ROGUE RIVER BASIN, OREGON AND CALIFORNIA

LETTER

FROM

THE SECRETARY OF THE ARMY

TRANSMITTING

A LETTER FROM THE ACTING CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY, DATED JULY 13, 1962, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON A SURVEY OF THE ROGUE RIVER BASIN, OREGON AND CALIFORNIA, AUTHORIZED BY PUBLIC LAW 183, 74TH CONGRESS, APPROVED JULY 1, 1935, AND THE FLOOD CONTROL ACTS, APPROVED JUNE 22, 1936 AND JULY 3, 1958

SEPTEMBER 21, 1962.—Referred to the Committee on Public Works and ordered to be printed with six illustrations

U.S. GOVERNMENT PRINTING OFFICE
WASHINGTON : 1962

89588 O

CONTENTS

TABLES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

ILLUSTRATIONS ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

(Only Plates 1, 5, 7 and 9 printed)

EXHIBITS ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

APPENDIXES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

(Only Appendix A printed)

LETTER OF TRANSMITTAL

DEPARTMENT OF THE ARMY
WASHINGTON 25, D. C.

IN REPLY REFER TO:

Honorable John W. McCormack

September 20, 1962

Speaker of the House of Representatives

Dear Mr. Speaker:

I am transmitting herewith a favorable report dated 13 July 1962, from the Acting Chief of Engineers, Department of the Army, together with accompanying papers and illustrations, on a survey of the Rogue River Basin, Oregon and California, authorized by Public Law 183, 74th Congress, approved 1 July 1935, and the Flood Control Acts, approved 22 June 1936 and 3 July 1958.

In accordance with Section 1 of Public Law 534, 78th Congress, Public Law 85-624, and Public Law 87-88, the views of the States of Oregon and California, the Department of the Interior and the Public Health Service are set forth in the inclosed communications. The views of the Departments of Agriculture and Commerce, and the Federal Power Commission are inclosed. Pertinent replies of the Chief of Engineers to the above comments are inclosed also.

The Bureau of the Budget in the attached letter to me dated 18 September 1962, notes that cases are made in the report and accompanying papers for the assignment of operational responsibility for the proposed reservoirs in the Rogue River Basin to either the Corps of Engineers or the Bureau of Reclamation, and it would recommend that if the project is authorized by the Congress the terms of authorization permit later determination of the appropriate agency to assume the operating responsibility for the recommended project.

After careful consideration of the matter of operational responsibility, I concur in the recommendations of the Chief of Engineers and I recommend authorization of the proposed reservoirs for construction, operation and maintenance by the Corps of Engineers.

The Bureau of the Budget advises that while there would be no objection to the submission of the report to the Congress, no commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if

authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation. A copy of the letter from the Bureau of the Budget is inclosed.

Sincerely yours,

Cyrus Vance

Cyrus R. Vance
Secretary of the Army

1 Incl (dup)
Rept w/accompg
papers & illus

COMMENTS OF THE BUREAU OF THE BUDGET

EXECUTIVE OFFICE OF THE PRESIDENT
BUREAU OF THE BUDGET
WASHINGTON 25, D.C.

September 18, 1962

Honorable Cyrus R. Vance
Secretary of the Army
Washington 25, D. C.

Dear Mr. Secretary:

Acting Assistant Secretary Fitch's letter of July 27, 1962, submitted the proposed report of the Chief of Engineers on the Rogue River Basin, Oregon and California, authorized by Public Law 183, 74th Congress, approved July 1, 1935, and the Flood Control Acts approved June 22, 1936, and July 3, 1958.

The Chief of Engineers recommends the development of the water resources of the Rogue River through the construction of reservoirs at the Lost Creek, Elk Creek, and Applegate sites for purposes of flood control, irrigation, water supply, hydroelectric power, fish and wildlife enhancement, and general recreation. The Federal cost for construction is estimated at $106,700,000 with annual operation and maintenance charges estimated at $802,400. Local interests will repay all capital costs allocated to water supply, and will make arrangements with the Secretary of the Interior for repayment, under the provisions of Federal Reclamation law, of capital costs allocated to irrigation. The total costs allocated to the water supply and irrigation purposes are estimated at $22,569,000 for construction, and $101,000 annually for operation and maintenance. The ultimate net Federal cost is, therefore, estimated to be $84,131,000 for construction, and $701,400 for annual operation and maintenance. The stated benefit-cost ratio is 1.5.

The report indicates that the repayment capacity of prospective irrigation water users ranges from 15% to 25%. Consequently, the report recommends that irrigation costs in excess of the amount that irrigation water users could repay in a 50-year repayment period would be assigned for repayment from general power revenues of the Columbia River Power System. We note, however, the report does not include any specific repayment plan for costs allocated to irrigation. We would expect, therefore, that at the time the Department of the Interior makes its recommendations for such water distribution systems as may be needed to utilize the irrigation storage water capacity of the reservoirs, these recommendations will include a detailed repayment plan for costs of both irrigation water supply storage and the distribution systems.

The Secretary of the Interior has expressed the view that operational responsibility for the three reservoirs deserves further consideration. He contends that the composition of project benefits, the influence of fishery requirements on basic releases and current comprehensive irrigation development activities of the Bureau of Reclamation in this Basin point to the desirability of assigning operational responsibility to that Bureau.

In responding to the Secretary of the Interior's comments, the Chief of Engineers states that because downstream flood threats would not be completely controllable by construction of the reservoirs, the Corps of Engineers should maintain and operate the project to meets its flood control responsibilities.

The Bureau of the Budget recognizes merit in the views of both agencies but does not believe that this matter has received sufficient study to enable a decision to be made at this time. While there would be no objection to the submission of the proposed report to the Congress, the Bureau of the Budget would recommend that if the project is authorized by the Congress the terms of authorization permit later determination of the appropriate agency to assume operating responsibility for the recommended projects. We request that our views on this matter be brought to the attention of the Congress in your transmittal of the report. No commitment can be made at this time as to when any estimate of appropriation would be submitted for construction of the project, if authorized by the Congress, since this would be governed by the President's budgetary objectives as determined by the then prevailing fiscal situation.

Sincerely yours,

Deputy Director

COMMENTS OF THE GOVERNOR OF OREGON

MARK O. HATFIELD
GOVERNOR

OFFICE OF THE GOVERNOR
STATE CAPITOL
SALEM 10, OREGON

March 29, 1962

Lt. Gen. Walter K. Wilson
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

The Water Resources Board has completed its review of your report on a survey of the Rogue River Basin, Oregon and California, as authorized by various congressional acts. Also reviewed by the Board were the reports of the District and Division Engineers and the Board of Engineers for Rivers and Harbors.

I am pleased to concur in the findings of the Water Resources Board and would hope for authorization of this project by Congress and appropriation of adequate funds to permit the start of construction at a very early date.

The report adequately recognizes the benefits which will accrue to municipal, irrigation, power development, recreation, fishery, and flood control uses of the waters of the Rogue River and its tributaries. We are particularly grateful for recognition of the requirements of the fishery resource and would hope for Congressional approval of recommendations of the Fish Commission of Oregon and the Oregon State Game Commission as contained in Appendix C of your report.

Sincerely,

Governor

MOH:ao

cc: Oregon Congressional Delegation

COMMENTS OF THE STATE OF OREGON

STATE OF OREGON
STATE WATER RESOURCES BOARD
500 PUBLIC SERVICE BUILDING
SALEM 10

March 29, 1962

Chief of Engineers
Corps of Engineers
U. S. Army
Washington 25, D. C.

Dear Sir:

The State Water Resources Board has received and reviewed your report on a survey of the Rogue River Basin, Oregon and California, authorized by Public Law 183, 74th Congress, first session, approved July i, 1935 and the Flood Control Acts of June 22, 1936 and July 3, 1958. Also reviewed by the board were the reports of the District and Division Engineers and the Board of Engineers for Rivers and Harbors.

The State Water Resources Board has cooperated with state and federal agencies on specific aspects of the studies leading to the current report and has followed with continuing interest the overall study of the Corps of Engineers for this basin.

The report recommends development of water resources of the Rogue River by construction of reservoirs at Lost Creek and Elk Creek in the Upper Rogue and Applegate Reservoir on Applegate River.

The report assigns substantial benefits to municipal, irrigation, power development, recreation, fishery, and flood control.

It is apparent that the principles of multiple-purpose use and consideration of all beneficial uses of water have guided the planning and that all alternatives of physical development that are reasonably possible of economic justification have been adequately examined.

We note that the benefit-cost ratio for the development is 1.5 to 1.00 based upon a 100-year period of analysis.

The State of Oregon has adequate authority and will take such actions as necessary to insure maintenance in the streams of waters released for fishery purposes.

We recommend authorization by the Congress and urge that adequate funds for construction be appropriated at the earliest opportunity with the assumption that non-federal assurances, financial and otherwise, will be met as needed and that the recommendations of the Fish Commission of Oregon and the Oregon State Game Commission, as contained in Appendix C of the report, will be observed.

Sincerely yours,

Donel J. Lane
Secretary

DJL/jc
cc: Governor Mark O. Hatfield

WILLIAM E. WARNE
Director of
Water Resources

JAMES F. WRIGHT
Chief Deputy Director

B. ABBOTT GOLDBERG
Deputy Director—Contracts

REGINALD C. PRICE
Deputy Director—Policy

ALFRED R. GOLZÉ
Chief Engineer

EDMUND G. BROWN
GOVERNOR OF
CALIFORNIA

WILLIAM E. WARNE
ADMINISTRATOR
RESOURCES AGENCY

ADDRESS REPLY TO
P. O. Box 388
Sacramento 2, Calif.

THE RESOURCES AGENCY OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
1120 N STREET, SACRAMENTO

April 24, 1962

Lieutenant General Walter King Wilson
Chief of Engineers
Headquarters, Department of the Army
Office of the Chief of Engineers
Washington 25, D. C.

Reference: Your File No. ENGCW-PD

Dear General Wilson:

The proposed water resources development project on the Rogue River, California, and Oregon, was transmitted on March 19, 1962, to the Director of the Department of Water Resources, State of California, for review and comment in accordance with the provisions of Public Law 534, 78th Congress, and Public Law 85-624. Included with the letter of the Chief of Engineers were reports of the Board of Engineers for Rivers and Harbors and the District and Division Engineers.

Authority for state review is contained in Section 12580 of the California Water Code, which declares that "the State should engage in the study and coordination of all ... flood control projects, undertaken by ... the United States ...." Subsequent sections of the Water Code further outline state authority for review in respect to local and state participation.

The Department of Water Resources has the responsibility of assembling and presenting comments of all interested agencies of the State of California. The following comments, therefore, may be accepted as the views and recommendations of the State.

COMMENTS OF THE DEPARTMENT OF WATER RESOURCES

The Department of Water Resources has a direct interest in all projects involving the development of water resources of the State and a particular interest in the extent to which these projects are compatible with The California Water Plan.

The Rogue River Project, as outlined in the report, is in consonance with The California Water Plan. This is a master plan to guide and coordinate the activities of all agencies in the planning, construction, and operation of works required for the control, development, protection, conservation, distribution, and utilization of California's water resources for the benefit of all areas of the State and for all beneficial purposes.

Although the proposed water resources development project under consideration is almost entirely within the State of Oregon, parts of the upper Rogue River Basin are in California. In the following comments the State limited its consideration to the effect of the project on that part of the drainage basin located in California.

Of primary interest to California is the Applegate Dam and Reservoir. The Applegate Dam to be constructed in Oregon will store water originating in California and will back water up into California. The Applegate Project will be a multipurpose dam and reservoir with one of its purposes flood control. It will subject land in California to inundation along the Applegate River. The State has no objection to the construction of the dam nor inundation of the land.

Under Section 12826 of the California Water Code, the State of California is not allowed to participate financially in the cost of lands, easements, and rights-of-way necessary for multiple purpose dams or reservoirs constructed by the United States. Section 12826 states as follows:

> "No money appropriated for flood control projects shall be allocated for the purchase of lands, easements, and rights-of-way necessary for multipurpose dams or reservoirs constructed by the United States...."

Comments of the United States Forest Service's comments in a letter dated November 21, 1961, to the Portland district office stated that the relocation of Forest Service Highway No. 14 is a project obligation to Jackson County, Oregon; Siskiyou County, California; and to the State of Oregon. In order to clarify California's project obligation in connection with the Applegate Dam and Reservoir Project on the Applegate River, the department contacted the Portland district office. The district replied that the cost of lands, easements, and rights-of-way and relocation of Forest Service Highway No. 14 will be federal project costs.

COMMENTS OF THE DEPARTMENT OF PARKS AND RECREATION

The Department of Parks and Recreation reviewed the Rogue River Basin Report, but stated that it has no comments.

COMMENTS OF THE DIVISION OF HIGHWAYS

The Division of Highways reviewed the Rogue River Basin Report, but stated that it has no comments.

COMMENTS OF THE DEPARTMENT OF CONSERVATION

The Department of Conservation indicates that the area involved is within the protection responsibilities of the United States Forest Service. We note that the Forest Service has made a very comprehensive analysis of the impact of the project as proposed upon their responsibilities.

COMMENTS OF THE DEPARTMENT OF FISH AND GAME

The Department of Fish and Game states that its comments are largely a reiteration of the comments in the Fish and Wildlife Service report, pertaining to fish and wildlife affected by the Corps of Engineers' Rogue River Project. The Fish and Wildlife Service report is included as "Appendix A" of the master report. The department's recommendations are summarized as follows:

1. This department concurs with the recommendations of other agencies, that anadromous fish facilities be provided at the proposed Applegate Dam for movement of adult fish upstream and juvenile fish downstream.

2. Water, of not more than 60°F. temperature, should be released below Applegate Dam to provide suitable habitat for salmon and steelhead. Such releases would be necessary to provide transportation flows for both adult and juvenile anadromous fishes below Applegate Dam.

3. Only a limited acreage of deer habitat will be inundated in California. Deer utilizing range in Oregon that will be inundated by Applegate Reservoir, however, migrate into California and are hunted here during the open season. Means of mitigating deer losses, attributable to inundation of habitat, should be further explored, and associated costs should be included as a non-reimbursable project cost. Consideration should be given to protective devices to prevent deer losses in project canals.

CONCLUSIONS AND RECOMMENDATIONS

The State of California is interested in this project primarily because about 167 square miles of the Rogue River Basin are in California. None of the water to be developed by the project contributes to any stream in California; therefore, the primary benefits of the project do not accrue to interests within the State of California.

