reservoir and the Roza division; and Columbia Basin, Wash., and Grand Coulee Dam.

On the Owyhee project Mr. Walters inspected a large part of the Mitchell Butte division, which was opened to entry on May 16 last, and was greatly pleased with the number of entries made, as well as with the generally substantial character of the improvement apparent.

Mr. Walters returned to Washington on September 11.

Changes in legal staff Department of the Interior

Secretary Ickes has promoted F. L. Kirgis, of the staff of the Board of Appeals, to the position of first assistant solicitor for the Department of the Interior.

Felix S. Cohen, of the legal staff, has been appointed to fill the vacancy caused by the new assignment of Mr. Kirgis.

The following resignations have been received:

Herbert R. Baker, junior clerk, Denver office, to enter private business.

Myron F. Bergstrom, junior clerk, Denver office, to take a position with a corporation in Charleston, W. Va.

George F. Crowe, associate engineer, Denver office, to return to former employer in Boston, Mass.

John W. Devine, assistant clerk, employed on Western Slope Surveys, to accept position with a railroad company.

William D. Dickinson, junior engineer, Denver office, to return to school and work toward a doctor's degree.

Henry L. Eggers, junior engineer, Denver office, to take up work in an architect's office in Los Angeles, Calif.

Frank E. Goehring, junior engineer, Denver office, to accept a civil service position with the Bureau of Public Roads.

John N. Kerr, assistant engineer on the Colorado River Basin investigations, to return to private industry.

Constant R. Marks, junior engineer, Denver office, to take up work with the Tennessee Valley Authority.

Walter F. Miles, junior engineer, Denver office, to accept employment with firm in Tacoma, Wash.

Willis Scott, clerk, Parker Dam, to take up work with a commercial firm.

Samuel Shulits, associate engineer, Denver office, to accept position as assistant professor in the Colorado School of Mines.

John C. King, Jr., junior engineer, Denver office, to become an instructor at Robert College, Istanbul, Turkey.

Claud W. Kellogg, senior clerk, Moon Lake project, to accept employment with the Social Security Board.

Charles W. Dey, accounting clerk, Washington office, to return to private industry in California.

Arthur Davis, junior engineer, All-American Canal project, to accept civil service appointment in the Indian Service at Fort Apache, Ariz.

James C. Clark, junior engineer, Denver office, to accept position with the college of engineering, University of Illinois.

Herman McCoy, messenger, Denver office, to enter college.

Mrs. Evelyn K. Petri, junior clerk in the Denver office.

Kenneth C. Tippy, assistant engineer, Denver office, to take a position with an association in Chicago, Ill.

Charles H. Tornquist, engineer at Boulder Canyon, to return to private industry.

Melvin L. Weston, assistant clerk, Denver office, to accept position with a business firm in Chicago, Ill.

The Secretary has approved the following transfers of personnel: Carl R. Hamilton, from rodman on the Colorado-Big Thompson project, to junior engineer in the Denver office; Wm. J. Quinn, inspector from the Moon Lake project, Utah, to Bartlett Dam, Ariz.; Richard T. Larson, from assistant engineer in the Denver office to associate engineer on the Salt River project; Benjamin L. Pickett, assistant engineer, from the Denver office to the Salt River project; George A. Griffith, inspector, from Boulder City, Nevada, to the Central Valley project, at Friant, Calif.; Richard Young, assist-

ant engineer on the Owyhee project, to the Contra Costa Dam on the Central Valley project; Albert N. Thompson, from assistant engineer with the Indian Irrigation Service, Albuquerque, N. Mex., to engineer in the Denver office; Nathan Young, inspector, from the Owyhee project, Oregon, to the Central Valley project, Contra Costa Dam near Antioch, Calif.; Harold L. Davis, assistant engineer from the Parker Dam project, California, to the Salt River project, Arizona; Lester H. Van Liew, inspector, from field service at Portland, Oreg., to Los Angeles; and Smith A. Ketchum, junior engineer, from Denver to the Riverton project, Wyoming.

Ray B. Dame, Associate Chief of the Division of Motion Pictures of the Department of the Interior, and John F. Sikes, Reclamation photographer, left Washington for the West early in August for the purpose of taking both motion and still photographs of general E. C. W. camps and scenes on a number of the Federal reclamation projects, including C. C. C. activities on the projects visited.

Excerpts

(Continued from p. 240)

few small acreages of ladino clover seed, the project's most valuable asset, were harvested and the yield and quality satisfactory.

Owyhee.—The second cutting of alfalfa was harvested and digging and shipment of early potatoes completed. About 530 cars of early potatoes were shipped, and the intermediate and late crop it is estimated will amount to 150 cars. Crested wheat grass for seed was harvested, with one field one year out of sagebrush yielding slightly under 1,000 pounds per acre. Quotations on the price of crested wheat grass range from 50 to 85 cents per pound. Marketing conditions are good, with the highest prices offered for farm products in years. Approximately 1,000 acres were sold through the Vale-Owyhee Land Settlement Board this month.

Rio Grande.—All crops, with the exception of alfalfa, developed rapidly and were in good condition; marketing returns, except for alfalfa, were good.

Riverton.—Harvesting and threshing of grain is in progress. The yield is good though less than 1935. A very good yield of beans is expected. Sugar beets and potatoes are in good condition although stands are less than last year. As most farmers are securing third cuttings of alfalfa, the average yield per acre for the season will be greater than in 1935.

Shoshone.—Harvesting of an average yield of beans began August 15 and most

Senator William Gibbs McAdoo was the principal speaker at the ceremonies held September 7 opening the new Friant-Madera road and celebrating the start of work on the Friant Dam, a feature of the Central Valley project, California. He addressed an audience of more than 1,000 persons.

L. H. Mitchell, field supervisor of Operation and Maintenance, returned to Washington on September 26, having spent several months on the North Platte, Belle Fourche, Shoshone, and Uncompahgre projects. Mr. Mitchell reviewed lands that had been reclaimed from seepage by drainage. He also inspected other lands with low-producing qualities. About 800 farms having lands with soil disabilities were inspected, and on farms where alkali is a factor samples of soil were obtained and tests were made to determine the percentage of soluble salts.

The most important phase of Mr. Mitchell's work was the education of the project settlers in the best methods of eradicating perennial weeds and distinguishing poisonous weeds.

of the crop had been cut and shocked at the end of the month. One field threshed produced 2,500 pounds to the acre. Sugar beets are making an excellent growth. Most livestock is still on summer range and is in good condition. Frequent showers have helped the winter range adjacent to the project.

Sun River.—Harvesting was well along at the close of August. There is a keen demand for alfalfa and pea straw, with practically all the surplus sold or contracted for. Yields are below average, due to unfavorable weather conditions. Hay will be almost an average crop. Project cattle and sheep flocks were generally in good condition. Feeder lambs were in demand at about 7½ cents. The cooperative wool pool, 5,000 fleeces, was sold at 23¼ cents f. o. b. Fairfield. Interest of qualified settlers in homestead and farming opportunities continued keen. The Resettlement Administration has about 12,000 acres optioned, with a few options accepted. It is understood that about 50 sets of buildings will be completed this fall.

Vale.—Several farms were sold during the month, and of the 27 public units opened for entry in May, 18 have been filed on and 7 applicants have been notified of selection.

Yuma.—The citrus crop, normal for this time of the year, is developing in fine shape and indications are that the sizes will be larger than last year. The grade will be somewhat inferior because of damage by winds early in the spring. Harvesting will begin in October. Cot-

ton picking began early in August; 1,575 bales were ginned and indications are for a better crop than usual. Harvesting of alfalfa seed was practically completed during the month, and about 75 percent of the crop had been sold. Some carrots have been seeded, and land was prepared for lettuce, seeding to begin early in September. Eleven carloads of livestock for feeding were received during the month, two carloads shipped to market by rail and more than seven carloads by truck.

A Farm Career

Not so many years ago the average farm boy felt that if he were to fulfill his destiny and make his mark in the world he must necessarily leave the farm and seek success in the city. But recently a change has come about, with the result that nowadays more farm lads are staying on the old homestead, or branching out and securing land for themselves, quite content to make farming their career.

An interesting commentary on this situation is provided by a widely known economist, Dr. O. E. Baker, University of Wisconsin, who not only believes that the farm offers a worthwhile career to the average boy, but expresses the hope that his own 5-year-old son will become a farmer.

Dr. Baker believes that the farmer has better food and more of it, even in times of depression, than his city neighbor. Also, he is convinced that the farmer enjoys better health on the whole, and that he is more appreciative of the property which he accumulates during his lifetime. Again, he points out that the farmer is more likely to raise a family and thus do his share toward perpetuating the race than are many city folk who hesitate to accept additional responsibilities because of the insecurity of their outlook.

One of the chief criticisms of farm life in the past is that it lacks the opportunities for culture that exist in the city. Dr. Baker, however, has no fears on that score. Moreover, he feels that his boy will not lose face in the social world because he will have to work with his hands. He points out that the world is beginning to have a renewed respect for the dignity of labor, and that parents are no longer as eager as they were a few years ago to train all their children for white-collar jobs, a situation no doubt bred of experiences of the depression period.

Certainly Dr. Baker's comments furnish a refreshing and stimulating viewpoint that has particular significance in a region such as our own, where farming comprises one of the major pillars of our economic and social structure.—*Standard, Eureka, Calif.*

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation.

John C. Page, Acting Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; John C. Page, Chief Engineering Division; A. R. Golz, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Dehler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Div.

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thrallkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do.	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
Carlshad	Carlshad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Ft. Sumner, N. Mex.	Wilfred W. Baker	Engineer		do.	do.
Casper Alcova	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voven	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do.	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		B. E. Stoutemyer	Portland, Oreg.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficene	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do.	do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do.	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do.	do.	do.	do.	do.	do.
Minidoka	Burley, Idaho	Dana Templin	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	F. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpff	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do.	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Cahalito Dam	Cahalito, N. Mex.	S. F. Crecelius	Constr. engr.		do.	do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. O. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do.	do.	do.
Stanfield	Ontario, Oreg.	R. J. Newell	do.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	L. J. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do.	do.	do.
Upper Snake River Storage	Ashton, Idaho	H. A. Parker	do.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent	do.	do.	do.
Yakima	Yakima, Wash.	J. S. Moore	do.	Philo M. Wheeler	do.	do.
Roza div.	do.	Chas. E. Crowner	Constr. engr.	Alex. S. Harker	do.	do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non Federal

³ Island Park Dam.

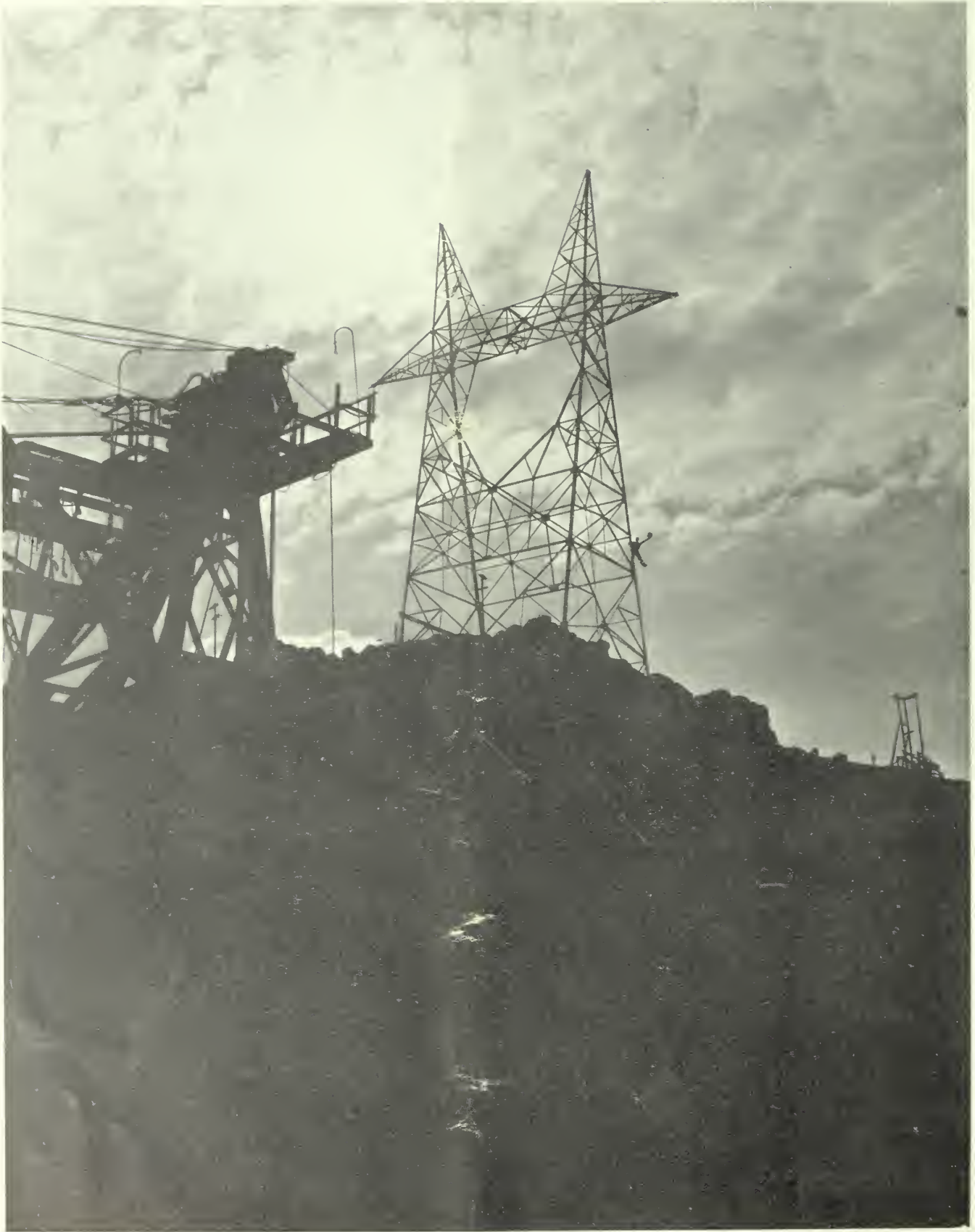
Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	Address
			Name	Title		
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	S. Cache W. U. A.	Logan, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsely	Horsely irrigation district	do.	Henry Schmor, Jr	President	Dorothy Evers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do.	Fort Belknap irrigation district	do.	H. B. Bonebright	do.	L. V. Bogy	do.
do.	Hailem irrigation district	Harlem, Mont.	Thos. M. Everett	do.	Geo. H. Tout	Harlem.
do.	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich.
do.	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do.	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding.
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do.	H. W. Emery	Fallon.
North Platte: Interstate div.	Pathfinder irrigation district	Mitchell, Nehr.	T. W. Parry	do.	Flora K. Schroeder	Mitchell.
do.	Fort Laramie irrigation dist.	Gering, Nehr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering.
do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mary Harrach	Torrington.
Northport div.	Northport irrigation district	Northport, Nehr.	Mark Idings	do.	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
do.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotegut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	H. P. Wangen	Fairfield.
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	Enos D. Martin	Hermiston.
West div.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting supt.	J. Frank Anderson	Montrose.
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

Important investigations in progress

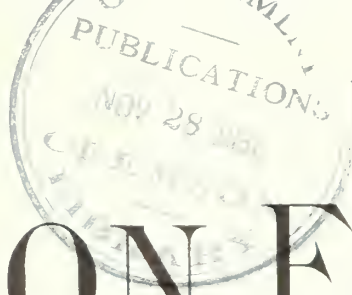
Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise	Boise, Idaho	Lester C. Walker	do.
Rio Grande	Denver, Colo.	Wm. C. Sloan	do.
Western Slope	Grand Junction, Colo.	Frank C. Merriell	do.

SALLIE A. B. COE, Editor.



THIS 135-FT. TOWER WILL CARRY HIGH TENSION LINES FROM TRANSFORMERS IN THE NEVADA WING OF THE POWER HOUSE AT BOULDER DAM TO THE SWITCHING STATION

27.5 11/1936



THE RECLAMATION ERA

VOL. 26, NO. 11



NOVEMBER 1936

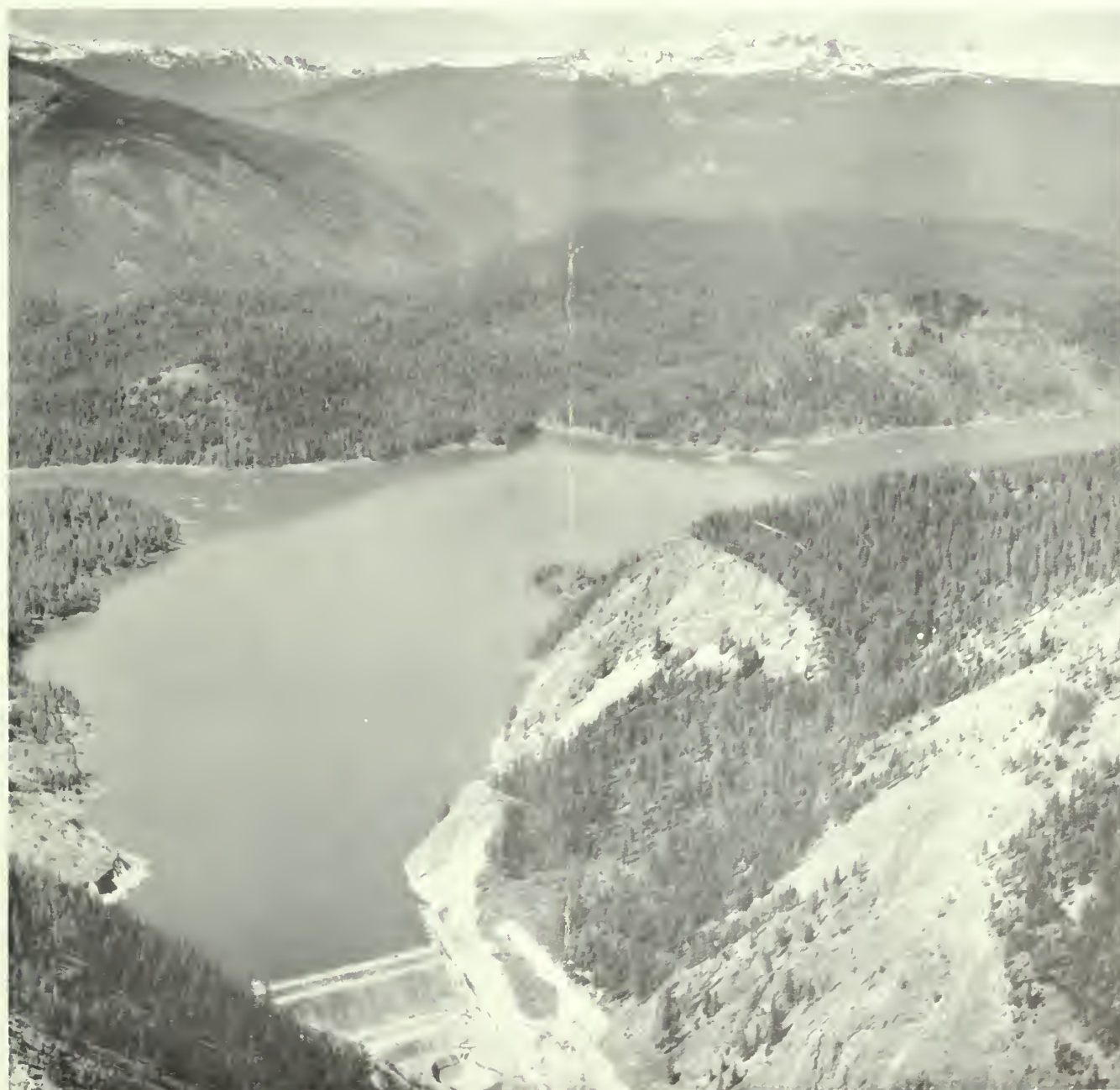


Photo by Joseph Yolo.

AIR VIEW OF TIETON DAM AND RESERVOIR, YAKIMA PROJECT, WASHINGTON.

Reclamation

RECLAMATION has been an established Government policy for 30 years—a little more. There has been ample demonstration and accomplishment. Federal reclamation projects have done as well as any other line of business—better than most of them. We of the West know that reclamation is good for our country. We are ready to prove that it is good for the whole Nation. Useful and seasonal production, diversification, and conservation of national resources combine to prove the case. That's the up to date of it. And now in this year 1936 the accumulated evidence of a depression, a wide extending drought that has caused even Iowa to call for irrigation, the research of competent committees—State and Government—have accumulated the evidence that there must be a better use of the land and water resources of America. The court of public opinion is making up a verdict. The Nation, I think, is awake. If we have a new prosperity, industry and agriculture—both will take their places as cornerstones. Reclamation will then be secure.

*Address by O. S. Warden, president of the National Reclamation Association
at the Pacific Northwest Business Conference in Boise, Idaho, September 9, 1936*

THE RECLAMATION ERA

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Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 11

NOVEMBER 1936



Memorial to Dr. Elwood Mead, Late Reclamation Commissioner

Address by John C. Page, Acting Commissioner¹

WE PAUSE here today to honor one whose death last January deprived the world of one of its outstanding builders.

Engineer, teacher, law giver, humanitarian, and master planner, Dr. Elwood Mead left an indelible mark on this western section of the United States. His handiwork was wrought as well in many other parts of the world and his influence was felt wherever irrigation farming was practiced, but here amid these western hills and western deserts Dr. Mead's skill and thought are embodied in great and permanent structures of both masonry and society.

Born January 16, 1858, on a farm at Patriot, Ind., the son of Daniel and Lucinda Davis Mead, Elwood Mead began life humbly. He received his education at Purdue University, where in 1882 he was graduated as a bachelor of science, and in 1884 as a master of science, and where in 1904 he received that school's first honorary degree of doctor of engineering.

He began his work as an assistant engineer in the Army Engineering Corps on a survey of the Wabash River in his native Indiana. But soon he went out to the then still young West, where his talents were to find wider play.

DR. MEAD WRITES WYOMING'S WATER LAW

In 1886, after a brief period as professor of mathematics at the Colorado Agricultural College, he became professor of irrigation engineering in that university. It was the first such chair established in any American school. In addition, he served as assistant State engineer of Colorado. In these two positions, Dr. Mead had an opportunity to study the problems which were then only beginning to arise as a result of the fact that the western one-third of

the United States receives insufficient rainfall for an intensive agriculture. He

Puerto Rico University Honors Dr. Mead

IN the midst of such grandeur in design and construction, emerges the majestic figure of an engineer of great vision, that of Dr. Elwood Mead, Commissioner of Reclamation, who devoted great efforts to make possible the realization of this everlasting monument of engineering. He died on January 26 of this year after the fulfillment of his masterpiece. He was a decided defender of the rights of the State as the sole owner of the ground and surface waters, and a promoter of irrigation projects which have brought joy and happiness to more than 600,000 persons that have been set up on farms created during his 12 years as Commissioner of Reclamation of the Department of the Interior of the United States.

He was a true creator of the Nation's wealth; a great heart, which inspired sympathy among his fellow workers; he embodied the true prototype of what the engineer ought to represent; a man of vision, one of resourcefulness, who labors for the welfare of mankind.—C. Calor Mota, Head, Department of Civil Engineering, University of Puerto Rico.

went eagerly, therefore, to Wyoming as territorial engineer so that he might

apply what he had learned in a community which was just being organized. In 1888, he became the first State engineer of Wyoming. As such he wrote the water law which was incorporated in the new State's constitution, discarding the old principles of riparian ownership which were throwing into confusion the legal status of the precious waters of the West. Under the Mead plan, the State retained title to all water, surface and underground. Diversions from streams and all appropriations of water from that time on down to the present in Wyoming have been under the orderly plan first proposed and first administered by Dr. Mead.

The importance of the new water law of Wyoming was soon recognized. It was spread throughout the West by adoption in newer States. In recognition of this great contribution, the University of Michigan in 1925 bestowed upon Dr. Mead the honorary degree of doctor of laws, thus citing him:

"Dr. Elwood Mead, Commissioner of the Bureau of Reclamation, engineer, lawgiver, and administrator, whose labors will endure through the ages yet to come, by framing and putting into operation the irrigation laws of the State of Wyoming, established a precedent followed not only by the newer States of the West, but also by Canada, Australia, South Africa, and New Zealand. He brought order out of confusion and opened a way where none had been."

Dr. Mead served Wyoming 10 years, during which time he became nationally known as an authority on water and irrigation problems, and during which time he broadcast the proposal that irrigation farmers should mutually own their water systems.

In 1899 Dr. Mead became Chief of the Division of Irrigation and Drainage Investigations of the Department of Agriculture and served concurrently as Pro-

¹ Address delivered on Sept. 29 on occasion of unveiling of memorial plaque to Dr. Mead at Boulder Dam.

fessor of Institutions and Practice of Irrigation at the University of California. Eight years later he went to Australia as chairman of the Victorian State Rivers and Water Supply Commission. Further pioneering in Australia, where Dr. Mead assisted in establishing a system which is a model in the British Empire, spread his fame throughout the world. There Dr. Mead opposed the "land hog" and advocated breaking up large holdings in order to establish new communities of land owners and in order to advance settlement.

Dr. Mead returned to the United States in 1914 to become Professor of Rural Institutions at the University of California and later Chairman of the California State Land Settlement Board. It was from these positions that President Coolidge called him to Washington in 1924, appointing him Commissioner of the United States Bureau of Reclamation.

Serving under three national administrations, Dr. Mead directed the work of this Bureau until death came in his seventy-ninth year. The prestige which he brought to the Bureau and the effort he expended in promotion of its work advanced it greatly.

Dr. Mead emphasized the purpose of the national reclamation policy. He expressed this object as the creation of new opportunities and the building of new homes and communities. Thousands in the West owe the chance they have had to make homes and to build cities to the vision of Dr. Mead. Thousands upon thousands more find security for themselves and their families as a result of his works.

We are gathered today on the scene of one great achievement of this man, and many of you visited a few days ago at Grand Coulee another project largely influenced and actually begun by Dr. Mead.

Here Boulder Dam now stands forever to control and make useful the Colorado River. Here before us stretches away for 100 miles the waters of a new lake, one dedicated to the service of the people of our arid West, and most fittingly named for the man whose life was spent in a like service, Dr. Elwood Mead.

It is highly appropriate that we should have with us on this occasion the members of the Grand Tour of the Third World Power Conference and the Second Congress of the International Commission on Large Dams. It is well because Dr. Mead was vice president of the International Commission on Large Dams and because he was a member of the Executive Committee of the Third World Power Conference. But beyond this, it is appropriate because Dr. Mead worked in many lands. He not only devoted years in Australia but he went to the Holy

Land to advise the Zionists upon the problems involved in reclaiming the arid lands of Palestine. He served on commissions in Cuba and Haiti, and acted as adviser to the governments of New South Wales, Canada, Java, and Mexico.

He was a member of the American Society and the British Institute of Civil Engineers, of the American Society of Engineers, and of the American Society of Agricultural Engineers.

As an officer of the Bureau of Reclamation and one who served under Dr. Mead and knew him as a wise and kind administrator, I feel greatly honored by the privilege of paying him this tribute. I

shared with all those who knew him a great love for the man and a great respect for his genius.

Our sorrow at his passing is tempered only by the knowledge that his was a long and valuable life. We find consolation in the fact that time cannot erase the influence Dr. Mead had on our body politic and can only weather the magnificent structures he built, such as this one here in Black Canyon—Boulder Dam.

I now present this monument. May it stand here on this spot overlooking Lake Mead as a reminder to new generations that theirs is a better lot because of the life and services of Dr. Elwood Mead.

Construction to Date

Contracts valued at \$141,856,760 for construction work and purchase of materials on Federal irrigation projects have been let since the emergency program of the Bureau of Reclamation was launched 3 years ago.

Major items in the program are 35 dams for the conservation of waters in the arid West. Of these dams 4 have been completed and put in service, 20 are under construction and contracts for the construction of 3 more soon will be ready for award. Eight additional dams are in various stages of preliminary design.

The construction of these dams together with the canals and appurtenant works constitute the largest single improvement program undertaken to date in connection with storage and utilization of the waters of arid western States.

Construction contracts now in force total \$85,974,677 in value while \$55,882,083 has gone for the purchase of materials, equipment, and supplies and to finance work by Government forces. Items purchased range from generators, cement, and steel to lighting fixtures and roofing materials. These purchases have served to spread the work of building these self-liquidating projects throughout the Nation.

A total of 12,000 men are employed by contractors on construction now in progress and 4,000 are employed in work being done by Government forces, making a grand total of 16,000 actually employed at the scene of construction. An even larger volume of indirect labor is provided.

In addition to the dams which soon will go into construction, advertisements for bids have been issued on specifications for half a dozen other construction jobs and one very large purchase contract has been advertised. Bids were opened November 2 at Denver, Colo., for the manufacture and delivery of twenty 102-inch paradox service gates and twenty 102-inch ring follower emergency

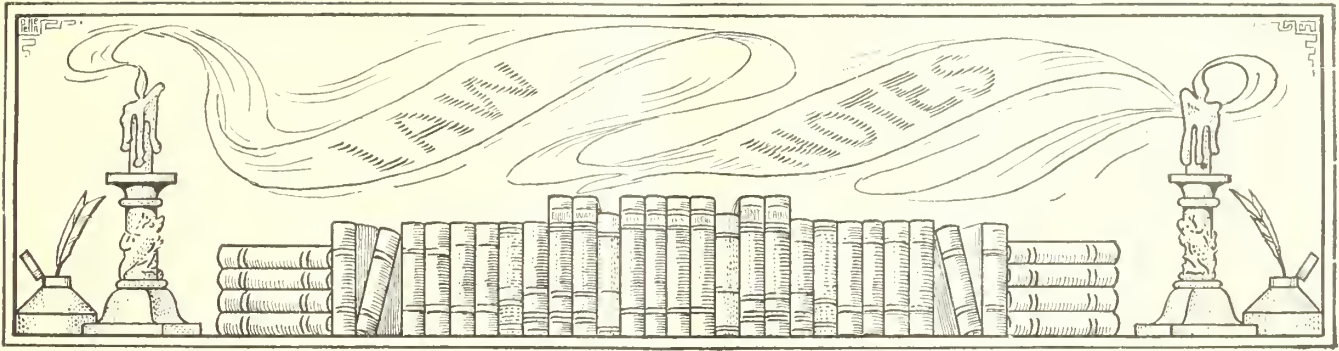
gates for Grand Coulee Dam, Columbia Basin project in Washington. This is the largest job of its type ever put on the market.

The four dams about to go into construction are the 110-foot earth-fill Boca Dam on the Little Truckee River in California, which will store water for the Truckee Meadows area of Nevada; the Marshall Ford Dam, a 265-foot concrete straight-gravity flood-control dam on the Colorado River of Texas, near Austin; the 80-foot earth-fill Fresno Dam of the Chain of Lakes storage (Milk River) project in Montana; and the Pine River Dam, of the earth-fill type, which is to be constructed near Durango, Colo. A contract for construction of the Boca Dam was recently awarded to the Geo. W. Condon Co., Omaha, Nebr., at their bid of \$729,435. Bids were opened October 20 at Austin, Tex., for construction of the Marshall Ford Dam. Bids were opened October 30 at Malta, Mont., for the Fresno Dam. Prospective contractors are being advised that the Pine River Dam will be advertised in January with bids to be opened probably early in February. This advice is being given in order that they may visit the site before the heavy snows set in.

Dams under construction include both storage and diversion structures. They will add to the total of 133 dams previously constructed by the Bureau of Reclamation, 72 of which have been for storage of waters and 61 for diversion of waters of western streams.

The eight dams now being designed include a few large storage dams such as those of the Central Valley project in California and some small diversion dams. Several of these will be advertised in the next few months.

GOOD progress is being made on the new modern creamery building at Worden, Mont., on the Huntley project.



Petition for Rehearing Denied

THE opinion of the United States Circuit Court of Appeals, Ninth Circuit, in *American Falls Reservoir District No. 2, appellant, v. Crandall et al., appellees*, was published in the June and July issues of the RECLAMATION ERA.

On a petition for rehearing, the court on September 28, 1936, filed the following opinion, affirming the decree of dismissal and denying the petition for rehearing.

"HANEY, Circuit Judge:

"In the opinion filed, the court fell into the error, as the parties did, of saying that in the absence of an indispensable party, the court was without jurisdiction to adjudicate the water rights of complainant. Equity rule 39 and 28, U. S. C. A., section 111, removed any defect of jurisdiction, but the court cannot make a decree in the absence of such party. *Shields v. Barrow*, 58 U. S. (17 How.) 130, 141, 15 L. Ed. 158; *Barney v. Baltimore*, 73 U. S. (6 Wall.) 280, 285, 18 L. Ed. 825; *California v. Southern Pac. Co.*, 157 U. S. 229, 250, 39 L. Ed. 683, 15 S. Ct. 591; *Minnesota v. Northern Securities Co.*, 184 U. S. 199, 236, 46 L. Ed. 499, 22 S. Ct. 308; *Bogart v. Southern Pac. Co.*, 228 U. S. 137, 146, 57 L. Ed. 768, 33 S. Ct. 497.

"In the petition for rehearing, it is asked that leave to amend be given appellants. In *Fourth Nat. Bank v. New Orleans & C. R. Co.*, 78 U. S. (11 Wall.) 624, 631, 20 L. Ed. 82, it is said:

"* * * It is doubtless the general rule that a bill in chancery will not be dismissed for want of proper parties; but the rule is not universally true. It rests upon the supposition that the fault may be remedied, and the necessary parties supplied. When this is impossible, and whenever a decree cannot be made without prejudice to one not a party, the bill must be dismissed. Nothing is to be gained by retaining it, when it is certain that the complainant can never be entitled to a decree in his favor. * * *

"It is alleged in the bill that 'this suit is a suit in equity brought by a tenant in

common or joint tenant for the partition of lands in a case where the United States is one of such tenants in common or joint tenants.' Mention is made of the fact that suit might be brought including the United States as a party under 28 U. S. C. A., section 41, subdivisions (20) and (25). In view of the foregoing, we add that if the United States had been made a party, and we would otherwise have had jurisdiction of the suit, it appears that appellant has not, by dedication, acquired any right to the natural flow as claimed. In *Vineyard v. North Side Canal Co.*, 38 Ida. 73, 223, pp. 1072, 1075, it is said concerning the constitutional provision quoted hereinabove:

"The gratuitous distribution of water does not constitute a dedication under this section. The word 'distributed' must be read in the light of the words 'sold' and 'rented' which precede it, and of the words 'upon payment therefor' which follow."

"Here there is neither allegation nor proof that appellant has paid anything for the rights claimed to have been dedicated. The statute, when read in the light of the foregoing quotation, we believe must mean that appellant, under such circumstances, could acquire the rights claimed only upon payment, and there being no proof of such fact here, the decree of dismissal was properly entered.

"In view of the foregoing, the last paragraph of the original opinion modifying the decree of the court below and reading—

"That said bill of complaint herein be, and the same is hereby, dismissed, without prejudice, and with costs to the defendant taxed at \$143.60, for want of a necessary party; that the United States is a necessary party to this suit; that because the United States was not made a party to this suit, the court is *without jurisdiction* to adjudicate the water rights set up in the Bill of Complaint."

"is hereby modified to read as follows:

"That said bill of complaint herein be, and the same is hereby dismissed, with

costs to the defendant taxed at \$143.60, for want of a necessary party; that the United States is a necessary party to this suit; that because the United States was not made a party to this suit the Court cannot adjudicate the water rights set up in the bill of complaint."

"As thus modified, the decree of dismissal is affirmed and the petition for rehearing denied."

Supreme Court Denies Arizona's Petition

On October 12 Arizona was denied by the Supreme Court its plea for a rehearing of its petition for permission to sue California and five other States for a final determination of water rights on the Colorado River.

In asking the rehearing John L. Sullivan, Special Assistant Arizona Attorney General, contended the tribunal's refusal of permission deprived the State of its property without due process of law.

The court denied the original petition after California, Utah, Nevada, Colorado, Wyoming, and New Mexico had argued that Arizona had no legal cause for action and that there was "nothing more than a potential controversy."—*Billings (Mont.) Gazette*.

ABOUT 70 inquiries concerning settlement opportunities on the Riverton project were received during the month of September, and a number of prospective settlers looked over the project. Eleven farm units are now available for entry. Seven sales of private land were made to a promising group of farmers.

THE Vale project reports continued interest in the Willow Creek unit by prospective settlers and the sale of several farm units on this division. A number of new settlers have seeded their lands to red clover and alfalfa.

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

NOVEMBER 1936

Public Relations Service

The work of the Bureau of Reclamation, ordinarily labeled "western development", is receiving more and more attention of the country as a whole because of the indirect benefits to the East and the direct benefits to the West, placing it in an important position in the economic picture of the country. Probably no other one development has drawn attention to Bureau activities more than Boulder Dam. The history of the river, the prolonged activities of the basin States, and the National Legislature in bringing about this development have kept the subject of Boulder Dam fresh in the minds of the public, and construction activities since the passage of the Boulder Canyon Project Act, December 21, 1928, have been unusual and colorful.

PICTORIAL MATERIAL AVAILABLE

It is gradually becoming known that the Bureau is in a position to tell its story through the medium of photographs, motion pictures, and lantern slides accompanied by lectures. This service is being taken advantage of by educational groups and interested civic, scientific, and technical groups through-

out the country, and the demand has prompted the collection of new material during the past summer.

Photographs for publication and for school use are furnished free of charge, and motion pictures and lantern slides with lectures, if desired, are also furnished for stated periods without charge. The only expense involved is the small charge of expressage from and to our headquarters in Washington.

In order to give some idea as to the material available there is listed below the films we have in 16- and 35-millimeter stock:

16- and 35-millimeter stock

Subject	Number of reels
Boulder Dam, Nev.-Ariz.....	4
Grand Coulee Dam, Wash.....	2

35-millimeter stock

Belle Fourche, S. Dak.....	1
Boise project, Idaho.....	1
Great Salt Lake Basin, Utah.....	2
Minidoka project, Idaho.....	2
Owyhee project, Oreg.-Idaho.....	1
Southern reclamation.....	2
Storage and diversion dams.....	2
Story of Federal Reclamation.....	2
Vale project, Oreg.....	1
Yakima project, Wash.....	2

Hundreds of colored lantern slides are available from which lecture sets may be made and the following are suggested subjects:

The story of reclamation.—This follows the story from the snow-capped mountains of the West (source of irrigation water supply) to storage of water, dams of the several types constructed by the Bureau, canals, siphons, laterals, diversion dams, and other irrigation structures, methods of applying water to the land, crops grown, diversified farming, cooperative marketing, and civic development set up as a result of the establishment of irrigation farming in a community, such as clubs, churches, etc.