The recommendations and suggestions of the Department of Fish and Game and U. S. Fish and Wildlife Service should be adhered to in order to minimize damage to fish and wildlife resources in the Applegate drainage basin within California.

The State of California has no objection to authorization and construction of the Rogue River Basin project and it would appear to be beneficial to the State of Oregon.

I request that this letter be considered as expressing the views and recommendations of the State of California on the proposed report of the Chief of Engineers.

It is further requested that this letter be transmitted to the President of the United States and to the Congress, along with all material that may be so transmitted.

The opportunity to review the Rogue River Report is very much appreciated.

Sincerely yours,

/s/ William E. Warne

Director

89588 O-62—2

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
WASHINGTON 25, D. C.

June 11, 1962

Dear General Wilson:

This is in reply to your letter of March 14 requesting our comments on reports on the Rogue River Basin, Oregon and California. The recommended plan of development provides for construction of three multi-purpose reservoirs at the Lost Creek, Elk Creek, and Applegate sites for flood control and other purposes. The projects would be constructed and operated by the Corps of Engineers.

This Department recommends authorization of the project by the Congress at this time. We believe, however, that the question of operation of the reservoirs deserves further consideration. Recreation, fish and wildlife enhancement, hydroelectric power, and irrigation will provide over 70 percent of the benefits. Use of single purpose storage for flood control is not required. The Bureau of Reclamation has been and is currently engaged in comprehensive irrigation development in the Basin. Substantial additional costs of up to $50,000,000 will be incurred in utilizing the water conserved in the reservoirs for irrigation. Under the proposed plan, basic releases would be dictated by fishery requirements. Incidental to this criterion, normal operation of the reservoirs on a day-to-day basis would be determined by irrigation and power requirements. From this viewpoint, operation of the reservoirs by the Bureau of Reclamation would be desirable.

The District Engineer in his report suggested that no construction be undertaken until this Department has on hand signed contracts for repayment of the cost of irrigation storage capacity. We feel this item is so important that proper language to safeguard this restriction on construction should be included in your recommendations and in the authorizing legislation.

The cost of mitigation of damages caused by the projects to fish and wildlife are considered as joint costs and are allocated to all project purposes. Under the Fish and Wildlife Coordination Act, such costs on Bureau of Reclamation projects have been allocated to fish and wildlife and considered nonreimbursable.

The Fish and Wildlife Service is pleased that its recommendations have been satisfactorily incorporated in your report and appreciates the excellent cooperation of the Portland District Engineer which has made possible the inclusion of conservation and development of fish and wildlife resources as a project purpose.

The Bureau of Mines advises that before construction further consideration should be given to the mineral resources of the area.

Sincerely yours,

Secretary of the Interior

Lt. General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

IN REPLY REFER TO
ENGCW-FD

12 July 1962

The Honorable Stewart L. Udall

The Secretary of the Interior

Dear Mr. Secretary:

Reference is made to your letter of 11 June 1962 commenting on the proposed report of the Chief of Engineers on the Rogue River Basin, Oregon and California.

Your letter expresses the opinion that operation of the reservoirs by the Bureau of Reclamation would be desirable. As you know, the proposed Lost Creek, Elk Creek, and Applegate Reservoirs would be operated to provide overall maximum benefits for flood control, irrigation, water supply, and fishery enhancement. Under this plan of operation the percentage of total benefits creditable to each project purpose would be about as follows: flood control, 22 percent; irrigation, 15 percent; water supply, 5 percent; fish and wildlife enhancement, 18 percent; recreation, 9 percent; and hydroelectric power, 31 percent. The project would not provide complete control of flood waters and damaging floods could still occur downstream from the proposed reservoirs. Accordingly, it is considered desirable that the Corps of Engineers maintain and operate the project in order to minimize damages and meet its flood control responsibilities.

In keeping with Department of the Army responsibility for construction, operation, and maintenance of the Lost Creek, Elk Creek, and Applegate Reservoirs the proposed report has been revised to provide that prior to construction local interests give assurances satisfactory to the Secretary of the Army that they will make necessary arrangements with the Secretary of the Interior for repayment of irrigation costs under the provisions of reclamation law. In order that urgently needed flood control and other services may be provided under this arrangement without either undue delay or detriment to the Federal interest should these projects be authorized, the Chief of Engineers will consult with and obtain the concurrence of your Department on a satisfactory basis for proceeding with project construction considering, among other factors, the acceptance of assurances of local cooperation. A copy of the revised report is inclosed for your information.

Full consideration will be given to the mineral resources aspect of the project during the detailed planning and design stage if the project is authorized by Congress.

Sincerely yours,

(Signed)

WILLIAM F. CASSIDY
Major General, USA
Acting Chief of Engineers

COMMENTS OF THE PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE — WASHINGTON 25, D. C.

BUREAU OF STATE SERVICES — Refer to:

April 19, 1962

Major General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

This is in reply to General Barney's letter of March 14, 1962, requesting comments on the U. S. Army Engineers' Report on the Rogue River Basin, Oregon and California.

We believe the water supply and pollution control aspects of the project have been adequately covered in the Public Health Service report included in Volume II, Appendix B. We call your attention to the final paragraph of the transmittal letter which accompanied that report:

"The Comprehensive study of water supply and water quality management now being conducted by the U. S. Public Health Service in the Columbia River Basin and the Pacific Northwest will more accurately define the future municipal and industrial water supply and low flow augmentation requirements and particularly the benefits for low flow augmentation for water quality control than has been possible at this time."

It is recommended that adequate measures for vector mosquito control be undertaken throughout the construction and operation of the project, and that these measures be included in the plans as they are developed. Assistance on this aspect of the project may be obtained from the Public Health Service and the Oregon State Board of Health.

The opportunity to review the report is appreciated. We stand ready to provide further consultation concerning vector control, water supply and pollution control aspects of the project on your request.

Sincerely yours,

Keith S. Krause

Keith S. Krause
Chief, Technical Services Branch
Division of Water Supply and
Pollution Control

COMMENTS OF THE PUBLIC HEALTH SERVICE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

PUBLIC HEALTH SERVICE — WASHINGTON 25, D. C.

BUREAU OF STATE SERVICES — Refer to:

April 19, 1962

Major General Walter K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Dear General Wilson:

This is in reply to General Barney's letter of March 14, 1962, requesting comments on the U. S. Army Engineers' Report on the Rogue River Basin, Oregon and California.

We believe the water supply and pollution control aspects of the project have been adequately covered in the Public Health Service report included in Volume II, Appendix B. We call your attention to the final paragraph of the transmittal letter which accompanied that report:

"The Comprehensive study of water supply and water quality management now being conducted by the U. S. Public Health Service in the Columbia River Basin and the Pacific Northwest will more accurately define the future municipal and industrial water supply and low flow augmentation requirements and particularly the benefits for low flow augmentation for water quality control than has been possible at this time."

It is recommended that adequate measures for vector mosquito control be undertaken throughout the construction and operation of the project, and that these measures be included in the plans as they are developed. Assistance on this aspect of the project may be obtained from the Public Health Service and the Oregon State Board of Health.

The opportunity to review the report is appreciated. We stand ready to provide further consultation concerning vector control, water supply and pollution control aspects of the project on your request.

Sincerely yours,

Keith S. Krause

Keith S. Krause
Chief, Technical Services Branch
Division of Water Supply and
Pollution Control

DEPARTMENT OF AGRICULTURE
WASHINGTON 25, D. C.

4 June 1962

Honorable Elvis J. Stahr, Jr.
Secretary of the Army

Dear Mr. Secretary:

This is in reply to the Acting Chief of Engineers' letter of March 14, 1962, transmitting for our review and comment his proposed review survey report with respect to multiple-purpose development of the Rogue River Basin, Oregon.

The report recommends the development of the water resources of the Rogue River by construction of reservoirs at the Lost Creek, Elk Creek, and Applegate sites for flood control and other purposes at an estimated cost of $106,700,000 for Federal construction.

The proposed basin plan provides for flood control, irrigation water supply, fish and wildlife enhancement, power generation, and recreation benefits as project purposes. The three multiple-purpose reservoirs proposed for early construction are considered as basic elements of a basin plan for the Rogue River. The plan also provides for necessary arrangements by the Secretary of the Army and the Secretary of the Interior for repayment, under the provisions of reclamation law, of construction costs allocated to irrigation. This is estimated to be $13,700,000 for the Lost Creek-Elk Creek Reservoirs and $3,585,000 for the Applegate Reservoir, with the final cost allocation to be made by the Secretary of the Army with assistance of the Secretary of the Interior.

The benefit-cost ratio for the entire development is 1.5 to 1.0 on a 100-year period of analysis. Inasmuch as the costs allocated to irrigation apparently would exceed the amounts that could be repaid by the water users, special authorization would be required by Congress to permit financial assistance from other sources.

The primary interest of the Department of Agriculture in the proposed Rogue River Project is in connection with the planned irrigation phases of the river basin development. One of the activities of the Department of Agriculture in this Basin is providing technical services for drainage and irrigation water management. The proposed 39,000 acres of new irrigation and supplemental water supplies for 25,000 acres would definitely increase the need for Soil Conservation Service assistance in both drainage and irrigation water management.

The proposed basin development would not conflict with foreseeable drainage work except possibly in the use of natural stream channels for irrigation water distribution where these channels are a logical outlet for surface and subsurface drainage. When specific irrigation projects are developed, the Soil Conservation Service will have, for this reason, an interest in the proposed irrigation system improvement.

The developments proposed do not conflict with Department of Agriculture programs now under way or currently planned in the Rogue River Basin.

The Applegate Reservoir would be within the Rogue River National Forest. Field representatives of the Corps of Engineers and the Forest Service worked closely together in planning the proposed dam and reservoir at this site. Impacts of the proposed improvements upon protection, administration, and management of the Rogue River National Forest were determined by the Forest Service and are presented in the report. Recommendations and provisions to adjust, modify, and improve future use and management of the project area and adjacent lands were jointly planned and agreed to by the Corps of Engineers and the Forest Service. These adjustments are also documented in the report. This Department, therefore, concurs with those parts of the report which concern relationship of National Forest lands to the Applegate Dam and Reservoir.

The proposed plan for this reservoir includes a proposal for the acquisition of all remaining private land between the guide-taking line and the National Forest boundaries. About 930 acres would be so acquired primarily for recreation use and development. We fully endorse the proposed acquisition. After the lands are acquired, they should be consolidated with adjacent National Forest lands for management purposes. Except for those areas needed for administration and operation of water control facilities, the acquired lands should be transferred to the Department of Agriculture for jurisdiction pursuant to the Act of July 26, 1956 (70 Stat. 656) which authorizes such interchange.

We concur in the recommendation for installation of power facilities at the Lost Creek project and in the proposed integration of the power so developed in the existing Federal Northwest power system. In furtherance of the interests of the users of this power, including rural electric systems financed by the Rural Electrification Administration in this Department, we suggest that when reimbursable costs are finally allocated a payout period of 100 years be used and the element of taxes foregone eliminated.

When detailed plans are made by the Bureau of Reclamation for irrigation of the 39,000 acres of new land to be included in the project, it is assumed that a report of that agency will be available for review and comment. While in general the principal market crops of the Rogue River basin are not those in surplus supply in the Nation, this Department will want to evaluate the probable impact of the increase in production of feed grains

resulting from irrigation of this considerable acreage of new land. Supplemental water for the 25,000 acres now inadequately irrigated would be an asset to the agricultural economy of the project area and add to the economic stability of local farm families.

We appreciate the opportunity afforded us to review this report.

Sincerely yours,

Frank J. Welch
Assistant Secretary

LETTER TO THE SECRETARY OF AGRICULTURE

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

IN REPLY REFER TO
ENGCW-PD

3 July 1962

The Honorable Orville L. Freeman

The Secretary of Agriculture

Dear Mr. Secretary:

Reference is made to the letter of 4 June 1962 from the Assistant Secretary of the Department of Agriculture commenting on the proposed report of the Chief of Engineers on Rogue River Basin, Oregon and California.

With regard to the comments of the Assistant Secretary concerning the acquisition and management of lands in the Applegate Reservoir project area for recreational purposes, the report provides for acquisition of such lands. If the project is authorized by Congress, full consideration will be given during the detailed planning and design stage to transfer of those lands not required for project purposes to the Department of Agriculture for jurisdiction pursuant to the Act of July 26, 1956 which authorizes such interchange.

Sincerely yours,

(Signed)

W. K. WILSON, JR.
Lieutenant General, USA
Chief of Engineers

COMMENTS OF THE DEPARTMENT OF COMMERCE

THE UNDER SECRETARY OF COMMERCE
FOR TRANSPORTATION
WASHINGTON 25

May 21, 1962

Lieutenant General W. K. Wilson, Jr., USA
Chief of Engineers
Department of Commerce
Washington 25, D. C.

Dear General Wilson:

As requested in General Barney's letter of March 14, 1962, I am transmitting herein the comments of the interested Department of Commerce agencies on your proposed report on "Rogue River Basin, Oregon and California."

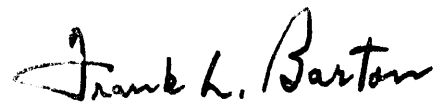
The Coast and Geodetic Survey advises that vertical geodetic control has been established along State Highway 62 in the immediate vicinity of the Lost Creek Reservoir site. Since 5.9 miles of this highway will be relocated, the existing monuments will probably require relocation. The estimated cost of this relocation is $2,000. The Corps of Engineers is requested to provide this funding. Horizontal geodetic control has been established in the project area with one monument located about four miles north and another five miles southwest of the Lost Creek Reservoir site. In the Elk Creek Reservoir area, vertical geodetic control has been established along State Highway 62, about two miles south of the proposed site and horizontal geodetic control is available about four miles northeast of the proposed site. In the Applegate area, vertical geodetic control has been established along the Southern Pacific Railroad, about 24 miles northeast of the proposed site and horizontal geodetic control is available about four miles east of the reservoir site. If additional control in either category should be required or if any existing control monuments should be endangered, the Coast and Geodetic Survey would appreciate being advised as early as possible. The Coast and Geodetic Survey's review also indicates that basic contour maps for later sedimentation studies will not be required.

The Bureau of Public Roads review of the report indicates that the construction of the three reservoirs will require the relocation of several State and local highways and that the cost of this relocation work has been made a part of the project cost. The Bureau of Public Roads notes that the Crater Lake highway is being reconstructed and that, within the project area, this reconstruction is being temporarily delayed pending a decision regarding the authorization of Lost Creek Reservoir. The Bureau of Public Roads desires to reemphasize

the need for project funds being made available as soon as possible in order that the reconstruction of the Crater Lake highway will not be further delayed. The Bureau of Public Roads also notes that there appears to be a considerable amount of indirection in the alignment of the road relocations proposed in connection with the Elk Creek and Applegate Reservoirs. It is suggested that the alignment of these relocations be restudied in regard to the economics of the transportation service they provide during the design phase.

Your courtesy in providing a copy of this report for our review is appreciated.

Sincerely yours,



Frank L. Barton
Deputy Under Secretary
for Transportation

COMMENTS OF THE FEDERAL POWER COMMISSION

FEDERAL POWER COMMISSION
WASHINGTON 25, D.C.

April 13, 1962

Lieutenant General W. K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

Reference: ENGCW-PD

Dear General Wilson:

This is in reply to General Barney's letter of March 14, 1962, inviting comments by the Commission relative to your proposed report and to the survey reports of the Board of Engineers for Rivers and Harbors and of the District and Division Engineers on the Rogue River Basin, Oregon and California.

The cited reports recommend construction of three reservoir projects in the Basin for flood control and other purposes at a total estimated first cost of $106,700,000. These projects would provide total storage capacities in acre-feet as follows: Lost Creek, 465,000; Elk Creek, 101,000; and Applegate, 72,000. The benefit-cost ratio of the proposed plan of development was shown to be 1.5 based on a 100-year period of analysis.

As recommended, hydroelectric power would be developed only at the Lost Creek project at which an installed generating capacity of 52,000 kilowatts is proposed. Use of the reservoir releases made for irrigation, water supply and fishery enhancement would make possible an average annual generation of about 336,800,000 kilowatt-hours. Daily stage fluctuations would be only those acceptable from the standpoint of assuring fishery enhancement and no reregulating reservoir is planned for construction in the fish spawning areas downstream from the Lost Creek dam.

The Commission staff has reviewed the reports of your Department and has made studies of the power possibilities of the proposed projects. The studies show that the proposed power installation at the Lost Creek project is economically justified. The studies show also that the economics of the power features could be improved if the peaking capabilities of the site could be realized. One means of accomplishing this would, of course, be to construct a small afterbay downstream from the Lost Creek dam.

Consideration was also given by the staff to another means of obtaining peaking capacity, under which no structures would be required below the Lost Creek dam. This would involve building a tunnel from the Lost Creek reservoir to a peaking power plant constructed on the rim of the proposed Elk Creek reservoir, and constructing a second power plant to operate at base load at the Elk Creek dam. Some minor shifting of storage capacity from Elk Creek to Lost Creek might be advisable and minimum flow releases would be necessary at the Lost Creek dam. Preliminary studies indicate such a development to be feasible.

Staff studies of the possibility of developing power at the proposed Applegate project indicate that an installation of about 5,000 kilowatts operating at base load would be feasible. The studies indicate also that an installation of about 9,000 kilowatts could be made at Applegate for peaking purposes if a reregulating dam, possibly including a 3,000-kilowatt base load plant, could be constructed downstream. Such enlarged capacity would enhance the economics of power development at the Applegate project.

The reports of your Department recognize that there are many additional reservoir and power projects in the Rogue River Basin that could be constructed in the future. The Commission's publication on Hydroelectric Power Resources in the United States lists some 19 potential projects having a total installed capacity in excess of 650,000 kilowatts. Reports by others, including one by the Oregon State Water Resources Board, show a similar potential for the Basin. It is recognized that the future development of such projects is contingent upon resolution of the conflicts with the fishery requirements. Also, the projects now recommended could fit into such possible long-range development plans.

Based on its consideration of the reports of your Department and the studies by its own staff, the Commission concludes that the recommended projects in the Rogue River Basin are adaptable to a comprehensive development of the available water resources and that the proposed development of hydroelectric power at the Lost Creek project is economically justified. The Commission believes that the suggestions made by the staff for improving the economics of power development in connection with the proposed projects should be studied further at the project design stage.

Sincerely yours,

Joseph C. Swidler

Joseph C. Swidler
Chairman

xxx

LETTER TO THE FEDERAL POWER COMMISSION

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

IN REPLY REFER TO

ENGCW-PD

11 May 1962

Mr. Joseph C. Swidler

Chairman, Federal Power Commission

Dear Mr. Swidler:

Reference is made to your letter of 13 April 1962 commenting on the proposed report of the Chief of Engineers on the Rogue River Basin, Oregon and California.

You note that the economics of power features at Lost Creek Reservoir could be improved if the peaking capabilities of the site could be realized, that a base-load plant at Applegate Reservoir apparently would be feasible, and that a peaking plant at Applegate would enhance the economics of power development at that site. You also note that daily stage fluctuation in Rogue River as a result of peaking operations could be only those acceptable from the standpoint of fishery enhancement. You suggest a small afterbay for reregulating purposes or, as an alternative, a tunnel from Lost Creek Reservoir to Elk Creek Reservoir, with a peaking plant at the downstream end of the tunnel and a base-load plant at Elk Creek Dam.

It is recognized that production of peaking power would enhance the economic feasibility of power generation at Lost Creek Reservoir. This possibility was carefully considered in the course of studies by the District and Division Engineers. The investigations, however, also included careful consideration of the present and probable future needs of the basin for control of floods, water supply, fish and wildlife resources development, irrigation, recreation opportunities and other products and services of water resource development as well as hydroelectric power development. Because of factors other than economic feasibility, however, it has been determined that provision of a peaking installation would be impractical at this time because recommendation therefor would render the plan controversial and subject to nation-wide opposition such as prevented adoption of plans previously proposed by other agencies.

As indicated in the report of the District Engineer, fishery enhancement is an important project function and the basis for a substantial part of the economic justification and local support for the project.

Also as shown in the report, both Federal and State agencies would strongly oppose development of any site downstream from that recommended in the report. The presently proposed site was selected to avoid, insofar as possible, encroachment on known major spawning areas for chinook salmon and other anadromous fish. Provision of an afterbay would inundate additional spawning area. Also, and of more serious consequence, it would result in inability to provide the degree of temperature control over released flows which is essential to realization of planned fish enhancement benefits in Rogue River. Thus, it would result in loss of support from fishery agencies and groups and result in a major loss of project benefits.

The use of a tunnel from Lost Creek to Elk Creek and reregulation by Elk Creek Reservoir would eliminate completely any problem of inundation of additional spawning areas. It would, however, result in complete loss of ability to provide low-temperature flows in Rogue River during the summer months and might even result in releases of substantially higher temperatures than the present flow in Rogue River at the mouth of Elk Creek. Consequently, serious fishery detriment, rather than enhancement, could be expected.

With reference to Applegate Reservoir, studies by the District office have shown that operation of a base-load power generating installation would be justifiable under certain conditions. However, in order to provide for economical base-load operation, it would be necessary to ignore some of the flow and temperature control requirements which are essential to realization of fishery benefits. Loss of fishery benefits would reduce the benefit-to-cost ratio to less than unity. Under the circumstances, the limited excess of base-load power benefits over incremental power costs would not be adequate to justify a recommendation for construction. Provision of a peaking installation and a reregulating reservoir as necessary to control stage fluctuations to safe levels would result in loss of ability to control release temperatures and concurrent loss of fishery benefits. As for a base-load plant, the excess of peaking power benefits over incremental power costs would not be adequate to justify a recommendation for construction. Further, as for Lost Creek Reservoir, loss of fishery benefits would result in widespread opposition to project construction.

In view of the above, I believe the plan, as recommended, will best provide for the present and probable future needs for all the products and services of water resources development of the basin.

Sincerely yours,

(Signed)

WILLIAM F. CASSIDY
Major General, USA
Acting Chief of Engineers

89588 O-62—3

FEDERAL POWER COMMISSION
WASHINGTON

OFFICE OF THE CHAIRMAN

Reference: ENGCW-PD

May 29, 1962

Dear General Wilson:

This refers to General Cassidy's letter of May 11, 1962, in reply to the Commission's letter of April 13, 1962, commenting on your Department's report on the Rogue River Basin, Oregon and California.

The Commission's comments on that report were directed toward increasing the amount of power to be developed and improving the economics of the power features of the proposed improvements. The suggestions in the letter for possible modifications of the recommended projects were made with full recognition that the final design of the projects would be determined after consideration of the requirements for the optimum development of all of the water resources of the basin.

The Commission appreciates the consideration you have given to its comments on your report.

Sincerely,

Joseph C. Swidler
Chairman

Lieutenant General
W. K. Wilson, Jr.
Chief of Engineers
Department of the Army
Washington 25, D. C.

ROGUE RIVER BASIN, OREGON AND CALIFORNIA

REPORT OF THE ACTING CHIEF OF ENGINEERS, DEPARTMENT OF THE ARMY

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON 25, D.C.

IN REPLY REFER TO
ENGCW-PD

13 July 1962

SUBJECT: Rogue River Basin, Oregon and California

TO: THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on a survey of Rogue River Basin, Oregon and California, authorized by Public Law No. 183, Seventy-fourth Congress, first session, approved 1 July 1935 and the Flood Control Acts of 22 June 1936 and 3 July 1958. My report includes the reports of the District and Division Engineers and the Board of Engineers for Rivers and Harbors.

2. The reporting officers recommend the development of the water resources of the Rogue River by the construction of reservoirs at the Lost Creek, Elk Creek, and Applegate sites for flood control and other purposes at an estimated cost of $106,700,000 for Federal construction. The annual charges, including $802,400 for operation, maintenance, and major replacements, are estimated at $4,072,200 and the average annual benefits at $6,147,600. The benefit-cost ratio is 1.5.

3. The Board of Engineers for Rivers and Harbors recommends the proposed work substantially in accordance with the plan of the District Engineer, subject to local cooperation, including assurances by local interests that they will reimburse the United States in accordance with the Water Supply Act of 1958, as amended, for costs allocated to municipal and industrial water-supply storage and will make arrangements with the Secretary of the Interior for repayment under reclamation law of costs allocated to irrigation. The total costs allocated to these water-supply and irrigation purposes are presently estimated at $22,569,000 for the construction work and $101,000 annually for operation and maintenance including major replacements.

4. I concur generally in the views of the Board. Accordingly, I recommend that reservoirs at the Lost Creek, Elk Creek, and Applegate sites be authorized for construction for flood control and other purposes, all generally in accordance with the plan of the District Engineer and with such modifications thereof, including reasonable adjustments in storage capacity for water supply and other purposes, as in the discretion of the Chief of Engineers may be advisable, at an estimated cost of $106,700,000 for Federal

construction and $802,400 annually for operation and maintenance including replacements: Provided that prior to construction:

a. Responsible non-Federal interests give assurances satisfactory to the Secretary of the Army that they will:

(1) Reimburse the United States in accordance with the Water Supply Act of 1958, as amended, for the first costs and the annual operation, maintenance, and replacement costs allocated to municipal and industrial water-supply storage, such costs being presently estimated at $5,977,000 and $24,900, respectively; and

(2) Hold and save the United States free from damages for water-rights claims resulting from construction and operation of the improvements;

(3) Make necessary arrangements with the Secretary of the Interior for repayment, under the provisions of reclamation law, of the construction cost and annual operation, maintenance, and replacement costs allocated to irrigation, presently estimated at $13,007,000 and $66,500, respectively, for the Lost Creek-Elk Creek Reservoirs and $3,585,000 and $9,900, respectively, for the Applegate Reservoir, the final cost allocation to be made by the Secretary of the Army, with the assistance of the Secretary of the Interior; and

b. The State of Oregon take necessary action to insure maintenance, in the streams, of flows to be released for benefit of the fishery.

WILLIAM F. CASSIDY
Major General, USA
Acting Chief of Engineers

ENGBR(1 Dec 61) 2nd Ind
SUBJECT: Rogue River Basin, Oregon and California

Board of Engineers for Rivers and Harbors, Washington 25, D. C.
25 January 1962

TO: Chief of Engineers, Department of the Army

1. Rogue River drains about 5,060 square miles in southwestern Oregon and northern California with Oregon containing about 97 percent of the area. The basin is made up of three major sectors, the eastern and western sectors consisting of rugged, mountainous terrain while the central sector, which lies between the Cascade and Coast Ranges, is considerably less rugged and contains almost all of the agricultural lands and related developments in the basin. More than three-quarters of the basin area is forest or timberland, the Rogue River, Umpqua, and Siskiyou National Forests, and other Federally and privately owned timberlands occupying the greater part of the mountainous areas surrounding the central valley.

2. The population of the Rogue River basin is located principally along the main stem and its major tributaries in the central sector of the basin. The population has been growing more rapidly than that of the nation or the State of Oregon. In 1960, the basin population was 106,740, about 6.1 percent of the state total. The principal cities and their 1960 populations are Medford, 24,425; Grants Pass, 10,118; and Ashland, 9,119. The principal economic activities in the basin are logging and lumbering, agriculture, and recreation. The timber and lumber industry provides the chief manufacturing activity, over 40 percent of all laborers' income being derived from this source. Agriculture, which is quite diversified, produced in 1959 an output valued at more than $17,000,000. The major agricultural enterprises are based on irrigated lands, the non-irrigated lands being used principally for pasture. About 72,000 acres were irrigated in 1959. Rogue River basin contains a wealth of recreational resources, including a nationally known fishery. In 1953 the number of visitors was estimated at 1,725,000 and the value of tourist expenditures at $14,000,000. More recent figures are not available but undoubtedly would exceed these amounts.

3. Flood damages occur in the Rogue River basin in a number of discontinuous areas along the main stream and its principal tributaries. The most recent major flood occurred in December 1955 and inundated more than 13,000 acres of land. This flood

was about equal in magnitude to the flood of February 1927 and was exceeded only by the floods of 1890 and 1861, the latter being the maximum of record. A recurrence of the 1955 flood under the 1960 level of development and prices would cause damages estimated at $4,450,000. Average annual flood losses throughout the basin are estimated at $640,000, of which $543,000, or about 85 percent, occur along the main stem of the river and along Applegate River. With the level of development foreseen for the area, it is estimated that future average annual flood damages along the main stem and Applegate River will amount to $2,440,000.

4. A considerable portion of the area now irrigated has an inadequate water supply, and some 220,000 acres of land are dry-farmed primarily for pasture because of lack of water. The potential for irrigation development is thus very large. Also the ground-water resources, now used extensively for water supply, are limited, and the low flows of the Rogue River and its tributaries are essentially fully appropriated for irrigation and domestic use. Further increases in withdrawals for these purposes will require that additional storage be provided.