Boulder Dam.—This lecture shows construction work and special features such as penstock pipe fabrication and

installation, 150-ton permanent cableway, cooling system, intake towers, spillways, etc., as well as selected views of Boulder City and Lake Mead.

Grand Coulee Dam.—This lecture shows the progress of construction, belt conveyor system, gravel screening plant, cement mixing plants, contractors' and Government cities, views of the coulee, etc.

Industries on Federal Irrigation Projects.—Shows varied industries which develop in the irrigated agricultural area—canning factories, mills, granaries, shipping houses, etc., on reclamation projects.

Unusual Construction Features on Federal Reclamation Projects.—Shows such features on the Boulder Canyon project, Columbia Basin project, Owyhee project, Uncompahgre project, Grand Valley project, and Yakima project. Also—

Project Scenic Attractions.

Zoology and Botany on Federal Reclamation Projects.

Colorado River and the Southwest, showing high lights of our projects on the Colorado River: Grand Valley, Boulder Dam, Parker Dam, Imperial Dam, All-American Canal, Yuma.

The Bureau has in its Washington photographic files thousands of negatives from which prints and enlargements can be made in our own laboratory and colored by an artist, if this is desired. For official showing these are loaned without charge. For private use a schedule of prices is set up as follows:

CONTACT PRINTS

Size (inches):

3 by 5—6 cents.
4 by 5—10 cents.
5 by 7—15 cents.
6 by 8—20 cents.
8 by 10—30 cents.

ENLARGEMENTS

Size (inches)	Uncolored	Colored
8 by 10.....	\$0.65	\$2.65
11 by 14.....	1.50	4.50
16 by 20.....	2.50	7.50
20 by 24.....	4.00	11.50
22 by 28.....	4.50	14.00
24 by 36.....	5.00	15.00
30 by 40.....	6.00	18.00

(Cut along this line)

COMMISSIONER,

Bureau of Reclamation,

Washington, D. C.

SIR: I am enclosing my check ¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Date).....

(Name).....

(Address).....

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Lantern slides on subjects selected from our prints are made in 3¼ by 4, uncolored, for 40 cents and colored for \$1.20.

The Bureau has received a number of requests for transparencies and has established the following price list for this character of work. The prices include coloring.

16 by 20 inches—	\$25.
20 by 24 inches—	\$35.
24 by 36 inches—	\$55
30 by 40 inches—	\$75

EXHIBITS FURNISHED

The interest in the Bureau's work is further evidenced by the number of exhibits which have been solicited and placed at national expositions such as Chicago, San Diego, and Dallas, and at the sessions of national conventions, such as the Third World Power Conference, and Second International Commission on Large Dams, the National Society of Professional Engineers, and the Upstream Engineering Congress, all held at Washington, D. C., Colorado Society of Civil Engineers at

Denver, Colo., and the American Society of Agricultural Engineers at Estes Park, Colo.

Inquiry is invited, if you are interested, in securing the installation of an exhibit by the Bureau or having our Public Relations Service supply photographs, films, lantern slides, literature or other forms of educational material in our field which you may arrange as an exhibit yourself.

The country is entitled to know the activities of the various Government agencies and we stand ready to supply pictorial and printed material to make known the work of the Bureau of Reclamation.—*M. A. Schnurr.*

Why Not Irrigation?

By Seth H. Dibble, Bureau of Reclamation, Malta, Montana

TO THE average layman, the thought of irrigation conjures a mental picture of man-made ditches traversing semiarid lands, and the next step in the mental process definitely assigns that picture to the undulating prairies of the West. Thus, conversely, irrigation and the West are synonymous terms.

This treeless western expanse was not laid down when Nature first began her terrestrial experiment. As the earth's crust cooled and settled into position, a vast mountain range formed along the western coast. Moisture-laden air from the ocean failed to surmount this barrier and was either precipitated on its western slope or carried to the elevated plateaus of the North, where perennial frosts transformed the moisture into creeping mountains of glacial ice. Grinding and shearing as they came, vast masses of drift were carried to the lower regions east of the mountain chain and deposited to form these now known arid and semiarid lands.

Nature has always insisted that the earth be productive, but the growth she found suitable for this newly made land was shallow of root and scant of top, and while nutritious to the *n*th degree, demanded little and returned little to the soil. No excessive precipitation leached its vital growth-producing elements. And now, after recurring centuries, we find these western lands as strong and fertile as when first formed, teeming with all the essentials requisite for growth perfection. All they need is water.

WATER THE PRIME NEED

Here we find no tired lands grown old with production; no thin soils that need two fish in every hill; no ground swarming with parasite mold. These are neither clay lands that require nitrogen, nor vegetable-mold demanding potash. Here plants stand erect—no spineless stems with drooping heads. Their sun-

formed food cells have no imperative need for additional vitamins. Here Nature finds it possible to better her eastern efforts and fill the Nation's basket with a grade of foodstuffs impossible of production on any other soils. All she needs is water.

The red soils of the extreme East may have some historic value in that they typify the heroic struggles of our valiant forefathers, but they will not yield as in the days of John Alden. The black soils farther west seem to reflect vast coal beds beneath, but they need the physician's prescription for lime and phosphate and potash. Great reaches of eastern lands lie unfruitful and exhausted, but the thirsty old-young lands of the West are eager to bear the burden, so why not give them water.

If these lands will produce a wheat that betters the best bread; a wheat, transplanted from the steppes of Russia, so hard that it brought forth the miller's curse when first it reached his mill; a wheat for which that same miller now willingly pays a premium for its protein content; a wheat no other land will produce—why not irrigation?

If these lands alone can take the beet out of the coffee adulteration class and make it fill the Nation's sugar bowl with a product slightly less in saccharine content than its rival cane, with a greater labor employment and a less consumer cost—why not irrigation?

If from this soil can be unearthed row upon row of a superior potato, demanding a premium on the eastern market, perfect as seed for the southern grower, firm, a good keeper and fine of flavor—why not irrigation?

Here are lands eager to cuddle the nitrogen nodules of the alfalfa plant, to keep the winter feed rack bulging with fodder, and to crowd the seedhouse floor with blue-tagged bags. If the "buffalo grass" on this horizon-rimmed bowl can

furnish trainloads of beef, kidney-choked with suet, why not winter feed for the foundation herds—why not irrigation?

Here are lands where the skilled herder rides herd on the coyote, while his 2,000 sheep form a fan in their feeding. If the native forage from this sun-drenched prairie can feed the maws of a million wool sacks, why must the sheepman pray for an open winter? Why not filled mows and granaries—why not irrigation?

Here are lands that will grow wheat like that milled in the Volga: World prize-winning oats and ryes and barleys; grapefruit and dates; oranges and lemons; beef and mutton; wool and sugar, all unexcelled by their eastern relations. Here are lands, like the Nile, kept young by the silting; lands veiled by Providence for just that purpose. So why not irrigation?

Klamath Four-H Clubs

On September 28 and 29 Klamath County's Four-H Clubs and Future Farmers of America held the Klamath Junior Livestock and Baby Beef Show at the county fair grounds. On the last day of the show 89 of the animals entered were sold at auction, the total sales amounting to \$5,793. The grand champion Four-H steer entered by Don West of Henley was sold to the district manager of Safeway Stores for \$732.96, or about 72 cents per pound.

THE steam plant recently constructed on the Provo River project by the Utah Power & Light Co. at the mouth of Provo Canyon, with an initial capacity of 18,500 kilovolt-amperes, is being made ready for operation. From this plant and the Olmsted hydroelectric plant, a 44,000-volt transmission line has recently been constructed to the Park City mining district.

R. E. A. Electrified Farm¹

THE J. M. Hughes family, owners of the R. E. A. electrified farm near Herndon, Va., know farm life in all its phases. After years of hard work and a great deal of avoidable drudgery that goes with life on so many of our farms, they now have the opportunity to appreciate the advantages of the most modern equipment available for the farm and the rural home.

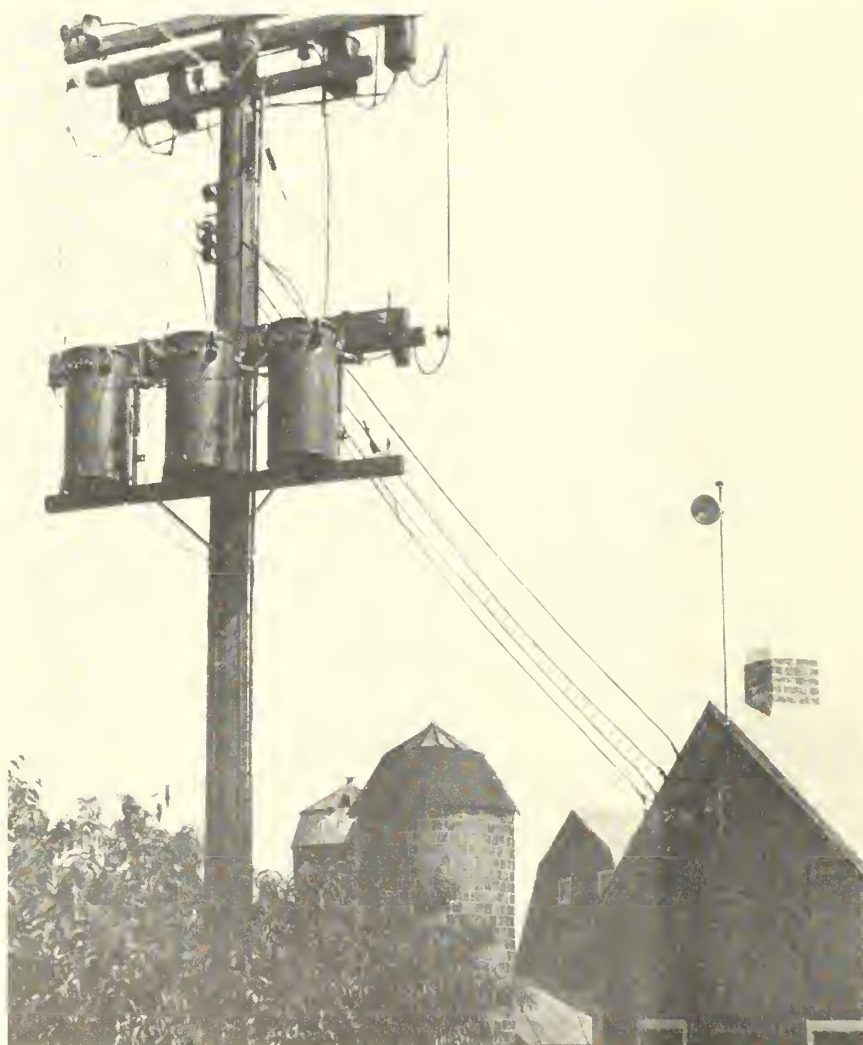
The electrification of the Hughes farm is a joint enterprise of the Exhibits Committee of the World Power Conference, the National Electrical Manufacturers Association, the plumbing industry, and the Rural Electrification Administration. The Virginia Public Service Co. extended its power lines to the farm.

The present purpose of the farm is to demonstrate to visitors some of the practical uses of electricity, both in the home and on the farm.

Mrs. Hughes' story of what electricity means to her and to her family well illus-



HAROLD L. ICKES, SECRETARY OF THE INTERIOR, TURNS SWITCH THAT STARTS THE POWER ON THE REA ELECTRIFIED FARM NEAR HERNDON, VA. AT THE LEFT IS MORRIS L. COOK, REA ADMINISTRATOR; IN CENTER IS GOVERNOR GEORGE C. PEERY OF VIRGINIA.



ELECTRIC POWER BROUGHT TO THE FARM

trates just how much it can mean to the thousands of rural families to whom it is now being brought.

After their marriage Mr. and Mrs. Hughes decided to make farming their means of livelihood. She was city bred, and her family had doubts about their daughter's happiness in her choice. They realized more than she the difficulties and hardships that lay ahead. But with faith in their ability to overcome all obstacles, the young couple started out.

Mrs. Hughes sometimes recounts those many difficult years. She explains:

"Only our love for life in the country kept us here. Life has been difficult, to say the least. More than anything in the world, I first missed running water in the house. It meant many trips a day for someone—and I was usually the one. Water became a precious liquid. While it was hard, too, for the men, I was never free from the house for a minute. Just as the boys reached the age when they could have been of some help to me, they were needed in the fields and at the barn.

"I was never through the work of serving one meal when it proved time to begin the preparations for another. The rest of the work—and there was plenty—had to be sandwiched, somehow, between them. One of the trials of my life was seeing to it that the kitchen wood box was kept filled. When all the men were busy I oftentimes had to carry the wood. The

¹ Published by courtesy of the Rural Electrification Administration.

heat radiating from that stove often made me feel faint. The range needed constant watching, and sometimes when I was busy with other things it would go out entirely, which did not improve my disposition any.

"In spite of it all, we thought that the country was the proper place in which to bring up the boys. And we liked it, too. The work was hard, but we did pretty well. Finally, when my sons went off to Washington to school, I visited them there a few times. It was then I began to realize what I was missing. It surprised me to find the comforts of life in the city so taken for granted. It all seemed luxurious to me, and I reveled in it. When the boys talked of working in the city I could scarcely blame them, but Mr. Hughes urged them to run the farm for him. It was our home and we hated ever to give it up or to have it run by strangers.

"Now", concluded Mrs. Hughes, "after all those difficult years we are eating the fruits of our labors and enjoying life as we never have before."

MODERNIZATION BEGUN

Throughout the 200 years of the farm's existence gradual changes and improvements have been made. The original log framework of the house still stands, but the outer walls have been covered with white siding and the inner walls with plaster. The house has been enlarged and modernized until now it is as comfortable and convenient as any city home.

Dairying is the main source of income, and about 80 sleek cows graze in the meadows. The crops include corn, wheat, hay, and barley. A few hogs, poultry, and eggs add to the farm profits.

Electric power has brought relief from constant drudgery and has added to the comfort of this family. Electricity pumps water for the house, the dairy barn, the milk house, and for the livestock. In the house is a modern bathroom, and there is hot and cold running water in the kitchen and the laundry. An electric refrigerator keeps food fresh, eliminates waste, and furnishes ice for household uses. The electric range is the type that can be set to turn on and off automatically. Mrs. Hughes can, and does, place meat and vegetables in the oven, set the clock control, and leave the kitchen for hours, with the assurance that when she returns she will find the meal perfectly cooked. After the meal, the dishes are placed in the electric dish washer. With a minimum of effort and in a few minutes' time they are clean and sparkling. Electricity runs the washing machine, saving long hours of labor; it heats the flatiron and the ironer; by means of the radio it brings news of the world and entertainment to the Hughes family; and there are many other appli-



ABOVE: OLD-FASHIONED PUMP; BELOW: MRS. HUGHES TURNS SWITCH OF HER NEW ELECTRIC PUMP, WHICH PROVIDES RUNNING WATER IN KITCHEN, BATHROOM, AND LAUNDRY OF THE OLD FARM HOUSE, ALSO FOR COW BARN, POULTRY HOUSE, MILK HOUSE, TO THE WATERING TROUGH FOR THE STOCK, AND FOR AN OVERHEAD IRRIGATION SYSTEM IN THE TRUCK GARDEN.

ances which contribute to their happiness and comfort.

Not alone the house, but the farm buildings and the yard are well lighted. Specialized dairy equipment milks the

cows electrically and cleans and refrigerates the milk until it is shipped. The cow barn and milk house are kept clean by water under pressure. Due to care and

(Continued on p. 260)

Notes for Contractors

Spec. no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded	
				Name	Address				
833-D....	Sept. 22 (10 bidders).	Shoshone-Heart Mountain, Wyo.	Transformers for construction substation.	R. E. Uptegraff Mfg. Co.... Wagner Electric Corp..... Pennsylvania Transformer Co.	Pittsburgh, Pa..... St. Louis, Mo..... Pittsburgh, Pa.....	\$3,156.00 3,315.27 3,387.21	F. o. b. Cody, Wyo..... do..... do.....	Sept. 30	
696.....	Sept. 30 (18 bidders).	Truckee Storage, Calif.	Construction of Boca Dam.	Geo. W. Condon Co..... D. McDonald and McDonald & Kahn Co. S. J. Groves & Sons Co....	Omaha, Nebr..... San Francisco, Calif..... Minneapolis, Minn.	729,435.00 740,650.00 749,050.00		Oct. 26	
806-D....	Sept. 8.....	Boulder Canyon, Ariz.-Nev.	Granite for flagpole base at Boulder Dam.	Pacific Cut Stone & Granite Co.	Alhambra, Calif....	23,987.00		Sept. 30	
835-D....	Oct. 1 (15 bidders).	Salt River, Ariz....	Motor-driven reduction unit and miscellaneous parts for radial gates at Horse Mesa Dam.	Commercial Iron Works.... H. R. L. Motor Co..... General Iron & Steel Works. Lakeside Bridge & Steel Co. John W. Beam.....	Portland, Oreg.... Seattle, Wash..... Portland, Oreg.... Milwaukee, Wis... Denver, Colo.....	11,100.00 11,366.00 12,150.00 1,933.00 2,015.00	It. 1, f. o. b. Portland..... It. 1, f. o. b. Seattle..... It. 1, f. o. b. Portland..... It. 2, f. o. b. Milwaukee, ½ percent discount. It. 2, f. o. b. Peotone, Ill., ½ percent discount.	Oct. 16 ----- ----- Oct. 10	
				Consolidated Steel Corp., Ltd. John W. Beam..... Allison Steel Mfg. Co..... Lakeside Bridge & Steel Co.	Los Angeles, Calif. Denver, Colo..... Phoenix, Ariz..... Milwaukee, Wis...	2,324.00 4,375.00 5,785.00 5,793.00	It. 2, f. o. b. Los Angeles..... It. 3, f. o. b. Denver..... It. 3, f. o. b. Mesa, Ariz..... It. 3, f. o. b. Milwaukee, ½ percent discount.	Oct. 12	
42613-A..	Sept. 29 (6 bidders).	do.....	5,000 barrels of Portland cement in cloth sacks.	Southwestern Portland Cement Co. Graham Bros., Inc.....	Los Angeles, Calif. do.....	1 2.12 1 1.75	F. o. b. El Paso, Tex., 60 cents discount and sacks. F. o. b. Long Beach, Calif., 60 cents discount and sacks.	Oct. 8	
40654-A..	Sept. 1.....	Upper Snake River, Idaho.	4,900 barrels of Portland cement in cloth sacks.	Henry Cowell Lime & Cement Co. Idaho Portland Cement Co.	San Francisco, Calif. Inkom, Idaho.....	1 2.12 1 3.00	F. o. b. Cowell, Calif., 50 cents discount and sacks. F. o. b. Chester, Idaho, 50 cents discount and sacks.	Oct. 7	
691.....	Sept. 14....	Casper-Alcova, Wyo.	Turbines, governors, and generators.	Pelton Water Wheel Co.... do.....	San Francisco, Calif. do.....	94,490.00 18,944.00	Sch. 1, f. o. b. San Francisco..... Sch. 2, f. o. b. Rockford, Ill.	Oct. 5 Do.	
830-D....	Sept. 15....	Boulder Canyon, Ariz.-Nev.	One 30-ton gas-engine-powered locomotive.	Allis-Chalmers Mfg. Co.... Davenport-Besler Corporation.	West Allis, Wis.... Davenport, Iowa..	186,500.00 12,363.33	Sch. 3, f. o. b. West Allis..... F. o. b. Davenport.....	Oct. 7	
836-D....	Oct. 2 (12 bidders).	All-American Canal, Ariz.-Calif.	Trash-rack metal work for Gila Valley Canal headworks. ²	Associated Piping & Eng. Co., Ltd. California Steel Products Co. Consolidated Steel Corp., Ltd. Hansel-Elcock Co.....	Los Angeles, Calif. San Francisco, Calif. Los Angeles, Calif. Chicago, Ill.....	4,248.00 4,774.00 5,035.00 5,912.00	It. 1, rack units, 2 percent discount. do..... do..... It. 2, bottom guides, ½ percent discount.	----- ----- ----- Oct. 16	
				California Steel Products Co. Consolidated Steel Corp., Ltd. Associated Piping & Eng. Co., Ltd. Hansel-Elcock Co.....	San Francisco, Calif. Los Angeles, Calif. do..... Chicago, Ill.....	6,683.00 6,906.00 6,400.00 6,483.00	It. 3, plates & beams, 2 percent discount. do..... It. 3, plates & beams, ½ percent discount. do.....	----- ----- ----- Oct. 13	
				Consolidated Steel Corp., Ltd. do.....	Los Angeles, Calif. do.....	8,518.00 19,439.00	do..... It. 1, 2, and 3.....	----- -----	----- -----
45093-A..	Sept. 14....	Uncompahgre, Colo.	8,000 barrels of Portland cement in cloth sacks.	United States Portland Cement Co.	Denver, Colo.....	14,624.00 1 2.40	It. 2 and 3..... F. o. b. Portland, Colo., 50 cents discount and sacks.	Oct. 6	
A - 42, 111-A..	Oct. 5 (2 bidders).	All-American Canal, Ariz.-Calif.	Steel reinforcement bars, 3,286,422 pounds.	Columbia Steel Co.....	San Francisco, Calif.	83,796.82	F. o. b. Laguna, Calif., ½ of 1 percent-10 B. P. V.	Oct. 23	
813-D....	July 22....	Boulder Canyon, Ariz.-Nev.	Laboratory-type oscillographs (item 2). Phase shifter and single-phase phantom load (item 5). Potentiometers, galvanometers, volt-box, etc. (item 7). 8-slide wire rheostats (item 9). 3 electric time stamps (item 17); items 6, 8, 12, 13, 14, 15, 16 canceled.	Colorado Fuel & Iron Co. Westinghouse Elec. & Mfg. Co. Graybar Electric Co.....	Denver, Colo..... do..... do.....	83,638.76 1,540.50 429.00	do..... do..... F. o. b. Newark, N. J.....	Oct. 13 ----- Do.	
				Gray Instrument Co.....	Philadelphia, Pa..	924.00	F. o. b. Washington, D. C., 2 percent discount.	Do.	
				Beck Bros.....	do.....	96.00	F. o. b. Boulder City, Nev..	Aug. 15	
				International Business Machine Corp.	Denver, Colo.....	370.50	F. o. b. Endicott, N. Y.....	Oct. 13	
831-D....	Sept. 17 (9 bidders).	Klamath, Oreg.-Calif.	Pumping unit for plant no. 6, Tule Lake division.	Pomona Pump Co.....	Pomona, Calif....	1,512.00		Oct. 16	
				Fairbanks, Morse & Co..	Kansas City, Mo..	1,670.00	F. o. b. San Francisco and Beloit, Wis.		
				Sterling Pump Corporation.	Stockton, Calif....	1,735.00	3 percent discount.....		
838-D....	Oct. 16 (7 bidders).	Owyhee, Idaho.	Gate valves for Dead Ox pumping plant.	Kennedy Valve Mfg. Co..	Elmira, N. Y.....	114.50	Item 1, 2 percent discount...		
				Mueller Co.....	Chattanooga, Tenn.	135.50	Item 1, 2 percent discount, f. o. b. Ontario, Oreg.		
				Michigan Valve & Foundry Division.	Detroit, Mich....	129.00	Item 1.....		
				Kennedy Valve Mfg. Co..	Elmira, N. Y.....	3,263.64	Item 2, 2 percent discount...		
				Michigan Valve & Foundry Division.	Detroit, Mich....	3,376.00	do.....		
				Koppers Co.....	Fort Wayne, Ind..	3,592.06	do.....		

See footnotes at end of table.

Notes for Contractors—Continued

Spec. no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
843-D	Oct. 15 (12 bidders).	Parker Dam, Calif.-Ariz.	Trash-rack metalwork for Parker power plant.	Mississippi Valley Structural Steel Co.	St. Louis, Mo.	20,288.00	Item 1.	
				A. J. O'Leary & Son Co.	Chicago, Ill.	20,860.00	Item 1, ½ percent discount.	
				John W. Beam	Denver, Colo.	20,900.00	Item 1, ½ percent discount f. o. b. Peoria, Ill.	
				Virginia Bridge Co.	Roanoke, Va.	3,798.00	Item 2, f. o. b. Birmingham or Memphis.	
				Spuck Iron & Foundry Co.	St. Louis, Mo.	4,500.00	do.	
				A. J. O'Leary & Son Co.	Chicago, Ill.	4,725.00	Item 2, ½ percent discount.	
				do.	do.	1,515.00	Items 3, ½ percent discount.	
				Virginia Bridge Co.	Roanoke, Va.	1,769.00	Item 3, f. o. b. Birmingham or Memphis.	
				Spuck Iron & Foundry Co.	St. Louis, Mo.	1,860.00	Item 3.	
				do.	do.	2,800.00	Item 4.	
				A. J. O'Leary & Son Co.	Chicago, Ill.	2,875.00	Item 4, ½ percent discount.	
				Mississippi Valley Structural Steel Co.	St. Louis, Mo.	2,949.00	Item 4.	
				A. J. O'Leary & Son Co.	Chicago, Ill.	970.00	Item 5, ½ percent discount.	
				Virginia Bridge Co.	Roanoke, Va.	1,107.00	Item 5, f. o. b. Birmingham or Memphis.	
				Spuck Iron & Foundry Co.	St. Louis, Mo.	1,220.00	Item 5.	
A-42, 106-A.	Oct. 2 (6 bidders).	All-American Canal, Calif.	Steel reinforcement bars.	Colorado Fuel & Iron Corporation.	Minnequa, Colo.	23,867.55	F. o. b. Knob, Calif., ½ percent discount B. P. V.	
				Bethlehem Steel Co.	Los Angeles, Calif.	23,919.74	F. o. b. Colorado, Calif., ½ percent discount B. P. V.	
				Columbia Steel Co.	Torrance, Calif.	23,919.74	do.	
				Tennessee Coal, Iron & Railroad Co.	Fairfield, Ala.	25,098.21	F. o. b. Knob, Calif., ½ percent discount B. P. V.	
702	Oct. 20 (3 bidders).	Colorado River, Tex.	Construction of Marshall Ford Dam.	Brown & Root, Inc., and McKenzie Construction Co.	Austin, Tex.	5,781,235.00		
				Utah Construction Co.	Ogden, Utah	5,909,049.00		
				W. E. Callahan Construction Co.	St. Louis, Mo.	7,322,496.00		
837-D	Oct. 13 (7 bidders).	Owybee, Idaho.	Construction of Dead Ox pumping plant.	Benjamin H. Sheldon	Ontario, Oreg.	9,736.00		Oct. 17
				David A. Richardson	do.	13,100.50		
				John Klug	Easton, Wash.	14,188.50		
842-D	Oct. 20 (11 bidders).	Ogden River, Utah.	Suspension bridge and pipe for Ogden Canyon siphon.	California Steel Products Co.	San Francisco, Calif.	5,792.00	Item 1.	
				Virginia Bridge Co.	Roanoke, Va.	5,732.00	Item 1, f. o. b. Memphis.	
				Provo Foundry & Machine Co.	Provo, Utah.	7,800.00	Item 1, f. o. b. Ogden, ½ percent discount.	
				Bethlehem Steel Co.	New York, N. Y.	1,554.00	Item 2, f. o. b. Trenton.	
				American Steel & Wire Co.	Worcester, Mass.	1,775.00	Item 2, f. o. b. Ogden, 2 percent discount.	
				J. A. Roebling Sons Co.	New York, N. Y.	1,904.00	do.	
				Berkeley Steel Construction Co., Inc.	Berkeley, Calif.	6,983.00	Item 3, ½ percent discount.	
				Alco Products, Inc.	New York, N. Y.	7,500.00	Item 3, f. o. b. Dunkirk, N. Y.	
				Provo Foundry & Machine Co.	Provo, Utah.	8,930.00	Item 3, f. o. b. Ogden, 2 percent discount.	
844-D	Oct. 20 (6 bidders).	All-American Canal, Ariz.-Calif.	Valves, pipe, and appurtenances for pedestals of scrapers in desilting works.	Long Beach Iron Works.	Long Beach, Calif.	17,000.00	Item 1.	
				Los Angeles Valve & Fittings Co.	Los Angeles, Calif.	18,925.00	Item 1, f. o. b. Potholes, Calif.	
				Enterprise Foundry Corporation.	San Francisco, Calif.	18,000.00	do.	
				Long Beach Iron Works.	Long Beach, Calif.	14,500.00	Item 2.	
				Enterprise Foundry Corp.	San Francisco, Calif.	14,000.00	do.	
				Los Angeles Valve & Fittings Co.	Los Angeles, Calif.	15,000.00	Item 2, f. o. b. Potholes, Calif.	
820-D	Oct. 27.	Boulder Canyon, Ariz.-Nev.	16-inch engine lathe (item 1).	Smith Booth Usher Co.	do.	3,075.00	2 percent discount.	Oct. 21
			6-foot radial drill (item 2).	American Tool Works Co.	Cincinnati, Ohio.	5,394.00		Do.
			6-foot radial drill (item 3).	(All bids rejected.)				
			Milling machine (item 4).	Mine & Smelter Supply Co.	Denver, Colo.	5,185.00		Oct. 20
			Grinder (item 5).	do.	do.	1,487.50		Do.
839-D	Oct. 19 (25 bidders).	Boulder Canyon, Ariz.-Nev.	Transformers and switching equipment.	The Standard Transformer Co.	Warren, Ohio.	7,885.00	\$110 and \$720.	
			Item 1—Three 33,000-volt transformers.	American Transformer Co.	Newark, N. J.	8,955.00	\$275 and \$1,320.	
			Item 2—Seven 16,500/34,500-volt transformers.	Kuhlman Electric Co.	Bay City, Mich.	9,051.00	\$450 and \$1,377.	
				American Transformer Co.	Newark, N. J.	22,965.00	Deduct \$550 for omission of impulse tests.	
				Wagner Electric Corporation.	St. Louis, Mo.	23,294.00	Deduct \$1,155 for omission of impulse tests.	
				Maloney Electric Co.	do.	24,774.00	Deduct \$160 for omission of impulse tests.	
				Westinghouse El. & Mfg. Co.	Sharon, Pa.	25,041.00	Deduct \$1,155 for omission of impulse tests.	
				Allis-Chalmers Mfg. Co.	Pittsburgh, Pa.	24,711.00	Deduct \$495 for omission of impulse tests.	

See footnotes at end of table.

Notes for Contractors—Continued

Spec. no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
846-D...	Oct. 22 (9 bidders).	All-American Canal, Ariz.-Calif.	Radial gates for Gila Valley headworks; sluiceway, bypass and influent channels of desilting works: Item 1—Nine 35-foot 8-inch by 14-foot 8-inch radial gates. Item 2—Twelve 61-foot by 7-foot radial gates. Item 3—Fourteen 21-foot by 17-foot 6-inch radial gates. Items 1, 2, 3, and 4.	Lakeside Bridge & Steel Co. Pacific Iron & Steel Co., Ltd. Berkeley Steel Constr. Co., Inc. Koppers Co. (Bartlett-Hayward Div.). Lakeside Bridge & Steel Co. Pacific Iron & Steel Co., Ltd. Berkeley Steel Constr. Co., Ltd. Lakeside Bridge & Steel Co. Pacific Iron & Steel Co., Ltd. Berkeley Steel Constr. Co., Ltd. Koppers Co. (Bartlett-Hayward Div.). Consolidated Steel Corp., Ltd. Lakeside Bridge & Steel Co.	Milwaukee, Wis. Los Angeles, Calif. Berkeley, Calif. Baltimore, Md. Milwaukee, Wis. Los Angeles, Calif. Berkeley, Calif. Milwaukee, Wis. Los Angeles, Calif. Berkeley, Calif. Baltimore, Md. Los Angeles, Calif. Milwaukee, Wis.	24,892.00 27,927.00 31,000.00 34,000.00 8,420.00 8,930.00 8,950.00 16,192.00 19,377.00 18,500.00 21,500.00 19,994.00 47,719.00	F. o. b. Lynwood, Calif. ½ of 1 percent discount... F. o. b. Potholes, Calif., ½ of 1 percent discount. F. o. b. Lynwood, Calif. ½ of 1 percent discount... F. o. b. Lynwood, Calif. ½ of 1 percent discount... F. o. b. Potholes, Calif., ½ of 1 percent discount.	
699.....	Oct. 22 (3 bidders).	Salt River, Ariz.	40-foot by 44-foot 6-inch regulating gate and gate hoist for Horse Mesa auxiliary spillway: Item 1—One 40-foot by 44-foot 6-inch gate. Item 2—One 40-foot by 44-foot 6-inch gate. Item 3—Gate frame, counterweight metal work, appurtenances. Item 4—One motor-driven gate hoist. Items 1, 3, and 4. Items 2, 3, and 4.	Consolidated Steel Corporation, Ltd. do do S. Morgan Smith Commercial Iron Works Consolidated Steel Corporation, Ltd. do do	Los Angeles, Calif. do do York, Pa. Portland, Oreg. Los Angeles, Calif. do do	37,645.00 36,027.00 11,300.00 32,000.00 38,900.00 45,950.00 89,566.00 87,961.00		
845-D...	Oct. 21 (4 bidders).	Boulder Canyon, Ariz.-Nev.	Crawler tractor and power shovel. Item 1—One 70-horsepower gasoline-engine-powered crawler tractor. Item 2—One ½ cubic yard combination power shovel and clam-shell excavator.	Caterpillar Tractor Co. do Harnischfeger Corporation do Browning Crane & Shovel Co. Speeder Machinery Corporation.	Peoria, Ill. do Milwaukee, Wis. do Cleveland, Ohio Cedar Rapids, Iowa.	7,245.00 7,913.00 11,320.00 9,423.00 11,748.00 13,400.00	Discount \$50/unit F. o. b. Boulder City, Nev. Discount 2 percent. do Discount ½ of 1 percent. Discount 1 percent.	
700.....		All-American Canal, Calif.	Closed drains, station 3552 to station 3713, and open drains, station 3713 to station 3800.					
703.....	Nov. 30	Boulder Canyon, Ariz.-Nev.	One 3,000-ampere, 23,000-volt bus structure; two 600-ampere, 15,000-volt oil circuit breakers; two 23,000-volt, 4,000-ampere oil circuit breakers.					
706.....		Central Valley	25 duplex cottages at Government camp, Friant Dam.					
707.....		do	Office building, dormitories, and residences at Government camp, Friant Dam.					
709.....		do	Earthwork, canal lining, and structures, Friant-Kern Canal, station 4+00—station 300+69.					

¹ Per barrel.² All low bids f. o. b. shipping point.³ Deductions for omission of impulse tests and reduction in price for 2,400-volt connection.⁴ All bids f. o. b. Boulder City, Nev.⁵ Alternate bid.

Electrified Farm

(Continued from p. 255)

cleanliness in production, milk from this farm always brings the highest prices.

ENTIRE FARM ELECTRIFIED

Before the farm was served with electric refrigeration for the milk and for domestic purposes, the Hughes' ice bill amounted to about \$30 a month. There was some waste in the handling of the ice, and it consumed much time. The elimination of this expenditure is but one of the off-sets to the cost of electricity. In most instances where electricity is used, the cost of former methods may be deducted. Only by making such deductions can a fair estimate of the real cost of electricity and electrical equipment be reached.

The portable 5-horsepower motor runs the hay hoists, which eliminate the labor of pitching hay to the lofts of the horse and cow barns. An electric corn-sheller, feed-grinder, and mixer prepares the great quantities of feed necessary for so much

livestock. And, as one of the Hughes boys so aptly put it as he expertly thrust corn into the sheller, "Unless you've shelled corn by hand, you really can't appreciate one of these machines."

Plants get an early start in the electrically heated hot bed on the Hughes farm, and an overhead irrigation system keeps the garden safe in dry spells.

Here, on the R. E. A. electrified farm, may be traced the evolution of farming methods and rural living standards from pioneer days to modern times.

THE new custom mill 13 miles southwest of Lovelock on the Humboldt project was completed recently and operations were started on September 30. Ten men are regularly employed at the plant, and it is expected that the facilities offered for handling ore in small quantities will result in placing several nearby properties on a productive basis.

A NUMBER of new warehouses and loading facilities are under construction at Tullake, Calif.

THE new branch plant of the Washington Cooperative Egg & Poultry Association at Sunnyside, Yakima project, was dedicated with appropriate ceremonies on September 22. The new plant will be occupied jointly with the Yakima Dairymen's Association.

WASHINGTON State Apples, Inc., new grower organization which will advertise Washington apples nationally, has announced plans to conduct operations in 35 cities out of 70 in which studies have been made. Each variety of apple will be advertised in season and field men may be used in some of the markets.

ACCORDING to an official conservative estimate more than 250,000 tourists visited Grand Coulee Dam during the past 7-month period. Except for week-end travel the visiting season is practically over.

Progress of Investigations of Projects

Colorado-Big Thompson, Colo.—Surveys were continued near Granby, Colo., surveying the Ranch Creek Reservoir site near Tabernash and the canal lines from the Fraser River to this reservoir and from the reservoir to Granby Reservoir site. Several pits and drifts were completed at Granby Dam site to determine the location of bedrock. Design and cost estimates are being made, for inclusion in the final report. Three models of the Grand Lake area have been completed and one is on exhibit at Greeley, Colo.

Blue River Transmountain, Colo.—Seven plane-table parties have continued taking topography of the Green Mountain and Dillon Reservoir sites on the Blue River. Survey has been completed of a canal line from Clear Creek to the South Platte above the Old High Line canal crossing the South Platte about 18 miles southwest of Denver at Watertown. A detailed plane-table survey was made of the geology of the Maryland Creek, Acorn, and Boulder Dam sites. A meeting held with various city and State officials resulted in a decision to investigate the possibilities of a transmountain diversion from the Blue River to Clear Creek.

Western Slope, Colorado: (a) *Florida Mesa project.*—Surveys have been made of the lower Florida Canyon and the topography of two reservoir sites near Miller Creek above the canyon and for

the diversion of water from the Florida River to the Pine River with irrigation demand studies and water-supply data initiated for the latter.