5. Local interests desire comprehensive development of the water resources of the basin for flood control, irrigation, water supply, fish and wildlife enhancement, recreation, and power. The District Engineer, in response thereto, considered the existing water-resource developments and many proposals for the further development of the water resources of the basin. Some 36 single-purpose and multiple-purpose reservoirs were investigated. Of these, he determined that three multiple-purpose reservoirs are feasible and economically justified at the present time. Pertinent features of the three reservoirs are summarized in Table 2 of the District Engineer's report. Each of the three reservoirs would provide joint storage for flood control and conservation purposes, including irrigation, fish and wildlife enhancement, and recreation. The Elk Creek and Lost Creek Reservoirs would have water-supply storage and Lost Creek would include hydroelectric power development. The increased flows at reduced temperatures that would be provided for fishery enhancement would also provide substantial water quality control benefits. The District Engineer estimates the total first cost of the comprehensive development at $106,700,000, and the annual charges at $4,072,200. The three reservoirs would provide substantial flood-control benefits along the main river and in the valley of Applegate River. Average annual flood damages in these areas would be reduced by 56 percent. The reservoirs would provide

water for substantial irrigation development. Over 39,000 acres of new lands would be irrigated and supplemental water would be provided for about 25,000 acres. Some 20,000 acre-feet of storage would be provided to meet the growing demand for domestic and industrial water. In addition, substantial benefits would be realized from the power, recreation, and fish and wildlife features of the development. The total benefits are summarized as follows:

Flood control	$1,360,000
Irrigation	925,000
Water supply	322,700
Fish and wildlife enhancement	1,130,200
Hydrolectric power	1,881,700
Recreation	528,000
Total benefits	$6,147,600

The benefit-cost ratio for the entire development is 1.5, based on a 100-year period of analysis, and each project considered separately has a favorable benefit-cost ratio. The District Engineer recommends the construction of the three reservoirs subject to certain conditions of local cooperation. The Division Engineer concurs.

6. The Division Engineer issued a public notice stating the recommendations of the reporting officers and affording interested parties an opportunity to present additional information to the Board. Careful consideration has been given to the communications received.

Views and Recommendations of the Board of Engineers for Rivers and Harbors.

7. Views.--The Board of Engineers for Rivers and Harbors concurs in general in the views and recommendations of the reporting officers. The recommended improvements will substantially reduce flood damages in the basin and will provide a large amount of storage for conservation purposes, including irrigation, water supply, enhancement of the Rogue River fishery, and recreation. Hydroelectric power will be produced at the Lost Creek Reservoir. The improvements are economically justified and the requirements of local cooperation are appropriate.

8. Recommendations.--Accordingly, the Board recommends that reservoirs at the Lost Creek, Elk Creek, and Applegate sites be authorized for construction for flood control and other purposes, all generally in accordance with the plan of the District Engineer and with such modifications thereof, including reasonable adjustments

in storage capacity for water supply and other purposes, as in the discretion of the Chief of Engineers may be advisable, at an estimated cost of $106,700,000 for Federal construction and $802,400 annually for operation and maintenance including replacements: Provided that prior to construction:

a. Responsible non-Federal interests give assurances satisfactory to the Secretary of the Army that they will:

(1) Reimburse the United States in accordance with the Water Supply Act of 1958, as amended, for the first costs and the annual operation, maintenance, and replacement costs allocated to municipal and industrial water-supply storage, such costs being presently estimated at $5,977,000 and $24,900, respectively; and

(2) Hold and save the United States free from damages for water-rights claims resulting from construction and operation of the improvements;

b. Responsible local interests make necessary arrangements with the Secretary of the Interior for repayment, under the provisions of reclamation law, of the construction cost and annual operation, maintenance, and replacement costs allocated to irrigation, presently estimated at $13,007,000 and $66,500, respectively, for the Lost Creek-Elk Creek Reservoirs and $3,585,000 and $9,900, respectively, for the Applegate Reservoir, the final cost allocation to be made by the Secretary of the Army, with the assistance of the Secretary of the Interior; and

c. The State of Oregon take necessary action to insure maintenance, in the streams, of flows to be released for benefit of the fishery.

FOR THE BOARD:

KEITH R. BARNEY
Major General, USA
Chairman

REPORT OF THE DISTRICT ENGINEER

SYLLABUS

Rogue River Basin, in southwestern Oregon, is nationally known for its fishery, scenic, and recreation resources. Population centers and economic developments are concentrated in the valleys of the upper Rogue and certain tributaries. Lumbering, agriculture, and recreation are its principal industries. The basin has numerous natural resources, a rapidly growing population, and a great potential for development and utilization of its resources on a sustained basis.

The water resource needs of the basin include flood control; storage and controlled release of water for irrigation, water supply, fish and wildlife enhancement, and water quality control; generation of hydroelectric power; and provisions for increased recreational use.

In response to specific Congressional authorization, a study has been made of a plan for comprehensive water resource control and development for the basin. The study has been made in cooperation with the other Federal and State agencies interested in various phases of water resource and related developments.

The proposed basin plan is comprehensive. It provides for early and continued realization of flood control, irrigation, water supply, fish and wildlife enhancement, power generation, and recreation benefits as project purposes. It is adaptable to continued development for those and other purposes, as future needs may warrant.

The basin plan includes existing water resource developments, principally for irrigation; irrigation developments now under study by the Bureau of Reclamation; the multiple-purpose reservoirs and related supplemental works which are needed and justified at this time; possible-future single and multiple-purpose storage projects; and related water-resource works and programs by others.

The three multiple-purpose reservoirs proposed for early construction would be basic elements of any acceptable basin plan. The record of a public hearing held in Grants Pass, Oregon, on 25 September 1961, shows strong support for the plan, and particularly the reservoirs proposed for construction at this time.

In consideration of all factors, the District Engineer recommends the adoption of the comprehensive basin plan described herein, and the authorization and early construction of multiple-purpose reservoirs and appurtenant works at Lost Creek site on upper Rogue River, at Elk Creek site on Elk Creek in upper Rogue River Basin, and at Applegate site on upper Applegate River, all as described herein.

U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
628 Pittock Block
Portland 5, Oregon

NPPGW-6 1 December 1961

SUBJECT: Rogue River Basin, Oregon, Survey Report for Flood Control and Comprehensive Water-Resource Development

TO: Division Engineer
U. S. Army Engineer Division, North Pacific
Portland, Oregon

CHAPTER I - GENERAL

1. AUTHORITY

This report is submitted in response to the following authorizations:

a. Public Law No. 183, 74th Congress, 1st session, approved 1 July 1935:

> "Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to cause a preliminary examination to be made of the Rogue River and its tributaries in the State of Oregon, with a view to the control of its floods, in accordance with the provisions of Section 3 of an Act entitled 'An Act to provide for control of the floods of the Mississippi River and of the Sacramento River, California, and for other purposes,' approved March 1, 1917, the cost thereof to be paid from appropriations heretofore or hereafter made for examinations, surveys, and contingencies of rivers and harbors."

b. Section 6 of the 1936 Flood Control Act:

> "The Secretary of War is hereby authorized and directed to cause preliminary examinations and surveys for flood control at the following named localities . . . Rogue River and tributaries, Oregon . . . ."

A survey under that authority was assigned by the Chief of Engineers on 29 July 1937.

c. Section 206 of the 1958 Flood Control Act (Public Law 85-500 of the 85th Congress):

> "The Secretary of the Army is hereby authorized and directed to cause surveys for flood control and allied purposes, including channel and major drainage improvements, and floods aggravated by or due to wind and tidal effects to be made under the direction of the Chief of Engineers, in drainage areas of the United States and its Territorial possessions, which include the following named localities: . . . Rogue River, Oregon, in the interest of flood control, navigation, hydroelectric power, irrigation, and allied purposes . . . ."

2. EXTENT OF INVESTIGATION

a. Summary of studies. - Rogue River Basin as a whole is relatively undeveloped with vast reaches of rugged, timbered, and unpopulated land. Nonetheless, or perhaps in part because of that fact, the water and related resources of the basin are a matter of more than local concern. The use of those resources contributes to the economic and social welfare of the State, the region, and the Nation. The fishery resource, in particular, is a matter of national concern and significance. The study gave full consideration to those facts, and to the desires of local interests as expressed at public hearings, meetings, and through personal contacts and correspondence. At various times during the study, the District Engineer made personal reconnaissance of the basin and of problem areas and potential project sites. He also met with local groups and individuals to discuss needs, problems, and potential project plans. Studies were aimed at analyzing basin needs and developing a comprehensive plan for basin-wide water resource development which could be put into use as needs and circumstances might warrant. Studies included obtaining information as to local needs and desires; compiling basic data for preliminary and detailed project analysis; and extensive coordinating with local, State, and Federal interests and agencies. Limited ground reconnaissance of the entire basin was made and more than 30 potential reservoir sites were investigated to determine those at which survey scope studies would be warranted. (See table 1.) Geologic investigations were made at subsequently described damsites. These investigations included reconnaissance; geologic mapping; core-drill borings; open trenches; drifts; soil classification, including permeability tests; and determination of liquid limits and plasticity indices.

b. Functional and geographic scope. - The study included consideration of all potential project functions named in the authorizing legislation. Fishery and wildlife enhancement was considered under the provisions of Public Law 85-624, water supply under Title III to Public Law 85-500, and water quality control under Public Law 87-88. Consideration was given to needs and potentials of the entire basin, except that, because of fishery and recreation problems, no consideration was given to single-purpose projects for power generation in the headwaters

or in the Coast Range. Neither was any specific consideration given to the navigation aspects of the basin as navigation problems were covered by a prior report. (See paragraph 3a(3).) Further, navigation and flood-control developments would not be closely related and the proposed flood-control improvements would have only minor beneficial effects on existing or prospective future navigation. Rogue River is navigable only to shallow draft craft above the harbor at Gold Beach. (See paragraph 36b.)

c. Scope of presentation. - Maps were prepared and foundations and materials were explored for three dam and reservoir sites. Similar data for other sites considered in some detail were furnished by the U. S. Bureau of Reclamation. Hydrologic studies, appraisals of flood damages and property values, and analyses of potential benefits were made with the assistance of other agencies as appropriate. The Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service, in cooperation with State and local agencies, made extensive studies of streamflows and temperatures as related to fishery enhancement and gave consideration to wildlife aspects of the plans studied. Their report is attached hereto as Appendix A. The U. S. Public Health Service made extensive studies of water supply conditions and needs. Their report is attached as Appendix B. Alternative layouts and estimates of cost for reservoir projects described herein were made to select plans suited to the topography and geology of each site and the purposes to be served. Allocations of cost were made for those reservoir projects which were found to be economically feasible. Recommendations herein are based on the foregoing studies plus full consideration of the plans of other agencies, remaining basin potentials, and expressed desires of interested parties.

3. PRIOR REPORTS

a. Corps of Engineers. -

(1) Three navigation studies of portions of Rogue River were published up to 1916, as follows:

(a) Examination of Rogue River, House Executive Committee Document No. 97, 45th Congress, 3rd session, dated 17 February 1879.

(b) Examination of Rogue River, Grants Pass to Gold Beach, House Executive Committee Document 51, 52nd Congress, 2nd session, dated 5 December 1892.

(c) Preliminary Examination of Rogue River Bar and Entrance, House Document 491, 64th Congress, 1st session, dated 5 January 1916.

In addition, there were three unpublished studies and reports on navigation improvements in the period from 1916 to 1939. None of these early reports resulted in recommendation for or authorization of projects.

(2) A preliminary examination report was prepared in 1936 under the authority of Section 6 of the 1936 Flood Control Act. That report was favorable to preparation of a survey scope report for flood control.

(3) A survey scope report on improvements for navigation at Gold Beach, at the mouth of Rogue River, was published in 1954 as Senate Document No. 83, 83rd Congress, 2nd session. (See paragraph 36b.)

b. Bureau of Reclamation. - Several reports on irrigation development for Rogue River Basin and segments thereof have been prepared by the U. S. Bureau of Reclamation. The incidental flood-control functions of projects so reported on have been analyzed by the Corps of Engineers. Recent reports considered incidental to preparation of this report include the following:

(1) "Alternative Plans for Development of the Water Resources of Rogue River Basin," dated 5 March 1948. This was an informational report, preliminary to a public hearing.

(2) "Rogue River Basin Project, Oregon," dated February 1950. This report contained a proposal for certain of the plans described in the report of 1948. Lewis Creek Dam on Rogue River near Trail, Oregon, was the key structure. The report was released in April 1955, after completion of studies by the U. S. Fish and Wildlife Service and U. S. National Park Service. Release was made with the notation that the plan proposed therein was no longer under consideration by the Department of Interior.

(3) "Talent Division, Rogue River Basin Project, Oregon," dated December 1953. This report contained a proposal for a project to provide irrigation water for about 8,640 acres of new lands and about 9,250 acres of land needing supplemental water, all in the Bear Creek drainage area. The project, now nearing completion, serves somewhat different areas, as described in Chapter VI. (See paragraph 37a(1).)

(4) "Illinois Valley Division, Rogue River Basin Project, Oregon," dated December 1955. This report proposed a project to provide irrigation water for about 13,660 acres of new land and about 3,000 acres of lands needing a supplemental supply, all in upper Illinois Valley.

(5) "Merlin Division, Rogue River Basin Project, Oregon," dated June 1958. This report proposed a project to provide irrigation water for about 9,620 acres of land on Grave and Jumpoff Joe Creeks northwest of Grants Pass, Oregon.

(6) "Agate Dam and Reservoir, Rogue River Basin Project, Oregon," dated December 1959. This report proposed a project to provide irrigation water for about 1,810 acres of new land and about 4,820 acres of land needing supplemental water, all in the area north and northeast of Medford, Oregon.

c. Oregon State Water Resources Board. - The Board prepared a report on Rogue River Basin, Oregon, dated January 1959. It is a summary of data on water resource potential and current uses, and a program, with the force of State law, for future uses of the waters of the basin.

d. U. S. Fish and Wildlife Service. -

(1) An Interim Report on the Fish and Wildlife Resources in Relation to Plan "A", Rogue River Project, Oregon, January 1950.

(2) A Preliminary Report on Fish and Wildlife Resources Affected by Illinois Valley Division, Rogue River Basin Project, Oregon, November 1955.

(3) Fish and Wildlife Resources of the Rogue River Basin, Oregon, April 1956.

(4) Letter Report on Merlin Division, Rogue River Basin Project, Oregon, 30 June 1958.

(5) Letter Report on Evans Valley Division, Rogue River Basin Project, Oregon, 17 March 1961.

e. National Park Service. - National Park Service, Recreation Resources of the Rogue River Basin, Oregon, dated June 1954. Correlated with the 1950 Bureau of Reclamation report listed above, released for information only.

CHAPTER II - BASIN DESCRIPTION

4. LOCATION AND EXTENT

Rogue River Basin, comprising about 5,060 square miles, is located in southwestern Oregon. It lies between the crest of the Cascade Range to the east, the Siskiyou Mountains to the south, the Umpqua and Coquille River Basins to the north, the Coast Range and the Pacific Ocean to the west. It flows into Pacific Ocean at Gold Beach, Oregon, about 265 miles south of the mouth of Columbia River and about 320 miles north of the entrance to San Francisco Bay. The basin, roughly crescent-shaped with the extremities near Crater Lake at the crest of the Cascades and Gold Beach at the coastline, includes most of Jackson and Josephine Counties, a considerable part of Curry County, and minor areas in Douglas, Klamath, and Coos Counties in Oregon, as well as about 150 square miles in Siskiyou and Del Norte Counties in California. (See plate 1.)

5. STREAMS

a. Rogue River. - Rogue River rises at the extreme eastern tip of the basin near Crater Lake and flows generally westward about 210 stream miles to its mouth at Gold Beach. The upper reaches of the river above Trail flow through narrow, steep canyons. Developments occur only along small benches at infrequent intervals. Below Trail the valley widens into the largest arable and most highly developed section in the basin. Medford is located on Bear Creek about 15 miles upstream from its confluence with the Rogue near Gold Ray Dam. Sams Valley is located on the right bank of Rogue River between Trail and Gold Ray Dam. From Gold Ray (river mile 122), Rogue River flows about 23 miles generally in a canyon with areas of benchland subject to overflow occurring at intervals on either side utilized principally for riverfront homesites and commercial enterprises. Proceeding downstream, a short distance below Savage Rapids Dam, near the lower end of the canyon reach, the valley widens to form the second largest area of development in the basin, in which the city of Grants Pass is located. This fertile valley extends downstream from Grants Pass about 12 miles to the entrance of a narrow, deep, rocky gorge which extends through the Coast Range to the ocean.

b. Principal tributaries. - Principal tributaries, in upstream to downstream order, are as follows:

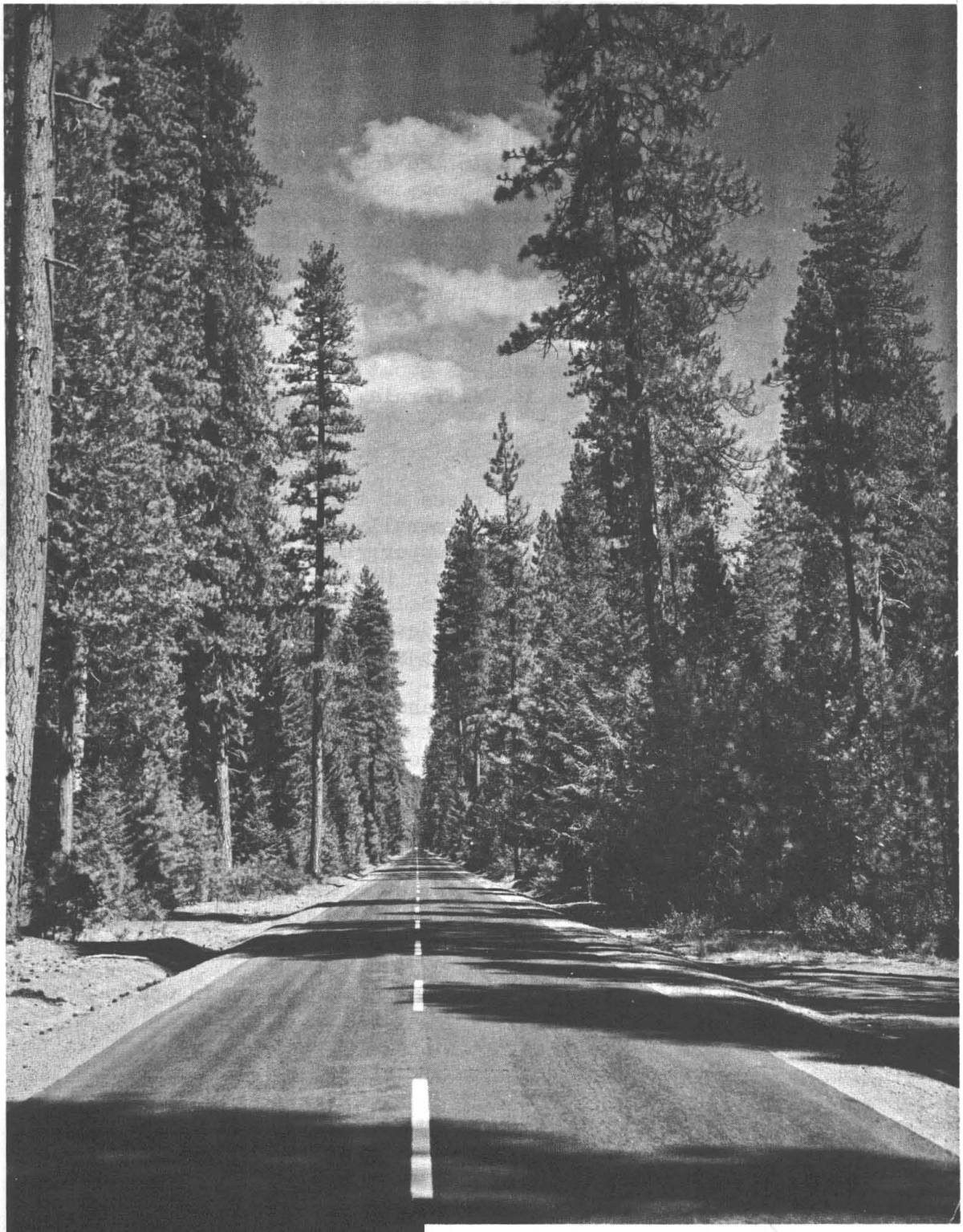


Figure 1. Pine forests along Highway 62 in upper Rogue River Basin are scenic and provide sustained yield for industry. (Oregon Highway Commission photo)

Tributary stream	Entrance at river mile	Drainage area, square miles	Tributary from
South Fork Rogue River	164	245	Left bank
Big Butte Creek	152	253	Left bank
Elk Creek	148	135	Right bank
Little Butte Creek	129	374	Left bank
Bear Creek	123	341	Left bank
Evans Creek	108	218	Right bank
Applegate River	91	768	Left bank
Illinois River	23	982	Left bank

In addition to the foregoing principal tributaries, there are more than 1,000 lesser named tributaries and a larger number of smaller unnamed streams. The two tributaries on which projects are proposed are described briefly in the following subparagraphs.

c. Elk Creek. - Elk Creek rises near the Rogue-Umpqua basin divide, on the south slope of Quartz Mountain about 20 miles north-northeast of Trail and flows in a southerly direction about 7 miles through steep, narrow canyons to the confluence with Button Creek. The valley widens intermittently and continues in a southwesterly direction about 12 miles to join with the Rogue near Trail. A few scattered farms and dwellings are located along the narrow benches in the lower reaches of the valley.

d. Applegate River. - Applegate River originates in California on the north slope of the Rogue-Klamath basin divide above 5,000-foot elevation and flows generally eastward about 10 miles through very rugged, narrow, deep canyons to its confluence with Butte Fork. The valley widens slightly and continues north-northeasterly for about 4 miles to join Elliott Creek near the California-Oregon state line. A few scattered residences are located along the narrow shelves through this reach. The valley continues north-northeast about 15 miles to join the Little Applegate River, and widens intermittently, reaching a width of about one-half mile in places. Several small farms and residences are located in this reach, which becomes more populated in the lower portions. From the Little Applegate the river flows north-northwest about 3 miles and the valley widens to about 1.5 miles. The town of Ruch is located at the lower end of this reach, about 1 mile east (right) of the river. The valley narrows to about one-half mile in width and continues west-northwest about 5 miles to the town of Applegate. From Applegate the river runs northwest about 20 miles through a broad, flat valley extensively developed for farmsteads and agriculture, and joins Rogue River about 6 miles west of Grants Pass. The channel capacity through the developed areas is about 10,000 cubic feet per second.

89588 O-62—4

6. TOPOGRAPHY

Rogue River Basin is made up of three major sectors:

a. Eastern sector. - The eastern sector or headwaters area lies on the west slope of the Cascade Range. The area generally is rugged, mountainous terrain and large portions are almost precipitous. Elevations range from less than 2,000 feet[1] to an elevation of 4,000 to 6,000 feet along the eastern rim. Peaks at the crest of the Cascade Range rise to elevations of 7,000 to 9,500 feet.

b. Central sector. - The central sector lies between the Cascade and Coast Ranges. It contains almost all of the agricultural lands and related developments in the basin. It consists generally of relatively flat valley floors separating ranges of hills of rolling to relatively steep character. Elevations range from less than 900 feet near Grants Pass at the western edge to about 1,500 to 1,800 feet at the foot of the Cascade slope.

c. Western sector. - The western sector consists generally of areas in the Coast Range and slopes of the Siskiyous. The terrain is nearly as rugged as the eastern sector, but elevations are lower, ranging from sea level at Gold Beach to a maximum of about 5,000-foot peaks in the Coast Range. The Siskiyous to the south are somewhat higher than the unnamed divide between the Rogue and the Coquille and Umpqua Basins to the north.

d. Lands flat enough for agricultural use generally are limited to areas along Rogue River from near Shady Cove downstream to a point below Grants Pass; along Bear Creek from about Ashland downstream to its mouth; along the lower reaches of Little Butte and Evans Creeks; along Applegate River and the upper reaches of Illinois River; and small areas along the lower reaches of lesser tributaries generally in the central sector.

7. GEOLOGY AND SOILS

a. General. - The geology of Rogue River Basin is complex. It includes rock formations ranging from the oldest to the youngest in the State. The upper river and its tributaries east of Bear Creek Valley originate in the high Cascades and cross the relatively narrow belt of Tertiary lavas and pyroclastics of the Western Cascade geologic province. Below Bear Creek Valley, the river follows a circuitous route across the Klamath Mountain complex to the sea. Rocks of this area are mainly pre-Tertiary metamorphosed sediments and volcanic rocks, granitic intrusives, and serpentine. The major downstream tributaries, the Illinois and the Applegate, head in the Siskiyou Mountain portion of the Klamath geologic province. Numerous sites exist for low dams but sites capable of supporting high storage dams are scarce and usually will require large quantities of construction materials.

1 All elevations in this report refer to mean sea level.

b. Several periods of alluviation are recognized dating from late middle Tertiary time. Gold-bearing gravels are found in terraces as well as in isolated bars high above the present streambeds. Many alluvial basins with transported soils are found in sections of Bear Creek, the Middle Rogue, Applegate River, and the headwaters of Illinois River. Thin to medium depth clayey soils have formed on the metamorphic rocks of the Klamath complex but the granitic rocks usually are deeply weathered and have coarse sandy soils. Soils in the Western Cascades are thin to medium depth and are silty to clayey. A blanket of fresh pumice from the Mount Mazama (Crater Lake) explosion covers the headwaters of the main river and, with young porous lava, forms an excellent absorption field and underground reservoir. See Appendix E for more detailed discussion of geology.

8. STREAM CHARACTERISTICS

a. Streams in the upper reaches of Rogue River Basin have steep gradients and flow through narrow channels cut deeply in pumice or lava rock. Stream gradients in these sectors range from about 25 feet per mile upward to near 500 feet per mile. Slopes along the central and lower valley average about 9 feet per mile. Consequently, velocities, particularly at flood stage, are high, creating erosion problems in many places.

b. Topography and geology of the basin are conducive to rapid runoff, and streamflow closely follows the rainfall pattern. Floods are characterized by high peaks with durations of only a few hours. Total flood duration normally is only 2 to 4 days. The higher flows generally occur during the period November through March, and low flows during June through October. However, extensive areas of porous lava and pumice along the eastern boundary of the basin act as natural reservoirs to maintain summer flow. The channel capacity of Rogue River at Grants Pass is about 45,000 cubic feet per second. Capacity of Applegate River at Applegate is about 14,000 cubic feet per second. Flows of more than bankfull capacity occur on an average of about once in 2 to 4 years. There have been about 18 damaging floods since 1905. (See Appendix F.)

9. VEGETATION

More than three-quarters of the basin area is forest or timberland. Much of the forested area contains, or is capable of producing, marketable timber. Commercial timber species include Douglas fir (about 70 percent of the total), other firs, Ponderosa and sugar pine, hemlock, and red cedar. Hardwood species, such as alder, maple, and oak, make up only a small percentage of the total commercial timber volume. About 50,000 acres of semiarid foothill areas, generally the southward-facing slopes, are covered with a sparse growth of oak, madrona, and underbrush, and there are probably about 170,000 acres of rocky, mountainous land with a sparse cover of stunted fir, Ponderosa pine, and lodgepole pine. Untimbered and uncultivated lands in the basin generally support a light

cover of annual grasses and weeds which grow in early spring but are dry throughout most of the rest of the year. Lands devoted to agriculture amount to about 9 percent of the basin area, and more than half of those are natural pasture.

10. MAPS

The U. S. Geological Survey has recently completed mapping Rogue River Basin to a scale of 1:62,500. These maps depict the topography with a fine degree of accuracy and show manmade features as of 1950 to 1955. The Oregon State Water Resources Board has prepared a map of the basin showing names of all lakes and streams. A strip map and profile of Rogue River and principal tributaries were prepared by the U. S. Geological Survey in 1925 to a scale of 1:31,680 with a 5-foot contour interval. The U. S. Soil Conservation Service has made soils surveys on about 335,000 acres in the basin, and less comprehensive conservation surveys on an additional 315,000 acres. Damsite and reservoir maps made for this study are contained in main report and appendixes. Mapping generally was from aerial photographs, by use of appropriate ground control and the multiplex projector. Aerial photography was obtained for Rogue River from the mouth upstream to a point above Lost Creek Reservoir, and for the principal tributaries, including Elk Creek, Big and Little Butte Creeks, Evans Creek, Applegate River, and Illinois River.