(b) *La Plata project.*—Surveys of Long Hollow Reservoir site were continued, obtaining additional data for the supply and outlet ditches. On reconnaissance a reservoir site on Upper Gulch was studied and surveys of this location are now under way. A study of an off-channel reservoir at Parrott City above Hesperus for the protection of upper river diversions may result in a survey of this site.

(c) *Mancos Valley project.*—Following preliminary estimates on the east of the Weber Reservoir, reconnaissance of another reservoir on the head of the West Mancos was completed. Land classification maps were finished during the month and are now available to the project. Studies have been made of a possible diversion of the East Mancos River and the La Plata River to a reservoir on Cherry Creek.

(d) *Paonia project.*—Exploration of the Spring Creek site on Muddy Creek continued throughout the month, first by test pits and later by drilling. Test pits were started at reservoir sites on Minnesota Creek and Smith Fork and surveys were completed on the Gould Reservoir. The exploration crew was moved from the Spring Creek site to Minnesota Creek and the diamond drill that had previously

been working on the Rio Grande investigations was put into operation on the Minnesota Creek site at which location 138 feet of hole had been drilled by the end of the month.

(e) *Roan Creek project.*—Surveys have been completed on one reservoir site on Dry Fork, three on Kimball Creek, and one on Carr Creek and are now awaiting exploration. Summary of the land classification is also complete.

(f) *Silt project.*—Topography has been completed in the canyon of the main fork of Elk Creek and along the ridge separating that creek and West Elk. A canal survey was completed from West Elk to Harvey Gap Reservoir, a distance of 5¼ miles, and surveys of a reservoir site north of Harvey Gap were started.

(g) *West Divide Creek project.*—Test pits and diamond drilling were started at the Owens Creek Reservoir site on Buzzard Creek. A supply ditch for this reservoir which takes water from 8 square miles of Plateau Creek drainage was surveyed and canal location from the reservoir to Divide Creek was continued as was also the investigation of two possible tunnel locations.

(h) *Yampa Reservoirs.*—Surveys of 3 reservoir sites on this project are practically completed and reconnaissance has been made for a canal leading from Yampa River to Watson Creek. Test pits were being continued at the two lower dam

(Continued on p. 264)

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Planning the use of our irrigation resources. *Agricultural Engineering*, Aug. 1936, v. 17, no. 8, pp. 325-328.

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Bids called for Boca Dam on Nevada irrigation project. *Western Construction News*, Sept. 1936, v. 11, pp. 285.

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Solving Boron problems in Los Angeles water supply. R. F. Gondey, *Western Construction News*, Sept. 1936, v. 11, pp. 295-297.

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The Why of Boulder Dam, illus., Doc. Wm. Monroe White, *Allis-Chalmers Electrical Review*, Sept. 1936, v. 1, no. 1, pp. 20-23.

Power generation begun at Boulder Dam. *Eng. News-Record*, Sept. 17, 1936, v. 117, p. 423; editorial, p. 418.

The Story of Boulder Dam, illus., v. 5, 24 pp. Eighteenth and twenty-first articles, by L. P. Sowles, Copeland Lake, and W. R. Nelson that appeared in the *Compressed Air Magazine* and published by Ingersoll-Rand, 11 Broadway, New York.

Brahtz, J. H. A.:

Pressures due to percolating water and their influence upon stresses in hydraulic structures, *Communication No. 1, 2d Congress on Large Dams*, Washington, D. C., 1936, 29 pages.

Brown, Victor J.:

Road relocations and bridges involved in power irrigation project, illus. (Lower Platte River project.) *Roads and Streets*, Sept. 1936, v. 79, no. 9, pp. 38-44.

Caballo Dam:

Caballo Dam on Rio Grande to store 350,000 acre-feet, illus. *Western Construction News*, Sept. 1936, v. 11, p. 394-395.

Columbia River:

Improving the Columbia for Navigation. T. M. Robins, illus. *Civil Engineering*, Oct. 1936, v. 6, no. 10, pp. 636-638. (Good profile of Columbia to International Boundary.)

Flood Formula:

New cloudburst flood formula. I. Gutmann, *Eng. News-Record*, Oct. 1, 1936, v. 117, p. 474-475.

Fraps, J. A.:

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Grand Coulee Dam:

Frozen earth used to stop slides at Grand Coulee. *Western Construc-*

tion News, Sept. 1936, v. 11, pp. 300-301.

Concrete bridge pier righted after slide causes tilting, illus. *Eng. News-Record*, Sept. 17, 1936, v. 117, pp. 410-411.

Construction plant at Grand Coulee Dam, illus. C. D. Riddle, *Civil Engineering*, Oct. 1936, v. 6, no. 10, pp. 639-642.

Program for Grand Coulee's second cofferdam, illus. *Eng. News-Record*, Oct. 1, 1936, v. 117, pp. 464-466.

"Freezing" sand at Grand Coulee, illus. *Excavating Engr.* v. 30, no. 9, p. 476.

Goodwin, Geo. E.:

Benefits of irrigation west of the Cascades, illus. *Civil Engineering*, Oct. 1936, v. 6, no. 10, pp. 667-670.

Haw, John W.:

Irrigation and the Land Use Program, illus. *Civil Engineering*, Oct. 1936, v. 6, no. 10, pp. 663-667.

Relation of Reclamation of Arid Land by Irrigation to the National Land Use Program. J. W. Haw, director, *Agricultural Development*, Northern Pac. R. R., address at sixty-sixth convention of A. S. C. E., Portland, Oreg., July 15-18, 1936. 16-page pamphlet.

Los Angeles Aqueduct:

Wholesale rate for Colorado Aqueduct Water Fixed. *Southwest Builder and Contractor*, Sept. 25, 1936, v. 88, no. 13, p. 14.

Price set (\$15 per acre-foot) for aqueduct water. *Eng. News-Record*, Oct. 1, 1936, v. 117, p. 486.

Record pumping plants on Colorado River Aqueduct, illus. *Western Construction News*, Sept. 1936, v. 11, pp. 304-305.

May, D. R. and J. H. A. Brahtz:

Proposed methods of calculating the stability of earth dams. Question VII, *2d Congress on Large Dams*, Washington, D. C., 1936. 38 pages.

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Electrical features of Boulder Power Plant. *Engineering* (London, England), Dec. 1936.

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Mead Memorial at Boulder Dam, illus. *Eng. News-Record*, Oct. 1, 1936, v. 117, p. 489.

Biography of Elwood Mead, by B. A. Etcheverry, H. E. Erdman, and Frank Adams. *The Faculty Bulletin*, University of California, Sept. 15, 1936, v. 6, no. 1, pp. 6-8.

Mead, Lake:

A lake in the desert (editorial on climatic changes). *Eng. News-Record*, Oct. 1, 1936, v. 117, p. 484.

Nelson, Wesley R.:

The Boulder Canyon Project, maps and plates, *Smithsonian Annual Report*, 1935, pp. 429-452. A comprehensive illustrated article on the construction of Boulder Dam on the Colorado River. *Smithsonian Separate No. 3369*.

Power and Dam Congresses:

Power and large dams. *Eng. News-Record*, Sept. 17, 1936, v. 117, pp. 413-417.

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Canal and tunnel progress on the Roza project, illus. *Western Construction News*, Sept. 1936, v. 11, p. 306.

Secley, D. C.:

Analysis of Butterfly valve rotors for Boulder Dam. *Technical Memorandum No. 526*, July 6, 1936, 139 pages. Price \$3.90. Issued by Office of Chief Engineer, Bureau of Reclamation, Denver, Colo.

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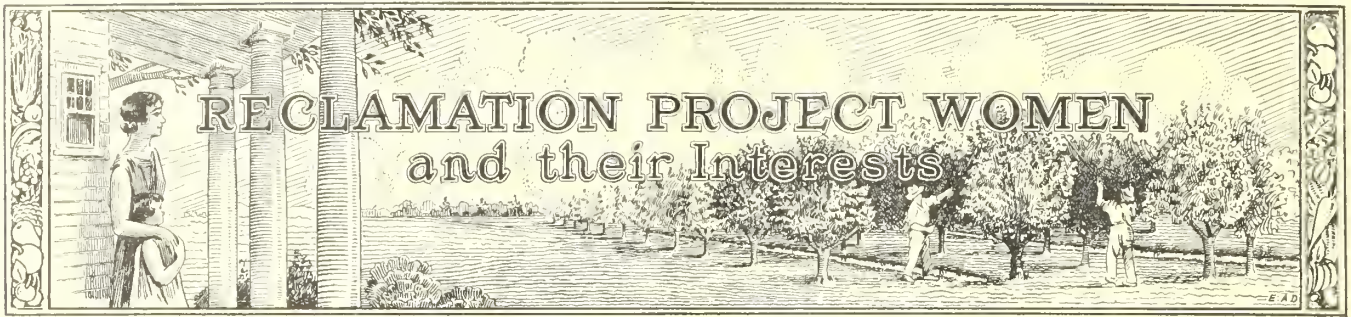
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Circuit Breakers for Boulder Dam line, illus., reprint no. 567. *Electrical Engineering*, June 1936, 11 pages. Westinghouse Golden Jubilee.

Commercial Fertilizer Profitably Used

Two farmers on the Yuma project, Arizona, have obtained very profitable results from the use of commercial fertilizer in the production of alfalfa and cotton. Ammophosphate was used in quantities up to 200 pounds per acre, but the tests showed that an application of 100 pounds per acre gave equally good immediate returns and resulted in an increase of 100 percent in the quantity of hay and more than doubled the alfalfa seed crop, as well as improving the quality. On a field of 24 acres in cotton, which has been cropped continuously to cotton for 12 years, the yield was increased to an average of almost two bales per acre with an improvement in quality.



First Impressions of the West

AFTER a service in the Government of more than 20 years and a second-hand knowledge only of the great section of the country in which the Bureau of Reclamation operates, the writer under official authorization left Washington on August 26 last for a brief tour of three of our most active projects.

COLUMBIA BASIN PROJECT

Following a pleasant drive from Spokane with Mr. Funk, chief clerk of the

Columbia Basin project, Washington, my first objective, Grand Coulee Dam, was reached on August 30, and briefly surveyed, with Mr. Funk as conductor. The up-to-date Administration building and surrounding grounds bear witness to the fact that this is a well-organized office and that the employees responsible for the upkeep of the lawn take a personal pride in its attractive appearance.

After a satisfying dinner in the mess hall as the guest of Mr. Markhus and his

daughter, Ruth, we picked up Mrs. Markhus and took in the project works, with Ruth as the very competent driver. The Government auto took us around many curves and up and up over loose stones to the sand and gravel plant. With a less experienced chauffeur that drive would have been perilous. The system was not in operation, but Mr. Markhus described its operations very clearly—the separation of the three sizes of stones, and their passage through the long conveyor system to the crushing plant and the concrete mixing plant. From the sand and gravel plant we drove 32 miles along the coulee and noted the beautiful coloring and rock formations on its face. The coulee is 52 miles long, has a maximum thickness of 8 miles, and a depth of 1,000 feet. Geologists, who have estimated its age as 25,000 years, are convinced the entire coulee was brought down from the north in a glacier during the ice age, and since then has been remarkably preserved. The various formations are readily recognized; for instance, a huge rock, when viewed from a certain vantage point, bears a marked likeness to a steamboat and is called "Steamboat Rock." Several great formations without stretch of the imagination resemble old castles, even the shapes of the windows and doors, as well as the pinnacles, being easily visible, and these formations are therefore known as "Castle Rocks." Farther on we visited the wonderful dry falls, showing the alkaline lake just back of the falls, and heard a Government representative describe it most graphically.

At Mason City, where the night was spent at the contractor's hotel, the temperature was considerably lowered by the sprinkler system which can be seen in operation on the roofs of the various buildings. By this unique and continuous flow of water the otherwise hot days are made pleasant and the nights are comfortably cool. Tourists, impressed with the system and the simplicity of its operation, have left the project determined to consider its feasibility in their respective communities. In addition to this unusual and interesting feature the



COLUMBIA BASIN PROJECT, WASHINGTON
UPPER: HOMES OF OFFICIALS IN COULEE DAM.
LOWER: DRY FALLS OF THE COLUMBIA.

visitor is impressed with the delightful temporary cottages of the employees as well as the permanent homes of the officials in both Coulee Dam and Mason City. To the C. C. C. boys belongs the credit of clearing the grounds and planting the grass seed; to the occupants of the homes we take off our hats for their success in perpetuating the beautiful lawns, foliage, and flowers. The newcomer is struck with the landscaping and marvels that regardless of the value of the cottage each occupant seems to vie with the rest in making his home the most attractive on the project. Beautiful rock gardens are in evidence and flowers, mostly petunias of all descriptions and colors, are seen on every lawn.

With Mr. Markhus as conductor, the dam in actual construction was next viewed and a broadcast by a Government representative was heard at Vista Point. Following a delightful luncheon in the charming home of Mrs. Miner, wife of the assistant construction engineer, in company with several of the project ladies, Mr. Schlop-kohl, a young inspector, drove me to Yakima, a distance of 170 miles over high canyon roads with hairpin curves and projecting rocks, which distance was covered in 3½ hours—record speed.

YAKIMA PROJECT, WASHINGTON

Visitors to the Yakima project from the Bureau are accorded every courtesy at the hands of Supt. and Mrs. J. S. Moore, both of whom are untiring in showing their guests the various divisions and pointing with pride to the extensive operations completed and in progress on this great project. My first view of irrigation in practice was at the Weaver home, from which we also looked out over the rich Naches Valley. While on the project Mr. Taylor, in charge of storage reservoirs, took me to the Tieton earth-filled dam, the largest of its kind, which was my first view of a real dam.

My short stay in Yakima was marked by visits to the homes of a number of the project ladies and tours over the various divisions and to engineering structures. My luncheon with Miss Tyler as hostess and other ladies from the project office, and the tea given by Mrs. Moore at which I met the wives of the project officials, were occasions of much pleasure to me. Passing through Portland en route to Boulder City, in my brief stop between trains I enjoyed taking breakfast with Miss Gibbs of the chief counsel's office. Western hospitality and cordiality keep pace with western engineering and irrigation development and they were everywhere apparent on the projects visited.

BOULDER CANYON PROJECT, ARIZ.-NEV.

And now for Boulder. It was my good fortune to be at the dam when President



CLE ELUM DAM, YAKIMA PROJECT, WASHINGTON.

Roosevelt in the course of an address before the World Power Conference in Washington turned on the switch starting in motion the first unit of the generators at the powerhouse. At this time also water was released from the twelve 7-foot needle valves, six on each canyon wall, and, as the water came plunging down into the river from a height 177 feet above the level of the Colorado River (10 feet higher than the fall of Niagara) the mist rose far above the discharging valves and the crowd on the top of the powerhouse was treated to a deluge, or at least a heavy sprinkle.

Mr. Heinemann met me at Las Vegas and showed me over Boulder City and the dam by day and by night. In the

late afternoon we were watching the discharging valves over a high point in the roadway just opposite the face of the dam, when a beautiful rainbow appeared between the Nevada and Arizona canyon walls and was visible for a considerable length of time. The night view of the dam is indescribably lovely, the lighting is perfect, and the visitor stands in amazement at this marvelous accomplishment of man, who has put to the best and most profitable use the natural features which an all-wise Father had placed at his disposal in the distant ages. What a blessing engineering structures of this character, small or large, have been and will continue to be throughout coming years and to generations yet unborn.



BOULDER CANYON PROJECT
DISCHARGING VALVES AS VIEWED FROM CREST OF DAM

SUMMATION

Superb scenery, wonderful climate, beautiful flowers of all colors and shades in rich profusion, irrigated crops superior in quality and quantity, attractive homes, humming industries, but, best of all, real people who fit into the wide-open spaces, with no limit to their hospitality, folks who open their hearts, their homes, and their country to the visitor—these make the first and lasting impression on the visitor. New and abiding friendships and pleasant memories cannot do otherwise than follow such a western trip.

Without this insight into conditions on some of the projects over which the De-

Progress of Investigations

(Continued from p. 260)

sites and diamond drilling has been started at the upper site.

Rio Grande Basin, Colo.-N. Mex.—The following surveys and investigations are in progress:

(a) *Wagon Wheel Gap Dam site.*—Denver office designs and estimates for both straight and arch gravity dams are almost completed.

(b) *Vega-Sylvestre Dam site.*—At the end of the month a test-pit crew was moved into the vicinity of the dam site for the purpose of locating suitable material for the embankment. Drilling with the churn drill at the Blanco Dam site was continued, one hole being abandoned due to the failure of wall casing at 55 feet. One transit party, two plane-table parties, and one level party continued the work on the diversion canal lines, and by the end of the month the work was completed as far as the Little Navajo River, a distance of about 50 miles from the initial diversion on the West Fork of the San Juan. On the Colorado dam sites and reservoirs, all test pit and diamond-drilling work has been finished. Testing for embankment materials for the Vega Sylvestre site and for concrete materials for the Wagon Wheel site is in progress. The geological report on the dam sites and tunnel for the San Juan-Chama transmountain diversion has been completed. All of the field work on these investigations, with the exception of the State Line Reservoir survey, will be virtually completed by the middle of November.

(c) *Conejos Dam site.*—Drilling on dam sites nos. 1 and 2 near Platoro was finished at the middle of the month and the drilling outfits were then transferred to the Western Slope surveys. A study was made to determine the gross water supply for three possible reservoir sites under investigation near Platoro.



DOWNSTREAM FACE OF BOULDER DAM.

(d) *San Juan-South Fork transmountain diversion.*—All field work on this feature, with the exception of a small amount of topography at the South Fork and Wolf Creek tunnel portals, was completed at the middle of the month and the topographic party moved to Weminuche Pass for a survey of the Pine River-Rio Grande transmountain diversion.

(e) *Animas-Rio Grande transmountain diversion.*—All field work was completed and computations, estimates, and maps are now being made.

(f) *San Juan-Chama diversion.*—The seven test pits under way at the Lower West Fork Dam site at the beginning of the month were about completed. Water-percolation tests of four of the pits have also been completed. Survey of the Upper West Fork Dam site was initiated.

Boise (Boise-Weiser-Payette), Idaho.—Work was continued on the transmountain diversion line from the North Fork of the Payette River, near Smiths Ferry, to the Middle Fork of the Payette River, via Sriver Creek. A line 11½ miles long has been run from the North Fork of the Payette River at Cabarton across the Divide into and across Round Valley to ascertain the possibility of diverting from the Cabarton Reservoir site for storage in Round Valley. Surveys are now in progress on a line from the mouth of Six Bit Creek on the Salmon River to the mouth of Lodgepole Creek on the Payette side for the purpose of determining the feasibility of a transmountain diversion from the South Fork of the Salmon River to the Payette River. Survey of the Weiser watershed to determine the present irrigated acreage and the location and area of lands suitable for irrigation is in progress.

partment of the Interior, through its Bureau of Reclamation, presides, my previous efforts for the Government have been uphill and necessarily handicapped. My viewpoint has been changed with a closer contact with western development, and my future work for the Government will be simplified and my value to the service should be correspondingly enhanced as the activities on the various projects constructed and in progress are more readily visualized. Thus the purpose of my visit will have been realized.—*S. A. B. Coe, Editor.*

Buffalo Rapids, Mont.—Field surveys of the irrigable area and land classification of the project were completed during the middle of the month and summaries of the results are being made.

Gallatin Valley, Mont.—An economic report was completed during the month of September.

Madison River diversion, Montana-Idaho.—Surveys on the Cherry Creek reservoir and the dam site were completed and borings are now being taken at or near the corner of each 40-acre tract along the Madison River to obtain drainage and soil data for later alkali and chemical-analysis tests.

Deschutes, Oreg.—A survey of the Plainview Canal was completed and test pit work begun from Lake Creek immediately below Suttles Lake to a junction with the Squaw Creek Canal near the Plainview tract. A topographic survey of the Suttles Lake Reservoir dam site and resort improvements have been completed. A topographic survey of the lands irrigated from Lake Creek and also of the head of the Metolius River was made. A preliminary report on the North Unit pumping plan is completed.

Black Hills, S. Dak.—Field work was continued in the vicinity of Hot Springs, where topographic maps were made of the Horse Camp Draw Reservoir site and the irrigable area lying below the site.

Dixie project, Utah.—The taking of water measurements and silt samples of the Virgin River were continued during the month and comparisons made with previous records. The run-off of the river at Virgin, Utah, for the past year was approximately 111,000 acre-feet as compared to the past 12-year average of 123,000 acre-feet and the past 25-year average of 160,000 acre-feet.

Salt Lake Basin, Utah—Salt Lake Metropolitan Water District Aqueduct.—Field work was continued in completing the alinement surveys for the aqueduct and obtaining additional topography at various locations in Provo Canyon. From the mouth of Provo Canyon north

to the Thirtieth South Reservoir near Salt Lake City, excavation quantities for two different sizes of pipe were computed from profile and cross-sections taken along the survey of what has been designated as the lower elevation or high pressure line, and it is intended that these quantities be used in the preparation of cost estimates.

Blue Bench.—Arrangements have been made for beginning field surveys to determine the possibility of diverting water from Rock Creek to both the upper and lower Blue Benches and from Duchesne River to the Lower Blue Bench.

Colorado Park.—Stream-discharge observations extending over the past 2 years are complete, as are the canal surveys and water-supply studies. Land classification is completed and a report will be prepared at an early date.

Colorado River Basin.—The classification of the undeveloped lands lying adjacent to the present irrigated areas within the Montezuma Valley, and in the vicinity of Cortez, Colo., was continued, covering a total of 29 square miles. An area of 32 square miles of irrigated lands in the Montezuma Valley was also mapped; 72,100 acres of the lands were surveyed during September; 37,000 acres of land was classified during the month. The classification of all known arable areas tributary to the main branch of the Colorado together with similar areas along the tributaries of this river above Gunnison, has now been completed.

RECLAMATION TABLE 17.—Power plants operated on Bureau of Reclamation projects during fiscal year 1935-36

Project	Name of plant	Out- going line voltage	Plant capacity (kilo- watts)	Num- ber of units	Head in feet	First cost of plant	Cost of operation and main- tenance without depreci- ation	Estimated depreci- ation	Cost per kilowatt- hour exclusive of depreci- ation	Distribution of kilowatt-hours generated				Total output (kilowatt- hours)	Gross power sales
										Sold to consumers	Irrigation and drain- age require- ments	Used for other purposes	Losses		
Boise	Black Canyon	66,000	10,000	2	75.4 to 96.7	\$414,317.21	\$12,991.61	None	\$0.00033	12,21,077.515	128,624.440	11,467,314	152,528,475	1,864,394.00	
	Boise River	22,000	1,875	3	21.4 to 25	167,905.37	2,207.12	None	(1)				4,683,100	Not reported	
	Grand Valley power plant	2,300	3,750	2	73 to 79	210,500.00	3 None	3 None							
	Minidoka	33,000	10,000	6	(52.04 max. avg. 147.09 max. avg. 144	1,110,190.86	104,981.49	\$10,476.00 Present value nominal	.001423	\$ 19,541,511	\$ 35,937,142	5,626,750	4,240,293	\$ 65,345,696	\$ 8172,427.08
Newlands	American falls Plant ^a	33,000	540	1		76,975.00									
	Lahontan	66,000	1,875	3	110 to 20	7,324,793.52	16,628.31	6,495.97	.00087	2,067,260	351,200	11,150	283,970	2,713,580	26,380.58
	Guernsey	33,000	6,000	2	70 to 90	454,244.27	12,772.54	3 None	.001202		None		10,388,585	10,624,500	10 11 217,122.90 None
	Lingle	33,000	1,750	4	106	184,791.74	11,291.18	3 None	.001375	17,096,648	None	12 219,250	Unknown	219,250	
North Platte	Elephant Butte	2,300	150	1	18 to 180	8,440.50	3,441.13	None	.0157	None	None	12 219,250	Unknown	219,250	None
	Pilot Butte	33,000	2,000	2	100 average	262,899.00	13,794.20	\$7,800.00	.01050	969,668	None	256,792	87,150	1,313,610	19,703.51
	Roosevelt	110,000	19,250	7	70 to 240	1,372,193.73	32,760.03	68,609.70	.000720				45,529,000		Total for system, 12,588,677.55
	Horse Mesa	33,300	3,300	3	265	982,756.47	28,213.08	49,137.82	.000210				134,540,000		
Stewart Mountain	45,000	13,000	1	35 to 114	344,070.32	9,084.17	17,203.51	.00028317	Total for system, 41,641,643	Total for system, 274,319	Total for system, 47,086,686	32,080,000			
Mormon Flat	110,000	8,750	1	40 to 150	472,011.68	11,130.26	23,600.58	.0002185				50,939,000			
Salt River	Cross Cut	111,000	5,250	6	111	663,920.33	26,543.34	33,196.02	.002467	12,233,389,687	41,641,643	274,319	10,757,900		Total for system, 12,588,677.55
	South Consolidated	40,000	2,000	2	34	176,202.81	9,493.13	8,810.14	.001153				8,230,600		
	Arizona Falls	11,000	1,000	2	19	115,566.47	6,939.75	5,778.32	.002336				2,970,679		
	(Chandler)	11,000	600	1	40	177,410.37	7,120.69	8,870.52	.002094				3,400,240		
Shoshone	Shoshone	33,000	7,000	3	220	880,375.56	16,218.64	28,747.40	.00170	8,478,365	None	86,040	1,006,995	89,600.11	89,600.11 47,968.21 22,821.79 None 63,938.00
	Strawberry Valley	11,000	1,000	2	123.5	143,527.82	15,655.54	16,000	.00247	13,389,735	None	41,086	307,310	47,968.21	
	Yakima-Kennewick	66,000	3,000	1	40	404,843.88	16,616.69	13 None	.000698	16,626,910	None	28,849	343,121	22,821.79	
	Yakima-Sunnyside	6,600	187	1	73	23,000.00	1,813.95	1,056.4	.002	None	748,300	None	(24)	None	
Yuma	Siphon Drop	33,000	2,000	2	12.70 maximum 9.90 minimum	364,886.00	13,633.75	11,184.00	.001653	21,745,000	723,195	67,030	416,556	8,662,721	63,938.00

¹ Included with Black Canyon power plant.

² To Idaho Power Co. and F. E. Conolly, Inc.

³ Contractor operates and maintains power plant at own expense and distributes all power generated.

⁴ Includes \$60,000 charged for the construction of water for American Falls Reservoir.

⁵ Includes \$6,677,050 kilowatt-hours from Idaho Power Co.

⁶ American Falls (west side) plant operated only in case of emergency; not operated since 1927. The estimated cost includes the island plant, which is partly dismantled.

⁷ Previous reports have shown first cost only.

⁸ \$8,034 charged to operation and maintenance cost.

⁹ Both Lingle and Guernsey.

¹⁰ Includes \$2,672.57 for rental.

¹¹ Hydroelectric plant for power and lights at Elephant Butte Dam and camp service.

¹² Includes purchased power.

¹³ Cost of joint irrigation and power canal not included.

¹⁴ Includes \$6,394.94 of purchased power.

¹⁵ \$1,674 charged to operation and maintenance cost.

¹⁶ Operated by the Grandview Irrigation District under Government supervision.

¹⁷ Includes \$491,500 kilowatt-hours of winter power delivered to Pacific Power & Light Co. in payment for transmission of power to irrigation districts.

¹⁸ No information.

¹⁹ Includes 60 kilowatts of purchased power.

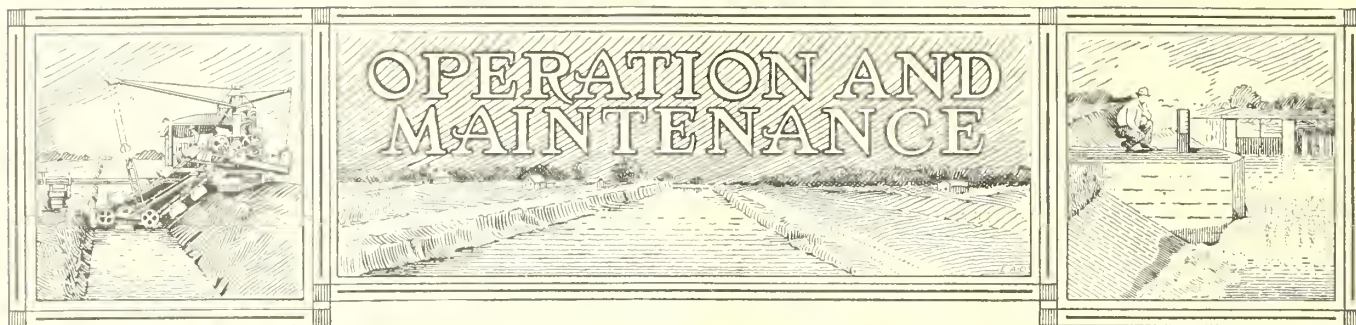
Excerpts from September Project Reports

Orland.—Olives were picked from a few groves, but the major part of the crop will be harvested much later. The quality this year is excellent, and a normal yield is expected. The Orland exchange depot opened on September 28 for the reception of olives, and it is estimated that 700 tons will be handled this year. An interesting development is the shipping of olives direct to the eastern markets for processing there. It is asserted that olives can be shipped in refrigerator cars and kept in good condition for periods as long as a month.

Belle Fourche.—Corn is well matured; the major portion escaped frost damage, and although the returns will be low because of thin stands, the roughage from this crop will have more than average value in connection with livestock wintering.

Riverton.—Harvesting of grain has been completed and threshing has been in progress. The yield of grain is good, but somewhat less than in 1935. A third

(Continued on p. 269)



Gold Mining on the Humboldt Project, Nevada

By Roy M. Whitacre, Bureau of Reclamation, Reno

FRED WILCOX, veteran prospector and miner of western Nevada, had located several mining claims in the Crabbe mining district near the East Walker River about 20 miles south of Yerington. Fred did considerable work trying to determine whether the ore was in sufficient quantity and of sufficient value to ship. The values were there but the gold was streaky and not in sufficient quantity to mine and then haul 20 miles to a railroad to be shipped to a smelter. Wilcox disliked to pass up the gold claims, but as the proposition was too small to be of interest to capital and as he did not have sufficient finances to build a modern mill, it seemed that his mine would go the way of most prospect holes.

However, Wilcox with undaunted faith in his discovery, decided to erect a mill for himself on the East Walker River nearby. He patterned his outfit after the old Spanish gold mills or "arrastres" that had in the 1840's and 50's recovered a good deal of precious metal in the vicinity for the Spanish dons. The original arrastres were merely a circular stone and mortar bowl in which the ore was dumped to be ground up by heavy boulders pulled around and around by horses or mules, the waste being washed off while the heavier metal sank to the

bottom and later shoveled out and panned by hand.

OLD AUTO PARTS MADE USEFUL

Like all prospectors, Fred was a jack-of-all-trades. He erected a paddle wheel with 11-foot arms and attached extension paddles which could be regulated according to the height of the water in the river. To the other end of the shaft was attached a 4-foot wheel which drove the drive shaft for the mill itself. As previously stated, Wilcox was practically broke, so he headed for the dump yards near Yerington and recovered there a transmission and drive shaft from an old Maxwell car and the drive shaft, differential, and rear wheels of a model T Ford. He cut trees along the river, hewed them by hand, and built a solid frame on which to hang his driving unit.

The rear wheels of the Ford he set perpendicular to the ground. One wheel set 18 inches above the floor of his grinding bowl, the second riding free above the framework. The drive shaft he hooked to the transmission of the Maxwell so that by merely shifting gears he could regulate the speed of the grinding process. The drive in front of the transmission is attached to the 12-inch wheel which is turned from the water wheel by a 3/4-inch cable. Despite the collection, when

the paddles dip into the river the apparatus works to perfection.

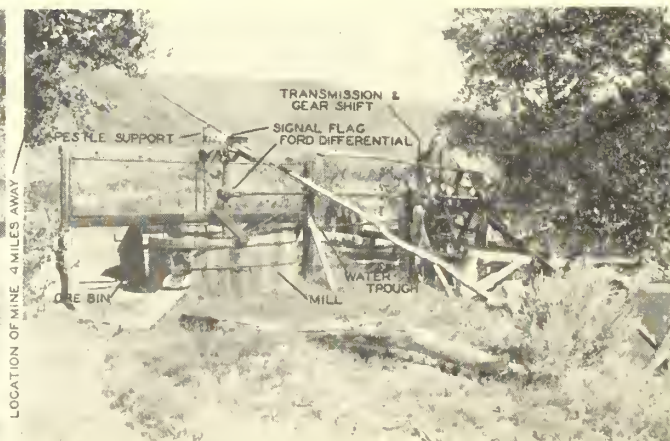
The grinding mill is a 6-foot redwood tank held together with iron tie rods. Inside the mill are three large granite boulders weighing about 200 pounds, which have been hand-drilled to permit the attaching of eyebolts. The eyebolts are chained to a cross arm bolted to the lower wheel of the Ford which hangs in the mill.

Immediately in front of the mill an old piece of iron acts as an ore bin. If the material is too large it is placed in a mortar and crushed with a 15-pound pestle, the handle of which is 7 feet long. The handle is attached to a tree limb which has sufficient tension to lift it free of the mortar after each stroke.

Even the water for the mill is an automatic feature. Attached to each paddle wheel is a gallon can. As the wheel dips into the water the can fills. When it reaches the top of the circle the can dumps its water into a trough through which it is conveyed to the mill.

Wilcox is a busy man. In order to keep his mill running he must get out sufficient ore, and to make wages he must keep it running continuously, so he has made it automatic. He loads the mill

(Continued on page 272)



Extensive Cattle Feeding Planned for Yuma Project

By R. C. E. Weber, Superintendent

DURING the summer of 1936 an extensive program of cattle-feeding operations on the Yuma project was completed by the California Live Stock Commission Co., with headquarters at Union Stock Yards, Los Angeles, Calif.

Through purchase, lease, or otherwise, control of a considerable area of land in the valley division was acquired by the company. On a 160-acre tract located about 1½ miles southwest of Somerton, Ariz., the company erected an alfalfa grinding mill, built a large alfalfa hay barn, together with sheds, feeding pens, and an ensilage pit at a cost of approximately \$16,000.

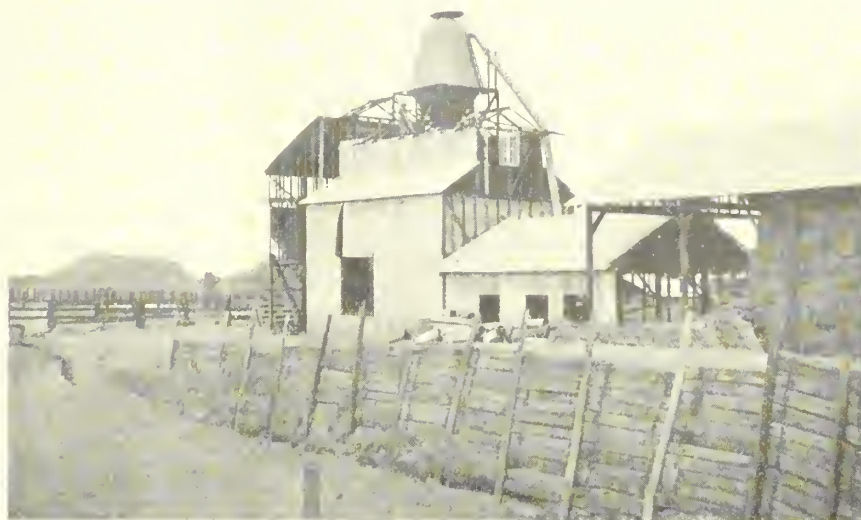
The grinding equipment of the plant is complete and includes the most successful features of mill operation as ascertained by an inspection of some 20 or more feed mills operating in the Southwest. A Williams hay grinder with a capacity of 4 tons per hour has been installed for grinding both hay and straw, and a separate grain machine for grinding all varieties of grain. The plant is also supplied with a molasses mixer and sufficient storage capacity to handle a carload of molasses. The bulk of the feed will probably be treated with molasses (black strap variety) before being fed to the stock. The entire plant will be electrically operated, energy being available from the local power company serving the valley division of the project.

The company plans to store and use 3,000 to 5,000 tons of ensilage per year, which will be put up when it is available in the early fall from maturing maize grown extensively on irrigated lands and will be fed during the winter, all being consumed prior to the following June. Ensilage will be used in connection with dry feed, either hay or straw, and concentrates which may be corn, barley, or wheat, together with cottonseed meal.

ENSILAGE STORAGE INEXPENSIVE

Construction of storage facilities for ensilage on the Yuma project is relatively simple and inexpensive as compared with the usual silo type of storage used elsewhere. The company has excavated an open pit, the sides of which consist of old railroad ties and telephone poles, with sufficient bottom width to permit turning of a wagon. The ensilage is placed directly on the earth, which consists of sandy soil, covered with a light layer of straw, and allowed to remain until needed for feeding.

The capacity of the feed lots will be ample for the accommodation of 2,000



CATTLE FEEDING PLANT OF CALIFORNIA LIVE STOCK COMMISSION CO., 1½ MILES SOUTHWEST OF SOMERTON, SHOWING ENSILAGE PIT IN FOREGROUND, GRINDING MILL, AND ALFALFA HAY STORAGE BARN, TOGETHER WITH CATTLE FEEDING PENS AND ALFALFA HAY STACKED IN BACKGROUND.

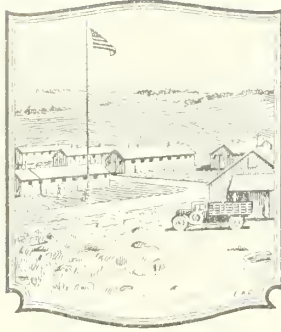
head of cattle at one time. The company expects to turn over this number of stock about three times per year. Assuming that 5,000 head of cattle fed on an average of 120 days, the annual feed consumption would approximate 3,000 tons of hay or straw, 5,000 tons of ensilage, and 3,000 tons of concentrates. Feeding operations are scheduled to begin with the cooler weather during the early fall months. The company is uncertain as to the feasibility of summer feeding, but plans to undertake it next year in a limited way for experimental purposes. From investigations, however, the officials believe that cattle can be handled at Yuma through the summer months to advantage and show a gain in weight comparable with the results of winter feeding, if shade is provided and the pens are not too crowded.

It is the intention of the company to purchase necessary feed for the year's operation at the time of harvest, and with this in view facilities have been provided for storage. Already considerable quantities of alfalfa hay, both baled and loose, are stored at the plant. The company is in the market for hay and straw that is for sale in the southern portion of the Valley as well as grain and maize. This year there will probably be an insufficient quantity to meet the requirements of the Somerton mill and feeding yard, but with a ready and conveniently located outlet—such as this plant will afford—the company anticipates no difficulty in the

future in interesting farmers in raising sufficient feed crops to fully supply all demands. The activities of the corporation will provide an outlet for much roughage suitable for feeding purposes which has not been utilized previously. The local demand for staple products that can be used for stock feeding will be reflected in improved prices for these farm commodities.

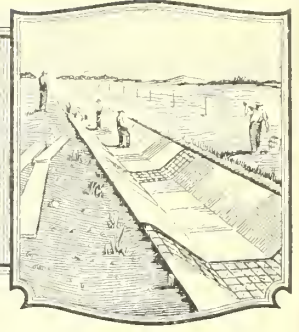
Identified with the California Live Stock Commission Co. are individuals who have been actively engaged for a number of years in the feeding and handling of cattle in Arizona and southern California. Included in the company's board of directors are P. E. Tovrea, of the Tovrea Packing Co. at Phoenix, Ariz., and L. C. Main, of Brawley, Calif., and Phoenix, both of whom are substantially interested in the Yuma activities of the livestock company.

Occupying a strategic location between the extensive summer pasture ranges of Arizona, New Mexico, and western Texas and the livestock market of the Los Angeles metropolitan area in southern California, and possessing transcontinental main-line railroad and improved highway facilities, the Yuma project appears destined to become the scene of even larger winter stock-feeding operations in the future than during the past, when as high as 7,000 head of cattle and 31,500 lambs were received during one winter season for finish feeding for market.



EMERGENCY CONSERVATION WORK

Civilian Conservation Corps



The Civilian Conservation Corps: Irrigator

By Henry L. Lumpee, Assistant Clerk, Vale, Oreg.

DURING the years of its existence the Bureau of Reclamation has completed many projects, has seen, as a result of its efforts, many a desert beaten back and land once waste metamorphosed into the lush greenness that means pro-

duction. Despite repetition, the wonder of this transformation does not grow old. Each new project completed arouses again a feeling of satisfaction tinged with awe that man can make so much of that which is barren and inhospitable.

Now, in eastern Oregon, there is approaching completion one more irrigated area carved from the sagebrush. The last bit of major construction necessary to finish the Vale project is entering its final phase. This work is being accomplished by C. C. C. enrollees of E. C. W. Camp BR-45. Their task is the building of 65 miles of small irrigation ditches and the erection of 690 minor concrete and steel water-control structures, the whole being scattered throughout an area approximately 15 miles long by 3 miles wide and comprising the lateral system for the Vale project's great Willow Creek unit of 15,000 acres.

When these laterals are finished, as it is expected they will be in 1937, then the Vale project's far-flung system of dams, canals, tunnels, laterals, culverts, and siphons, will have been completed. The irrigation waters can flow to every farm tract on the project, to all of the 30,000 acres which comprise it.

C. C. C. TO COMPLETE VALE PROJECT

The irrigation of approximately half of the Vale project has already been accomplished by the Bureau. Construction work necessary for this was done by private companies under Government contract. But to the Civilian Conservation Corps goes the privilege of completing the project by the construction of the Willow Creek lateral system.

The 140 C. C. C. members of E. C. W. Camp BR-45, Vale, Oreg., are doing this work under Bureau of Reclamation supervision. One hundred and twenty-seven of these boys came from Ohio, Kentucky, and West Virginia. The remaining 13 members are local experienced men.

At the outset of the work the main undertaking confronting the camp was to excavate the 144,240 cubic yards of earth and rock required to be moved to form the laterals, place the 77,700 pounds of reinforcement steel and pour the 1,500 cubic yards of concrete to form the necessary turn-outs, weirs, culverts, siphons, bridge abutments, etc. This was to be done without the machine that



WILLOW CREEK UNIT, VALE PROJECT, OREGON.

UPPER: THE CCC POURS CONCRETE FOR A SERIES OF DROPS.

LOWER: NEW GRAIN FIELDS FOLLOW THE COMPLETION OF LATERALS.

contractors consider most essential to construction of this kind—namely, a dragline. By using tractors, scrapers, fresnos, trucks, cement mixers, wheelbarrows, picks, and shovels, the camp has been making excellent progress, accomplishing the work in the following manner:

From the rights-of-way for the laterals a crew clears the sagebrush and debris, which is piled and burned. Behind the clearing crew come tractors, operated by enrollees, drawing scrapers or fresnos. A 50-horsepower Diesel tractor equipped with a bulldozer draws a road grader, a 35-horsepower gasoline tractor draws a cubic yard fresno, and a 20-horsepower tractor draws a $\frac{1}{2}$ cubic yard fresno, alternating with a scarifier. The big blades and scoops rough out the structure sites and laterals. The excavations are then hand-finished to the required depths and slopes by other crews using picks and shovels.

Lastly the concrete and steel structures and wooden bridges are built by still other crews. Different groups cut reinforcement steel for the structures, run the screening plant supplying gravel for the concrete, haul by truck the various necessary materials and supplies, and work in the machine shop and garage.

This construction, begun in October 1935, is now more than half completed. The work is being performed under the general direction of C. C. Ketchum, E. C. W. regional director and Vale project superintendent. In immediate charge are Camp Supt. R. E. Hill, one general foreman, four junior foremen, one mechanic, and one blacksmith. O. L. Kime, assistant engineer, is in charge of the Bureau's engineering force for the work.

HOUSING AND RECREATION

The enrollees are housed in an all-year type camp consisting of eight barracks, a mess hall, offices, garage, infirmary, recreation hall, school, etc. The buildings are located 8 miles north of Vale on the paved John Day Highway near the center of the Willow Creek unit. The camp was built by the Army in the summer of 1935 and was occupied by enrollees in October of the same year.

The enrollees work 8 hours a day, 5 days a week, and during this time they are directly under the supervision of the Bureau. The Army provides their meals, clothing, medical care, housing, pays their wages, and has them in charge when they are off the job. Supervisory personnel and the required construction materials are furnished by the Bureau.

Considerable entertainment in the form of sports, picture shows, lectures, etc., is afforded the enrollees at the camp, and

many of them take advantage of the varied courses of study offered by the Army. Camp BR-45 regularly ranks at or near the top in the Ninth Corps Area in regard to the number of study courses completed by its enrollees. In fact, although the camp comprises about 1 percent of the total number of C. C. C. enrollees in the Ninth Corps Area, it received approximately 15 percent of all certificates issued to show that courses of study have been completed. In addition the camp has presented several entertaining vaudeville skits at the theater in Vale, and programs over radio station KFXD, Nampa, Idaho.

On the radio programs the value of the Civilian Conservation Corps experience to the enrollees is occasionally mentioned. A few years hence when the Willow Creek unit, now a sagebrush waste, has become a prosperous farming community, the value of the emergency conservation work accomplished by the Civilian Conservation Corps on the Vale project will be obvious.

And by their work—perhaps unwittingly—they are raising to themselves a mighty monument, whose component parts will be green fields, trees, and comfortable farm homes.

September Project Reports

(Continued from p. 265)

cutting of alfalfa has been completed with a good yield. Some laterbeans were damaged by an early frost, but the yield is excellent. Some fine yields of alfalfa and sweetclover seed are reported. Few sugar beets and potatoes have been dug, and prospects for a good crop are excellent. Current prices for hay, grain, potatoes, and beans are about the same as last month, with a very favorable market prevailing.

Sanpete.—Sheep and cattle on the grazing areas are in excellent condition. They are now being moved from the high mountainous areas to the lower elevations. Prices remained good for dairy and poultry products, as well as for practically all farm crops.

Yuma.—A new high for cottonseed was reached during the month. The price, the highest in many years, was \$36 per ton. As a matter of comparison, cottonseed reached a low of \$8 per ton in 1932.

Minidoka.—The beet harvest was begun on September 28, and the operation of the Burley Sugar Factory started 2 days later. The beet crop this year is an unusually good one, both in yield and quality.

Huntley.—The harvesting of the beet crop began on September 28. Yields reported to date are very good.

Milk River.—Ideal weather conditions for the harvest of the season's crop prevailed throughout September. The cutting of the third crop of alfalfa and the late grain was completed early in the month. On many farms, the third cutting of hay was reported to be the best of the season. Potatoes are being harvested without frost damage, and good crops generally are reported.

Humboldt.—All crops are in good condition. Harvesting of the second cutting of alfalfa was completed on all ranches except the larger ones. The yield and quality of this cutting are exceptionally good and will average between 2 and $2\frac{1}{2}$ tons per acre. Turkeys are maturing rapidly and will be in prime condition for the Thanksgiving market.

Carlsbad.—Crops were in excellent condition during the month. Economic conditions on the project farms were excellent.

Vale.—All crops are in good condition. Some crops of head lettuce are growing well and should produce excellent yields.

Klamath.—Prices for all farm products were satisfactory. It is estimated that 1,000 tons of alfalfa hay have been shipped from the project at prices ranging from \$10.25 to \$11.50 per ton f. o. b. cars. Present indications are that the total value of agricultural products this year for Klamath County, including the portion of Tule Lake division in California, will approximate \$10,000,000, compared with the previous maximum of \$7,000,000 produced in 1934.

Owyhee.—Lettuce is in good condition, and if favorable weather conditions continue, excellent yields will result, which, with present indications of good prices, should result in a very profitable crop. Excellent yields of red clover seed are reported on several farms on the new lands of the project. What was estimated to be the poorest portion of one field yielded 7 bushels of red clover seed per acre, which at the present price of 20 cents per pound would indicate a return of \$84 per acre.

Moon Lake.—Crops are better than they have been for several years, although the lack of sufficient water is noticeable, particularly on lands under the Uintah River canals. Sheep and cattle on the ranges are in good condition. Marketing conditions for dairy and poultry products remained very good, and prices for other commodities also continued fairly high.

Provo River.—Harvesting of crops was continued with good yields of peaches, pears, and other fruits. Marketing conditions remained good.

Grand Valley.—The estimated beet yield will average 13 tons per acre, which is an increase of 30 percent over 1935 yields. The increase is attributed to improved curly top resistant seed and favorable growing conditions.

The Social Side of the Sunnyside Division, Yakima Project

By Mrs. Ella S. Tuttle, Bureau of Reclamation, Sunnyside, Wash.

WHATEVER force has charge of civic affairs apparently selected the Yakima Valley as a favorable spot for the propagation of civic organizations of all kinds, for here they simply bud, bloom, blossom, and fruit into bumper crops.

Sunnyside, for example, is a comparatively young city—"fortyish" in fact—with a population of 2,100, has 13 churches, 11 civic clubs, and 13 lodges, to say nothing of granges and the many social and study groups.

It may be of interest to know that the first women's club on the Sunnyside division of the Yakima project was started at the suggestion of Mr. Ross K. Tiffany, employed on United States reclamation work from 1910 until he resigned as project manager in 1920. Through the efforts of Mrs. S. J. Harrison and others, the club was organized in March 1907, with Mrs. Tiffany president. Mrs. R. C. McCredie was president in 1908, president of the State federation

from 1911 to 1913, and was sent as delegate from the State of Washington to the general convention in Boston in 1914. Mr. S. J. Harrison donated small areas for parks and the women's work began.

The work of the clubs of the valley down through the years has been to improve the parks, plant trees, beautify homes and streets, help support libraries, provide playgrounds and drinking fountains, and to improve general community conditions, as well as to assist the Red Cross and other interests.

The Tuberculosis Society carries on its usual work.

The women's Orthopedic Club, with State affiliations, assists the Rotarians in their splendid work in the care and support of crippled children in the Orthopedic Hospital in Seattle.

The American Legion Auxiliary, with State and national affiliations, joins the American Legion in its work for the

World War veterans' hospitals and care of the families of disabled soldiers.

The American Association of University Women, affiliated with the national organization, while primarily a social and study club, gives some support to the local public library at Sunnyside.

The women's Garden Club is concerned largely with the beautifying of rural homes and gardens. This club holds shows three or four times a year.

The Business and Professional Women's Club is the "baby" club, having been organized in March 1934, and is affiliated with State, national, and international federations. The work of the two clubs on this division has been largely in co-operation with the commercial clubs. This year Mrs. Jessie Severyns of Sunnyside was on the State nominating committee at the State convention in Seattle, and Miss Emily Thiel of Grandview has recently been appointed chairman of the educational program of the State federation.

Floods in Texas

Heavy rains fell over the Colorado River Basin above Austin September 14-22 and 26-29, producing floods that swept through towns and farm lands from the city of San Angelo through Austin, the State capital, and on to the Gulf of Mexico, a distance of approximately 635 miles. The flood ranged in width from a quarter-mile to 4 miles.

Flood waters from the Concho River merged with those in the Colorado River and moved downstream in a channel already well filled with water from the other tributaries.

The total damage above Austin has been estimated at \$6,000,000, the major portion being in the city of San Angelo with a population of 26,000 people.

The heaviest rains were centered around San Angelo with a total for 4 days of 27 inches. This is in excess of the 21-inch average annual fall. Water Valley, a neighboring town, had a 20-inch fall in 15 hours.

The flood reached Austin on September 22 with a gage height of 25 feet. A second flood, coming from rains nearer Austin, was recorded on September 28 with a gage height of 32 feet. A photograph of the last flood is attached hereto.



FLOOD OF THE COLORADO RIVER AT AUSTIN, TEX. VIEW SHOWS RIVERSIDE TOURIST CAMP UNDER WATER.

Meeting of Consulting Boards

Future meetings of the boards of consulting engineers have been scheduled as follows:

Grand Coulee Dam, November 10 to 15, inclusive.

Imperial Dam, December 12 to 14, inclusive.

Central Valley Project, December 15 to 20, inclusive.

No other meetings are contemplated prior to February or March 1937.

In addition to the board members, Chief Designing Engineer J. L. Savage will attend all of the meetings; Chief Engineer R. F. Walter will attend the Grand Coulee meeting; and Assistant Chief Engineer S. O. Harper will attend the Central Valley meeting.

Reclamation Organization Activities and Project Visitors

John C. Page, Acting Commissioner of Reclamation, returned to Washington on October 10 after a 6 weeks' inspection trip over the Bureau's irrigation projects in the West. In commenting on his trip Mr. Page stated that everywhere he found Reclamation officials heartened by the attitude of the Western States. He was especially pleased at the plans for aggressive action on the part of the supporters of western irrigation as evidenced by the Salt Lake City meeting of the directors of the National Reclamation Association and the Provo meeting of the Federal Irrigation Congress.

Mr. Page further stated that the crops and general conditions in the irrigated areas were in striking contrast to the terrible situation in the drought areas.

E. K. Burlew, Administrative Assistant to the Secretary of the Interior, accompanied Mr. Page over a number of the projects.

R. F. Walter, Chief Engineer of the Bureau of Reclamation, returned to Denver on October 11. Mr. Walter came to Washington the latter part of August to serve as Acting Commissioner during the absence of Mr. Page.

The following transfers from the Denver office have been approved by the Secretary of the Interior:

Robert S. Thomas and Kenneth F. Vernon, assistant engineers in the Denver office, and John K. Ayers, junior engineer, have been transferred to the Central Valley project, Mr. Vernon being assigned to Antioch, Calif., and Mr. Ayers to duty on the Friant Dam.

Secretary Ickes has approved the appointment of Thomas George Morrissey, junior engineer, Denver office; Erling S. Loftfield, inspector, Salt River project; Francis S. Clemmer, junior engineer, Colorado Basin project; George Lloyd Rule, inspector, Friant Division, Central Valley project, California, previously employed in the engineering service division of the Tennessee Valley Authority; and Ernest Davis, engineering draftsman, Boulder Canyon project.

Bernard D. Glaha, photographer at Boulder City, Nev., has been formally transferred to the Central Valley project, Sacramento, Calif.

Charles Shields Hale, associate engineer, Humboldt project, has been transferred to the position of engineer on the



MR. MCPHERSON (CENTER) RECEIVING FROM CLYDE BOYDSTON, WATERMASTER (RIGHT), CLOCK PRESENTED BY YUMA PROJECT EMPLOYEES, WHILE CHIEF CLERK N. O. ANDERSON, LOOKS ON.

Truckee storage project in the same State. Mr. Hale will assist the construction engineer and supervise field operations in connection with the construction of the Boca Dam, Truckee Storage project.

The formal reinstatement of Dean C. Allison as inspector, Taylor Park Dam, Uncompahgre project, Colorado, became effective October 1.

Frank J. Amador, Jr., inspector on the Caballo Dam, N. Mex., resigned at the close of September 8 to accept a position as instructor at the New Mexico A. & M. College, State College, New Mexico. Champ C. Magruder has been appointed inspector at Caballo Dam to succeed Mr. Amador.

Mrs. Violet M. Dunne has been appointed clerk on the All-American Canal project, Arizona, to succeed Mrs. Mae Moy, resigned.

Victor Barth, inspector on the Boulder Canyon project, has been transferred to the Denver office.

Miss Frances E. Ganz, junior clerk, Salt River project, was married on September 24, and her name on the Bureau's records was changed to Mrs. Frances G. Stoddard.

Orville R. McPherson Retired

Orville R. McPherson, ditchrider with automobile on the Yuma project, was retired at the close of September 30, 1936, having reached the retirement age of 65 years recently established for this position in the Reclamation Bureau by agreement between the United States Civil Service Commission and the Department of the Interior.

Mr. McPherson has been employed continuously on the Yuma project since November 1911 and at the time of his retirement had completed nearly 25 years of service on the project. He was engaged on construction work prior to 1915, in which year he was appointed ditchrider in the Valley Division, the duties of which position he has discharged to the satisfaction of both the water users and the project management.

Mr. McPherson has built a home within a short distance of the project residence he has occupied during the past 21 years while serving as ditchrider. He will spend much of his time in connection with his 10-acre unit on the Yuma auxiliary project which he planted to grapefruit in 1931.

On his retirement from the Bureau, Mr. McPherson was presented with a handsome electric clock by his fellow employees of the Yuma project.—R. C. E. Weber, Superintendent.

William Roberts, an employee in the hydraulic laboratory of the Denver office, died in the Presbyterian Hospital on September 7, after a very brief illness.

Mrs. Lucile R. Carter, assistant clerk on the Boulder Canyon project, was married on August 13, to Ted L. Wieland. She retains her position in the Bureau and the records are being corrected to show her name as Mrs. Lucile R. Wieland.

H. E. French, Seventh Corps Area liaison officer, called at the Belle Fourche project office recently with reference to the E. C. W. camp activities and the relation of the work personnel to the Army.

Harlowe M. Stafford, engineer in charge, Rio Grande joint investigation, Santa Fe, N. Mex.; Fred C. Scobey, of the Bureau of Agricultural Engineering, also of Santa Fe; and R. A. Hill, of Los Angeles, were recent visitors on the Rio Grande project.

W. A. Werner, junior engineer, and D. B. Upstill, instrumentman, have been transferred from the Pine River project, Colorado, to the Rio Grande Basin project.

Walter C. Berger, former Chief Clerk on the Carlsbad project, succumbed to pneumonia in a Carlsbad hospital on October 2. At the time of his death Mr. Berger occupied the position of Chief Clerk and Finance Officer for the Carlsbad Caverns National Park.

Washington Irrigation Institute Meets at Coulee Dam

Acting Commissioner of Reclamation John C. Page sent greetings on October 14 to the Washington Irrigation Institute in session at Coulee Dam, Columbia Basin project, as follows:

"Greetings to the twenty-fourth annual meeting of Washington Irrigation Institute which I am delighted is being held at Coulee Dam. I regret my inability to be present in person, but cannot let this occasion go by without sending a message to your gathering of appreciation for the fine work the institute is doing and what I know it means to the entire Northwest. You could hold your convention at no more inspiring place. Best wishes for a fine meeting."

Yakima Superintendent Honored

Election of John S. Moore as vice president of the Washington Irrigation Institute, with his advancement to president next year almost "in the bag", comes as pleasing news to Yakima reclamationists. Mr. Moore came to Yakima to succeed as popular a project manager as this section has ever had; many expressed doubt whether any appointee could win comparable standing. Mr. Moore said nothing but plugged along at his job, aiding community enterprises when he could and always on the alert to boost for reclamation and any cause in which his water-users were interested. As a result, his service here has been marked by a complete harmony with irrigation officials and irrigationists as well as with the business interests of the valley. The Washington Irrigation Institute did well in electing him to office and will win increased prestige under his direction.—*Yakima Daily Republic*.

Oregon Reclamation Congress Meets at Vale

The Oregon Reclamation Congress, of which Judge Robert W. Sawyer, publisher of the Bend (Oregon) Bulletin, is president, met at Vale, September 4-5, for its first all-State convention since 1923. Attorney Robert D. Lytle welcomed the delegates on behalf of the city of Vale. Other addresses were delivered by Col. Milo Fox, of the United States engineers; John W. Haw, agricultural agent of the Northern Pacific Railroad; Raymond G. Larson, county agent; Arthur King, of the Oregon State College; W. D. B. Dodson, Washington representative of the Portland Chamber of Commerce; Judge David F. Graham; Dennis Woods of the Federal land bank; Marshall N. Dana, associate editor of the Oregon Journal, and Frank Morgan, of Nyssa.

THE construction on the Grand Valley project of 35 new homes and farm buildings and remodeling of 7 present buildings on the farm resettlement project in the lower valley will be under way shortly as announced by the Resettlement Administration. All necessary farm buildings are included in the program and frame construction is anticipated. Material will be purchased in carload lots. The project comprises 3,767 acres in Mesa County.

Gold Mining

(Continued from p. 266)

with ore, sets the flag on the higher of the Ford wheels, dips the paddles into pen stock, and heads up the hill 4 miles away to do his mining. Every time he comes out with a load of ore or waste he looks at his mill, which is visible from the dump. If the flag which he attached to the wheel is waving, everything is all right; if it isn't something is wrong, and down he goes to see what is the matter.

The mill, although crude, serves its purpose and makes for Fred Wilcox better than wages. How much better no one knows but Fred and he won't tell.

Yuma Valley Advances

Don Wisener, observing trends in farm and ranch produce and feed prices during recent weeks, is of the opinion that Yuma Valley residents are in a position to profit by the upturn in prices.

Concerning recent developments he says in a statement handed to the Sun;

"Agricultural conditions in the Yuma district have a brighter outlook than for many years. With the alfalfa seed market holding at the 18-cent mark, cotton on the rise, and feed prices rising, the farmers of the community will have a little more of the 'wherewithall' to drive the wolf from the door and buy a few of the pleasures of life.

"During the past week there has been considerable activity in the winter pasture market. A number of feeders of livestock have been contracting for pasture at 30 cents per month for feeder lambs and 45 cents for old ewes with lambs. This is considerable of an advance over last year, but does not look like the top. The quotations for pasture for feeder lambs in Imperial Valley are 40 cents per month on the basis of \$10 hay with advances or declines according to the market which would make a price of 60 cents per month for \$15 hay. This seems to be a very fair deal to all parties as they are protected from fluctuations in the feed market."

"Everything points to better times for the Yuma Valley farmer."—*Yuma Daily Sun*.

A PACKING plant for head lettuce has been constructed at Vale, headquarters town for the Vale project, Oregon.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation. **John C. Page**, Acting Commissioner, Bureau of Reclamation
Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; John C. Page, Chief Engineering Division; A. R. Golze, Supervising Engineer, E. C. W. Division; Wm. F. Kubaeh, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Plans; C. M. Day, Mechanical Eng.; H. R. McBirney, Senior Engineer, Canals; E. B. Dehler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Official in charge		Chief clerk	District counsel	
		Name	Title		Name	Address
All-American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thraikill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do.	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	Pt. Sumner, N. Mex.	Wilfred W. Baker	Engineer		do.	do.
Casper Alcoa	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Voyer	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do.	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		do.	do.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do.	do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Malta, Mont.	H. H. Johnson	do.	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do.	do.	do.	do.	do.	do.
Minidoka	Burley, Idaho	Dana Templin	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moon Lake	Duchesne, Utah	E. J. Westerhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Gnerey, Wyo.	C. F. Gleason	Supt. of power	A. J. Stimpfig	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Jakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Carmody	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Ontario, Oreg.	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do.	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pine River Dam	Bayfield, Colo.	Charles A. Burns	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Provo River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do.	do.
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Creelius	Constr. engr.		do.	do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peek	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone-Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.	do.	do.	do.
Stanfield	Ontario, Oreg.	R. J. Newell	do.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do.	do.	do.
Upper Snake River Storage	Ashton, Idaho	H. A. Parker	do.	Emmanuel V. Hillins	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do.	do.
Yakima	Yakima, Wash.	J. S. Moore	do.	Philo M. Wheeler	do.	do.
Roza div.	do.	Chas. E. Crownover	Constr. engr.	Alex S. Harker	do.	do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

¹ Acting.

² Non Federal.

³ Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Operating official		Secretary	
			Name	Title	Name	Address
Baker (Thief Valley div.)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating.
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	W. W. Blindauer	Manager	Elsie H. Wagner	Hamilton.
Boise	Board of Control	Boise, Idaho	Nm. H. Tuller	Project manager	F. J. Hanagan	Boise.
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine.
Hyrum	South Cache W. W. A	Logan, Utah	B. L. Mendenhall	Superintendent	Harry C. Parker	Logan.
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	Manager	Chas. A. Revell	Bonanza.
Klamath, Horsely	Horsely irrigation district	do.	Henry Schmor, Jr.	President	Dorothy Eyers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Persson	Manager	O. B. Patterson	Sidney.
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook.
do.	Fort 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.
do.	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich.
do.	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do.	W. C. Trathen	Rupert.
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Frank O. Redfield	Burley.
Gooding	Amer. Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding.
Newlands	Gering-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do.	H. W. Emery	Fallon.
North Platte: Interstate div	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do.	Flora K. Schroeder	Mitchell.
Fort Laramie div	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleener	Superintendent	C. G. Klingman	Gering.
do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mary Harrach	Torrington.
Northport div	Northport irrigation district	Northport, Nebr.	Mark Iddings	do.	Mabel J. Thompson	Bridgeport.
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan.
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	D. D. Harris	Ogden.
Salt River	Salt River Valley W. U. A	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix.
Shoshone: Garland div	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell.
do.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver.
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotgut	President	E. G. Breeze	Payson.
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw.
Greenfields div	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	H. P. Wangen	Fairfield.
Umatilla: East div	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	Enos D. Martin	Hermiston.
West div	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	A. C. Houghton	Irrigon.
Uncompahgre	Uncompahgre Valley W. U. A	Montrose, Colo.	Jesse R. Thompson	Acting supt	J. Frank Anderson	Montrose.
Yakima, Kittitas div	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg.

Important investigations in progress

Project	Office	In charge of—	Title
Colorado River Basin, sec. 15	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Gallatin Valley	Bozeman, Mont.	R. R. Robertson	Engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise	Boise, Idaho	Lester C. Walker	do.
Rio Grande	Denver, Colo.	Wm. G. Sloan	do.
Western Slope	Grand Junction, Colo.	Frank C. Merriell	do.

SALLIE A. B. COE, Editor.

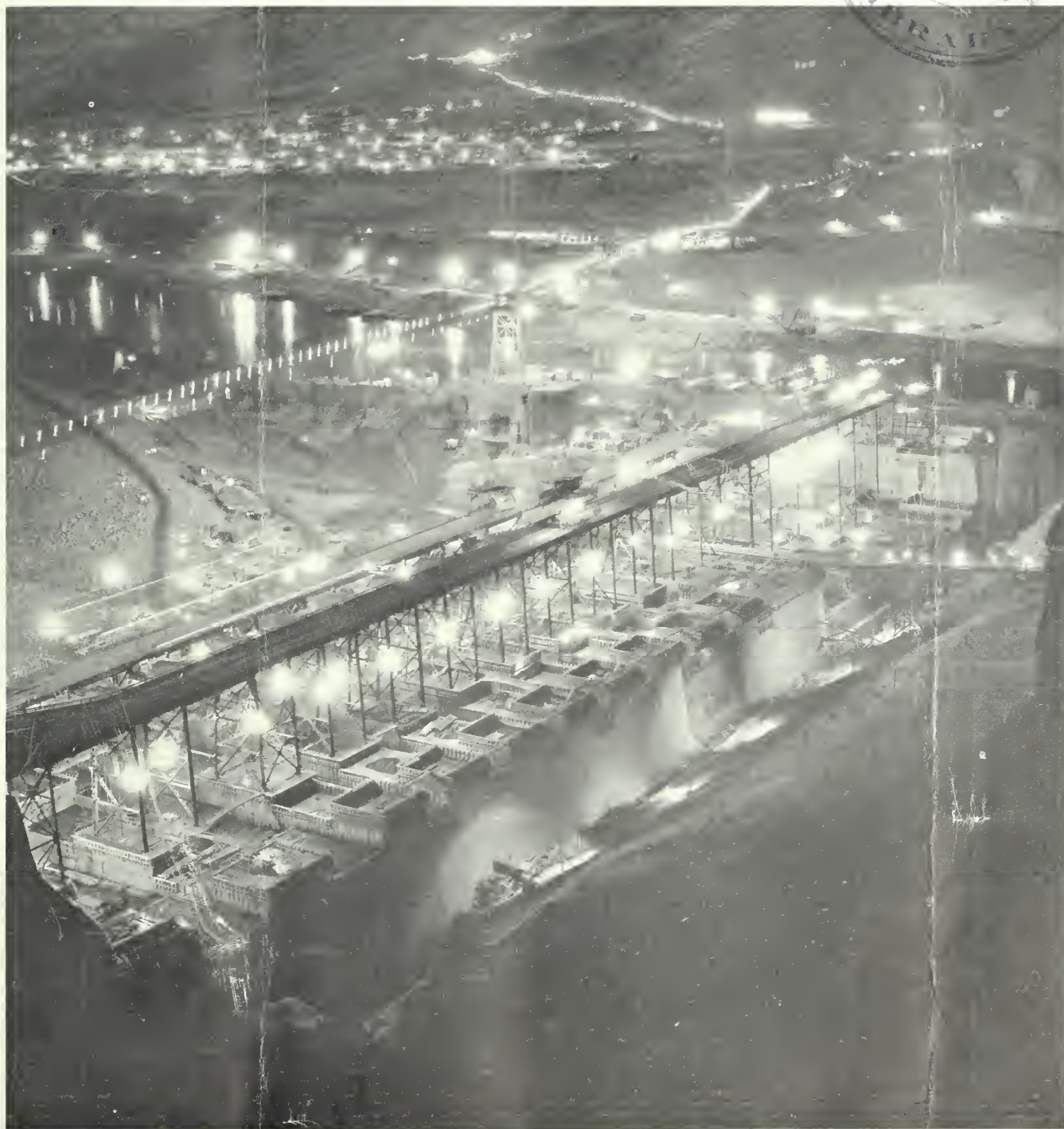
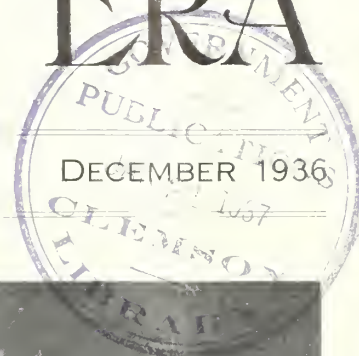


COLUMBIA BASIN PROJECT, WASHINGTON.
THE RELATIONSHIP BETWEEN GRAND COULEE DAM AND THE GRAND COULEE, THAT ANCIENT GLACIAL RIVER BED FROM WHICH IT GETS ITS NAME.

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THE RECLAMATION ERA

VOL. 26, NO. 12



COLUMBIA BASIN PROJECT, WASHINGTON
GRAND COULEE DAM CONSTRUCTION BY NIGHT. VIEW OF DAM FROM WEST ABUTMENT

President Roosevelt and Secretary Ickes Send Greetings to the National Reclamation Association

"The National Reclamation Association was organized to encourage the conservation of water, the greatest western resource, and its use for irrigation. The program under the Federal reclamation policy has steadily gone forward and has relieved unemployment not only in the West, but in the industrial East where these western developments create a market for the products of the factories. The prolonged drought has given added emphasis to the benefits of irrigation.

"To the annual gathering of your Association in Spokane, November 23-24, I send my greetings and best wishes for a most successful meeting. Your achievements as a group are very gratifying, particularly in educating the public as to the place Federal reclamation takes in our economic existence and in helping administrative officers preserve a sound policy."

Franklin Delano Roosevelt,
President of the United States.

"It has just been brought to my attention that you have called the fourth annual meeting of the National Reclamation Association in Spokane, Wash., for November 23-24. I desire to express to your group my appreciation of assistance rendered during the past year and since my last message to you.

"The Association is in a position to consult and advise with those of us who are charged with the administration of the Federal reclamation policy. This it is doing. As a result of the joint efforts of the Administration, the Association and the representatives in Congress for the various irrigation States, a progressive program of construction is under way which, not only by its size, but by the evidence of planning involved, should be very gratifying to western interests.

"I send you my cordial greetings and wish for you a constructive meeting."

Harold L. Ickes,
Secretary of the Interior.

THE RECLAMATION ERA

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Price 75 cents a year

HAROLD L. ICKES
Secretary of the Interior

JOHN C. PAGE
Acting Commissioner, Bureau of Reclamation

Vol. 26, No. 12

DECEMBER 1936



*The Objectives of Reclamation*¹

By John C. Page, Acting Commissioner, Bureau of Reclamation

THE task of the Bureau of Reclamation is the strengthening of the agricultural foundation for the civilization which is growing up so rapidly here in the arid West. For a generation the Bureau has been the most important agency at this work. It is appropriate from time to time to inquire again into the objectives of our work, and it is good to have these objectives restated, for they must not be lost sight of even temporarily. The purpose of the Bureau of Reclamation is to plan and to construct irrigation projects.

WATER OF PRIME IMPORTANCE

It is axiomatic that the public welfare can be most efficiently advanced by conservation and judicious use of natural resources. Water is the most valuable resource of the area west of the one hundredth meridian. Its conservation and wise use, therefore, create the greatest benefit and imposes the most grave responsibilities in this arid region.

Many who are not familiar with the problems have assumed that there will be no end to irrigation, not realizing that all the available water of the West is insufficient to provide adequate supplies for more than about 3 out of each 100 acres in the far western States. Definitely there is an upper limit, and while it has not been reached, thoughtful people will realize that this limit placed by the available water is closely approached in some, and not infinitely far distant in any area today. Farmers of humid regions need not fear that the West will overreach itself. The concern in regions more bountifully supplied with water should be, on the other hand, that the maximum agricultural development in the West may be all too small.

¹ Address delivered Nov. 23, 1936, Spokane, Wash., at the fifth annual meeting of the National Reclamation Association.

LAND NEXT IN IMPORTANCE

Next to water in importance in this region is land, the resource which in humid sections holds the first position. Because of the upheavals of nature—recent in terms of geology—much of the West is incapable of supporting vegetation. This nonproductive area is in addition to the vast expanses which must remain unused because there is insufficient water. There remain only 3 percent of this western territory where land and water occur in combination suitable for successful farming. Fortunately, however, some of the western soils are inherently productive to a greater degree than those in humid sections. This is true because plant food remains in soils of the arid region where the leaching action of heavy rainfall does not operate. The well-nigh perfect control of water and crop methods possible under irrigation permits, in addition, the maximum beneficial use of the land which can be cultivated. With proper cultivation, irrigation farming has more permanency.

History discloses that the most ancient civilizations were founded on irrigation. It also indicates that agriculture and allied human activities have a greater degree of permanence in irrigated areas. In our own Nation, though it is comparatively young, areas in the humid section, once opulent, now are declining because of soil exhaustion, but in the arid West farms first irrigated by the Spanish at about the time the Pilgrims were landing at Plymouth Rock, still are in production today. Prehistoric Indian civilization in Arizona flourished on irrigated land. Now our cities rise above irrigated fields in the same locale.

IRRIGATION A NATIONAL NECESSITY

Thus it behooves the people of the West to think not only of the benefits to be

derived from irrigation by this generation, but to consider also the great responsibility which rests upon them for conservation of both water and land in anticipation of future needs. As generations come and go, greater and greater reliance will be placed in the lands of this area for the support of our Nation.

Careful planning then is not only justified, but to proceed without it would be a foolhardy shirking of a responsibility. Selfish considerations must be eliminated and efforts must be unified to develop wisely and carefully the resources which have been entrusted to the West.

It was with this vision and for the purpose of assuring leadership that the Bureau of Reclamation was proposed by Theodore Roosevelt. This vision also inspired another Roosevelt, Franklin D. Roosevelt, our President, when he gave reclamation its greatest impetus through allotment of funds for a great new program of construction. Consistently from the beginning, the Bureau of Reclamation has sought to plan well, and has endeavored to build for permanency and the greater good of the greatest number.

RECLAMATION PROJECTS INCREASINGLY COMPLEX

When the Bureau of Reclamation was young, it was a much simpler matter to plan and construct projects, but the easy developments have been exhausted. The size, scope, and complexity of projects have increased, but the Bureau has continued a well-rounded plan to provide a use of western waters as intelligent as it could be made by the conscientious body of men of which the Bureau is composed.

Storage of supplemental supplies, generation of hydroelectric power, pumping to lands above the river levels, and flood control, are features which have been added by the requirements of increasingly complex projects. Complete control of

great rivers has been achieved, and scores of storage reservoirs have been put in operation.

Most of these reservoirs provide a large measure of flood protection, and many serve power plants in addition to canals. While requirements of storage for maximum flood control and for irrigation and power generation conflict in some instances, all the dams constructed by the Bureau of Reclamation are effective in the reduction of peak run-off during flood periods.

The projects where the development of water power is possible have benefited greatly both from the revenue derived from the sale of energy and from the opportunity to use electricity in homes and industries. This resource is assuming greater and greater importance as machinery is improved and as the investment in storage works increases. More water power opportunities are created by the large dams necessary in this era.