CHAPTER III - ECONOMIC DEVELOPMENT

11. POPULATION

The population of Rogue River Basin is located almost exclusively along the main streams in Jackson and Josephine Counties. Most of the remainder of the population is located in Curry County, with some in the fringe areas in Klamath County, Oregon, and in northern California. The principal city, Medford, with a population (1960 census) of 24,425, is located on Bear Creek, a major tributary to Rogue River. Grants Pass (population 10,118) on the Rogue and Ashland (population 9,119) located on Bear Creek are the second and third largest cities in the basin. The Bureau of Census figures from 1920 to 1960, inclusive, show that the basin has experienced a rapid growth in population. The rate of increase was 58.2 percent from 1920 to 1930, 18.2 percent from 1930 to 1940, 65.3 percent from 1940 to 1950, and 22 percent from 1950 to 1960. Of the 106,744 residents in the basin in 1960, 41 percent were living in urban communities and 59 percent were located in the rural areas. Immigration accounted for about 40 percent of the gain in population during the period from 1950 to 1960. Table 1, Appendix D, shows the distribution of population in Rogue River Basin during the period 1920 through 1960.

12. LAND USE

a. Most of the usable lands within Rogue River Basin are well developed and fully utilized, within the limits imposed by climatic conditions, soils, topographic features, and availability of water. The upper valley extends westerly from a short distance below Trail on Rogue River, where a fairly broad alluvial plain is formed by the merging of the valleys of Little Butte Creek, Bear Creek, and Rogue River, downstream approximately 20 miles to the vicinity of Gold Ray Dam. It has an area of about 60 square miles, constituting the largest body of agricultural land in the basin. The most intensive developments in the basin are located in Bear Creek Valley.

b. About 9 percent of the area of Rogue River Basin, or about 285,000 acres, is tillable land. Irrigated and intensively cultivated areas total about 64,000 acres. The nontillable land varies in character from semiarid range to heavily forested mountains. About 2.5 million acres, representing about 78 percent of the area of the basin, are covered by forests of commercial value. About 2 million acres, or about two-thirds of the basin area, is publicly owned and about one-third privately owned. Most of the publicly owned land is in timber and, with few exceptions, is not suited for agriculture.

13. FOREST RESOURCES

The Rogue River, Umpqua, and Siskiyou National Forests and other Federally and privately owned timberlands occupy the greater part of the rugged and mountainous areas surrounding the central valley. The basin

includes about one-half of the southwest Oregon unit of the National Forests. This unit encompasses the largest concentration of virgin forests remaining in the United States outside of Alaska. (See table 3, Appendix D.) The resource is being managed to produce a sustained yield, and the present cut is near the sustained-yield capacity. Harvest of forest products comprises by far the largest industry in the basin at the present time. Over 40 percent of all laborers' income is derived from some phase of timber manufacturing. (See table 2, Appendix D.) The timber and lumber industry provides the chief source of manufacturing activity in the basin, and future industrial expansion and development are dependent primarily on this natural resource. Additional forest-based enterprises and increased and better utilization of forest by-products will result in additional manufacturing in that field.

14. AGRICULTURE

a. Major agricultural enterprises in the basin are restricted generally to irrigated lands in Jackson and Josephine Counties. Livestock raising, dairying, poultry raising, fruits, specialty crops, field crops, and vegetables, comprise the main agricultural pursuits in the basin and were valued at more than $17 million in 1959. The non-irrigated lands are used principally for pasture. Grazing capacity of the forest land is limited. Only about 10,000 head of cattle are provided summer grazing on public forest lands. Pears were introduced into Rogue Basin about 1900 and the acreage in pear orchards increased rapidly during the early part of the century. About 10,000 acres are now devoted to the production of about 75 percent of the Nation's Bosc pears. Other agriculture of the basin is quite diversified. Gladioli bulbs, hops, mint, and ladino clover for hay, seed, pasture, and silage are leading crops. Dairying and general livestock are to be found on most of the 3,000 farms in the basin. The Medford district has about 25 fruit-packing and exporting firms, 6 modern cold-storage plants, and a large, modern iceplant. About 4,000 people are employed during the packing season which covers a period of about 2-1/2 months. About 6 percent of the payroll consists of processing and packing agricultural products. The areas in farms and general land use are given in Appendix D.

b. In both Jackson and Josephine Counties the rate of agricultural development is below that of the past. Many of the farms are only 5- to 10-acre tracts. Farm income is being increasingly supplemented by earnings from other activities. A limited local market, suitable soils, and availability of water are controlling factors in the type of crops presently raised. The poor soils and adverse topography in the wooded areas limit the amount of arable lands available. Better utilization of available water for irrigation would make possible the conversion of some of the better lying semiarid lands, now used for dry-land type agriculture, to irrigated lands. Improved water use and protection against flooding would increase production and lower crop loss, which would greatly enhance the value of the affected area.

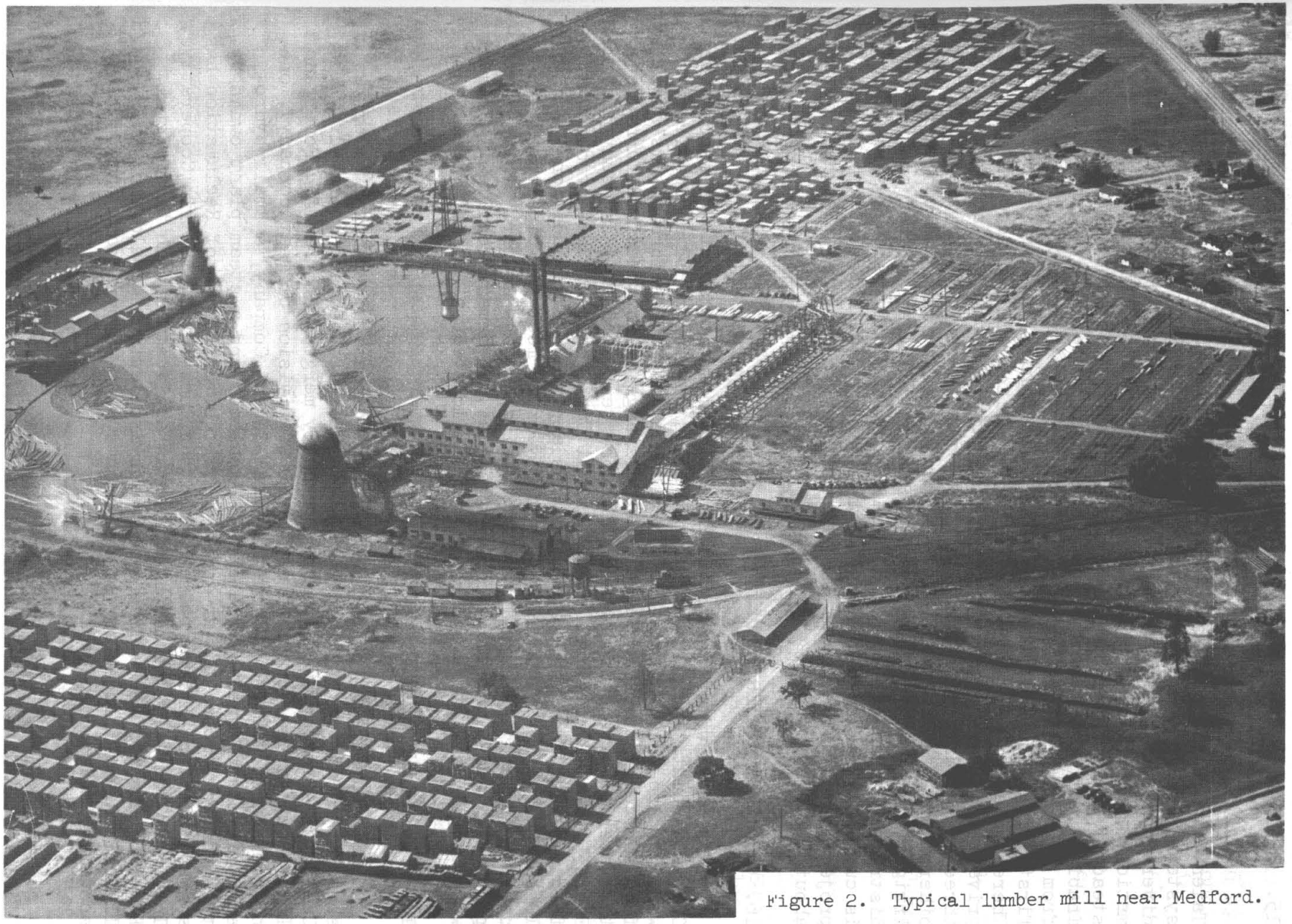


Figure 2. Typical lumber mill near Medford.

15. IRRIGATION

Irrigation was first practiced in Oregon in 1852 on what is now the Talent Irrigation District. The practice quickly spread, and private systems were in operation by 1860. The earlier systems made direct diversion from the streams with no provision for storage. Census information, available since 1919, indicates that irrigation increased steadily until 1944, but has changed little since that time, due to inability of districts to supply additional water and to removal of lands from agricultural use. About 72,000 acres were irrigated in 1959. The first irrigation district, the Fish Lake Company, was organized in 1894. There are at present nine districts, organized and financed chiefly by private and state organizations which serve about 42,000 acres. Only three of the districts presently have water storage facilities. The other districts are supplied water through individual and cooperative irrigation systems. The Bureau of Reclamation has assisted some of the districts in rehabilitation of their canals and diversion systems, and is currently making additions to the storage facilities of the Talent project which will augment the water supply to existing areas and supply about 5,300 acres of new land.

16. MUNICIPAL WATER SUPPLY

Municipal water rights in the basin amount to about 331 second-feet. Of that amount, the city of Medford holds rights to 262 second-feet, which includes 100 second-feet from Rogue River. Medford now is supplied from sources in the Big Butte Creek drainage basin. Medford furnishes the water requirements for the cities of Central Point, Jacksonville, and Eagle Point. Grants Pass holds a right for 12 second-feet or 8,800 acre-feet per year from Rogue River and has applied for an additional 10 second-feet or 7,300 acre-feet per year to meet anticipated future needs. Ashland is the only town utilizing storage as part of its municipal supply and plans additional storage as the demand requires. Present water supply and storage for the city is located on Ashland Creek.

17. POWER DEVELOPMENT

Data supplied by the Federal Power Commission for Rogue River Basin shows five existing hydroelectric powerplants owned and operated by the California-Oregon Power Company (recently merged into Pacific Power and Light Company and now known as the COPCO Division of that company), one hydroelectric plant owned by the Ideal Cement Company, a small hydroelectric plant owned by the city of Ashland, and a steam plant owned by the Medford Corporation at Medford. The U. S. Bureau of Reclamation has a small plant on Emigrant Creek, and the Coos-Curry Electric Cooperative, Inc., of Coquille, Oregon, has filed an application with the Federal Power Commission for a license for a hydroelectric development on Illinois River. Locations of the plants, with appurtenant data, are shown in table 4, Appendix D.

18. TRANSPORTATION

a. General. - Development of the area has been somewhat retarded by poor transportation outlets. The relatively small developed areas along the lower reach, the town of Gold Beach at the mouth of Rogue River, in Curry County, are physically separated from the main basin by the Coast Range. These areas do not trade with nor do they contribute directly to the economy of the interior valley areas which lie in Jackson and Josephine Counties. The only means of transportation between the interior valleys and the coastal areas is by highways which connect with the coastal highway many miles north or south of Gold Beach.

b. Railroads. - Only one branch-line railroad (formerly the main line) of the Southern Pacific Company traverses Rogue River and Bear Creek Valleys. It enters the basin from the north and passes through Grants Pass, Medford, and Ashland and on to California points. This line provides service for freight only.

c. Highways. - Interstate Highway No. 5 (U. S. Highway 99) passes through the central portion of the valley in a north-south direction. Upon completion of improvements now underway, the interior valley will be accessible from the north and south by a 4-lane highway with good alignment and grade. U. S. Highway 101 extends along the coastline. It also is being improved by extensive new construction. Oregon Highway 66 provides a year-around connection to points east of the basin and U. S. 199 connects the interior valley to U. S. 101. There are about 400 miles of paved state highways in the basin. The U. S. Forest Service and Bureau of Land Management are constructing new forest roads in order to utilize commercial timber now inaccessible.

d. Air. - Medford has a municipal airport and is served by several commercial airlines. Grants Pass has a new municipal airport, but is not yet served by scheduled flights.

e. Water. - A newly constructed harbor at Gold Beach provides sufficient depth for seagoing barges and for vessels having up to a 13-foot draft. (See paragraph 36b.) A contract mail-boat service operates shallow-draft boats to carry mail and sightseers from Gold Beach to Agness. The remainder of the stream system is used only for pleasure boating.

19. MINERAL PRODUCTS

An influx of white settlers occurred in 1850 as a result of the gold discovery which centered around Jacksonville. Gold mining is no longer of material consequence to the economy of the region. The value of mineral production in Jackson and Josephine Counties, including cement, stone, sand and gravel, clays, gold, carbon dioxide, chromite, tungsten, silver, and copper exceeded $4,000,000 in 1956 and 1957. There are also some potentials for developing coal, cobalt, and nickel mining within the basin.