This year, as has happened many times in the past, a severe drought has sharply contrasted irrigated areas of a large section of the West with the lands about them, which are forced to rely on rainfall. With an area comprising nearly one-fourth of the United States suffering complete crop losses due to drought, the irrigated lands have produced yields greater than their averages. Under such conditions the benefits of irrigation are impressive even to the casual observer. It is a revelation to one familiar for many years with irrigation, after traveling for hundreds of miles where the blight of drought has fallen, to come suddenly upon an irrigation ditch with verdant fields and fat cattle beyond it. It leaves no doubt that our reliance must be upon irrigation. A flowing canal this year was a mighty comfort to thousands of farmers in the western Great Plains. It was the envy of many thousands not so fortunate as to have its protection.

Irrigation projects this year are the sole support of many counties, municipalities, and school districts. Dry farmed areas and livestock are paying almost no taxes in many localities. There are counties in the drought area where less than 5 percent of the taxes are being paid, and there are others, which have irrigated sections, where more than 95 percent of the taxes are being paid promptly.

INDIRECT BENEFITS OF IRRIGATION

While not so prominently displayed, the indirect benefits of irrigation are equally important. The sure and certain production of crops on irrigated lands in the West provides a national balance which is extremely important in times of depression and stress, such as those experienced in recent years. Irrigation projects have been compared to piers on which the

railroads bridge the western part of the continent. A wide variety of specialty foods and products which cannot be supplied by other areas of our country originate on these irrigated lands and spread from coast to coast, improving diets and decreasing the total of things which must be imported. Idaho potatoes, Arizona and California grapefruit, oranges, and lemons, and Washington apples are prominently displayed, for example, in every market in the city of Washington, D. C. Only by expansion of the irrigated areas can new opportunities be provided in this day for those dislodged by calamity or by press of population growth. The public land frontier is gone.

The markets created in new communities which appear after irrigation is begun on lands which otherwise must forever remain desert, are tremendously valuable to manufacturing centers. The volume of interstate and inter-regional trade thus created provides a powerful safeguard for the industrial life of the Nation. With the great uncertainties of foreign markets which now exist, the development of domestic trade assumes ever increasing importance. The wealth created by irrigation is a national asset of vast proportions. The value of products from Federal irrigation projects each year closely approaches the total cost of our operating projects.

RESULTS OF IRRIGATION CONVINCING

The study made this year by the Washington State Planning Council of the Yakima project provided detailed information of the benefits of that area to the State and Nation. The report is a very valuable document and the State of Washington has made a great contribution to the cause of reclamation in its preparation and publication. When similar studies are made of other irrigated sections, such as the Salt River and Yuma Valleys in Arizona, the Imperial and Central Valleys in California, the Twin Falls and Boise areas in Idaho, to name only a few, the results will astound the people of the United States. It is safe to predict that the data would be sufficient to overwhelm opponents of further irrigation development.

Originally the Western States were blessed with a wide variety of natural resources in abundance. Many have been despoiled and are being used up at a tremendous rate. The oil fields, the mines, the forests, have been diminishing rapidly. To maintain the place which these Western States must occupy in our Nation, irrigation must be developed to replace these diminishing resources. The Bureau of Reclamation is fully convinced that the most important factor in the future well-being of the West will continue to be irrigation.

There are on file with the Bureau of Reclamation applications from 400 areas in the West for studies of proposed irrigation projects. The Bureau investigational program should be pushed so that a complete inventory of irrigation possibilities will be available as soon as possible.

VALUE OF SMALL PROJECTS

The Bureau of Reclamation was set up for the primary purpose of developing land and creating new opportunities. Its field of operation has in general been that of large undertakings. The scope of the work should now be extended to include many isolated projects of insufficient size to demand attention heretofore. Many such projects have been proposed by several of the Western States. They include supplemental water supplies and improvement of canal systems for areas ranging in size from a few hundred to a few thousand acres. Because of the value of these small projects in cementing the structures of the States, and because of their great number, they are of increasing importance. Wyoming alone has listed several hundred projects of this type. Construction of these projects will become an important part of the national program for control of little waters.

FUTURE RECLAMATION PROGRAM

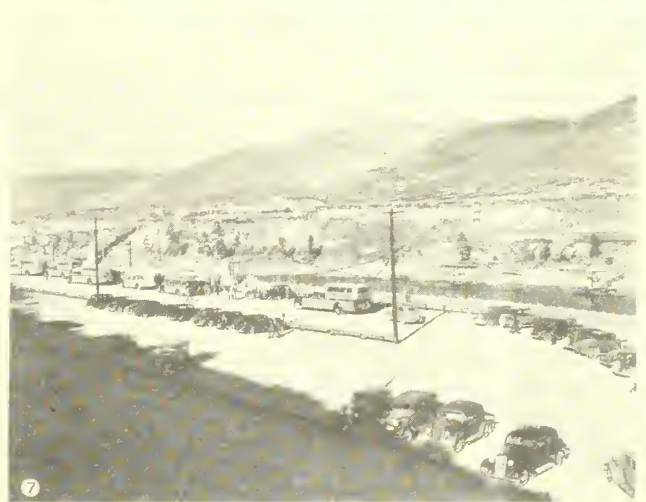
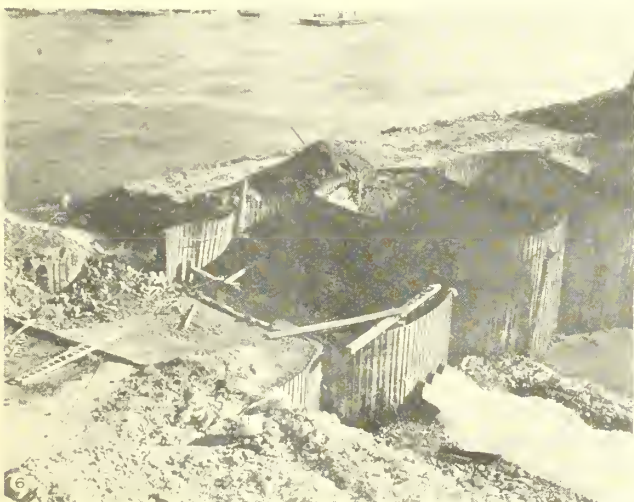
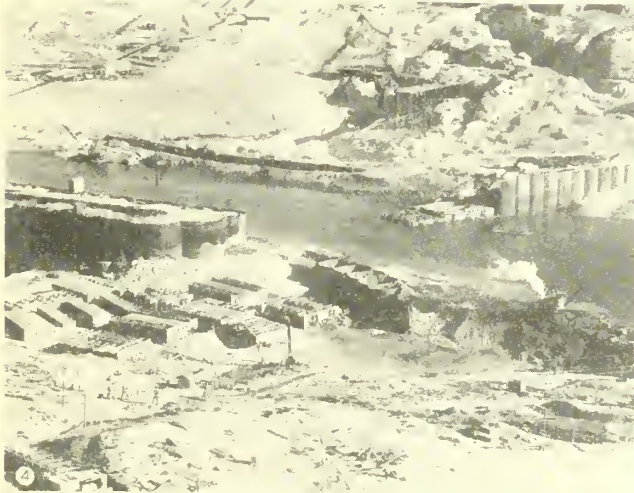
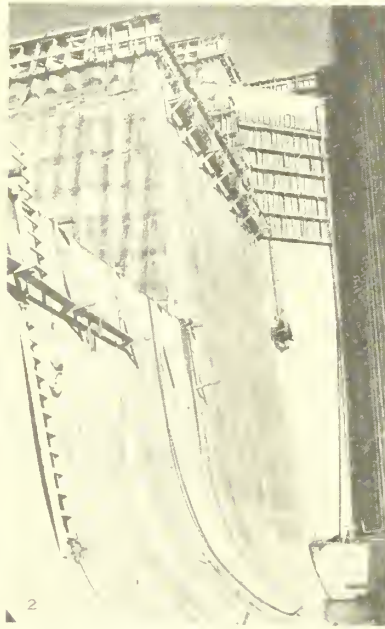
The development of hydroelectric power should be considered in the study of all projects, and where feasible power should be included in order that efficiency of water can be increased by double usage and in order that water users may have the benefit of power generation.

Flood control also should be considered in the planning of all storage reservoirs, and the cost of providing this benefit should not be assessed against the irrigated lands.

These plans, together with vigorous prosecution of work now under way and contemplated, will form the future program of the Bureau of Reclamation. However, it would be inconsistent on the part of the West to press demands for further moratoria on project repayments and support these plans for further expenditures. The Congress cannot be expected to continue appropriating funds for construction if representations are made at the same time that completed projects are incapable of returning the investment of the Federal Government in them.

The Western States must also realize that most of the large projects now being proposed are so complex and costly that few can meet the present requirement of the reclamation law that the investment be repaid in 40 years.

The Western States should give this situation serious consideration in order that a determination can be made con-



COLUMBIA BASIN PROJECT, WASHINGTON—GRAND COULEE DAM

1, To right, portion of upstream cross-river cofferdam projecting out into the Columbia River at the dam. 2, portion of upstream face of dam; 3, detail view looking through one of the channels through which the diverted river will flow; 4, upstream, cross-river cofferdam extending into Columbia River from east side, east side concrete mixing plant in background; the timber cribs in the immediate foreground are the bottom sections of the downstream cofferdam, used as a convenient carpenter shop and dry dock—to be floated out into position when water is admitted in the early stages of river diversion; 5, downstream face of dam prior to opening floodgates in cofferdam; 6, first water diverted from the Columbia River to the diversion channel through which the entire river will flow during construction of dam; 7, parking area at West Vista House.

cerning the method of financing these projects. More liberal terms on the part of the Federal Government might be justified in some instances. It is conceivable that State cooperation might be required. Perhaps a different method of assessing the costs of projects would be helpful, especially in instances where there are multiple tangible benefits. Perhaps some other basis can be found. In any case, this subject is worthy of careful thought.

It is hoped that a commission can be appointed to make a thorough study of financing, repayment, and other policies of the Bureau of Reclamation for future guidance.

Reclamation is at the crossroads, and the best thought of the West should be applied to the problems confronting us. We must not lose sight of our purposes. We must solve these problems which have been growing in importance through the years. Under the leadership of the late Dr. Elwood Mead reclamation went steadily forward. It must continue to do so.

The objectives of the Bureau of Reclamation cannot be more completely defined, nor the achievements more clearly set forth, than in these words of Dr. Mead:

"The fundamental idea of the Reclamation Act was the creation of homes, and in that it has been preeminently successful."

The Bureau of Reclamation has been honored in the past by fine support of its work on the part of all the Western States. It will hope to justify your confidence in the future.

National Reclamation Association Meets

The fifth annual meeting of the National Reclamation Association was held in Spokane, Wash., on November 23-24 and was presided over by O. S. Warden, president. The address of welcome was delivered by Gov. Clarence D. Martin, of Washington; and was followed by reports of the secretary-treasurer; the budget committee; and the Committee on the Cooperation With Federal Irrigation Congress; after which the appointments of committee chairmen were made.

Hon. William E. Borah and Hon. Lewis B. Schwellenbach, United States Senators from Idaho and Washington, respectively, addressed the conference.

Other addresses delivered at the meeting were as follows:

"American Agriculture—The Future", M. L. Wilson, Assistant Secretary of Agriculture.

"Reclamation Projects—Their Objectives", John C. Page, Acting Commission of Reclamation.

"Present Status of Reclamation Projects", R. F. Walter, Chief Engineer, Bureau of Reclamation.

"The Business Man and Reclamation", Eric Johnston, Spokane, Wash.

"Reclamation—A Frontier Development", Dr. Alfred Atkinson, president, Montana State College.

"Relation of Irrigation to National Agriculture", Chester H. Gray, Washington representative, American Farm Bureau Federation.

"Reclamation—Its National Importance", Delos L. James, manager, agricultural department, United States Chamber of Commerce.

"National Policies in Agriculture", Allan C. Hardison, chairman, agricultural committee, United States Chamber of Commerce.

"Reclamation—The Yakima Valley", Ben H. Kizer, chairman, Washington State Planning Council.

"Reclamation in Regional Development", Marshall N. Dana, first president of the National Reclamation Association.

"Reclamation—A National as Well as a Regional Benefit", Ross K. Tiffany, executive office, Washington Planning Council.

"What the States May Do for Reclamation", Hon. Roy E. Ayers, Congressman and Governor-elect for Montana.

Walker R. Young, construction engineer, Central Valley project, California, and B. E. Stoutemyer, district counsel of Portland, Oreg., also attended the conference.

The meeting of the National Reclamation Association has proved to be the largest and most important session ever held.

The newly elected officers of the association are as follows:

O. S. Warden, Great Falls, Mont., president.

Roland Harwell, El Paso, Tex., first vice president.

H. Lloyd Miller, Sunnyside, Wash. second vice president.

L. A. Campbell, Helena, Mont., secretary-treasurer.

THE California Turkey Growers Association is building a plant for dressing turkeys and for handling local birds on the Orland project. A superior pack is anticipated as a result of its use. A charge of 15 cents per bird will be charged members making use of this service.

Zuider Zee Reclamation Project

Work on the Zuider Zee reclamation project, Holland, which has lagged for some time, is to be pursued with greater vigor during the coming fiscal year. The budget allotment for 1937 amounts to Fl. 27,625,000 (or \$15,347,000 at the present rate of exchange, Fl. 1.90 to the dollar).

The cost of this reclamation, it is understood, will be approximately \$12,500 per hectare (one hectare equals 2.47 acres)—\$5,000 per acre. The completion of the project will add a not inconsiderable amount of much needed land to the country.

Bright Outlook for Yuma

Don Wisener, observing trends in farm and ranch produce and feed prices during recent weeks, is of the opinion that Yuma Valley residents are in a position to profit by the upturn in prices.

Concerning recent developments he says in a statement handed to the Sun today:

"Agricultural conditions in the Yuma district have a brighter outlook than for many years. With the alfalfa seed market holding at the 18-cent mark, cotton on the rise, and feed prices rising, the farmers of the community will have a little more of the 'wherewithall' to drive the wolf from the door and buy a few of the pleasures of life.

"During the past week there has been considerable activity in the winter pasture market. A number of feeders of livestock have been contracting for pasture at 30 cents per month for feeder lambs and 45 cents for old ewes with lambs. This is considerable of an advance over last year but does not look like the top. The quotations for pasture for feeder lambs in Imperial Valley are 40 cents per month on the basis of \$10-hay with advances or declines according to the market which would make a price of 60 cents per month for \$15-hay. This seems to be a very fair deal to all parties as they are protected from fluctuations in the feed market.

"Everything points to better times for the Yuma Valley farmer."—*Yuma Daily Sun*, Sept. 10, 1936.

OTHER addresses delivered at the N. R. A. conference are of much interest to our readers. Some of these will appear in the January and succeeding issues of the "Era."

The Reclamation Era

Issued monthly by the Bureau of Reclamation, Department of the Interior, as approved by the Director of the Budget.

Subscription 75 cents a year to other than water users, payable in advance by check or postal money order drawn in favor of the Bureau of Reclamation.

Special reduced rates are given individual water-user owners or water-users' organizations for mass subscriptions on Federal irrigation projects.

DECEMBER 1936

National Reclamation Association

This association was formed 4 years ago. Its first meeting was held in Salt Lake City, Utah, December 5-6, 1932, the second in Boise, Idaho, November 26-28, 1933, the third in Salt Lake City, Utah, December 8, 1934, and as this issue goes to press, the fourth is called for November 23-24, 1936, in Spokane, Wash.

The National Reclamation Association was formed in the interest of water users on Federal reclamation projects, whose officers, directors, and membership are banded in the common interest "to promote the cause of reclamation by irrigation and to exert its efforts for the continuation of the services of the Federal Bureau of Reclamation and to cooperate with and assist it in bringing about the speedy completion of various Federal reclamation projects and to promote the adoption of such legislation affecting reclamation as shall meet the approval of its board of directors." Thus, by this clause in its constitution, the association sets up its purposes, medium of operation, and aims.

FIRST PRESIDENT OF ASSOCIATION

The association's first president was Marshall N. Dana, associate editor,

Oregon Journal, Portland, Oreg. He did such a fine job that he was reelected for a second term of 1 year, and at the end thereof was not a candidate for reelection

SECOND PRESIDENT

O. S. Warden, Great Falls, Mont., publisher, succeeded Mr. Dana. He too is a fine leader. The meeting he has called for Spokane is announced as being "vital to future development of irrigation in the Western States."

ON AGENDA OF SPOKANE MEETING

At a recent meeting of directors of the association from 14 Western States, a program was drafted and will be submitted to the Spokane meeting for support and endorsement. This seven-point program follows:

1. Necessity of increasing funds available for irrigation construction in the States. Under this plan the Reclamation Service would be taken over by the Federal Government as a public work, and would be financed by the Government rather than through the revolving fund, which now permits expenditures of only \$7,000,000 a year.

2. Opposition to any change in status of the Bureau of Reclamation through absorption by some other Federal department.

3. Adoption of Federal power policies favorable to irrigational development.

4. Revision of reclamation policies relating to repayment on part of project farmers in localities where present repayment schedules are difficult to carry out.

5. Development of a plan for suitable cooperation between States and Federal Government in construction of new projects.

6. Provisions for the Bureau of Reclamation to carry out its settlement plans on complete projects.

7. An increased budget for the association so a permanent office may be established in Washington, D. C., for developing a national educational campaign which would acquaint all States

with the types of reclamation work necessary in the West.

APPRECIATION OF ASSOCIATION'S ACTIVITIES

The late Commissioner of Reclamation, Dr. Elwood Mead, voiced his appreciation of the activities of the association as follows: "The work that the association is doing in defense of the national reclamation policy and in educating the public as to the benefits of its operation is of inestimable value. I am delighted that the organization is in existence and its personnel made up of well-informed men, who can act as missionaries in their part of the State, and at the same time their reputations are such as to lend prestige to the association and any activity it may engage in."

This statement cannot very well be improved on as a statement of appreciation. By continuing to have representative men make up the personnel of the association, water users on Federal reclamation projects can confidently expect constructive results.—*M. A. Schnurr.*

Orland Children Have Party

The annual party given to the children of Orland and vicinity by the Kiwanis Club was held Halloween night and was a great success. More than 1,000 costumed children participated in a parade through the streets of Orland and in a program arranged for them on the high-school grounds.

As a preventive for the usual Halloween depredations, the scheme has much to recommend it.

THE influx of land seekers on the Owyhee project continues and difficulty is now being experienced in finding lands to suit the late comers. The number of inquiries received requesting information regarding project lands continues to be high.

(Cut along this line)

COMMISSIONER,

Bureau of Reclamation,

Washington, D. C.

SIR: I am enclosing my check¹ (or money order) for 75 cents to pay for a year's subscription to THE RECLAMATION ERA.

Very truly yours,

(Date)_____

(Name)_____

(Address)_____

¹ Do not send stamps.

NOTE.—30 cents postal charges should be added for foreign subscriptions.

Significance of Grand Coulee Dam

By F. A. Banks, Construction Engineer, Bureau of Reclamation, Coulee Dam, Washington ¹

IT GIVES me great pleasure to be here today and participate with you in the dedication of this shaft of granite taken from the foundation of the Grand Coulee Dam, not merely because of my connection with this project, but because I feel that this monument will always be a source of pride and satisfaction to those engineers responsible for its creation on this campus and because I feel that it will always serve as an inspiration to future engineering students who may come here to lay the foundation for their professional careers.

Granite has always been symbolical of all that is solid and enduring and, although such is not always the case, this specimen will doubtless live up to its reputation. It is a part of a great granite batholith, now covering a large part of north central Washington, which was probably formed contemporaneously with

the Rocky Mountains during the Mesozoic era and prior to the upheaval of the Cascade Range. Since granite requires intense pressure for its crystallization, it must have been intruded under a cover of earlier rocks, probably pre-Cambrian several miles in thickness that have since entirely disappeared at the dam site by weathering and erosion. These same forces likewise cut deep channels in the granite which, during the Tertiary period were partially filled with basalt. The following period known as the Quaternary or Pleistocene was characterized in this vicinity by the repeated advance and retreat of glaciers. It was during this time that, aided by much water and ice, the Columbia River cut its way down through 1,500 feet of basalt and granite and, not satisfied with this task, also eroded the Grand Coulee.

As the erosion of the canyon took place and the weight of superimposed rock was removed from its floor, internal stresses

in the rock were relieved by minor movements which, together with the adjustments in the rock mass caused by its cooling, resulted in seams that are prevalent in all rock masses.

DIAMOND DRILLING

Although the geological structure of the country gave every assurance of an excellent foundation for the Grand Coulee Dam, no chances could be taken in a structure of its importance and magnitude. Consequently diamond drill holes were bored into the foundation and abutments to a total depth of 6 miles, and in addition a dozen or more holes 36 inches in diameter and up to 50 feet in depth are being sunk into the bed rock with calyx drills to provide a means for a detailed personal inspection of the rock in place and a checking of the results secured by diamond drilling, which information is essential for the proper sealing and consolidation of the foundation by grouting and its sub-

¹ Address delivered at Washington State College Oct. 3, 1936.



THE COLUMBIA RIVER, THE ARID WEST'S FINEST PRODUCER OF WATER AS IT RUSHES OVER RAPIDS ABOVE GRAND COULEE DAM.

sequent drainage to reduce uplift pressures.

The cylindrical block of granite which is being dedicated today is a section of a core taken from one of these exploratory holes under the west portion of the dam and is illustrative of the manner in which engineering and geological principles are put to practical use in the solution of problems that arise in the design and construction of modern engineering works of magnitude.

It is fitting, therefore, that this specimen taken in this manner and for this purpose from the foundation of the Grand Coulee Dam, should have a place on the campus of this institution to bear witness to the service rendered by its graduates in the building of this structure and to serve as an inspiration to those who follow in their footsteps in the progressive development of this marvelous section of our country.

As this core is a section of the foundation of the Grand Coulee Dam, just so is the Grand Coulee Dam a part of the Columbia

Basin project that is destined to become the foundation for a development that will transcend anything that has as yet been brought about in the Northwest by human effort.

The full significance of this project and the part that it will play in the future of the Northwest is difficult to visualize at this time, for many years will have passed before it has been completed and conditions as we know them now will not obtain then.

PEOPLE FROM EAST MIGRATING WESTWARD

The settlement of this country having first taken place on its southern and eastern shores, the pioneering spirit of its people has ever urged them toward its northern and western boundaries. And now with continued improvement in transportation facilities, more and more the people of the East attracted by the scenic features of the West and won by its superior climate, are migrating in this direction with the result that during the decade ending in 1930, the last for which there are

reliable records, there was an increase of 33 percent in the population of the Pacific slope which was about double that of the national average.

The Farm Chemurgic Council is performing a valuable service in promoting research to enable a wide variety of surplus agricultural products to be transformed through organic chemistry into raw materials usable in industry. The progress made in the use of soybeans in industrial processes is typical of what is being done in this direction. The use of soybean oil has been by no means thoroughly explored and yet it has been successfully used as fuel for operating Diesel motors and as a cooling agent for thread cutting machines, while soybean plastics may be used in the manufacture of telephone receivers and all such articles that must be molded and yet stand a greater strain than wood is able to resist. Finally what is left is suitable for animal food. Officials of this council predict that the time is not too far distant when the industrial demand for farm products



DEDICATION OF GRANITE SHAFT TAKEN FROM GRAND COULEE DAM.

Left to right: H. V. Carpenter, Dean of College of Mechanical Arts and Engineering; A. F. Darland, Field Engineer, Bureau of Reclamation; E. O. Holland, President of Washington State College; F. A. Banks, Construction Engineer, Bureau of Reclamation; Miss Thornton; G. E. Thornton, Professor Electrical Engineering, Washington State College; Hon. C. D. Martin, Governor of Washington.

will exceed the human and animal consumption.

Soil erosion is taking out of production in this country each year more land than has been irrigated by the Federal Government since the passage of the Reclamation Act. Flood and drought conditions during the past few years in various parts of the East and Middle West have contributed to the unrest of those affected and given material impetus to migration to the Northwest where there is but little gamble with weather, moisture, or sunshine. Such a condition plainly calls for the orderly and well planned reclamation of additional semi-arid lands by irrigation.

INCREASE IN POWER REQUIREMENTS

During the decade ending with 1930, the requirements for power in the Pacific Northwest increased at an average rate of 9.5 percent per year compounded annually. The effect of the depression has been to suspend for about 4 years the normal growth in power consumption. Production fell off a little after 1930 and reached a minimum in 1933; but during 1934 it returned to the 1930 maximum and for the past 2 years has resumed its former rate of increase. This rapid increase has taken place in spite of the fact that industrial development has not kept pace with the increase in population and leaves us only to surmise what the demand will be when proper utilization is made of the minerals, raw materials, and other resources of this region.

PLACE OF COLUMBIA BASIN IN FUTURE ECONOMIC PROGRAM

With this brief outline of the trends of the present time, let us consider the Columbia Basin project and how it may fit into the economic program of the future.

Columbia River Reservoir.—First, there is the Columbia River Reservoir with a storage capacity of more than 5,000,000 acre-feet created by the Grand Coulee Dam and extending from that structure to the Canadian border, a distance of 150 miles, thereby adding a corresponding amount to the navigable inland waters of the State. Furthermore, this reservoir is located at the highest possible point on the Columbia River within the boundaries of this country and the release of the waters therefrom during periods of low flow, not only increases the minimum navigable channel depths by 2 feet below Bonneville Dam and by 4½ feet below Grand Coulee Dam, with corresponding increase at intermediate points; but it also doubles the amount of firm power that can be developed at the six power sites on the Columbia River between

Grand Coulee Dam and the mouth of Snake River, and increases by 50 percent the firm power that can be generated at the various sites including Bonneville below this point. It becomes quite evident, therefore, why the Grand Coulee Dam is referred to as the key structure in the comprehensive plan for the development of this, the second largest river in this country, and why its construction has been authorized as an initial step therein.

Grand Coulee Dam and power plant.—Second, there is the Grand Coulee Dam

side of the spillway, will amount to 1,980,000 kilowatts, of which 800,000 kilowatts will be for the generation of firm power and the balance for secondary power for irrigation pumping and for standby service.

Pumping plant.—Third, is the pumping plant, consisting of 12 units of 1,600 second-foot capacity each, 10 of which will be for regular service and two for stand-by and emergency service. Each unit will be driven by a motor of 62,500 horsepower. This pumping plant, together with a short canal, will take water from the Columbia River Reservoir, raise it 280 feet, and deliver it to the Grand Coulee Reservoir.

This reservoir, which is the fourth major unit of the project, will be formed by a low dam in each end of the Upper Grand Coulee. Its capacity will be about 340,000 acre-feet and its purpose will be to provide a method of conveyance of water through the coulee and to control the flow so that secondary power can be used for pumping purposes.

Distribution system.—Fourth, there is the distribution system that conveys the water from the Grand Coulee Reservoir to the 1,200,000 acres of semi-arid but exceedingly fertile lands of the Big Bend country, lying between Ephrata and Pasco.

Such a project is essentially an irrigation project with power as an incidental product and stream control as a substantial contribution towards the development of the rest of the river for power and navigation purposes. It takes advantage of the Grand Coulee to divert water now running to waste in the sea and convey it to the sun-parched lands of the Big Bend country. Out of the now barren semi-arid tract, it creates an empire equivalent in area and productivity to three Yakima Valleys. Such a project would provide farm homes for 25,000 to 40,000 families representing 100,000 to 200,000 people, and in addition thereto support an urban population of equal size.

The firm power by-product will find a ready market in the orderly expansion of power uses, will encourage the development of natural resources and new industries, and will insure the return of the Government's investment in the project.

In this short discourse, I have attempted to suggest to you some of the factors and trends that seem to justify an orderly expansion in land development in this northwestern part of our country, and to point out to you how that expansion can be effected by the construction of the Columbia Basin project. I trust that you feel, as I do, that this project has a proper place in the economic development of the Northwest.

Resolutions

The Washington Irrigation Institute at its twenty-fourth annual meeting at Coulee Dam, October 15-16, passed resolutions stressing the necessity of a program which will enlist the support of all parts of the West, and reaffirmed the stand it has maintained for 25 years in regard to the paramount importance of supplementing existing water supplies and completing the sound projects already under way.

Other resolutions urged the Bureau of Reclamation and the Congress of the United States to continue appropriations of approximately \$3,000,000 a year for the further development of the Roza lands on the Yakima project; the completion of Grand Coulee Dam and the development of the Columbia Basin project; the making of an adequate appropriation in support of the commission delegated to visit various irrigation projects in the West to study conditions and to make recommendations as to the best, most feasible and practical, comprehensive, permanent plan water-right payment; that a study of reclamation in the State of Washington be made which will be so comprehensive as to set out all of the important facts relating thereto, and draw from them all conclusions which will further a development of sound reclamation policies for the State and Nation.

and power plant. The dam will be 4,300 feet long, 550 feet high, and 500 feet thick at the base. It will have a spillway 1,650 feet long, capable of passing a million second-foot flood. The volume of concrete required will be 11,000,000 cubic yards, or more than 2½ times that required for the Boulder Dam. The power installation, symmetrically placed on each

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Technical Memoranda:

Nearly 540 Technical Memoranda have been issued by the Office of the Chief Engineer in Denver. These memoranda deal with a large variety of engineering and technical investigations in connection with the construction of dams and irrigation structures. A limited number of these memoranda are for sale. Application should be made to Chief Engineer, Denver, Colo.

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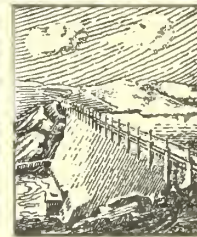
Yakima Ships Rams to Russia

Forty head of purebred registered Romney rams have been sold by Coffin Bros., a local sheep concern, to representatives of the Russian government. Before the transaction was completed each animal was given a rigid physical examination and declared to be in perfect condition. The rams will be used to improve the quality of stock in Russia. Foundation stock for the local band was brought from New Zealand about 20 years ago. Earlier in the season the firm shipped 15,000 head of Romney ewes to Kentucky and 600 ewes and 35 rams for foundation stock at the Matanuska government colony in Alaska. The company has recently shipped in 16,000 ewe lambs from other States for winter feeding.

THE Boosters Club on the Orland project is making extensive preparations for the annual Orange Fiesta and turkey show which has been expanded to cover 2 days of activity.



ENGINEERING



Construction of the Casper-Alcova Project

THE Alcova Dam diversion tunnel, 20 feet in diameter and 1,380 feet long, including a 33 by 40 by 60 foot valve chamber and a 14 by 16 foot elevator shaft 169 feet long, was completed by contract with the Lawlor-Woodward Co. in October 1934, and provided 300,000 man-hours of labor.

ALCOVA DIVERSION DAM

The construction of the Alcova diversion dam was begun by the contractor, W. E. Callahan Construction Co. and Gunther & Shirley, in August 1935, about 2 months in advance of the date when the contract time allowance began to elapse. Of the contract time, 37.1 percent had elapsed and on the basis of estimated contract earnings, 40.1 percent of the work was completed on October 1, 1936. The contract provides that all work must be completed not later than May 8, 1938. If the diversion tunnel is included, the entire structure is more than 50 percent completed. This work had provided 592,000 man-hours of labor to October 1.

The Alcova dam site is located in a narrow canyon into which, prior to beginning dam construction, a large number of hot springs, discharged at low river level (5,330) and below, an amount of water which probably totaled, in the dam-site area, about 20 cubic feet per second. That portion of the dam site upon which the impervious section of the dam is being constructed was stripped of gravel and boulders to bed rock, a maximum distance of 86 feet below low water level in the river. During the stripping operations, a total of 64,000 linear feet of grout holes was drilled in the underlying rock and 211,000 cubic feet of grout was forced into the crevices. This grouting cut off the inflow and provided a practically dry foundation upon which to place the impervious section of mixed earth and gravel.

The impervious section is now constructed to elevation 5,365, or 35 feet above low water and 121 feet above the lowest point in the foundation, and contains 310,000 cubic yards embankment measurement. The gravel section is now constructed to elevation 5,375 and

contains 84,000 cubic yards, the rock section to an average elevation of 5,368, and contains 145,000 cubic yards, and the upstream gravel blanket and riprap section to elevation 5,368 and contains 5,000 cubic yards.

Cut-off walls, a collection gallery, and tunnels have been completed under the impervious section. The operating house at the top of the diversion tunnel shaft has been completed. Concrete placed in



THE CANYON AT ALCOVA DAM SITE, LOOKING DOWN-STREAM FROM COFFERDAM.

these structures, together with that placed in the nearly completed trash-rack structures, amounts to 3,110 cubic yards.

Spillway excavation is in progress and 14,000 cubic yards of common and 65,000 cubic yards of rock excavation have been removed. In addition, excavation for dam foundation and stripping gravel deposits have been made in an amount of 195,000 cubic yards.

The contractor will continue the construction of the impervious section until freezing weather. Work on the spillway excavation and the construction of the rock-fill section of the dam will be carried on during the winter. About 320 men are employed on the work but during the coming winter, this number will probably be reduced to about 75.

SEMINOE DAM

The permanent buildings to be used by Government employees during the construction of the dam and the operation of the power plant were constructed during 1936 by contract. A water-supply system, furnishing an ample supply for both contractor's and Government employees, and a sewage-disposal system for the Government camp, have been completed by Government forces. Power for constructing the dam is supplied by the Mountain States Power Co. at Casper over a 66,000-volt line, 64 miles long, constructed by Government forces from Casper to the dam site. Telephone service at the dam site was provided by the construction, by Government forces, of a line 34.5 miles long, from a Government-owned line serving Pathfinder Dam. All roads in the mountains on the west side of the canyon, making the dam site accessible, were constructed by road contractors and by Government forces; but considerable widening has been done by the dam contractor during this year.

The construction of the Seminoe Dam and power plant is being performed under a contract with Winston Brothers Co. & Associates. Camp construction and plant installation, necessary to carry out the contract, were started in January 1936. Of the contract time, 21.4 percent has elapsed, and on the basis of estimated total contract earnings, the contract is 12.3 percent complete. Under the terms of the contract, all work is to be completed by March 23, 1939.

Work has been under way during the year on the following features, with progress as indicated:

1. Canyon wall stripping, 50 percent of 15,000 cubic yards, loose rock.
2. Spillway tunnel inlet and outlet cuts, 85 percent of 50,000 cubic yards, rock and common excavation.
3. Spillway tunnel, 55 percent of 22,000 cubic yards, rock excavation.
4. Dam and power plant, 43 percent of 77,000 cubic yards, common excavation.
5. Abutments and footings of dam and power plant, 5 percent of 119,000 cubic yards, rock excavation.

6. Diversion tunnel, 38 percent of its 400-foot length, rock excavation.

The widening and deepening of the river channel for 2,000 feet below the dam to form a tailrace for the power plant has proceeded, during the past 30 days of low water, to a status where 6 percent of the 140,000 cubic yards of common excavation and 20 percent of the 22,500 cubic yards of rock excavation have been hauled out to waste piles in Morgan Creek.

In addition to the pay quantities mentioned, the contractor has excavated footings in the rock of both canyon walls for a 12-ton movable cableway, traveling 150 feet up and down stream. The cableway towers are completed.

Two and one-quarter miles upstream from the dam site a screening and washing plant has been built and equipped for the processing of concrete aggregate for the 185,000 cubic yards of concrete required. Aggregate in the amount of 35,000 cubic yards has been dug from the river bottom within a mile of this plant and stock piled at the screening plant.

An aerial tram, now completed, using 32-cubic-foot buckets, will carry the aggregate to the mixing plant on the canyon wall above the dam. The mixing plant, equipped with one 4-yard mixer and weighing batchers, is now almost complete, as is also the 3,800-barrel steel silo for the storage of bulk cement. The cement will be hauled 37 miles in tank trucks from Pareo, Wyo., the nearest railroad point.

The contractor's schedule provides for completing this winter the excavation of the diversion tunnel; all of the spillway tunnel and the concrete lining of the horizontal section of the spillway tunnel, which becomes a part of the diversion scheme; the excavation of the abutments of the dam; continued operations in the tailrace, from the lower end to within 700 feet of the dam; and procuring enough sand and gravel from the river bed to carry concrete operations through the high-water period next spring and summer. The schedule also contemplates the construction of the cofferdams and diversion of the river before high water in the spring of 1937.

The number of men employed has been increased gradually until there are 530 men on the pay rolls. Unless the winter is unusually cold and accompanied by heavy snowfall with high winds, it is expected that the winter's employment on this work will not be curtailed.

The construction of telephone and transmission lines, camps, water supply, sewage disposal, trails, service roads, and all work in connection with the Seminole Dam contract has provided 925,000 man-hours of labor.

CASPER CANAL

The Casper Canal will divert water from the Aleova Reservoir and extend a distance of 60 miles to Middle Casper Creek to irrigate 35,000 acres in the first unit, lying mainly west and north of Casper.

Contract work on the first 3.6 miles of canal involved two concrete-lined tunnels of 2,860- and 4,420-foot lengths, one 300-foot and one 180-foot reinforced concrete siphon, one 73-foot reinforced concrete highway bridge, and 2.1 miles of canal excavation involving 444,000 cubic yards. All of this work was completed on or before October 1, 1935, and provided 439,000 man-hours of labor.

The contract for the construction of four concrete-lined tunnels, aggregating 2 miles in length, was awarded to W. E. Callahan Construction Co. and Gunther & Shirley in January 1936. At present, the portals to three of these tunnels have been excavated and 4,000 feet of tunnel driven from the outlet of tunnel no. 6.



SEMINOLE DAM SITE FROM TOP OF CANYON WALLS, LOOKING DOWNSTREAM.

The remaining 1,460 feet of this tunnel will be excavated by December 1. Present plans call for lining this tunnel while the others are being driven. Approximately 20,000 cubic yards of concrete aggregate has been stock piled at tunnel sites. On the basis of estimated total contract earnings on October 1, the contract was 26.3 percent complete, and of the contract time, 35.1 percent had elapsed. The entire contract is to be completed by January 30, 1938. The total employment provided by this work so far amounts to 154,000 man-hours of labor. Tunnel excavation will be carried on throughout the winter and provide employment for about 120 men.

With the exception of the 5.6 miles of contract work, all of the 60 miles of main canal and all the laterals will be constructed by Government forces.

Preparatory to the actual excavation of the canal, it was necessary to construct service roads and 4,000-volt temporary power lines paralleling the canal, 15 miles of 57,000-volt temporary lines connecting to the 64-mile Government permanent transmission line between Casper and Seminoe, and four substations to feed the canal service lines. Other work included grubbing and bond plowing for canal embankment.

Excavation of the main canal is being accomplished by three Bucyrus electric class 14's and one class 9½ draglines, which were transferred from other projects and reconditioned. Going into service during May and June of this year, they are now moving dirt at the rate of 300,000 cubic yards per month. A total of 1,237,500 cubic yards, representing 9.8 miles of canal, had been moved up to October 1 and there remained to be excavated 4,362,500 cubic yards in 46.6 miles of canal.

The actual construction of canal structures, lateral excavation, and structures will not get fully under way until next spring. In the meantime, preparations are being made to undertake an extensive structure program at that time. Structure sites are being excavated as encountered along the canal. Equipment already in use consists of one ½ cubic-yard dragline, one 50-horsepower tractor and bulldozer, and one 35-horsepower tractor and blade for preparing the canal right-of-way; also three 210-cubic-foot air compressors, one wagon drill, and eight jackhammers for drilling and blasting classified material ahead of the dragline excavation. Material already on hand includes 1½ million pounds of reinforcing steel. Already purchased and scheduled for early delivery are one 1½-cubic-yard dragline, two ¾-cubic-yard draglines, one 95-horsepower tractor and bulldozer, three 110-ton steel weighing and batching plants, including scales for concrete aggregate; material for the construction of approximately 300 feet of steel-ribbed, wood-lagged siphon forms (these to be assembled this winter), eight carloads of lumber, water and storage tanks, concrete pumperete machine and pipe, three 10-cubic-foot concrete mixers, and two 7-cubic-foot concrete mixers. In addition, a contract for the preparation of 32,000 cubic yards of concrete aggregates for canal structures has been let. Surveys are in progress to determine the location and size of laterals and the location and type of lateral structures.

Caballo Dam, N. Mex.

By Ruth Ellen Ballmer, Caballo, N. Mex.

THE Government camp for the Caballo Dam nestles on the north slope of a little hill between Hatch and Hot Springs, N. Mex. It is 100 miles north of El Paso, Tex., and 180 miles south of Albuquerque, N. Mex.

Standing on the top of this little hill you can see some of the most beautiful scenery that New Mexico has to offer. To the west the mountains of the Black Range form a majestic dark background for the lighter colored, little, irregular foothills nearer. As New Mexico's golden sun comes up from the east its rays shine across the plains and touch the tips and peaks of the Black Range turning them to rich golds and reds. Cradled among the foothills are little adobe houses, typical southwestern homes. To the north, the broad, flat valley of the Rio Grande spreads out before you. Turning to the east you face the closer Caballos or "Horse" Mountains. They form the background of the river which flows at their feet. Looking toward the south you see how the cultivated parcels of ground make a patchwork on the broad valley. In the valley between the two ranges peaceful cattle graze where long ago the "First Americans" lived and went their way.

MODERN CAMP EQUIPMENT

Now, turning away from scenery and facing the reality of today, a town that has sprung up almost overnight is seen in the foreground. In this small but extremely neat camp there are 12 residences of various sizes, 1 dormitory, the office

building, the laboratory, and the garage, which also includes the shop and the warehouse. A tall water tank painted shiny aluminum, stands as a sentinel on the ridge behind the camp. The engineers with their families, who live in this camp, take great pride in its neatness. They have adhered to the typical New Mexican landscape by planting yucca, ocotilla, many types of cactus, greasewood, salt cedar, etc. At the west end of the one main street, a turn-around is uniquely planted with barrel and cane cactus. Each yard and driveway is marked off with rocks and the sidewalks have been covered with a white sand containing just enough clay to make it firm.

Everything in camp is modern and sanitary. Water, supplied from a drilled well, is plentiful, but as is usual in the southwestern country, not to be wasted. The water is pure, very soft, and potable. The sewer system is complete in all details. Camp refuse is regularly collected three or four times a week.

The houses are very conveniently and comfortably arranged. Because of the extremely hot weather during the summer months, the houses are furnished with as many windows as possible. In the summertime a special ventilating system under the eaves allows for the circulation of air over the ceilings. In cold weather, these ventilation ducts are closed. The houses are constructed of double insulating building board. Electricity is furnished by a small local plant in the garage. Electric refrigerators, kerosene hot-water heaters, and circulating oil-burning heaters are

part of the furnishing of each home. In short, everything is thoughtfully planned for the comfort and convenience of the inhabitants.

CONSTRUCTION OF DAM

The work on the dam is progressing rapidly. What took Mother Nature ages and ages to perfect and arrange is being rearranged in a very short time by the giant shovels, carryalls, and caterpillars, which aid in the building of Caballo Dam. From the foothills of the Caballos across the Rio Grande and westward a distance of about 4,000 feet a strip of land has been cleared. This is really the beginning of the Caballo Dam. Earth taken from one part of the project must be transported and rolled into place in the dam embankment. This earth must possess certain characteristics and any that does not is discarded and not allowed to be placed in the dam. Many pits have laboriously been dug in the "borrow" area and the samples taken from these tested in every conceivable manner to establish the fitness of the material. The samples are carefully screened to find the proportion of rock to fine soil; the fine materials are compacted in small cylinders with various amounts of moisture to find the comparative density and the necessary amounts of water to arrive at this density; they are later placed in a slightly larger cylinder and water allowed to seep through them to find out how much water will be passed through the various types of soil. That type which passes the greatest amount of water will be relegated to the outer portion of the dam and the soil which allows the least amount of water to go through will be placed in the center of the dam as the "core" material. All of the material, when placed in the dam will be rolled with a huge roller having many projecting feet on it. The layers will be comparatively thin, when compacted or rolled, being only 6 inches thick. All of the material as it is placed in the dam will have to be moistened to just the proper degree so that it will compact the best. Everything will have to be carefully inspected to see that it is being done in the proper manner and that the proper materials are being used.

Caballo Dam will serve two purposes. It will act as a storage dam for irrigation waters and also as a flood-control dam. Some means have to be provided to allow the irrigation water to be discharged from the dam. This will be done through an outlet tunnel. At present, the tunnel excavation is nearing completion and it eventually will traverse the east abutment



CABALLO DAM, N. MEX.

LOOKING WEST ALONG AXIS OF DAM.

of the dam and the irrigation water will flow down to the canals and laterals below the dam. This great tunnel will be 13 feet 6 inches inside diameter when it is lined with concrete 18 inches in thickness. It will be provided with adequate facilities for controlling the amount of water that will be allowed to flow through it. As a safety measure, a large spillway of approved design, is provided. This channel will be 108 feet wide and 21 feet deep at the radial gates, and will provide the overflow capacity for flood waters should it so happen that a large flood occurs in the river at a time when the reservoir is full to capacity.

At the present time, all of this work is still in its infancy. The large Diesel shovel and dragline the contractor is

using has completed nearly one-half of the excavation for the spillway and the miners are driving the tunnel from both ends. All of the loose dirt and brush has been removed from the foundation of the embankment where it goes over the higher terrain but down in the river proper where the main part of the dam is to be constructed, nothing can be done as yet because there is no place to divert the present river. This will have to wait until the tunnel is completed so the contractor can turn the water from the river into the tunnel and thus dry up the foundation of the dam so he can start placing the material upon it. Some of this river bottom sand and silt will have to be removed and the remainder compacted before actual construction of the dam section can begin.

As an added flood protection it will be necessary to divert Percha Arroyo into the reservoir. This, usually dry, tributary to the Rio Grande has been known to carry immense floods and provision must be made for them. This will necessitate the construction of a smaller diversion dam and channel and some sure means of crossing this channel with a long highway bridge.

Approximately 2 years will be required to complete the entire project. The lake formed by the waters behind the dam will extend about 15 miles to the north and the capacity of the reservoir will be approximately 350,000 acre-feet. The whole project, when completed, will cost \$2,500,000.

Facts—Not Fancy

THE ultimate Grand Coulee Dam, the foundation section of which is now under construction on the Columbia River in the State of Washington, will be as high as a 46-story building (550 feet) and as long as 14 ordinary city blocks (4,200 feet). It will contain 11,250,000 cubic yards of concrete masonry, which is about 4 times the volume of the Great Pyramid, the Pyramid of Cheops, and $3\frac{1}{2}$ times that of Boulder Dam, largest concrete dam in the world. The volume of Grand Coulee exceeds the combined volume of the 20 largest concrete dams in this country. This huge mass of concrete will weigh 23,000,000 tons. It would build a monument 100 feet by 100 feet, $5\frac{1}{4}$ miles in height; or if placed on an ordinary city block would rise 2.7 times the height of the Empire State Building in New York City (1,248 feet), or to a total height of 3,375 feet. It would build a standard paved highway 16 feet wide from New York to Seattle and return by way of Los Angeles. The concrete will require 12,500,000 barrels of cement, weighing 2,350,000 tons. If this were all shipped in one freight train, it would be 500 miles long and contain 50,000 box cars. The maximum daily requirement for cement will be 60 cars. With two mixing plants running at full capacity, it is estimated that a cubic yard of concrete will be placed in the dam every $5\frac{1}{2}$ seconds. The base of the dam covers 34 acres.

The capacity of the power plant will be 2,700,000 horsepower, 50 percent larger than the Boulder plant (largest in the world) and equaling the combined installed capacity of the 12 largest plants (with the exception of Boulder) in this

country. Eighteen main generating units will each be 30 percent larger than those at Boulder, which far exceed in size any other. Each of the generators will be 40 feet in diameter, 34 feet high, and weigh over 2,000,000 pounds. The amount of electrical energy to be provided yearly would light 4,000,000 homes. Each of the two powerhouses will be 765 feet long, 112 feet wide, and 292 feet high, or the height of a 24-story building. Power can be generated at a cost of $2\frac{1}{4}$ mills, less than one quarter of a cent, per kilowatt-hour.

The average annual run-off of the Columbia River at Grand Coulee is 79,000,000 acre-feet, with a record maximum of 101,000,000 acre-feet, or enough water to cover the six New England States with $2\frac{1}{2}$ feet of water or supply metropolitan New York City for 95 years. A spillway 1,654 feet long with a capacity of 1,000,000 cubic feet per second will be provided. This spillway can discharge 450,000,000 gallons a minute. A reservoir will be formed by the dam which will extend 151 miles to the Canadian border, the longest man-made reservoir in the world. Water stored in this reservoir will be used to irrigate a body of land comprising 1,200,000 acres, an area as large as the State of Delaware. It has been estimated that completion of the Columbia Basin project will provide homes for 1,400,000, practically doubling the population of the State of Washington. Based upon the present per-capita wealth of this region, the increase in taxable wealth will amount to \$3,000,000,000.

A pumping installation exceeding in magnitude any yet devised by pump

manufacturers will include 12 pumps of 1,600 cubic-feet-per-second capacity, and each driven by a 65,000-horsepower direct-connected motor, with a maximum pumping head of 367 feet and normal head of 295 feet. This plant will be able to handle 8,617,000 gallons per minute, or one-sixth of the average flow of the Columbia River. Approximately 600 tons of water will be lifted every second.

There will be imbedded in the dam a system of pipes containing more than 2,000 miles of 1-inch steel tubing, through which cooling water will circulate to remove chemical heat due to setting of the cement in the mass concrete.

The west side cofferdam is of the steel cellular type, 3,000 feet long, 110 feet in height and it contains 17,000 tons of interlocking steel sheet piling. There will be 60 gate-controlled outlets through the spillway section of the dam, each $8\frac{1}{2}$ feet in diameter. The spillway crest will contain 11 drum gates each 135 feet long and 28 feet in height.

The dam is located at the north end of the weirdly beautiful natural phenomenon known as Grand Coulee, at a point where the Columbia River in a prehistoric age, forced from its channel by glaciers, carved a gigantic gash in the earth's crust 50 miles long, 2 to 6 miles wide, and 600 to 800 feet deep. Employees of the principal contractor, numbering 4,000, live in Mason City, the only all-electric city in the United States. The Columbia Basin project, comprising irrigation, power development, river regulation, flood control, and improvement of navigation will require from 40 to 50 years for completion.

Vista Points on Columbia Basin Project

THE building of a dam has always been a matter of interest to the public as a whole and in the instance of the Grand Coulee Dam, this is quite pronounced as it is becoming more and more known that it is the largest structure of its kind in the world.

The dam and power plant of the Columbia Basin project are located comparatively near centers of population in the Pacific Northwest and on excellent State highways connecting important national parks. Spokane, 92 miles east, is a gateway to west coast points. Yakima is about 160 miles southwest of the dam and on the principal route to Portland, Oreg. Wenatchee is 90 miles west, on the Snoqualmie Pass road to Seattle and Tacoma. Canadian travel is via Seattle or, down the Okanogan, through Oroville.

During 1935 tourist travel to Grand Coulee was estimated at more than 150,000 and for the year 1936 it has been well in excess of 200,000.

Early in 1935 President Roosevelt, Secretary Ickes, and Dr. Moad, late Commissioner of Reclamation, issued invitations to the public interested in Government construction work to visit and inspect such projects, and this, no doubt, was largely responsible for the large influx of visitors last year. The Bureau was not prepared to give ade-

quate attention to those visitors—in fact it could give only partial attention to parties who had made appointments, but during the winter plans were perfected for two vista points, one on each side of the river, and early in the summer work on the west vista house and parking grounds was completed. Later in the season, a similar arrangement was provided across the river.

The west side vista house is located at the end of a leveled-off parking lot directly above the tailrace slope and consists of a covered grandstand where there is seating space for about 300, and car parking space for about 250 cars. The grandstand is provided with a first-class public-address loud-speaker system, including one large horn, directed to the parking area, through which arriving tourists are advised of the sightseeing facilities afforded. Entrance to the grandstand is in the center of the building and on one end is an upstairs office where the control panel of the loud-speaker is located. Underneath this, on ground level, is a room housing the nearly completed model of the dam. In addition, there are the rest rooms, a first-aid room, and a supply room.

From each vista house the tourist views the entire works area. On the west side, in addition to concrete placing, an excellent close-up is had of the di-

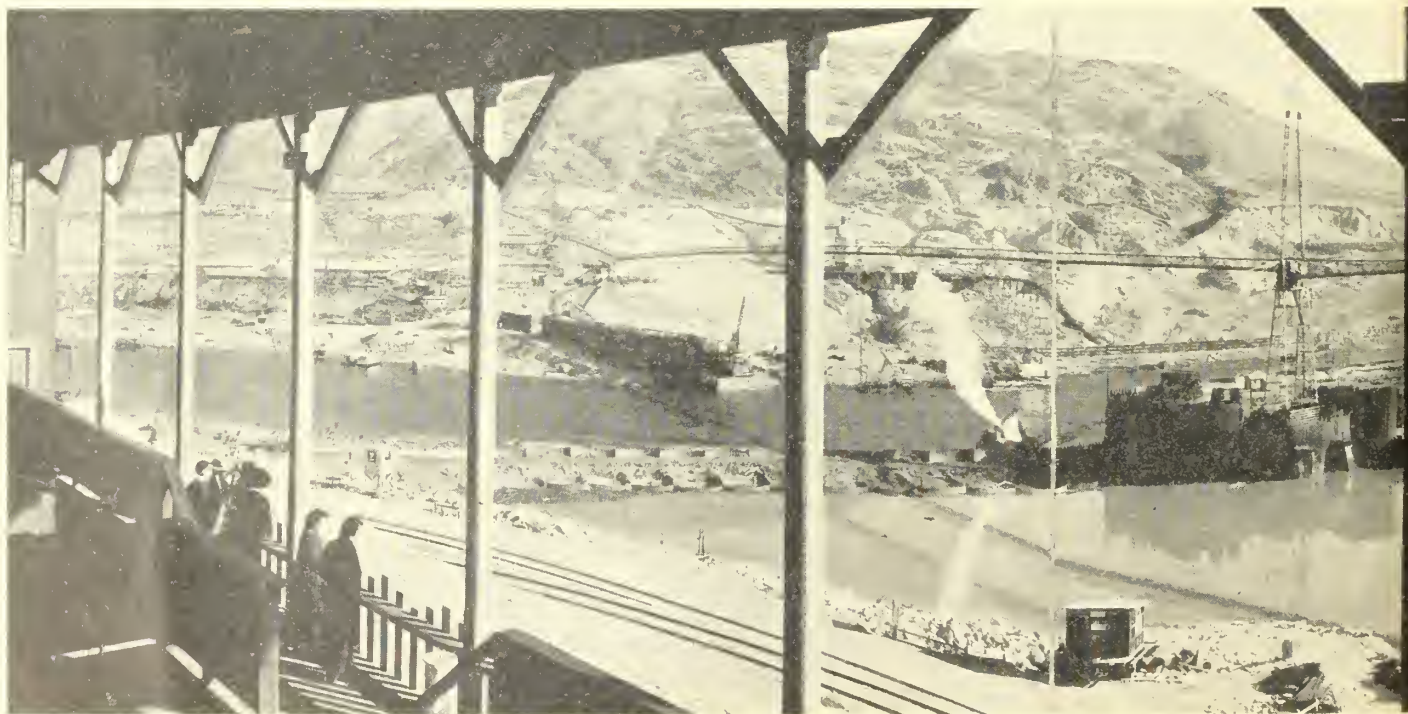
verted river. The east vista house is located adjacent to the large aggregate storage piles and to the conveyor belts transporting sand and gravel to the two concrete-mixing plants. This house has a room in which it is planned to accommodate an Indian representative from the Colville Agency, located directly northeast of the dam site. As an encouragement to Indian handicraft the representative will display and have for sale merchandise made by the Indians.

The vista points have proven very satisfactory in providing visitors with comfortable quarters and unobstructed views of the more interesting operations, without approaching areas of danger. Expressions of appreciation are often heard for the facilities available. Field glasses may be rented at a reasonable rate from a local licensee.

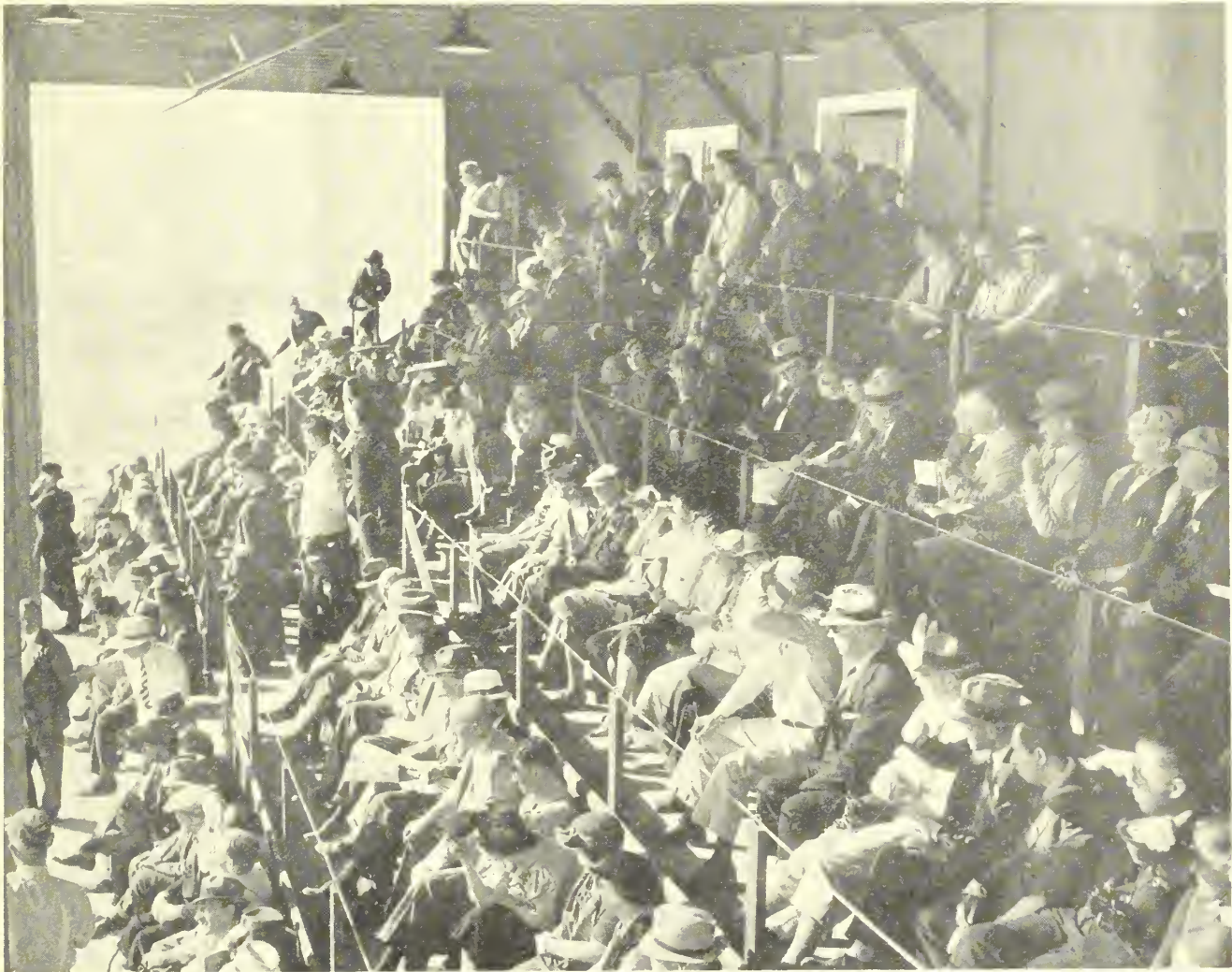
Erratum

THE title of the article appearing on pages 266 and 272 of our November issue was given as "Gold Mining on the Humboldt project, Nevada." Corrected, it should read "Gold Mining in Nevada."

ALL labor seems to be well employed on the Frenchtown project.



PANORAMA FROM WEST VISTA HOUSE WITH WEST TAILRACE FLOODED.



VISITORS FROM WORLD'S POWER CONFERENCE AT THE EAST VISTA HOUSE.



PROCEDURE INVOLVED IN THE DIVERSION OF THE COLUMBIA RIVER.

Notes for Contractors

Specification no.	Bids opened	Project	Work or material	Low bidders		Bid	Terms	Contract awarded
				Name	Address			
A-42, 106-A	Oct. 2	All-American Canal, Ariz.-Calif.	Steel reinforcement bars, 942,776 pounds.	Colorado Fuel & Iron Co.	Minnequa, Colo.	\$23,867.55	F. o. b. Knob, California, ½ percent discount.	Oct. 30
836-D	do.	do.	Trash-rack metalwork for Gila Valley canal headworks.	Associated Piping & Engineering Co.	Los Angeles, Calif.	4,248.00	Item 1.	Oct. 27
696	Sept. 30	Truckee Storage, Nev.-Calif.	Construction of Boca Dam.	Geo. W. Condon Co.	Omaha, Nebr.	6,400.00	Item 2.	Do.
698	Oct. 12	Owyhee, Oreg.-Idaho.	Earthwork and structures, Dead Ox Flat pump canal and Crystal feeder canal.	Henry L. Horn	Nyssa, Oreg.	729,435.00		Oct. 26
839-D	Oct. 19	Boulder Canyon, Ariz.-Nev.	33,000-volt transformers and switching equipment for Boulder power plant.	Standard Transformer Co.	Warren, Ohio	7,885.00	Item 1.	Nov. 3
				Pacific Electric Mfg. Co.	San Francisco, Calif.	6,100.00	Item 3.	Do.
				Westinghouse Electric & Mfg. Co.	Denver, Colo.	314.00	Item 4.	Do.
				Royal Electric Mfg. Co.	Chicago, Ill.	237.00	Item 5.	Nov. 2
				Royal Electric Mfg. Co. (No award)	do.	133.50	Item 7.	Do.
838-D	Oct. 16	Owyhee, Oreg.-Idaho.	One 12-inch manually operated gate valve and four 24-inch electrically operated gate valves.	The Kennedy Valve Co.	Elmira, N. Y.	114.50	Item 1.	Nov. 4
						3,263.64	Item 2.	Do.
29, 048-A	Oct. 15	Riverton, Wyo.	Cement, 8,500 barrels.	Monolith Portland Midwest Co.	Laramie, Wyo.	13.019	F. o. b. destination, less 50 cents tax and discount ¹	Nov. 9
845-D	Oct. 21	Boulder Canyon, Ariz.-Nev.	One 70-hp. crawler tractor (item 1).	Caterpillar Tractor Co.	Peoria, Ill.	7,245.00		Nov. 5
			One ½ c. y. truck-mounted power shovel convertible (item 2).	Harnischfeger Sales Corporation.	Milwaukee, Wis.	11,320.00		Nov. 9
699	Oct. 22	Salt River, Ariz.	40- by 44.5-foot gate and gate hoist for auxiliary spillway at Horse Mesa Dam.	Consolidated Steel Corp., Ltd.	Los Angeles, Calif.	36,027.00	Item 2.	Do.
			Valves, pipe, etc., for desilting works at Imperial Dam.	do.	do.	11,300.00	Item 3.	Do.
844-D	Oct. 20	All-American Canal, Ariz.-Calif.		S. Morgan Smith Co.	York, Pa.	32,000.00	Item 4.	Do.
704	Oct. 23	Boise-Payette, Idaho.	Earthwork, bench flume and structures.	Long Beach Iron Works.	Long Beach, Calif.	30,238.00	Items 1 and 2.	Do.
844-D	Oct. 20	Casper-Alcova, Wyo.	Dragline excavators, and buckets.	H. J. Adler Co.	Ontario, Oreg.	51,483.50	Items 1 and 4.	Nov. 12
				Haas, Doughty & Jones and Marshall & Stacey.	San Francisco, Calif.	71,973.03	Items 2 and 3.	Do.
				Bay City Shovels, Inc.	Bay City, Mich.	18,000.00	Item 1.	Nov. 13
				Harnischfeger Sales Corporation.	Milwaukee, Wis.	6,322.00	Item 2.	Do.
				Erie Steel Construction Co.	Eric, Pa.	2,000.00	Items 3 and 4.	Do.
A-42, 128-A	Nov. 2	All-American Canal, Ariz.-Calif.	Steel reinforcement bars, 651,568 pounds.	Bethlehem Steel Co.	San Francisco, Calif.	16,516.90		Nov. 18
856-D	Dec. 10	Sun River, Mont.	Open drains, earthwork and structures.					
700		All-American Canal, Ariz.-Calif.	Closed drains, stas. 3552-3713 and open drains stas. 3713-3800.					
705		Pine River, Colo.	Construction of Pine River Dam.					
706		Central Valley, Calif.	25 duplex cottages at Government camp, Friant Dam.					
707		do.	Office building, dormitories and residences, Government camp, Friant Dam.					
708		Carlsbad, N. Mex.	High-pressure gates, pipes, and needle valves for outlet works, Alamogordo Dam.					
709		Central Valley, Calif.	Earthwork, canal lining and structures, Friant-Kern Canal, stas. 4+00 to 300+69.					
710		Colorado River, Tex.	24-102-inch Paradox gates and conduit linings for Marshall Ford Dam.					
711	Dec. 14	Yakima-Roza, Wash.	Earthwork, canal lining and structures, Yakima Ridge Canal, stas. 102-198.					
712		Colorado River, Tex.	Office building, dormitory, and residences, Government camp at Marshall Ford Dam.					
713		All-American Canal, Calif.	Construction of highway and railroad siphons at stas. 3579, 3683, 3710, and 3772.					
714		Carlsbad, N. Mex., Salt River, Ariz.	Two 54-inch and two 66-inch needle valves.					
715		Salt River, Ariz.	Construction of spillway for Mormon Flat Dam.					

¹ Price per barrel.

Progress of Investigations of Projects

Blue River transmountain diversion, Colorado.—Surveys are now under way locating control for the proposed tunnels from Blue River to Williams River and from Williams River to Clear Creek and in connection with a topographic survey of reservoir sites near Empire and Idaho Springs on Clear Creek.

Colorado-Big Thompson transmountain diversion, Colorado.—All field surveys have been completed on the diversion and parties are now working on two alternate canal location alignments to furnish the North Poudre with Colorado River water. One of these plans considers taking a canal from the Poudre River above the junction of the North Fork, and by means of an exchange with Colorado River water to supply the North Poudre by gravity. The alternate plan is to hold the outlet of Horsetooth Reservoir as high as possible and cross the Poudre River in a siphon near the Greeley waterworks. A canal would carry the water from the siphon to some point along the hogback west of the Monolith Cement Plant, where it would be pumped to an elevation that would allow it to run by gravity into the North Poudre Canal. Water-supply studies are under way to determine the amount of water available at Granby Reservoir site, Ranch Creek Reservoir site, Green Mountain Reservoir site on the Blue River, and on the economic operation of the Granby Reservoir for power and irrigation purposes.

Eastern slope surveys, Colorado.—Preliminary reconnaissance surveys have been made in 12 counties in the southeast portion of the State where county commissioners, county agents, and others have been contacted in connection with all of the projects. These counties are: Baca, Bent, Crowley, Douglas, El Paso, Huerfano, Kiowa, Lincoln, Otero, Prowers, Pueblo, and Las Animas.

Western slope, Colorado.—(a) *Florida Mesa project.*—Surveys have been completed on the lower Florida Canyon; and with the exception of the Lemon Ranch, on which two possible dam sites are located, the surveys of the upper end are virtually complete. Surveys were also made for the diversion of water from the Florida River to the Pine River with irrigation-demand and water-supply studies initiated for the latter. Detail topography of dam site no. 3 on the Florida River, completed in October, indicates a storage capacity of 20,570 acre-feet with a dam raising the water level of the river 150 feet.

(b) *La Plata project.*—A topographic survey of the Long Hollow Reservoir site

was completed during October and a survey of the dam site begun. It is indicated that a reservoir capacity of 14,534 acre-feet may be obtained at this site by the construction of a dam raising the water level 115 feet. Surveys are also under way on a reservoir site on Upper Hay Gulch. A study of an off-channel reservoir at Parrott City above Hesperus for the protection of upper river diversions may result in a survey of this site.

(c) *Mancos Valley project.*—Studies have been made of a possible diversion of the East Mancos and La Plata Rivers to a reservoir on Cherry Creek for joint storage for the two projects and search has been made for reservoir sites between West Mancos River and Chicken Creek. Canal lines have been surveyed for feeder canals from Horse Creek and Middle Mancos River to the Weber Reservoir site and surveys are now being made for a canal line from the East Mancos to Horse Creek. A reconnaissance of Jackson Gulch indicates the desirability of making a topographic survey to determine the possibilities of a reservoir and dam site. Two dam sites that have been surveyed for the Galeonda Reservoir near the headwaters of the West Mancos indicate a reservoir storage capacity of 8,000 acre-feet at either location with a dam raising the water level 200 feet.

(d) *Paonia project.*—Exploration is now in progress at the Spring Creek, Minnesota, and Smith Fork dam sites by test pits and drilling in connection with the determination of the character and depth of soils that may be encountered in construction. A subdivision has been completed of the irrigation on the area served by the Overland and Fire Mountain Canals and the Le Roux Creek relative to the redistribution from these systems. Some survey work will be done on McClure Pass to verify the preliminary estimates of the feasibility of the diversion of Crystal River to Muddy Creek.

(e) *Roan Creek project.*—Topographic surveys have been completed on three reservoir sites on Kimball Creek and one each on Dry Fork, Carr Creek, and Trail Gulch, thus completing the survey work on this project. Exploration of the dam foundations along the Dry Fork and preliminary quantity estimates indicate infeasibility due to the reservoir being small, the earth fill comparatively large, the water supply inadequate, and the foundations porous.

(f) *Silt project.*—Topography has been completed in the canyon of Elk Creek, along the ridge separating that creek and West Elk Creek, the Harvey Gap Reser-

voir and on another site above the reservoir, the latter indicating a storage capacity of 5,000 acre-feet with a dam raising the water level 120 feet. Preliminary estimates indicate 3 miles of pipe line, 7 miles of canal, and 3,400 feet of tunnel to supply water from the main Elk to the Silt project through the Harvey Gap Reservoir.

(g) *Troublesome project.*—Data relative to water rights, ownerships, and location of lands and their classifications and the areas irrigated from the creek have been obtained from the county records at Hot Sulphur Springs. After completing arrangements for camp quarters at the proposed dam sites and for office space in Kremmling, field parties began preliminary surveys from Kremmling to the dam sites.

(h) *West Divide Creek project.*—A canal line location, 14 miles long, has been surveyed from the Owen Dam site on Buzzard Creek to West Divide Creek, and preliminary surveys made on the location of two tunnels. Test borings made along the canal line indicate favorable soil for canal construction. Test pits on the Owen Dam site have been completed and the last diamond-drill hole was virtually completed at the end of the month. Additional topography is being taken on the Hay Stack Reservoir site and along a canal location from the end of the Highline to Hunter Mesa.

(i) *Yampa Reservoirs.*—Surveys have been made for a canal from the river to Hunt Creek, for supplying supplementary water from reservoirs on the Yampa River to lands on these streams. Work is under way to complete the project map, land classifications, water supply, and irrigation demand studies. Diamond drilling and digging of test pits are being continued.

Rio Grande Basin, Colorado-New Mexico.—The following surveys and investigations are in progress:

(a) *Wagon Wheel Gap Dam site.*—Work remaining to be completed includes additional drilling to determine more definitely the suitability of the abutments of the dam site and for an arched dam, surveys for the relocation of highways and the railroad through the reservoir and a study of the power and water yield and utilization. The State of Colorado has requested a reservoir capacity of approximately one million acre-feet which may be obtained at this location by the construction of a dam raising the water level 325 feet.

(b) *Vega Sylvestre Reservoir and dam site.*—The results of diamond drilling ex-

plorations are not conclusive with regard to the type of dam that would have to be adopted. Future work contemplated includes additional foundation explorations and the preparation of a revised plan and estimate therefor.

(c) *Conejos Dam site*.—Additional explorations were made about 1,500 feet below the Tipton site and 8 miles above without disclosing satisfactory materials for the location of a dam. Previous engineering reconnaissance surveys in the Platoro basin of the Conejos River about 15 miles upstream from the original site, confirmed by a favorable opinion from the geologists, had disclosed the existence of four additional dam and reservoir sites which might have possibilities. Preliminary surveys of a site 3½ miles below Platoro disclosed unfavorable conditions and insufficient storage capacity at a site 1½ miles below Platoro. A third site, located about 1½ miles above Platoro, proved to be very favorable and therefore topographic surveys were made of the dam site and reservoir area.

(d) *San Juan-South Fork transmountain diversion*.—It is proposed to make further investigations of the reservoir dam sites in the summer of 1937. The investigations so far made have indicated no major physical difficulties in connection with the tunnel.

(e) *Animas-Rio Grande diversion*.—Preliminary surveys have been completed on the proposed Howardsville Reservoir site on the Animas River and along the canal lines to divert the South Fork, Mineral Creek, and Cement Creek into the reservoir and along the proposed tunnel route to a branch of the Rio Grande. Water supply studies are now being made in the Denver office, and in the Spring, field work will be continued in drilling the reservoir site, making a careful geological survey of the tunnel site and searching for and surveying of additional reservoir sites on the tributaries of the Animas River.

(f) *Weminuche Pass transmountain diversion*.—Work at this site was initiated in September 1936. Preliminary field surveys have been completed and it is anticipated that further surveys and investigations will be made in the Spring.

(g) *San Juan-Chama diversion*.—Substantially all field work has been completed at the following reservoir sites: (a) Upper and lower west forks of the San Juan, (b) Blanco, (c) Navajo, (d) Boulder Lake, and (e) Stinking Lake. Connecting canal lines have been surveyed, geological examinations of all tunnel lines completed, and test pit work and drilling practically completed.

(h) *State Line Reservoir and Dam site*.—The work comprises a detailed dam site

survey, possibly a partial reservoir survey, a geological investigation, dam site exploration, and plan and estimate of cost. Field work on these investigations will begin about the middle of November.

Boise (Boise-Weiser-Payette), Idaho.—Dam site and reservoir topography have been completed at the Upper Payette Lake site, topography for a canal location taken down the south bank of the Payette River from the proposed Garden Valley Reservoir as far as Banks and for a transmountain diversion line from the North Fork of the Payette River, near Smith's Ferry, to the Middle Fork of the Payette River, via Scriver Creek. Additional surveys are now in progress on transmountain divisions from the mouth of Six Bit Creek on the Salmon River to the mouth of Lodgepole Creek on the Payette side and from Bear Valley and Marsh Creeks to the South Fork of the Payette via Warm Springs Creek. Surveys have commenced for the Carbarton Reservoir and Dam site where topography will be taken to an elevation 80 feet above the river bed at the dam site and will include a general land classification.

Madison River diversion, Montana-Idaho.—Survey parties have completed the topography of the Cherry Creek Reservoir on Madison River about 20 miles south of Three Forks, Mont., and are now working on the dam site topography. Borings are being taken at or near the corner of each 40-acre tract along the river to obtain drainage and soil data for later alkali and chemical analysis tests.

Buffalo Rapids, Mont.—Field work on an extension of project was initiated in July 1936. Surveys of the irrigable area and land classification of the project have been completed and activities are now confined to preparation of a report.

Gallatin Valley, Mont.—An economic and soil survey has been made of the Gallatin Valley to establish the basis for water requirements of the project. The economic report of the project was completed during September and work is now under way making a revised study of the water supply and reservoir capacity and advancing the report on these investigations.

Saco Divide, Milk River project, Montana.—Field topographic surveys were completed during June 1936. Work is now confined to the Malta office where land classification areas are being computed and canal lateral systems laid out in the preparation of a final report on these investigations.

Conehas surveys, New Mexico.—Investigation was begun of the irrigation possibilities of approximately 30,000 acres of land in the vicinity of Tucumcari by

means of a main canal 65 miles long from the Conehas Reservoir just below the confluence of the Canadian and Conehas Rivers about 50 miles northwest of Tucumcari to the lateral controlling points at the project.

Deschutes, Oreg.—Investigations are now being made of a diversion from Suttles Lake to irrigate the small Plainview tract of about 4,000 acres lying southeast of Sisters, the survey involving about 20 miles of canal to reach the project, the survey of one or two reservoir sites and a possible diversion from the Metolius River into Lake Creek to replace the present rights of that stream. An estimate of an alternate North Unit canal line diverting near Cline Falls has been completed with the exception of the diversion dam, the topography of which has been submitted to the Denver office for plans. Water supply studies from Lake Creek and Suttles Lake storage and the land classification of the Plainview tract were completed during October indicating an ample supply for the 4,000-acre project considered.