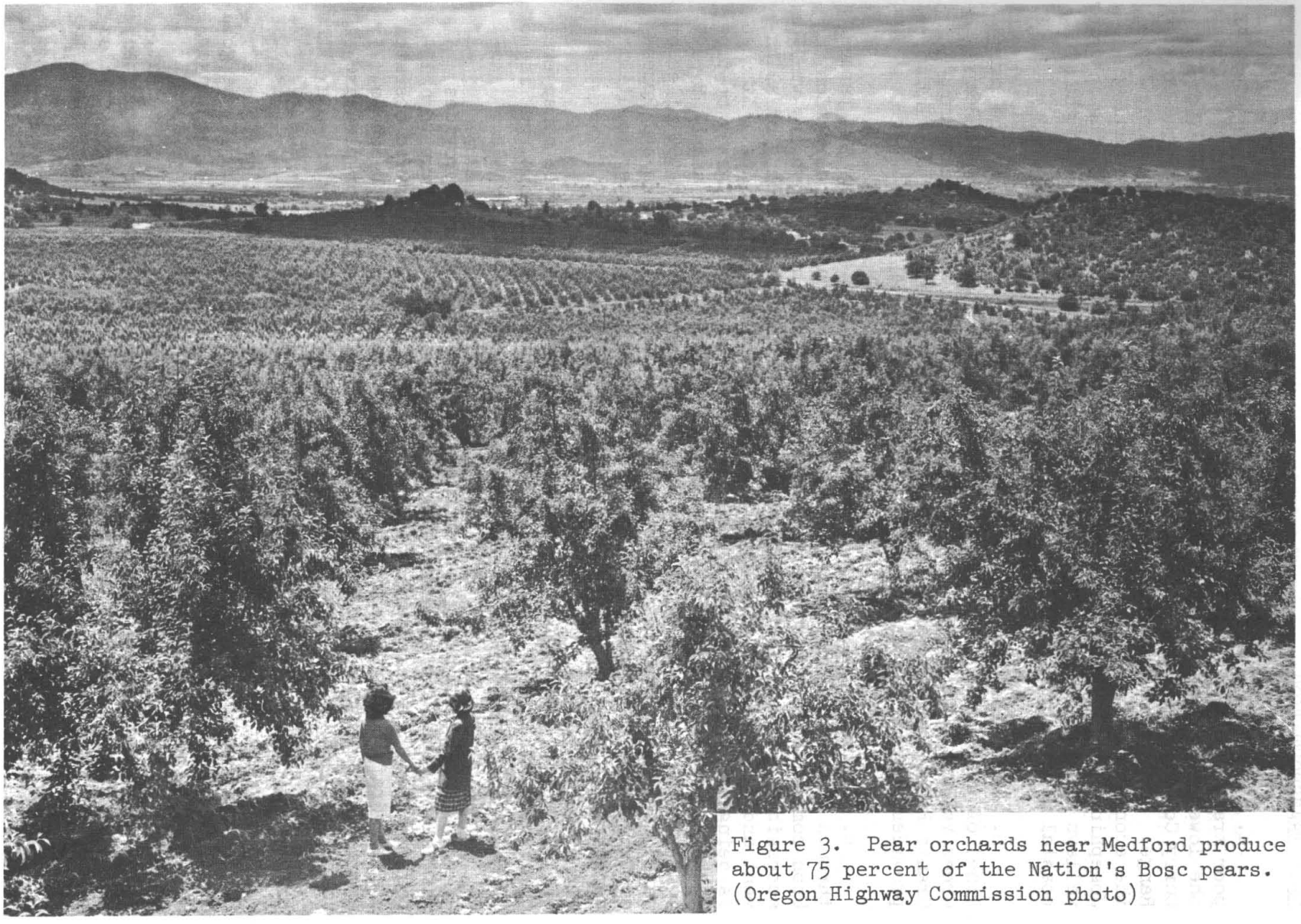


Figure 3. Pear orchards near Medford produce about 75 percent of the Nation's Bosc pears. (Oregon Highway Commission photo)

20. RECREATION

a. Rogue River Basin contains a wealth of recreational resources, consisting of mountain and river scenery; outstanding geological formations; extensive forested areas; excellent hunting; and a very valuable and nationally known salmon, trout, and steelhead fishery. Except for the extensively developed portion of the central valley section, the natural character of the basin has not been materially changed. Crater Lake National Park in adjacent Klamath County, Oregon Caves National Monument, and the nationally famous salmon and steelhead fisheries of Rogue River have made this area one of the best known and most popular recreational areas in the Nation. State parks provide picnicking and camping facilities. National forests provide a wide range of opportunities for popular recreational pursuits such as sightseeing, camping, trout fishing, boating, and hunting.

b. Recreational activities in the basin rank third in economic importance following lumbering and agriculture. Studies made in 1953 estimated the number of recreation-bound visitors at 1,725,000 and the total value of tourist expenditures at $14,000,000, exclusive of recreational expenditures of local residents. More recent figures are not available but because of the spiralling growth of outdoor recreation, present expenditures undoubtedly far exceed the above figures. Businesses especially benefited are those supplying recreational goods and services, including hotels, motels, and resorts, sporting goods stores and apparel stores, food and drink establishments, and businesses serving the needs of the motorists.

21. FISHERY

a. Rogue River Basin long has been nationally famous, and internationally known, for its anadromous and resident fishery resources. The principal anadromous fishes, and those on which the basin's fame is based, are chinook and coho, or silver, salmon; and steelhead and sea-run cutthroat trout. Anadromous fishes are those which spend most of their lives in the sea but return to fresh water to spawn. Sportsmen of the United States, and many other Nations, have traveled to the Rogue for the superlative salmon and steelhead fishing it has offered. The principal resident sport fishes are rainbow and cutthroat trout.

b. Although the anadromous fishery has declined in recent years, the chinook salmon and steelhead trout are still of great economic importance, both as commercial and sport fish. Commercial fishing by nets and seines was permitted on Rogue River through the spring of 1935 and by hook and line from 1936 to 1938. Since that date commercial fishing of Rogue River salmon has been confined to offshore trolling. Rogue River contributes fish to the commercial troll fishery and the ocean sports fishery as far south as Point Arena in California and north along the coast, probably as far as Alaska.

c. The nationally utilized sport fishery consists principally of spring and fall chinook salmon and resident and anadromous rainbow (steelhead) and cutthroat trout. The trout fishery, especially in Rogue River above Prospect and on Applegate River, is largely dependent on annual plantings of hatchery-reared fish by the Oregon State Game Commission. In the upper segment, native rainbow and cutthroat trout, as well as introduced brown and eastern brook trout, are taken. The resident-trout fishery of the basin is enjoyed by thousands of anglers, both resident and out-of-state, each season.

22. WILDLIFE

The wildlife resources of Rogue River Basin make an important contribution to the economy of the region. These resources are divided into four major categories which are big game, upland game, fur animals, and waterfowl.

a. Big game. - The principal big-game resource is the Columbian blacktailed deer, which ranges over most of the basin. For the past 7 years an average of approximately 10,000 hunters have harvested about 3,000 deer annually in Jackson, Josephine, and Curry Counties, principally in the more accessible middle and upper basin segments. Elk are found in limited numbers in various areas of the basin. These small herds are thought to be slowly increasing, but very few are harvested. Black bear still occupy much of their original range in the rugged, less accessible lands of the basin, but because of their scarcity and the difficulty of penetrating their habitat, they are seldom hunted.

b. Upland game. - Ring-necked pheasant and valley quails provide the most universal sport for regional hunters. Mourning doves and band-tailed pigeons are common seasonally on some of the agricultural lands, and there are small numbers of brush rabbits and silver-gray squirrels. The mountainous and woodland areas of the basin are occupied by mountain quails, ruffed grouse, sooty grouse, and silver-gray squirrels.

c. Fur animals. - Muskrats, minks, and beavers are the principal contributors to the basin's fur harvest. Such species as skunks, weasels, and raccoons are generally taken incidental to trapping operations directed at the more valuable fur species. The major trapping effort occurs in the middle basin segment.

d. Waterfowl. - Rogue River and its tributaries are essentially swift streams with comparatively little aquatic food or marsh habitat for waterfowl. Most of the waterfowl utilization occurs in the middle segment of the basin where croplands and irrigation or power reservoirs provide feeding and nesting area. Nesting, mainly by mallards and a few wood ducks, occurs along the natural watercourses, in small marsh areas, and along irrigation distribution systems. Migratory flights consist principally of mallards, baldpates, pintails, green-winged teal, scaups, and wood ducks, with a few goldeneyes, redheads, buffleheads, and ruddy ducks.

Figure 4. Pear packing plant in Medford.

23. OTHER

Service industries such as finance, communication, trade, advertising, education, and professional services contribute substantially to the economy of the area. The importance of the cities as centers of commerce is indicated by the number of workers in finance and trade, which account for 21.6 percent and 20 percent, respectively, of the basin payrolls.

24. TRENDS OF DEVELOPMENT

In considering projects for regulation of Rogue River, it is recognized that normal development may be expected to materially change the conditions along the stream and thereby affect flood damages and water resource utilization. In an effort to forecast these trends and developments, the past history of the area, its resources, and its relationship to the national economy were considered. Economic growth is dependent upon interrelated economic conditions, of which population, natural resources, power, and transportation are of major importance. A generally expanding economy with a high level of employment will provide an expected economic growth of about 5 percent per annum for the next 50 years. A somewhat lower economic growth rate of 4 percent thereafter is considered reasonable. The population in the basin has increased from about 45,000 to more than 106,000 in the past 30 years, or almost 3 percent per annum, and is predicted to reach 265,000 by 2010 and 470,000 by 2070. The conditions in support of this growth are given in Appendix D. The effect of the expected growth will be to raise the present value of the average annual benefits to be derived from flood-control projects during the next 100 years, by about 450 percent.

CHAPTER IV - CLIMATOLOGY AND HYDROLOGY

25. CLIMATOLOGY

The general location and character of Rogue River Basin are conducive to rather moderate climatological and hydrological conditions.

a. Temperature. - Average monthly maximum temperatures (August) range from 72 degrees F. at Medford to 58 degrees F. at Gold Beach. Average monthly minimums (January) range from 46 degrees F. at Gold Beach to 17 degrees F. at Crater Lake. Extremes of record are 115 degrees F. at Medford and minus 20 degrees F. at Crater Lake.

b. Precipitation. - Precipitation varies with elevation from about 20 inches in the interior valley areas to about 120 inches in the upper Coast Range and 70 inches in the upper Cascade Range. Much of the total precipitation at the higher elevations occurs as snow. Average annual rainfall for the basin above Gold Ray Dam is about 43 inches. About one-half of the average annual precipitation occurs during the November-January period while less than 5 percent occurs during the July-September period.

c. Climatological records. - Precipitation records are continuous since 1879. About 20 stations, some of which also record temperature and evaporation data, have been in operation throughout the basin since 1920. Most of the gages are located near the population centers at the lower elevations. However, there are 24 snow courses scattered throughout the higher portions of the basin. Average annual pan evaporation at Medford is about 43 inches, which is about the highest in Rogue River Basin.

26. RUNOFF AND STREAMFLOW DATA

Streamflow records in Rogue River Basin have been maintained at Raygold, near Gold Ray Dam, since 1905. About 13 gaging stations have been in operation more than 27 years and 21 for more than 10 years. The average annual runoff at Raygold is 2,113,000 acre-feet, or about 19 inches over the basin. This indicates an average annual loss of about 24 inches. The maximum and minimum runoffs have been 3,570,000 and 839,000 acre-feet, respectively. Maximum estimated peak discharge at the Lost Creek damsite was 45,000 cubic feet per second; at the Elk Creek site, 22,000 cubic feet per second; and at the Applegate site, 34,000, all of which were produced by the 1861 flood. Minimum mean monthly discharge at Lost Creek was 608 cubic feet per second (August 1931); at Elk Creek, 2 cubic feet per second (August 1946 and September 1951); and Applegate, 13 cubic feet per second (August-September 1931 and September 1934). Annual volumes of flow are as follows:

Stream	Location	Maximum (acre-feet)	Minimum (acre-feet)
Rogue River	Prospect gage[1]	1,884,000	673,000
Elk Creek	Near Trail[2]	307,600	61,875
Applegate River	Near Copper[3]	588,100	127,300

1 About 4 miles upstream from Lost Creek damsite, 31-year record.
2 About 2 miles downstream from Elk Creek damsite, 14-year record.
3 About 1 mile downstream from Applegate damsite, 21-year record.

Additional details are given in Appendix F.

27. FLOODS OF RECORD

a. The largest flood of historical record occurred in 1861 and had an estimated peak discharge at Gold Ray Dam of 131,000 cubic feet per second. The second largest occurred in 1890 when the discharge was estimated at 120,000 cubic feet per second. There have been two major floods since establishment of the gaging station at Raygold in 1905; one in February 1927 and the other in December 1955, each with peak discharge of 110,000 cubic feet per second. Damaging floods in the basin are almost an annual occurrence.

b. Floods have occurred in all of the months from October through April, with a maximum concentration in December, January, and February. Major floods result from heavy rains at times when there is a snowpack on the headwaters and the ground has been saturated by prior precipitation. Peak discharges are of only a few hours duration, and total flood duration is almost never in excess of 2 to 4 days. Spring freshets resulting from snowmelt are of longer duration, but peak discharges are not generally high enough to cause damage. Maximum annual floods in the period 1906-1960 occurred as follows:

Month	Number of occurrences
October	1
November	6
December	14
January	13
February	14
March	5
April	2
Total	55

28. STANDARD PROJECT FLOOD

Discharge-frequency curves were prepared from hypothetical probability curves and available records, using the 1861 flood as the maximum known discharge. The probability curves indicate that a flood such as that of 1861 might occur not more often than once in 100 years at the Lost Creek, Elk Creek, and Applegate damsites. There has been only one occurrence of that magnitude in the 100 years of historical record. As discussed in Appendix F, the 1861 flood has been adopted as the provisional standard project flood. The estimated peak discharges for provisional standard project floods are:

Damsite	Discharge, c.f.s.
Lost Creek	45,000
Elk Creek	22,000
Applegate	34,000

29. MAXIMUM-PROBABLE FLOOD

a. The necessity for safety of the Rogue River projects against failure from overtopping cannot be over-emphasized because of the economic developments below the dams and the potential loss of life in the event of failure. Therefore, the spillways and outlets must be designed to pass the maximum-possible flood without jeopardy.

b. Since the maximum-possible flood has not occurred in the basin it was necessary to derive a hypothetical flood for each project. In the derivation, all hydrologic elements were considered ideal for a flood-producing storm consistent with controlling factors including snowmelt, minimum surface loss, etc. Precipitation excess was converted to a flood hydrograph by applying a unit hydrograph and adding a base flow. Six-hour unit hydrographs were used to convert the 72-hour hypothetical storm into flood hydrographs. Details of the derivation are contained in Appendix F.

c. Computed maximum-possible discharges are as follows:

Location	Discharge, c.f.s.
Lost Creek damsite	102,000
Elk Creek damsite	45,000
Applegate damsite	82,000

89588 O-62—5

CHAPTER V - FLOOD DAMAGES

30. GENERAL

Flood damages in Rogue River Basin occur in a number of discontinuous areas along Rogue River and in the valleys of tributary streams. The areas subject to flooding, as shown on plate 1, are not extensive. Agricultural, residential, and recreational properties are, in general, most frequently damaged. Industrial properties, highways, and irrigation facilities are damaged less frequently. As discussed in Appendix D, extensive surveys have been made to determine damages caused by past floods to provide a basis for estimates of average annual flood damage.