Black Hills, S. Dak.—Topographic surveys have been completed for the Deerfield Reservoir site on Castle Creek, the Brennan Reservoir site located about 5 miles southeast of Rapid City and for a feeder canal thereto from Rapid Creek, the Crow Creek Reservoir site on the Belle Fourche watershed and the Pactola Reservoir about 20 miles above Rapid City on Rapid Creek. The topographic mapping of the irrigable areas on the Horse Camp project near Hot Springs was completed during October and surveys are now under way for the relocation of the railroad around the Pactola Reservoir site.

Salt Lake Basin, Utah.—(a) *Blue Bench project*.—Data are being assembled and arrangements have been made for beginning field surveys to determine the possibility of diverting water from Rock Creek to both the upper and lower Blue Benches and from the Duchesne River to the lower Blue Bench.

(b) *Currant Creek canal*.—Stream-flow records have been secured and water-supply studies are now being made to determine the quantity of water available for diversion to the Strawberry Reservoir through three alternative canal lines on which surveys and cost estimates have been prepared.

(c) *Dixie project, Utah*.—Land classification has been completed and tabulations made of all water rights as stipulated in four court decrees on adjudication of water rights covering the entire Virgin River system in the State of Utah, together with tabulations of certificates issued by the State engineer's office.

Water measurements and silt samples have been regularly taken and comparisons made with previous records, and field work has been completed.

(d) *Gooseberry project*.—Additional data on water supply have become available and studies are now being made to determine the yield of the Gooseberry Reservoir during a period of low run-off such as 1931 to 1934.

(e) *Ouray project*.—Stream-discharge observations extending over the past 2 years, water-supply studies, and canal surveys and land classifications have been completed.

(f) *Salt Lake Metropolitan Water District Aqueduct*.—Field parties are now at work making several alternate line surveys on high and low elevation alignments and taking sufficient additional side topography to permit the computation of excavation quantities for various sizes of pipe lines. An additional alternate

line was investigated for the purpose of determining the feasibility of a location on approximately the Bonneville level from the Alpine-Draper tunnel north to Little Cottonwood Creek.

Colorado River Basin.—In Utah the field work of classifying the arable land and determining the irrigated area has been completed on the Castle Creek, Blue Bench, and Ouray projects, the area along the Green River from Split Mountain Canyon to a point 10 miles below the Duchesne River and the lower 12 miles of the White River, the Duchesne, Strawberry, Lake Fork, Uinta, Whiterocks, Ashley, and Brush Creek areas. In Colorado, the field work of classifying the arable land and determining the irrigated area, and the preparation of maps have been completed on the Yampa River and the San Juan Basin. All field work and maps have been completed in the San Juan Basin, N. Mex.

Classification and maps are completed of the lower Gila and along the Colorado River below Boulder Dam in Arizona. Classification and maps have been prepared for the lands below Boulder Dam, in the Las Vegas area and the upper Meadow Valley Wash area in Nevada.

Hawaii water-supply studies, Hawaii.—Investigations are being made for the purpose of determining the amount of water that can be brought from the steep north slopes of the island of Molokai to the more gentle south slopes which are suited to farming. Trails are being cut into various watersheds; and as each is completed, the stream flow is analyzed and compared with previous records. It is anticipated that an aerial survey of the territory covered by these investigations will be made by the Army Air Corps during the month of October or November.

Excerpts from October Project Reports

Boise.—Large lettuce crop being harvested from lands below Deer Flat Reservoir.

Yuma.—On the auxiliary picking of the season's grapefruit continued throughout the month. At the end of October approximately 8 percent of the crop had been harvested. The grade and quality of the fruit this season are excellent.

Minidoka.—The potato harvest was practically completed and most of the beets had been dug by the end of the month. Although the beet yield is reported to be somewhat less than estimated, the sugar content is higher. The market price for potatoes remains high, and large quantities are being stored. A farmer near Paul harvested 57 bushels of wheat per acre from 20 acres, and 85 bushels of oats per acre.

Milk River.—Ideal weather for the completion of the sugar-beet harvest prevailed throughout the greater part of October, and at the end of the month the harvest was complete. A few beets still remain in a large stock pile at Harlem, but the greater part of the crop has been delivered to the factory. In general, yields were much better than had been anticipated and the average will be considerably above that of 1935. The quality of beets improved throughout the month and the average sugar content will be equal to or better than that of the past year.

Sun River.—Unusually good weather for harvesting prevailed during the month. In general the potato crop was exceptionally good this year, several farmers reporting yields of 400 bushels to the acre.

Klamath.—Harvesting of the potato crop was completed. The crop is the largest on record and is estimated at 7,500 cars.

Owyhee.—The harvesting of all crops except corn is practically completed. The sugar-beet crop exceeded all estimates. The highest yield reported was 28 tons per acre. One field of 107 acres averaged 20 tons per acre, and yields on the new lands, from which sagebrush was cleared last spring, averaged 10 to 15 tons per acre. The initial payment due November 15 on these beets is expected to be \$5.50 per ton. Indications are that there will be a considerable increase in beet acreage next season, as many farmers are already preparing old alfalfa fields for the planting of beets. The corn crops, it is estimated, will be the best ever had in this locality, with yields to date averaging 80 to 100 bushels per acre.

Yakima.—The excellent early demand for Jonathan apples from the valley is attributed largely to the national advertising campaign begun recently by Washington State Apples, Inc. Government market news reports of prices in eastern markets on Jonathan apples indicates an increase of 13 to 37 cents a box following the initiation of the campaign, according to the secretary-manager of the organization. Export shipments have been rushed to the coast in anticipation of the long-expected longshoremen's strike. Potatoes advanced in price during the month from \$22.50 to \$30 per ton for the No. 1 grade. Shipments of apples and pears so far this season have been greater than in any year since 1931, according to reports

of the Yakima Valley Traffic and Credit Association.

The price of wool this season ranges from 23 to 26½ cents a pound, which is 3 to 4 cents higher than at this time last year. To date about 100,000 pounds of wool have been sold in the valley.

Shoshone.—Sheep and cattle are in excellent condition. The winter range adjacent to the project is in fair condition, and the demand for range land continues strong. Practically every available acre on the project is now under lease.

Moon Lake.—Harvesting of crops was completed. Yields have been better this year than for several years past. Sheep and livestock from the ranges are in excellent condition. Marketing conditions for dairy and poultry remained good.

Frenchtown.—Good prices are being received for all farm products, as well as livestock.

Sanpete.—Crop yields were very good for the year. The harvest was completed during the month. Sheep and cattle from the grazing areas were in excellent shape. Considerable winter feeding of livestock will be made on project lands. Prices remained good for dairy and poultry products.

Rio Grande.—The ginning of cotton by the end of the month was well advanced. About 36,000 bales will be ginned from an estimated area of 31,200 acres, or about 1.15 bales per acre. This average was about 28 percent higher than the previous project average. All growing crops were in good condition.

Old and New World

By C. Christopoulos, Civil Engineer, Division Director, Bureau of Agriculture, Greece¹—Rockefeller Fellow for the Study of Agriculture in the United States, 1936

ALTHOUGH it might be appropriate if I dealt with a strictly engineering subject I have chosen instead the Old and New World. In this brief paper my aim is only to answer two of the more usual questions asked of an engineer who has crossed the Atlantic and the Continent to study the amazing progress of this country. These questions, so often asked, concern the situation in the Old World and a visitor's impressions of this country.

Greece, my native country, probably is not a representative illustration of the European countries as a whole, but undoubtedly it is the oldest of them. On the other hand, America is the youngest country in the world. Comparisons of conditions and impressions of the oldest and youngest of the civilized countries are really interesting and informative providing they are impartial.

Though it is a salient characteristic of the average American that his patriotism causes him to desire the preeminence of everything American, it would show lack of respect to my readers if I attempted to misrepresent my real impressions.

Geographically, Greece occupies the southeast peninsula of Europe lying between almost the same parallels of latitude as Colorado. Its mountains rise abruptly out of the sea to maximum elevations of about 10,000 feet. Many of the intervening valleys are a continuation of estuaries, but some of them are entirely separated from the sea. The prevailing geological formations are limes, marbles, schists, and conglomerates with white and blue colors predominating. These contrast to the volcanic formations and the brown, yellow, and gray colors of the western mountains of the United States. Concerning climate, we have from three to four rainy months, from December to March, and a very dry summer with occasional cloudbursts. The precipitation average ranges from about 15 inches on the eastern coast to about 30 inches on the west coast.

GRECIAN HYDRAULIC PROBLEMS

It seems that from the most ancient times this country has had big hydraulic problems. Most of the 12 labors of Hercules seem to have been hydraulic

¹ Mr. Christopoulos, who has recently spent some time at the Bureau of Reclamation with a view to becoming familiar with the more recent developments in irrigation practice, gives in this article something of Grecian conditions and some of his intimate impressions of this country after a year of residence and study.

engineering tasks, and indicate the type of difficulty lying in the subconscious thoughts of the people. It can be said that Grecian precipitation phenomena are very similar to that in the western part of the United States. Usually the highest temperatures are 100° to 110° F. and lowest winter temperatures are 30° to 40° F. Our soils are largely pure clays and clays mixed with sand. The present area is about 90,000 square miles with a population somewhat less than 7,000,000.

All of our valleys are badly in need of: (1) Protection from floods; (2) drainage in their lower parts; and (3) irrigation, which now, such as it is, is pumped from poor, individual wells.

At the present time our main agricultural products are grains, grapes, raisins, olives and olive oil, tobacco, and oranges. Our raisins, grapes, wines, and tobacco are of especially high quality. Industry is an important part of our national economy, but our population is more than 50 percent agricultural. Land is our main natural resource, but water is our most valuable potential resource with respect to irrigation and power.

Those who are responsible for the present and future welfare of our population have been seriously confronted with the problem of overpopulation, especially after the influx of about 1,500,000 refugees, an increase of nearly 23 percent to the population of the country. It seems that there is no solution other than the intensive development of our natural resources; especially since all doors to emigration have been closed to us.

That which in ancient times constituted the strength of the Greek nation and the main cause of its civilization, i. e., geographical position and the mountainous character of the country, has turned to be the source of its present troubles. Located in the middle of the Mediterranean it has easy access to all the then known world. It colonized most of the Mediterranean littoral at various periods when the metropolitan territory was not large enough to support its people, developed an unequaled civilization, and spread it all over the world. Then it had to fight against its neighbors and other barbaric nations, in order to defend its independence. It has been fighting and bleeding thousands of years. It fell more than once, but rose again full of vitality. We never have been numerous, probably on account of the continuous fighting. It is said that even in our most flourishing age, the age of Athens, Sparta,

Socrates, Plato, Pericles, Demosthenes, and Alexander, the population did not exceed 15,000,000.

DIFFICULTIES OF MODERN GREECE

Modern Greece, having inherited most of the bad qualities of its ancestors, some of their good ones, and none of the international conditions that were favorable in ancient times, tries strenuously to keep up in progress and civilization. It has good educational institutions, fairly good administration, and an excellent judiciary; but its geographical position places the country in the midst of conflicting interests. Its mountainous character makes for very difficult living conditions and causes the development of national resources to be expensive. Our main problems nowadays are: First, peace; and second, engineers, economists, and leaders, well-trained and honest.

Some months ago one of the most prominent Americans, the editor of the New York Times, Dr. Ogden, addressing the students of the University of California on the occasion of its anniversary, held that due to the fact of the very similar physical conditions existing between Greece and some of the Western States, the inheritance of Grecian civilization falls upon these peoples. Though Greece is by no means dead and so can hardly be inherited, and though the fruits of the Grecian civilization are an inexhaustible source which will be put to the use of all the world forever, it is true that the United States, better than any other country, is in a position to create an entirely new civilization, maybe greater than that of the Grecian, if any comparison is possible. If the physical conditions can have any effect it is true that there is much likeness between Greece and this country and a similar development of civilization seems probable.

GRECIAN ARCHITECTURE IN AMERICA

It is surprising the degree to which Grecian architecture adapts itself to this country. This Grecian architecture, born under blue skies and bright sunshine, finds itself at home in western United States. When the visitor looks at the beautiful American monumental buildings he does not get tired, but finds an infinite harmony between the architecture and surrounding nature. This is not true of the architecture transplanted here from northern cloudy European countries.

The fact that American architects have continued to use for more than 100 years Grecian styles for their monumental buildings is a proof of its adaptation and physical harmony.

Let us hope that under these clear skies and bright sunshine the Western States will perfect poetry, abstract thought, philosophy, and arts that were the main features of the ancient Grecian civilization of which Byron said, "To cherish Greece is to cherish the entire world." It is true present American civilization is not distinguished for abstract thought; on the contrary, the scientists of this country are distinguished for insisting upon tangible proof of the truth they are seeking. The laboratory is more extensively used in this country and in the various branches of knowledge than anywhere else. Maybe this is because of the practical ends which American scientists seek. After the pioneer conquered this country, the Americans at once turned to developing it intensely and its heterogeneous leaders were confronted with vital and vexing practical questions rather than with problems of pure thought and inspiration, consideration of which only takes place under well-established and traditional civilizations.

It is true that the first impression of the visitor from abroad is that this country is still under development. Very sparsely populated and with a history of a few decades it cannot be expected to have already reached the highest levels of human thought; but it has all the required background to exceed everything known up to the present, abundant natural resources, an extremely favorable international position, and a population full of vitality and eager for knowledge and progress. This country, quite young, the melting pot in which several nationalities have been fused, not only free from hampering traditions but on the contrary with traditions of freedom, progress, and confidence born of surmounting the obstacles of nature, promises to surpass all other nations in every branch of human activity and knowledge.

ENGINEERS PIONEERS IN COUNTRY'S DEVELOPMENT

Engineers have been and still are the pioneers in the development of the United States. Mining, irrigation, railroads, highways, electricity, and other engineering activities are the fundamental means of this development. The American engineer, subduing nature and putting it at the disposal of the American people, providing them, even to the most remote farmer, with more comforts than the world has ever known, is the main factor

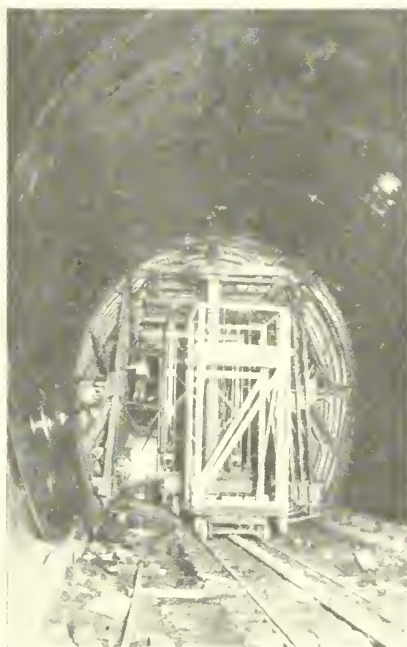
in the development and progress of this country, a country which is the most typical illustration of the present mechanical civilization. Here, more than elsewhere, engineers justify the inspired comparison which Mr. P. H. Holme draws in the columns of the Encyclopedia Britannica between "God Himself and the engineer."

Undoubtedly the leader in the development of the Western States has been the United States Bureau of Reclamation. Traveling through this country one thinks that the arid lands, covered with sagebrush, are endless; suddenly one

comes upon a paradise, an irrigation district, green, full of life, entirely electrified, with all the advantages of an abundant civilization.

I confess I envy you, young engineers of America. Under the guidance of the most experienced engineers in the world you are being trained for the most useful of human activities, that of forming a solid foundation for the unsurpassed civilization which is now being created by the American people; the strongest, healthiest, and most apt people for high ideals in all the world.

Parker Dam Construction



LINING FORMS AND SECTION OF FINISHED ARCH LINING IN DIVERSION TUNNEL NO. 2.

The Colorado River again has been driven from its bed to permit excavation of the foundation of a dam across its channel.

The river has been diverted successfully through two tunnels at the site of Parker Dam. This structure, 155 miles downstream from Boulder Dam during the con-

struction of which the river first was diverted, is being constructed to re-regulate the river, generate hydroelectric power, and to divert water into the aqueduct of the Metropolitan Water District of Southern California.

Two tunnels 29 feet in diameter and 1,730 feet long were drilled through the mountain on the Arizona side of the river and they are now carrying the flow of the Colorado River past the dam site. It is expected the river will flow through these tunnels for about 2 years before it is returned to its normal channel to fill the reservoir and flow over the completed crest of the dam. At the end of their service as diversion tunnels these bypasses will be sealed with concrete plugs.

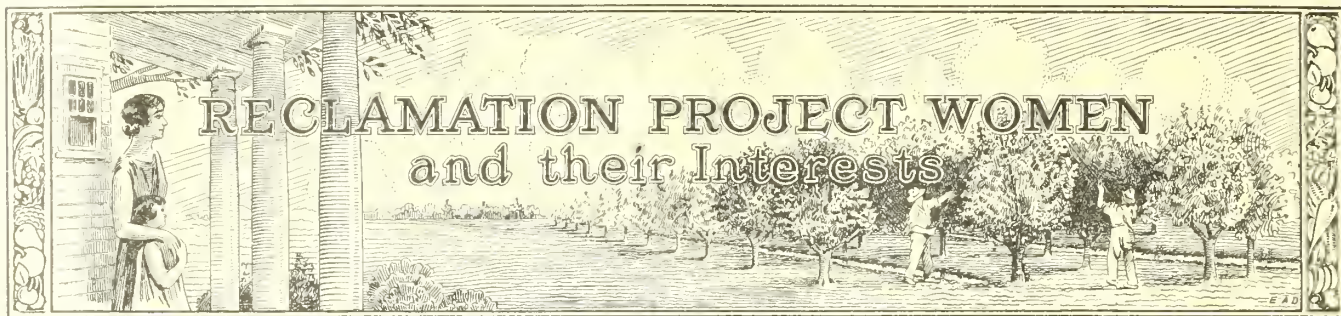
Dikes thrown across the river forced the waters into the tunnels. The two dikes, one upstream and one downstream, will form the enclosure in which two cofferdams will be constructed immediately, these to protect the excavation for the foundation. The upstream cofferdam will be 75 feet high, the downstream cofferdam 35 feet. The excavation will be about 240 feet deep.

Parker Dam will be a 340-foot concrete arch structure forming a reservoir of 700,000 acre-feet. It will raise the river 100 feet.

The diversion was made when the river flow was about 7,000 cubic feet, that being the quantity released at Boulder Dam. The tunnels are designed to safely carry 60,000 cubic feet per second.

A 40-acre farm 1 mile northeast of Rupert, Minidoka project, recently sold for \$4,000. Another farm of the same size near Heyburn, with about 25 acres in cultivation, and moderate improvements, brought \$2,300. A third 40-acre tract 1½ miles southwest of Burley sold for \$5,000. It is said to be well improved.

CONSIDERABLE mining activity is taking place in the Awakening Hills District, Humboldt project, about 60 miles north of Lovelock, where the famous Austin mine has been discovered. The development of this district will provide an excellent market for products raised in the Lovelock Valley.



Thirty Years of Reclamation on the Klamath Project

By Elizabeth Butler Loosley, Klamath Falls, Oreg.

NINETEEN hundred and six marks the year the Government took over the irrigation of the Klamath Basin, and now 30 years later, results are amazing. Klamath ranks first in the production of lumber and potatoes; her barley is noted for its malt content. Two years ago three farmers pooled their barley crop and it netted them \$200,000.

Modern school buildings, with gymnasiums, cafeterias, and buses that take children to and from school, are ours. An active parent-teachers association shows what women can do. Recently attending one of their meetings I heard two boys, aged 10 and 11 years, give an illustrated talk on forestry. It was well delivered, enlightening, and comprehensive. Delicious refreshments, made by the 4-H girls, were served by future hostesses with all graciousness. You should see the nicely appointed tables these girls prepare and the teas they preside over. The women took advantage of this occasion to display school work. The sewing is of a practical nature—undies, dresses, hats, and rugs. Some of the art turned out is very up-to-

date. You would scarcely recognize a wooden chopping bowl done in orange shades and blues as a utensil; it takes on an allure and would brighten any kitchen. The paper racks, end tables, and book ends the boys make come in for their share of decoration too.

Not only is the 4-H work directed along domestic lines, but the boys are also raising stock and poultry and are growing produce under skilled supervision.

COUNTY AGENT ACTIVE

For the past 18 years Klamath County has employed a technically trained county agent who advises and assists the farmers in the cultivation and selection of seed, in pest control, eradication of weeds, purchase and handling of dairy stock, and through his office cooperative marketing has assumed an important place in the management of farm business.

Enumerated are some of the associations that have been created to help the farmer: Turkey Grower, Poultry, Milk Marketing, Western Cattle Marketing, Klamath County Dairymen, Tule Lake Potato, and Hay Grower's.

Study groups, a League of Women Voters, a Round Table group who are studying international affairs, as well as charitable organizations, are in existence in Klamath Falls. Adjacent smaller towns have study clubs and branch libraries, and the women from the farming districts drive in to give some of the best papers on subjects pertinent to the times. Such activity is made possible by the fact that the homes are electrified and modern in every respect, a condition that greatly simplifies the work and allows ample leisure for community development.

Recently a woman said, "Tell me the date your study group meets so I can plan my marketing day. You see, I bring dressed chickens in once a week and I'll make the two coincide." One can readily see such mothers are going to continue to advance and see that their children have all advantages. Of course we realize all of our schools offer the opportunities listed and most of our communities afford the advantages enumerated, but nowhere have they been advanced more rapidly with greater outstanding results. One young man made the Olympic games, one recently was called to Walt Disney's studio, while others have walked off with scholarships and prizes given for growing stock and produce.

If you want a bird's-eye view of a portion of this vast country, visit the lava beds, climb Gilliam's Bluff. The panorama—fields outlined and interlaced with waterways, haystacks, herds of cattle sheep, and tukeys, potato cellars, granaries, and warehouses—tells why two railroads were eager to build into this territory.

RAILROADS

The Southern Pacific in 1909 built a branch line from Weed, Calif.; in 1926 this was extended to Portland, Oreg., and became the main line of the Southern Pacific system. This meant the business was here. In 1929 the Modoc Northern was built from Klamath Falls, Oreg., to Alturas, Calif., connecting with the



JUST ONE OF KLAMATH'S MANY MODERN HOMES.

Central Pacific at Fernley, Nev. In 1932 the Great Northern constructed a standard gauge from Klamath Falls to Bieber and a connecting line was built by the Western Pacific from Kiddie, Calif., on the main line. So the Klamath Basin towns have main lines to north and south and a direct connection with the east via Fernley over the Central Pacific. Also there is the Oregon, Pacific & Eastern Railway from Klamath Falls to Bly, Oreg., 65 miles, which serves inland country, largely forest products. As the basin is surrounded by sagebrush plateaus and forest ranges it is ideal stock country. These latter assets, timber and stock, linked with irrigation, originally attracted the railroads. So often we accept these developments without pausing to consider why they come. Irrigation is the answer!

In 1925 there were 1,115 acres in potatoes. By 1931 this had increased to 9,853 acres and 3,841 carloads had been shipped in 1936 by April. This year more than 4,000 carloads have gone out with another 2,000 to follow.

Modern bank buildings and 14 churches are in Klamath Falls, and each small town has a bank and at least two churches. It is no wonder that the back-to-the-farm movement has attracted so many to the Klamath Basin when we review its many advantages. Every acre is inhabited and producing, and the products are being marketed at the best prices. You see no abandoned farms.

There is still land to be put on the market. It is the Tule Lake sump lands, a portion of the old lake bed. This is south of the Government dike, that separates irrigable land from the



FIRST NATIONAL BANK, KLAMATH FALLS, OREG.

area reserved for dumping waste and drainage; 29,000 of the 39,000 acres is good land, smooth and fertile, and can be cropped, as it can be irrigated from confined waters within the diked system so long as the inflow of waste and drainage water can be prevented from overlapping the dikes. The Bureau of Reclamation has provided for discharging the flow of drainage, by pumping plants (numbers 4 and 5), into distributing canals to deliver water to agricultural lands of the sump when needed. It seems that time is here. This means still more land will come to life and that production will be increased.

RECREATIONAL FEATURES

Summing up all the advantages the people of this district enjoy we must not

overlook the fact that the lakes, the rivers, and the turbulent streams that feed this project, afford sports. There is swimming at all times, there is skiing and skating in winter, and fishing for the spring and on through the season. Powerboats dash around buoys and launches carrying gaily dressed crowds and zooming bands, white sailboats dip and skim across blue-green waters of Upper Klamath Lake until as you view the regatta you might well imagine yourself in Naples. When the frost has touched vines to gaudy hues and the crops are harvested, hunting takes its place in sports whether it is for elk, deer, or antelope, sage hens, china pheasants, or quail. At this time the round-ups are also on and one meets large herds being moved in to winter feed. Driving these thousands of cattle calls for the picturesque chuck-wagon, the folk songs, and tall tales around campfires, all of which make of this an occasion. (The writer does not wish to leave the impression our stock is not up-to-date; they know the truck, for many go to market this way; saddle horses are to be seen trucked from one drive to another to spell them; they know the trains and loading pens, for thousands of heads are shipped in to fatten here; they know the airplane, for wild horses are rounded up with them. What looks the queerest is a Ford saddled with one or more stock saddles.)

Considering the 30 years since its inception the Klamath project has accomplished much. It was largely under Dr. Elwood Mead's direction and guidance that all this has come to be. When we think of his passing we can truthfully say, "What more fitting monument for so great a man. He has made possible a soil rich in production, a people rich in happiness and contentment."



RESULTS—WHEAT GROWN ON KLAMATH PROJECT.

A Project Cooking School

By Miss Lois Bailey, Home Economist, Idaho Power Co.

MOST large cities have their weekly cooking schools but very few rural communities have the privilege of having a cooking school brought to them. That, however, is just what the Idaho Power Co. has done for the settlers along a new power line extension built last year between Vale and Harper, Oreg., on the Vale project.

Most of us consider that the days of pioneering are over, but in this locality it has just begun for some 80 families, and with the aid of electricity the women of these families are making very modern homes on land that was previously barren sagebrush country. There are 79 customers on 30 miles of line, and 44 of this number use electric cookery; 26

have electrically heated water. Because of the large number of new range customers the Idaho Power Co., with the aid of the kitchen coach, sent their home economist out to aid the women in the use of their electrical equipment by holding classes in this model kitchen trailer.

TRAVELLING KITCHEN

Pictures of the trailer are shown in this article. The interior was planned as a model kitchen with a seating capacity of 15 people. It is equipped with an electric range, refrigerator, dish washer, water heater, ample cupboards, excellent lighting and small appliances such as iron, toaster, electric mixer, and roaster.

Fifteen women were invited at each meeting and then a regular discussion of all homemaking problems was held as a typical kitchen-aid class worked out during the afternoon. The program was: First a sponge roll, which is a "never fail" recipe, and it is so good that the home economist tossed it around before the women and later served it to prove that it really was not tough. The recipe is as follows:

5 eggs, separated
 $\frac{3}{4}$ cup sugar
 $\frac{3}{4}$ cup flour (sifted 5 times)
 $\frac{1}{4}$ teaspoon salt
 1 teaspoon baking powder
 Beat whites until stiff, add half sugar, beat yolks until lemon colored, add half sugar. Sift dry ingredients together and add to the combined mixtures above. Bake in a cookie sheet lined with wax paper and bake at 375 degrees for 20 minutes. Roll and let cool, and then unroll and frost.

Miracle frosting

1 cup honey
 2 unbeaten egg whites
 Place this in the small bowl and turn mixer on high. Beat until stiff and fluffy.

This recipe shows a method of using an electric oven for a baking operation, and the frosting the use and advantage of an electric mixer.

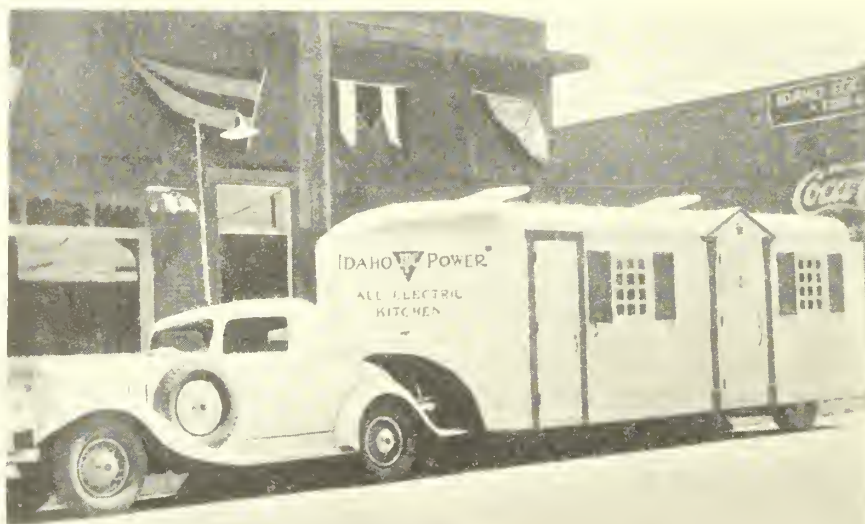
Next an oven dinner was taken from the refrigerator and placed in an electric roaster. This consisted of beef roast, browned potatoes, buttered carrots, and cherry pudding. The pudding recipe is also recommended to be excellent and is as follows:

2 cups cherries and juice
 $\frac{1}{2}$ cup sugar
 2 tablespoons tapioca
 Place in buttered casserole
 Mix $\frac{1}{4}$ cup butter, $\frac{1}{2}$ cup sugar and $\frac{3}{4}$ cup flour; add to top of cherry mixture. Bake for one hour and a half at 400 degrees.

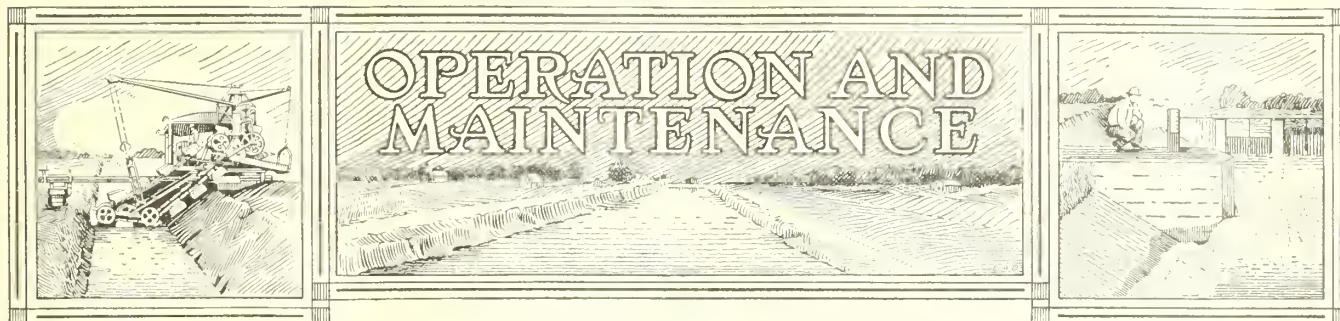
With this meal, a discussion followed on the value of foods and economy of the oven dinner. The refrigerator played an important part in this oven dinner because it saves and preserves the food until it can be used, and also by proper planning a woman can save time on actual preparation and cooking time of foods.

To complete the program a broiled dinner was placed in the oven to show the

(Continued on p. 300)



EXTERIOR AND INTERIOR VIEWS OF THE IDAHO POWER COMPANY'S KITCHEN COACH, IN WHICH THE COMPANY'S HOME ECONOMIST, MISS LOIS BAILEY, CONDUCTS COOKING SCHOOLS ON THE VALE PROJECT, OREGON.



Over-Irrigation

THE practices followed in some localities where water for irrigation is applied in quantities greatly in excess of the requirements for crop growth, and where water users fail to observe the principles of beneficial use, create conditions and problems which are of utmost concern to those charged with the responsibility of establishing and maintaining proper practices and conserving the two major natural resources of land and water, and in which the water users themselves should be even more vitally concerned.

George K. Parker, Chief Engineer, South San Joaquin Irrigation District, Manteca, Calif., in an address before the California Irrigation Districts Association during April 1936, directed thoughtful consideration to the effects of over-irrigation. The subject is so important to water users everywhere that the following extracts from Mr. Parker's remarks, as printed under the caption "Drainage and Irrigation" in *New Agriculture* for October 1936, are quoted for the benefit of readers of *The Reclamation Era*.

DRAINAGE REQUIRED

"All irrigated areas require drainage of some kind, either natural or artificial, surface or subsoil, varying only in method and degree. Irrigated areas having natural drainage are fortunate in that respect, although very few are so situated that over-irrigation will not indirectly damage adjacent areas at lower levels, and leach the area so irrigated, particularly if water is cheap and plentiful.

"The correct solution of the drainage problem for a given condition is susceptible to determination and control by competent authority available for the purpose. I think we will agree that the question of cost should be the greatest concern of the sources that have to pay; and yet the question of the excess use of water is given very little consideration, if any, by the sources that have to pay. Also these same sources are the only human ones who can control the cause of

the need for drainage, and thus indirectly the cost.

REDUCED PRODUCTIVITY

"In addition to the serious increased capital and operating cost of drainage, due to overapplication of water, there is the serious question of leaching the high lands to a point where production therefrom will be insufficient to pay the cost of drainage of excess water from the low lands; thus all the land sooner or later becomes submarginal in character relative to production. In fact, some authorities question the possibility of permanent civilization in irrigated areas where water is improperly applied. There is a great deal of historical data, both ancient and modern, in support of this point of view.

"If the members of the association will visualize the size of irrigation checks and the length of irrigation furrows, common to the major irrigation districts, I think you must agree that it is physically impossible to supply sufficient water to crops at the lower ends of such checks and furrows without seriously oversupplying the upper ends thereof, and if it does nothing else, this oversupply will eventually sterilize the local soil through leaching, and adjacent lands through high water table. In fact, the difference in fertility between the lower and upper ends of such checks and furrows, over thousands of acres, is visible to the naked eye; and it is only a question of time until soil so treated will go out of profitable production, and the best drainage system that could be devised would not prevent it, as the leaching process would still continue.

"The deterioration is usually so slow that the people affected hardly realize the situation before culmination. However, it is not the less sure and inevitable.

INFLUENCE OF ABUNDANT SUPPLY AND LOW WATER COST

"I am referring to all artificially irrigated areas anywhere that water is obtainable at comparatively low cost, that

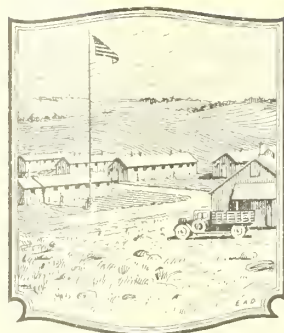
is to say, where there is not the automatic control of high cost or scarcity, or both. I will go further and say that overirrigation will ruin any soil anywhere for profitable production, and drainage will not cure the situation.

"Obviously, the answer is conservation of use and not drainage; and in areas such as I have described conservation of use is squarely up to the irrigator because, as you gentlemen know, and none better, governing bodies of elective or appointive officers seldom if ever can control the electors in such matters without their voluntary consent, and consent to direct compulsive control relative to the distribution of water is hard to get and difficult to administer, particularly where water is plentiful and distributed on a flat-rate basis. In fact, history and experience records show no instance of successful control of irrigation in those irrigated areas operating on a flat-rate basis where water is plentiful."

ACTUAL construction of a million dollar beet sugar factory at Toppenish, Yakima project, was started the latter part of September by the Utah-Idaho Sugar Co. Beets harvested this year in the Yakima Valley will be processed at the company's plant in Bellingham.

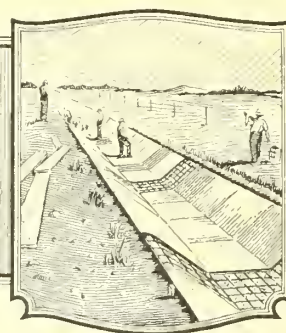
MANY potato dealers on the North Platte project, Nebraska-Wyoming, are enlarging storage facilities. Bean storage and cleaning plants are also being enlarged. Construction of an artichoke sugar factory has been started at Gering. All beet-sugar factories will operate this year.

UNEMPLOYMENT conditions on the Moon Lake project, Utah, are at a minimum owing to the construction program at Moon Lake Dam and the oiling and improvements to State roads in the vicinity by State road commission.



EMERGENCY CONSERVATION WORK

Civilian Conservation Corps



E. C. W. Activities on Reclamation Projects

By Louis S. Davis, Engineer, Emergency Conservation Work

AN Inspection trip to many of the C. C. C. camps operating under the work supervision of the Bureau of Reclamation was made in September by the writer, visiting 20 camps in Wyoming, Montana, Washington, Oregon, Idaho, Utah, and Colorado.

The first camp visited was BR-7 at Deaver, Wyo., on the Frannie division of the Shoshone project. This is not a thickly settled project and many canals and laterals extend for miles before water is delivered to the land. When camp BR-7 was established, the canal system was badly run down. Today, although much remains to be done, the main canals are cleaned, the ditch rider can use his car on the banks, and laterals are restored to their original carrying capacity. Drainage ditches have been cleaned and deepened. When the Bureau laid out the village of Deaver in 1917, a wood stave pipe line was laid from the reservoir to supply the town with water. This pipe deteriorated until it is now unserviceable, and the C. C. C. enrollees are replacing it with a new wrapped steel pipe, coated with asphalt, which should serve the town for many years.

IN MONTANA

At Ballantine, Mont., on the Huntley project, the enrollees from camp BR-57 have accomplished much work that will stand as a monument to them for years to come. In the past the Yellowstone River has ruined many acres of excellent farm land by erosion. Enterprising farmers have tried to control it and save their farms, but without success. The boys at camp BR-57 have built several rock jetties and dug a new channel. The high waters of last spring did no damage, and sand bars are forming below the jetties. It seems certain that "old man river" is rapidly coming under control on the Huntley project. These boys are also laying tile drains to reclaim water-logged lands and are building the Anita Dam, which will conserve water and reduce pumping requirements.

Camp BR-33, on the Sun River project, Montana, is a summer camp. The main canal traverses miles of open prairie where roads are but trails and often impassable. During the past summer, an operating road was built along this canal, which will provide a quick, safe access to the diversion dam and will greatly facilitate operation of the canal. A break in the concrete-lined channel, below the tunnel at the head of the canal, was quickly repaired with the help of the C. C. C. boys, and water again turned into the canal with a minimum of inconvenience to the water users.

At the summer camp BR-32, which is located on the St. Mary storage unit of the Milk River project, at Babb, Mont., the entire company, less the headquarters detachment, was fighting a serious forest fire in Glacier National Park. The regular summer work of this camp, excavating the steel siphon of the St. Mary canal system and placing it on concrete piers to avoid continued rusting, has been delayed by the calls for fighting forest fires.

IN WASHINGTON AND OREGON

The next visit was made to camp BR-48, on the Columbia Basin project, at Grand Coulee Dam, Wash. Enrollees at this camp are most fortunately situated. The work they are doing in landscaping and providing tourist facilities is varied and interesting. They have an opportunity to learn the details of landscape gardening and the procedure of construction being followed in the erection of the dam.

There are two summer camps assigned to the Yakima project, Washington, camp BR-49, which has been clearing the Clear Creek Reservoir area of dead and down timber; and camp BR-50, which has been doing similar work on Lake Kachess Reservoir area. While the work programs of these two camps are almost identical, the methods of transportation to and from work are widely different. At camp BR-49 the boys ride to work in

trucks. At camp BR-50 they ride on a large raft, towed and pushed by motor boats.

Camp BR-44, at Stanfield, Oreg., has been doing wonderful work on the rehabilitation of the Stanfield project, consisting in the replacement of flumes with lined canals on fills, restoring canals to their original carrying capacity, and replacement of old canal structures with new structures. While the camp has been assigned to the Stanfield project, it has generously divided the services of the C. C. C. enrollees between themselves and the nearby Hermiston and Westland projects. Results have been gratifying to all three projects, and camp BR-44 has made a place for itself in the community.

Two camps are located on the Owyhee project—camp BR-42, at Ontario, Oreg., and camp BR-43, at Nyssa. Both camps have been puddling the canals to eliminate leaks and paving the slopes on curves to prevent erosion. Canal banks have been leveled and surfaced to provide operating roads. Camp BR-42, on the Owyhee project, suffered a severe loss when Camp Superintendent Charles M. Jump died suddenly on Sunday, October 11.

The next stop was made at Vale, Oreg., where camp BR-45 is located on the Willow Creek division of the Vale project. Camp BR-45 will be remembered as long as water runs and concrete endures on the Willow Creek division, as the boys from the camp are building the main lateral system of this unit. At the end of October, they had moved 113,000 cubic yards of earth in the excavation of 60 miles of laterals and the construction of 385 concrete structures, involving 800 cubic yards of concrete.

IN IDAHO

The Boise project, Idaho, has three E. C. W. camps, one of which is inactive. Camp BR-24 is located at Deer Flat Reservoir, and is engaged in the work of restoring the impounding embankments,

which had been badly eroded by wave action, to their original cross section, and of paving their slope to prevent future erosion. All the rock used has to be quarried and hauled to the dam. The work that has been accomplished would be a credit to stonemasons of many years, experience. Camp BR-25, which is located at Arrowrock Dam, has been building a road up Grouse Creek, in cooperation with the Forest Service, to provide access to the area south of the reservoir. This camp was suspended on October 15, its uncompleted work to be continued by a side camp from BR-26, at Black Canyon Dam, which had been closed during the summer but was re-opened in October to complete the work planned around Black Canyon Dam and vicinity.

The next stop was made at camp BR-27, on the Minidoka project, Idaho. This camp is ideally situated on the shores of Lake Walcott. Their work has been the rock paving of eroded canal banks, the construction of operating roads, and the removal of rock obstructions in the canal. In cooperation with the Biological Survey, it is planned to provide protection for nesting places of water fowl through the creation of ponds having permanent water levels made by damming some of the ravines leading into Lake Walcott.

IN UTAH AND COLORADO

The Ogden River project, Utah, has been assisted materially by camp BR-12. The boys from this camp have cleared the reservoir area for Pine View Dam and have done a large amount of work on the 75-inch wood-stave pipe line. A side camp from BR-12 has constructed a canal for the Strawberry Valley project to divert Currant Creek and intercept run-off for the Strawberry Reservoir. This side camp was moved to Hyrum Dam when winter conditions prohibited work at Currant Creek.

The people on the Moon Lake project will long appreciate camp BR-11, which has constructed a canal system for the project. Midview Dam and dike, also under construction by this camp, are nearing completion and will soon be storing water in the Midview Reservoir for this project.

The Grand Valley project, Colorado, is fortunate in having two camps—BR-22, at Grand Junction, and BR-59, at Palisade. One has but to visit this project and view the work done to realize the value of the accomplishments to the project. The enrollees have lined miles of canals, thus conserving water and lowering the water table below the canal. They have replaced hundreds of old wooden structures in the lateral system



TOP: ENROLLEES LAYING RIPRAP—LOWER EMBANKMENT DEER FLAT RESERVOIR, BOISE PROJECT, IDAHO.
BOTTOM: C. C. C. CREW AT CHANNEL OUTLET, CLEANING AND SLOPING STANFIELD CANAL, STANFIELD PROJECT, OREGON.

with new concrete structures. They have cleared miles of ditches of brush and weeds and repaired or built operating roads throughout the project to facilitate the operation of the canal system.

The enrollees of camp BR-23, on the Uncompahgre project, Colorado, have won a place in the hearts of both the people of Montrose and the water users, by their conduct on the job and off. Their work has been the betterment of the project by the revetment of river and canal banks with large rock to prevent erosion, by the replacement of old structures with new, and by lining the canals and laterals with concrete.

A side camp from BR-23 completed in October a truck trail to the east portal of

the Gunnison tunnel. Where formerly a horse-drawn vehicle could get to the east portal with difficulty, a truck can now be driven over a good mountain road with safety.

It is impossible, in this space, to enumerate all the accomplishments of Emergency Conservation Work at the camps on the Reclamation projects. Suffice to say that their work is well done; is accomplished with great pride; and in amount and quality is a direct reflection of the ability and efficiency of the supervisory personnel. With competent supervision, the C. C. C. man will turn out as much and as good work per hour as the average man working for a contractor or on force account.

Reclamation Organization Activities and Project Visitors

John C. Page, Acting Commissioner of Reclamation, addressed the Washington Society of Engineers at the Cosmos Club in Washington on the night of November 4. Mr. Page discussed his recent field trip and illustrated his talk with motion pictures gathered last summer on the Owyhee, Casper-Alcova, and Columbia Basin projects by Ray B. Dame, Assistant Director, Motion Picture Division, and with shots on Boulder Dam made by Field Photographer B. D. Glaha.

Mr. Page returned to Washington on December 12 from Spokane, Wash., where he attended and addressed the National Reclamation Association, November 23-24. (See pp. 273-276.)

During the absence from the Washington office of the Acting Commissioner, George O. Sanford, General Supervisor of Operation and Maintenance, was designated Acting Commissioner.

Mr. Sanford gave an illustrated lecture on Grand Coulee Dam to the members of the Engineering Society of Western Massachusetts in Springfield on December 15. On the same date the Boulder Dam films were shown at the noon meeting of the Rotary Club at Holyoke.

Professor E. D. Tetreau, of the department of rural sociology at the University of Arizona, Tucson, recently called at the Yuma project office relative to a survey in Yuma County of rural population mobility and agricultural labor, conducted under his direction by four W. P. A. enumerators. The objects of the survey, which will include four Arizona counties (including Yuma), are as follows: (1) To find a concrete picture of when and where agricultural labor is needed in irrigated areas; (2) to find out how much of a supply of labor is available within practical driving distance.

L. M. Windsor, irrigation engineer, Bureau of Agricultural Engineering, Department of Agriculture, and Fred F. Friend, associate chief engineer, Bureau of Biological Survey, were visitors on the Carlsbad project during October.

C. A. Lyman, inspector for the Bureau, spent several weeks in Washington early this fall, and later visited the Klamath project.

J. L. Lockbridge, engineer examiner for the Public Works Administration, was a recent visitor on the Colorado River project, Texas.

Harold J. Mower, Project Superintendent, Survey of Federal Archives, WPA District No. 3, and field workers Clifford La Bronte, J. Vaur Waters, and Alma Rawlings made a survey of Moon Lake project office records and files during the month of October.

The following resignations have been submitted:

Miss Laura M. Williams, All-American Canal project, effective close of September 30.

Fred King, Central Valley project, Antioch, Calif., increased salary, effective close of September 5. His new address is Escelon, Calif.

Elmer J. Nemmers, assistant engineer, Riverton project, effective at the close of September 15.

William W. Lance, engineer, Denver office, at the close of October 31, to accept employment at Knoxville, Tenn., with the Tennessee Valley Authority.

The Secretary of the Interior has approved the following transfers:

Harold W. Brewer, junior engineer from Montrose to Fort Collins, Colo.

Bernard D. Glaha, photographer, from the Boulder Canyon to the Central Valley project.

J. W. Murphy, general foreman, from the Uncompahgre to the Casper-Alcova project.

Mrs. Vera S. Lachenmyer's reinstatement as assistant clerk, Orland project, was authorized by the Secretary and Departmental notice thereof issued on October 29.

J. R. Thompson was reinstated as general foreman on the Uncompahgre project.

Kenneth C. Bellows was recently appointed by transfer as assistant engineer to the Denver office from the War Department.

The Secretary of the Interior has approved the following transfers to the Denver office:

Virgil L. Minear, associate engineer, from the Owyhee project.

Henry E. Stradley, Jr., junior engineer, from Heart Mountain Division, Shoshone project.

J. Wayne Cahoon, junior engineer from St. George, Utah.

Joseph M. Barrett, from junior engineer, Ogden River project, to assistant engineer in the Denver office.

John H. Gibson, inspector, from Ogden River project.

William F. Bingham, associate engineer, from the Moon Lake project.

Edgar O. Baird, inspector, from the Humboldt project.

William Killmore, assistant engineer from the Taylor Park Dam, Uncompahgre project.

A. S. C. E. Meeting in Chicago

Means of farm improvement, from apples to water control and from the farm home to the "back forty", were discussed at the winter meeting of the American Society of Agricultural Engineers at Chicago, November 30 to December 4, the week of the International Livestock, Hay and Grain Exposition.

Individual papers on specific subjects, some of which were illustrated with motion pictures, were presented and discussed.

Cooking School

(Continued from p. 296)

broiling operation, which is so successful in an electric range. The dinner consisted of broiled veal chops, peas, potatoes, and apricots.

At the close of the meeting the women were served the sponge roll and tea, and they seemed to enjoy this type of meeting and to have gained a great deal of knowledge about their equipment.

FARM sales on the Belle Fourche project show greater activity in the number of inquiries received from the dry-land areas, and several deals in taxed farms and also for private holdings have been reported recently.

THE Federal Land Bank of Yakima reports that since the first of the year 92 sales of farms, representing a total value of \$234,000, have been made in Yakima and Benton Counties. A number of the sales were made to parties outside of the State.

ADMINISTRATIVE ORGANIZATION OF THE BUREAU OF RECLAMATION

HAROLD L. ICKES, SECRETARY OF THE INTERIOR

Theodore A. Walters, First Assistant Secretary, In Charge of Reclamation.

John C. Page, Acting Commissioner, Bureau of Reclamation

Miss Mae A. Schnurr, Assistant to Commissioner and Chief, Division of Public Relations; George O. Sanford, General Supervisor of Operation and Maintenance; D. S. Stuver, Asst. Gen. Supr. of Operation and Maintenance; John C. Page, Chief Engineering Division; A. R. Golze, Supervising Engineer, E. C. W. Division; Wm. F. Kubach, Chief Accountant; Charles N. McCulloch, Chief Clerk; Jesse W. Myer, Chief Mails and Files Division; Miss Mary E. Gallagher, Secretary to the Commissioner

Denver, Colo., United States Customhouse

R. F. Walter, Chief Eng.; S. O. Harper, Asst. Chief Eng.; J. L. Savage, Chief Designing Eng.; W. H. Nalder, Asst. Chief Designing Eng.; L. N. McClellan, Chief Electrical Eng.; Kenneth B. Keener, Senior Engineer, Dams; C. M. Day, Mechanical Eng.; H. R. McBurney, Senior Engineer, Canals; E. B. Debler, Hydraulic Eng.; I. E. Houk, Senior Engineer, Technical Studies; Spencer L. Baird, District Counsel; L. R. Smith, Chief Clerk; Harry Caden, Fiscal Agent; A. McD. Brooks, Purchasing Agent; C. A. Lyman, Field Representative; L. S. Davis, Engineer, E. C. W. Division.

Projects under construction or operated in whole or in part by the Bureau of Reclamation

Project	Office	Name	Title	Chief clerk	Name	Address
All-American Canal	Yuma, Ariz.	R. B. Williams	Constr. engr.	J. C. Thrailkill	R. J. Coffey	Los Angeles, Calif.
Belle Fourche	Newell, S. Dak.	F. C. Youngblutt	Superintendent	J. P. Siebeneicher	W. J. Burke	Billings, Mont.
Boise	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Boulder Dam & power plant	Boulder City, Nev.	Ralph Lowry	do.	Gail H. Baird	R. J. Coffey	Los Angeles, Calif.
Burnt River	Unity, Oreg.	Clyde H. Spencer	do.		B. E. Stoutemyer	Portland, Oreg.
Carlsbad	Carlsbad, N. Mex.	L. E. Foster	Superintendent	E. W. Shepard	H. J. S. DeVries	El Paso, Tex.
Alamogordo Dam	El Sumner, N. Mex.	Wilfred W. Baker	Engineer		do.	do.
Casper Alceva	Casper, Wyo.	H. W. Bashore	Constr. engr.	C. M. Vosen	W. J. Burke	Billings, Mont.
Central Valley	Sacramento, Calif.	W. R. Young	do.	E. R. Mills	R. J. Coffey	Los Angeles, Calif.
Colorado River in Texas	Austin, Tex.	H. P. Bunker	do.	William F. Sha	H. J. S. DeVries	El Paso, Tex.
Columbia Basin, Grand Coulee Dam	Coulee Dam, Wash.	F. A. Banks	do.	C. B. Funk	B. E. Stoutemyer	Portland, Oreg.
Deschutes	Bend, Oreg.	C. C. Fisher	Engineer		do.	do.
Frenchtown	Missoula, Mont.	J. W. Taylor	Resident engr.		W. J. Burke	Billings, Mont.
Gila Valley	Yuma, Ariz.	R. B. Williams	Constr. engr.		R. J. Coffey	Los Angeles, Calif.
Grand Valley	Grand Junction, Colo.	W. J. Chiesman	Superintendent	Emil T. Ficenec	J. R. Alexander	Salt Lake City, Utah.
Humboldt	Reno, Nev.	L. J. Foster	Constr. engr.	George B. Snow	do.	do.
Klamath	Klamath Falls, Oreg.	B. E. Hayden	Superintendent	W. I. Tingley	B. E. Stoutemyer	Portland, Oreg.
Milk River	Klamath, Mont.	H. H. Johnson	do.	E. E. Chabot	W. J. Burke	Billings, Mont.
Chain Lakes Storage	do.	do.	do.	do.	do.	do.
Minidoka	Burley, Idaho	Dana Templeton	do.	G. C. Patterson	B. E. Stoutemyer	Portland, Oreg.
Moore Lake	Duchesne, Utah	E. T. Westhouse	Constr. engr.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
North Platte	Guernsey, Wyo.	C. F. Gleason	Supt. of power	A. T. Stimpf	W. J. Burke	Billings, Mont.
Ogden River	Ogden, Utah	J. R. Iakisch	Constr. engr.	H. W. Johnson	J. R. Alexander	Salt Lake City, Utah.
Orland	Orland, Calif.	D. L. Iakisch	Superintendent	W. D. Funk	R. J. Coffey	Los Angeles, Calif.
Owyhee	Boise, Idaho	R. J. Newell	Constr. engr.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Parker Dam	Parker Dam, Calif.	E. A. Moritz	do.	Geo. W. Lyle	R. J. Coffey	Los Angeles, Calif.
Pike River	Bayfield, Colo.	Charles A. Burns	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Prairie River	Salt Lake City, Utah	E. O. Larson	Engineer	Francis J. Farrell	do.	do.
Rio Grande	El Paso, Tex.	L. R. Flock	Superintendent	H. H. Berryhill	H. J. S. DeVries	El Paso, Tex.
Caballo Dam	Caballo, N. Mex.	S. F. Creel	Constr. engr.		do.	do.
Riverton	Riverton, Wyo.	H. D. Comstock	Superintendent	C. B. Wentzel	W. J. Burke	Billings, Mont.
Salt River	Phoenix, Ariz.	E. C. Koppen	Constr. engr.	Edgar A. Peck	R. J. Coffey	Los Angeles, Calif.
Sanpete	Salt Lake City, Utah	E. O. Larson	do.	Francis J. Farrell	J. R. Alexander	Salt Lake City, Utah.
Shoshone	Powell, Wyo.	L. J. Windle	Superintendent	L. J. Windle	W. J. Burke	Billings, Mont.
Shoshone Heart Mountain	Cody, Wyo.	Walter F. Kemp	Constr. engr.		do.	do.
Stanfield	Boise, Idaho	R. J. Newell	do.	Robert B. Smith	B. E. Stoutemyer	Portland, Oreg.
Sun River, Greenfields div.	Fairfield, Mont.	A. W. Walker	Superintendent		W. J. Burke	Billings, Mont.
Truckee River Storage	Reno, Nev.	L. J. Foster	Constr. engr.		J. R. Alexander	Salt Lake City, Utah.
Umatilla (McKay Dam)	Pendleton, Oreg.	C. L. Tice	Reservoir supt.		B. E. Stoutemyer	Portland, Oreg.
Uncompahgre: Taylor Park	Gunnison, Colo.	A. A. Whitmore	Engineer	Ewalt P. Anderson	J. R. Alexander	Salt Lake City, Utah.
Repairs to canals	Montrose, Colo.	C. B. Elliott	Constr. engr.	do.	do.	do.
Upper Snake River Storage	Ashton, Idaho	H. A. Parker	do.	Emmanuel V. Hillius	B. E. Stoutemyer	Portland, Oreg.
Vale	Vale, Oreg.	C. C. Ketchum	Superintendent		do.	do.
Yakima	Yakima, Wash.	J. S. Moore	do.	Philo M. Wheeler	do.	do.
Rozz div.	do.	Chas. E. Crowner	Constr. engr.	Alex S. Harker	do.	do.
Yuma	Yuma, Ariz.	R. C. E. Weber	Superintendent	Noble O. Anderson	R. J. Coffey	Los Angeles, Calif.

1 Acting

2 Non Federal

3 Island Park Dam.

Projects or divisions of projects of Bureau of Reclamation operated by water users

Project	Organization	Office	Name	Title	Name	Address
Baker (Thief Valley division)	Lower Powder River irrigation dist.	Baker, Oreg.	A. J. Ritter	President	F. A. Phillips	Keating
Bitter Root	Bitter Root irrigation district	Hamilton, Mont.	N. W. Blindauer	Manager	Elsie H. Wagner	Hamilton
Boise	Board of Control	Boise, Idaho	Wm. H. Tuller	Project manager	F. J. Hanagan	Boise
Grand Valley, Orchard Mesa	Orchard Mesa irrigation district	Grand Jctn., Colo.	Charles Tharp	Superintendent	C. J. McCormick	Grand Jctn.
Huntley	Huntley irrigation district	Ballantine, Mont.	E. E. Lewis	Manager	H. S. Elliott	Ballantine
Klamath, Langell Valley	Langell Valley irrigation district	Bonanza, Oreg.	Chas. A. Revell	do.	Chas. A. Revell	Bonanza
Klamath, Horseshoe	Horseshoe irrigation district	do.	Henry Schmor, Jr.	President	Dorothy Evers	do.
Lower Yellowstone	Board of Control	Sidney, Mont.	Axel Person	Manager	O. B. Patterson	Sidney
Milk River: Chinook div.	Alfalfa Valley irrigation district	Chinook, Mont.	A. L. Benton	President	R. H. Clarkson	Chinook
do.	Fort 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
do.	Paradise Valley irrigation district	Zurich, Mont.	D. V. Norton	Superintendent	J. F. Sharpless	Zurich
do.	Zurich irrigation district	Harlem, Mont.	J. H. Birdwell	Manager	H. M. Montgomery	do.
Minidoka: Gravity	Minidoka irrigation district	Rupert, Idaho	Frank A. Ballard	do.	W. C. Trathen	Rupert
Pumping	Burley irrigation district	Burley, Idaho	Hugh L. Crawford	do.	Frank O. Redfield	Burley
Gooding	Anier Falls Reserv. Dist. No. 2	Gooding, Idaho	S. T. Baer	do.	P. T. Sutphen	Gooding
Newlands	Truckee-Carson irrigation district	Fallon, Nev.	W. H. Wallace	do.	H. W. Emery	Fallon
North Platte: Interstate div.	Pathfinder irrigation district	Mitchell, Nebr.	T. W. Parry	do.	Flora K. Schroeder	Mitchell
do.	Gering-Fort Laramie irrigation dist.	Gering, Nebr.	W. O. Fleenor	Superintendent	C. G. Klingman	Gering
do.	Goshen irrigation district	Torrington, Wyo.	Bert L. Adams	do.	Mary Harrach	Torrington
Northport div.	Northport irrigation district	Northport, Nebr.	Mark Iddings	do.	Mabel J. Thompson	Bridgeport
Okanogan	Okanogan irrigation district	Okanogan, Wash.	Nelson D. Thorp	Manager	Nelson D. Thorp	Okanogan
Salt Lake Basin (Echo Res.)	Weber River Water Users' Assn.	Ogden, Utah	D. D. Harris	do.	D. D. Harris	Ogden
Salt River	Salt River Valley W. U. A.	Phoenix, Ariz.	H. J. Lawson	Superintendent	F. C. Henshaw	Phoenix
Shoshone: Garland div.	Shoshone irrigation district	Powell, Wyo.	F. E. Martin	President	Geo. W. Atkins	Powell
do.	Deaver irrigation district	Deaver, Wyo.	Floyd Lucas	Manager	Lee N. Richards	Deaver
Strawberry Valley	Strawberry Water Users' Assn.	Payson, Utah	William Grotgut	President	E. G. Breeze	Payson
Sun River: Fort Shaw div.	Fort Shaw irrigation district	Fort Shaw, Mont.	E. J. Gregory	Manager	E. J. Gregory	Fort Shaw
Greenfields div.	Greenfields irrigation district	Fairfield, Mont.	A. W. Walker	do.	H. P. Wangen	Fairfield
Umatilla: East div.	Hermiston irrigation district	Hermiston, Oreg.	E. D. Martin	do.	Enos D. Martin	Hermiston
West div.	West Extension irrigation district	Irrigon, Oreg.	A. C. Houghton	do.	A. C. Houghton	Irrigon
Uncompahgre	Uncompahgre Valley W. U. A.	Montrose, Colo.	Jesse R. Tompson	Acting supt.	J. Frank Anderson	Montrose
Yakima, Kittitas div.	Kittitas reclamation district	Ellensburg, Wash.	W. V. Russell	Manager	G. L. Sterling	Ellensburg

Important investigations in progress

Project	Office	In charge of--	Title
Colorado River Basin, sec. 13	Denver, Colo.	P. J. Preston	Senior engineer.
Columbia Basin Economic Survey	Coulee Dam, Wash.	F. A. Banks	Construction engineer.
Gallatin Valley	Bozeman, Mont.	P. R. Robertson	Engineer.
Colorado-Big Thompson	Denver, Colo.	P. J. Preston	Senior engineer.
Island of Molokai	Honolulu, Hawaii	Hugh Howell	Engineer.
Boise	Boise, Idaho	Lester C. Walker	do.
Rio Grande	Denver, Colo.	Wm. G. Sloan	do.
Western Slope	Grand Junction, Colo.	Frank C. Merriell	do.

SALLIE A. B. COE, Editor.



GILA VALLEY PROJECT, ARIZONA
AN EXCAVATOR AT WORK ON THE GILA MAIN CANAL IS SEEN FRAMED BETWEEN GIANT CACTI



INDEX
THE RECLAMATION ERA. VOLUME XXVI
For the year 1936

Page numbers for separate issues

No.	Month	Pages	No.	Month	Pages
1.	January	1-32	7.	July	157-180
2.	February	33-60	8.	August	181-200
3.	March	61-80	9.	September	201-220
4.	April	81-104	10.	October	221-248
5.	May	105-132	11.	November	249-272
6.	June	133-156	12.	December	273-300

A

	Page		Page
Agency Valley Dam	86	Bell, Frank T., Romance under water	62
Agriculture, western, limited	232	Belle Fourche, farm census on, shows improvement	45
Aid for needy on Reclamation projects	46	Benchmarks, cooperate to preserve	162
Air coolers, description of home-made	196	Biddle, Maj. Gen. John, dies	60
Alexander, J. R., contractual set-up of a Federal irrigation project	114	Big-horn sheep, king of island in Lake Mead, killed	113
All-American Canal and appurtenant works	195	Bird refuge, a game	176
All-American Canal, construction of substructures of powerhouses	195	Bishop, Henry C., Yakima employee, dies	179
All-American Canal, Imperial Valley joyful over	47	Bishop, Marvin L., western wool grower needs reclamation	163
All-American Canal job, feminine experts on	187	Blue River, \$100,000 allotted for survey of	99
All-American Canal program sponsored by A. S. C. E.	73	Boettcher, W. A., Yuma pastures aged mule	153
All-American Canal, progress on	177	Boulder City settles down to permanency	93
All-American Canal to skirt Calexico	72	Boulder City, the building of	110
American Falls Reservoir District No. 2 v. Crandall, et al., opinion of Circuit Court of Appeals	140, 161	Boulder Dam, Babcock and Wilcox contract completed	231
American Falls Reservoir District No. 2 v. Crandall, et al., petition for rehearing denied	251	Boulder Dam generator is installed and penstock tested	73
American Society of Civil Engineers meeting in Chicago	300	Boulder Dam heat problem (editorial)	8
Appropriations for reclamation construction ample	185	Boulder Dam, important dates in history of	84
Arizona, history of irrigation development in	226	Boulder Dam in Chicago	49
Arizona's petition, Supreme Court denies	251	Boulder Dam in miniature	135
August project reports, excerpts from	240	Boulder Dam of world fame	10
Australian reservoir filled	167	Boulder Dam, operation of	83

B

Bailey, Lois, a project cooking school	296	Boulder Dam power plant, the planned use of color at	12, 48
Ballmer, Ruth Ellen, Caballo Dam, New Mexico	284	Boulder Dam, Six Companies' contract completed	69
Banks, F. A., Columbia Basin investigations and their purposes	95	Boulder Dam tourist mecca (editorial)	184
Banks, F. A., discusses Columbia development at N. R. A.	3	Boulder elevator service	186
Banks, F. A., significance of Grand Coulee Dam	278	Boulder, progress at	135
Bartlett Dam contract awarded	187	Boulder Reservoir officially named Lake Mead	35
Bashore, H. W., progress at Casper-Alcova	53	Brome grass, magazine recognizes value of	77

	Page		Page
Brumbach, Mrs. Mary, the Kingman Kolony Book Club	59	Crandall et al. v. American Falls Reservoir District No. 2, petition for rehearing denied ..	251
Burch, Albert N., dies	104	Crop, one, versus diversification	148
Bureau of Reclamation in Colorado, operations of	129	Crop values, average, per acre by 5-year periods ..	148
Bureau's program, excellent progress made on ..	40	Cropped area, percent of—comparisons of Shoshone and Newlands projects	149
Burlew, E. K., Administrative Assistant to the Secretary of the Interior, pays tribute to Dr. Mead	35	Crops for 1934 on 25 Federal irrigation projects (table)	79
		Cunningham, R. K., dies	80
		Cyrus Hall McCormick medal awarded to Dr. Mead	135
		D	
C		Dams, a bibliography on	219
Caballo Dam, New Mexico	284	Dams, high, in the United States	22
Caballo Dam on Rio Grande to be constructed ..	10	Dams, large, in the United States	50
California-Pacific and Texas Centennial Expositions	136	Dams, the highest and the largest	227
Canning operations, a Sunnyside water user's ..	101	Dana, Marshall N., pays tribute to Dr. Elwood Mead	115
Casper-Alcova, progress at	53	Davis, Louis S., E. C. W. activities on Reclamation projects	298
Casper-Alcova project, construction of the	282	Denver office engineers attend World Power Conference	230
Cattle feeding, extensive, planned for Yuma project	267	Department of the Interior, new building dedicated to conservation	105
Cattle-raising business	59	Depression, wholesome lessons taught by	137
Central Valley dams site investigations	217	Dibble, Seth H., a river labors and brings forth life	232
Central Valley project (Calif.), work to start on ..	11	Dibble, Seth H., nature lends a helping hand on the Milk River project	177
Central Valley staff	113	Dibble, Seth H., why not irrigation	253
Child welfare conference	135	Diversification, one crop versus	148
Christopoulos, C., Old and New World	292	Drafting division moves	200
Civilian Conservation Corps, The: Irrigator	268	Drought committee report	227
Coe, Sallie A. B., first impressions of the West ..	262		
Coke, W. W., value of ladino clover for pasture ..	98		
Colorado Canyon's secrets unlocked	6	E	
Colorado irrigation and power development and Rocky Mountain area receive allotments ..	99	E. C. W. activities on Reclamation projects	298
Colorado, operations of Bureau of Reclamation in	129	E. R. A. production garden and cannery on the Shoshone project	126
Colorado River of Texas project	186	Eastern industry profits by western reclamation ..	
Colorado River project of Texas, fund for restored	42	October inside front cover	
Colorado State-wide conference	109	Electrified farms on Grand Valley project	189
Columbia Basin development	3	Elephant Butte Lake popular	173
Columbia Basin engineers play basketball	93	Emergency Conservation Work activities	102
Columbia Basin investigations and their purposes	95	Emergency Conservation Work safety program ..	175
Columbia Basin project, vista points on	286	Emergency Conservation Work, Yuma project, Arizona-California	124
Columbia River, project returns to its ancient course	188	Eminent domain, the Federal Government's power of	64
Columbia River, salmon preservation on	62	Estes Park, what happened at	159
Commercial fertilizer profitably used	261	Exhibit, Bureau's at Third World Power Conference	229
Conference on snow measurements held at Ontario, Oreg	135	Exhibits, reclamation, now on display	205
Conservation			
Conservation (editorial)	90	F	
Construction program of Bureau of Reclamation, Congress provides funds for ..	197	Farm career, a	248
Construction, Reclamation, to date	250	Federal reclamation, is it foolishness	63
Consulting boards, meeting of	270	Feed the plant and the plant will feed you	123
Contractors, notes for	17,	Feminine experts on All-American Canal job ..	187
53, 70, 91, 117, 145, 170, 193, 214, 236, 256, 288	288	Fifty thousand turkeys	126
Contractual set-up of a Federal irrigation project	114		
Cooking school, a project	296		
Cotton, early ginning of, on the Yuma project ..	202		

	Page		Page
Project reports, excerpts from April 1936.....	152	Sanpete County Cooperative Sawmill Association.....	212
Project reports, excerpts from May 1936.....	175	Sautet Dam, the highest dam in France.....	52
Project reports, excerpts from June 1936.....	183	Schnurr, Mae A., National Reclamation Association (editorial).....	277
Project reports, excerpts from July 1936.....	218	Schnurr, Mae A., pays tribute to Dr. Mead.....	35
Project reports, excerpts from August 1936.....	240	Schnurr, Mae A., Public Relations service.....	252
Project reports, excerpts from September 1936.....	265	Schnurr, Mae A., the life and work of Dr. Elwood Mead.....	157
Project reports, excerpts from October 1936.....	291	Schnurr, Mae A., what happened at Estes Park.....	159
Project woman's interests, one.....	244	Schools in the Grand Coulee Dam area.....	85
Public land opening—Sun River.....	41	Scroggs, M. D., Sunnyside water user's canning operations.....	101
Public Relations service (editorial).....	252	Seminole damsite, methods at.....	234
R		Settlers' banquet at Nyssa, Oreg.....	178
R. E. A. electrified farm.....	254	Sharkey, F. J., schools in the Grand Coulee Dam area.....	85
Rappleye, Howard S., cooperate to preserve benchmarks.....	162	Singleton, H. P., progress made in irrigation research at Prosser.....	96
Reclamation..... November inside front cover		Snow measurements, conference on.....	135
Reclamation benefits.....	116	Specifications to schools.....	89
Reclamation construction program—national support deserved.....	185	Steele, Byrum W., resigns.....	179
Reclamation construction, tentative program for.....	198	Stoutemyer, B. E., legal status of water rights in Pacific Northwest.....	26
Reclamation, eastern industry profits by western October inside front cover		Sugar-beet seed growing on the Rio Grande irrigation project.....	78
Reclamation, Federal.....	133	Sun River land opening.....	41
Reclamation, the objectives of.....	273	Sunnyside division of the Yakima project allotted funds for a W. P. A. project.....	42
Reclamation, 30 years of, on the Klamath project.....	294	Sunnyside division, Yakima project, the social side of the.....	270
Reclamation tourist travel overcomes eastern prejudice.....	47	Sunnyside water user's canning operations.....	101
Reclamation, why the wool grower needs.....	160	Supreme Court denies Arizona's petition for rehearing.....	251
Repayment policy of the Bureau of Reclamation.....	81	T	
Reservoirs, large, in the United States.....	88	Texas and California-Pacific expositions.....	136
Rio Grande Basin, \$30,000 allotted for study of water resources in.....	99	Texas, floods in.....	270
Rio Grande irrigation project, sugar-beet seed growing on the.....	78	Third World Power Conference, Bureau officials participated.....	230
Rocky Mountain area and Colorado irrigation and power developments receive allotments.....	99	Third World Power Conference, foreign delegates to, called at Washington office.....	229
Roosevelt, President, appoints drought committee.....	187	Transmission lines.....	171
Roosevelt, President Franklin D., pays tribute to Dr. Mead..... February inside front cover		True, Allen Tupper, color and decoration at Boulder power plant.....	12, 48
Roosevelt, President Franklin D., sends greetings to National Reclamation Association January, December inside front cover		Turkey raising on Klamath project.....	216
Roosevelt, President Franklin D., started the first generator at Boulder Dam power house.....	224	Turkeys, 50,000.....	126
Ross, M. S., Sanpete County Cooperative Sawmill Association.....	212	Tuttle, Mrs. Ella S., one project woman's interests.....	244
Rothbard, S., the Federal Government's power of eminent domain.....	64	Tuttle, Mrs. Ella S., retired.....	122
Roza division, fossil remains found on.....	200	Tuttle, Mrs. Ella S., the Grandview Woman's Club.....	100
Russia builds huge plants to water Armenian deserts scheduled to cost millions.....	167	Tuttle, Mrs. Ella S., the social side of the Sunnyside division, Yakima project.....	270
Rye Patch Dam completed.....	174	U	
S		United States Chamber of Commerce, western division of, adopts resolution.....	42
Salmon, preservation of industry on Columbia River.....	62	United States v. Orr Water Ditch Co.....	84
Salt River contract ratified.....	43	Utah State Fair, Weber County exhibit.....	28
Sanford, Trent E., Boulder Dam in Chicago.....	49		

V		Page
Vale project, a project cooking school on.....	296	
Vale project goes forward.....	121	
W		
Walter, Chief Engineer, and Commissioner Mead to serve on subcommittee of American Na- tional Committee.....	10	
Walter, R. F., pays tribute to Dr Mead February inside front cover		
Walters, T. A., First Assistant Secretary, returns from West.....	247	
Warden, O. S., Reclamation November inside front cover		
Warden, O. S., wholesome lessons taught by depression.....	137	
Warne, William E., Congress provides funds for construction.....	197	
Warne, William E., orchard experiments dis- prove old theories.....	66	
Washington Irrigation Institute meets at Coulee Dam.....	272	
Washington Irrigation Institute meets at We- natchee.....	47	
Washington Irrigation Institute resolutions.....	280	
Washington State Planning Commission, east- ern industry profits by western reclamation October inside front cover		
Waste men, what to do with our.....	131	
Water conservation, importance of.....	201	
Water rights for irrigation, principles and pro- cedure for engineers—book reviewed by W. I. Swanton.....	72	
Water rights, legal status of, in Pacific North- west.....	26	
Water, romance under.....	62	
Water study, consultants appointed for.....	149	
Water Users Relief Act of 1936.. May inside front cover		
Weber County exhibit at Utah State Fair.....	28	
Weber, R. C. E., early ginning of cotton on the Yuma project.....	202	
Weber, R. C. E., Emergency Conservation Work, Yuma project, Arizona-California.....	124	
Y		Page
Weber, R. C. E., extensive cattle feeding planned for Yuma project.....	267	
Weed control.....	24, 56	
West, first impressions of.....	262	
West, problems of the.....	230	
Western agriculture limited.....	232	
Western North Dakota Reclamation and Con- servation Association formed.....	79	
Weymouth, F. E., addresses National Reclama- tion Association.....	3	
Whitaere, Roy M., gold mining in Nevada.....	266	
Wildlife reservations on reclamation projects.....	43	
Wolden, Irene, E. R. A. production garden and cannery on the Shoshone project.....	126	
Woolgrower needs reclamation, why the.....	160	
Woolgrower, western, needs reclamation.....	163	
World Power Conference broadcast—Boulder Dam portion.....	221	
Wyoming Reclamation Association meeting...	95	
Z		
Yakima apple growers.....	243	
Yakima conferences.....	104	
Yakima ships rams to Russia.....	281	
Yakima superintendent honored.....	272	
Yakima Valley conservation league 1936 pred- ator drive.....	246	
Yakima Valley, control of predators in the.....	245	
Young, Richard A., Malheur River siphon.....	164	
Yuma, bright outlook for.....	276	
Yuma County Farmers' Marketing Association, the.....	203	
Yuma pastures aged mule.....	153	
Yuma project, early ginning of cotton on.....	202	
Yuma project, extensive cattle feeding planned for.....	267	
Yuma, shipments from.....	99	
Yuma Valley advances.....	272	
Z		
Zuider Zee reclamation project.....	276	