31. TANGIBLE FLOOD DAMAGES

Tangible flood damages include physical damages, emergency costs, and business losses.

a. Physical damages. - Physical damages consist of direct damages to buildings and contents, crops, lands, drainage and irrigation works, fences and other improvements, industrial equipment, utilities, highways, and other facilities. Such damages are caused by inundation or erosion, or both. The principal damage areas along Rogue River are from a point immediately upstream from the town of Rogue River downstream to a point between the mouth of Applegate River and Robertsons Bridge. Damages in this reach include industrial, commercial, residential, recreational, and agricultural. Agricultural damages include those due to inundation of lands and destruction of improvements and those due to erosion of riverbanks; surface scour and erosion; and deposition of sand, gravel, and debris in cultivated areas. Bank erosion destroys agricultural lands, homesites, and access roads. Surface erosion by overbank flow removes valuable topsoil and creates overflow channels through cultivated fields. Such channels increase cost of crop production by decreasing accessibility of lands, and may develop into year-around channels permanently isolating areas of highly productive land.

b. Damage to permanent residences, recreational developments, and summer homes is high in the reach immediately upstream from Savage Rapids Dam and in the vicinity of the town of Rogue River. Damages along the upper Rogue are principally to recreational facilities, tourist facilities, and residences. Damages in Applegate Valley are principally agricultural, including considerable bank erosion.

c. Emergency costs. - Emergency costs include the costs to Federal and local governmental units, the Red Cross, and other agencies that have assisted in evacuation, flood fight, and emergency rehabilitation. Emergency residential costs include costs for evacuation and temporary housing elsewhere, and loss of wages when the resident was required to be absent from his usual place of employment because of flood conditions at his home. Due to the method used in collecting data on actual flood

damages, emergency costs to industrial and commercial projects were included in the statistics for business losses.

d. Business losses. - Business losses consist of loss of normal business profits because of inability to operate during the flood period and rehabilitation period after the flood. Also included are the loss of wages to employees and increased costs of operating, such as moving equipment and merchandise to prevent flood damages, and similar expense. Such losses are reduced in this basin by the fact that the floods ordinarily occur during those months when normal commercial and industrial activity in the flood plain is at its lowest seasonal point.

32. INTANGIBLE DAMAGES

The intangible flood losses in Rogue River Basin are not particularly serious. Because of the narrow flood plains and availability of flood warning, residents and others generally may readily reach places of safety during floods, and loss of life is held to a minimum. Probably the largest intangible damage is suffered by agricultural properties dependent on irrigation water which cannot be delivered when needed because of damage to irrigation structures in the flood plain. Intangible damages have not been considered in the economic evaluation of projects proposed herein.

33. TRENDS OF DEVELOPMENT

The trend of development within the basin will lead to a steady increase in the flood damages during the coming years. The advantages to be derived from having homes, tourist facilities, and industrial and commercial establishments near the streams seem to outweigh the fear of floods. For example, most of the improvements which were damaged or destroyed by the 1955 flood were repaired or replaced in their original locations by the same owners within months after the loss. Plans are being developed locally for additional developments in the flood plain. Some form of flood plain zoning or other local control, not anticipated to be realized, would be the only apparent means of halting, or even slowing, the present development trend in the flood plain.

34. FLOOD OF 1955

The 1955 flood was the most recent major flood in Rogue River Basin. Damages during that flood were responsible for renewed public interest in formulation of plans and construction of facilities for control of floods and development of water resources of the basin. Insofar as is known, only the floods of 1927, 1890, and 1861 were of comparable or greater magnitude. Because only relatively limited or no data were available as to damage during those floods, and because developments subject to damage were much less extensive at those times, careful and extensive surveys were made of damages during the 1955 flood. More than 13,000 acres of land, and improvements valued at more than $22,000,000, were inundated

and damaged in 1955. Fortunately, by reason of intensive flood warning and evacuation efforts, loss of life was avoided. Details of those surveys, and of the resulting damage of more than $4,000,000, are shown in Appendix D.

35. AVERAGE ANNUAL DAMAGES

Average annual flood damages amounting to about $640,000, based on current prices and economic development, were computed by stage-damage-frequency relationships as shown in Appendix D. The losses are measured by the cost of restoration of the properties to their former state of usefulness, or if this is not possible, by the reduction in the fair market value of the property.

CHAPTER VI - EXISTING PROJECTS

36. CORPS OF ENGINEERS

a. Emergency and continuing authorities. - There are no regularly authorized flood-control projects for Rogue River Basin, or any part thereof. However, some minor local protective works have been completed under emergency and general continuing authorities. Those works are listed as follows:

Location	Authority	Total cost
Rogue River	PL 406, 75th Congress	$23,592.79
Rogue River, mouth of Applegate	PL 406, 75th Congress	47,481.67
Applegate River, at Hoopes, Kinkle, and Krouse Locations	PL 406, 75th Congress	25,000.00
Applegate River, at Floyd Smith Location	PL 99, 84th Congress	1,518.03
Rogue River, Pierce Riffle	PL 526, 79th Congress	128,874.54
Rogue River, Pierce Riffle	PL 99, 84th Congress	66,786.74
Bear Creek, Medford	PL 526, 79th Congress	23,049.58

No Federal maintenance is required for the above works.

b. Navigation. - Navigation improvements have been made at Gold Beach, at the mouth of Rogue River (see paragraph 3a(3)), consisting of two jetties about 1,000 feet apart at the entrance; a channel 13 feet deep and 300 feet wide from the ocean to a point inside the jetties; and a turning basin 13 feet deep, 500 feet wide, and 600 feet long at the end of the channel. Construction was started in June 1959 and is being completed at the present time. Cost through 30 June 1961 was $2,973,982. Total estimated cost is $3,498,000.

37. IMPROVEMENTS BY OTHER FEDERAL AGENCIES

a. Bureau of Reclamation. - These improvements, principally irrigation works, include the following:

(1) Talent Division. - Talent Division (paragraph 3b(3))is a multiple-purpose project in Jackson County, providing irrigation, flood control, power generation, fish and wildlife, and recreation benefits. Recent information furnished by the Bureau indicates that the project

includes a transmountain diversion of flows from the headwaters of Little Butte Creek in Rogue River Basin into the upper Klamath River watershed; provisions to pick up additional flows in Klamath River Basin; the Howard Prairie Reservoir in Klamath River Basin; a canal system to transport the water from Howard Prairie Reservoir to the head of Bear Creek in Rogue River Basin; Hyatt Prairie and Keene Creek Reservoirs; facilities for developing about 16,000 kilowatts of hydroelectric power with head available along the transportation route; enlargement of the existing Emigrant Reservoir on Bear Creek downstream from the point of entry of the canal from Howard Prairie; and the necessary construction and improvement of main canals and laterals to serve about 5,300 acres of new lands and provide a supplemental supply to about 23,800 acres in the Talent, Medford, and Rogue River Valley Irrigation Districts. The Green Springs powerplant was placed "on-line" in May 1960. Total estimated cost, including rehabilitation and new features, is $26,500,000.

(2) Grants Pass Project. - This project includes the Savage Rapids Dam and Northwest Unit pipeline, and has an irrigable area of 10,370 acres in Josephine County. The Bureau of Reclamation rehabilitated the existing dam and has done some work on delivery facilities. Rehabilitation costs were about $810,000.

b. Soil Conservation Service. - About 1,425 landowners with an aggregate of about 336,000 acres of land are cooperating in some phase of on-farm soil and water conservation. About 500 basic farm plans, comprising about 100,000 acres, are in effect under a more comprehensive plan of agreement for improvement of soil and water conservation and utilization. Technical assistance is furnished by the Soil Conservation Service and cost of improvements is borne by the owner. An application has been made by local interests for assistance on Bear Creek under Public Law 566.

c. Forest Service. - The comprehensive forestry program on more than one million acres of National Forest land, though not strictly a water resource development, contributes materially to maintaining streamflows of satisfactory quality and quantity.

38. IMPROVEMENTS BY NON-FEDERAL AGENCIES

a. General. - The principal non-Federal improvements or developments in the water resources field are for irrigation and development of hydroelectric power. Private individuals and irrigation districts have made extensive use of State-granted rights to natural flows for irrigation of lands along Rogue River, Little Butte Creek, Bear Creek, Evans Creek, Applegate River, Grave Creek, and upper Illinois River and tributaries. In general, developments consist of low diversion weirs and canals to deliver water to the lands involved. The principal irrigation districts are as follows.

b. Medford and Rogue Valley Irrigation Districts. - These districts, located in lower Bear Creek Valley, had more than 13,000 acres under

irrigation in 1950, using water from two small reservoirs, and from Little Butte Creek and Bear Creek.

c. Talent Irrigation District. - This district is located in upper Bear Creek Valley. Major improvements have recently been made to the storage and major distribution system by the U. S. Bureau of Reclamation (paragraph 37a(1)).

d. Eagle Point Irrigation District. - Eagle Point District lies in the area of lower Little Butte Creek and between that stream and Rogue River. In 1950 this district had about 5,600 acres under irrigation. Water supply comes from the unregulated flow of Big Butte Creek.

e. The Table Rock Ditch Company. - This development is downstream from the mouth of Little Butte Creek. The company irrigates about 1,400 acres of land north of Rogue River by gravity diversion of natural flows from that stream.

f. The Gold Hill Irrigation District. - Located between the towns of Gold Hill and Rogue River, this district irrigates about 1,000 acres of land on the south side of Rogue River by gravity diversion of natural flows from that stream.

g. The Grants Pass Irrigation District. - About 8,980 acres out of a total irrigable area of about 10,370 acres around the town of Grants Pass are irrigated by this district. The district uses natural flows diverted from Rogue River by gravity canal and direct-lift pumps at Savage Rapids Dam.

h. Fort Vannoy Irrigation District. - This district irrigates 800 acres immediately downstream from Grants Pass by pumping natural flows from Rogue River.

i. The Murphy Ditch Association. - The association irrigates about 535 acres of land downstream from Murphy by gravity diversion of natural and return flows from Applegate River.

j. Pacific Power and Light Company. - The COPCO Division of Pacific Power and Light Company has five run-of-river electrical power generation plants along Rogue River from Prospect downstream to Gold Ray Dam, with a total nameplate rating of about 48,200 kilowatts. (See table 4, Appendix D.)

k. Ideal Cement Company. - This company has a 2,500-kilowatt installation on Rogue River at Gold Hill.

l. City of Ashland. - The city has a 300-kilowatt installation on Ashland Creek.

m. Medford Corporation. - The corporation has a steam-powered installation of 4,500-kilowatt capacity.

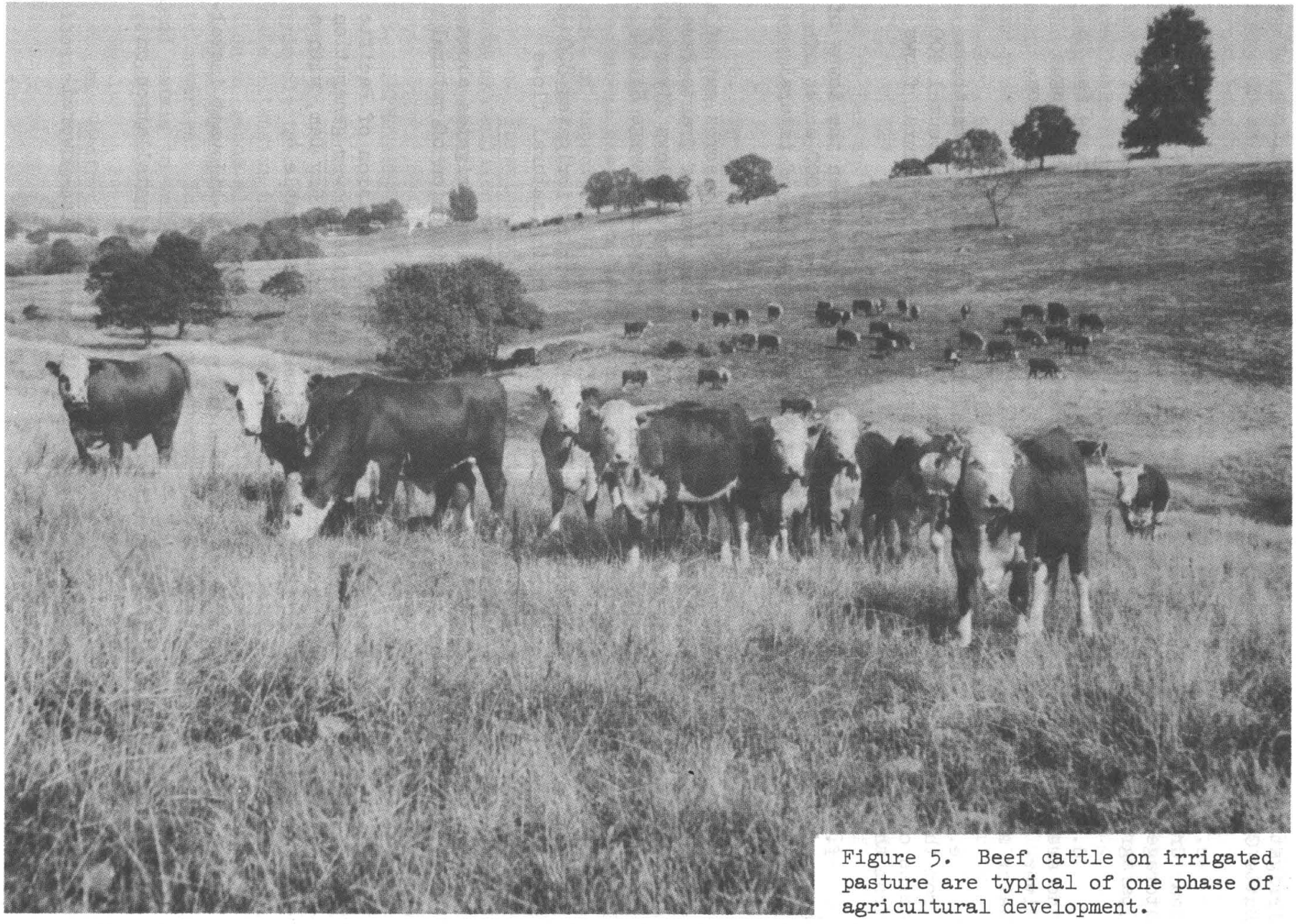


Figure 5. Beef cattle on irrigated pasture are typical of one phase of agricultural development.

CHAPTER VII - IMPROVEMENTS DESIRED

39. GENERAL

a. The desires of all concerned were determined by interagency coordination, public hearings, personal contacts with individuals and groups, informal meetings at various locations and with various groups from Gold Beach, at the mouth of Rogue River, to the area upstream from Trail. Those concerned have been kept well informed as to progress of studies and plans for proposed projects. Their current expressions in regard to the plan are believed to be considered opinions based on generally adequate knowledge of the needs of the basin as a whole and the potentials of the basin to serve those needs.

b. Current desires, as exemplified by statements at a basin-wide series of informal meetings from late 1959 to September 1961, and by materials submitted for the record at the final public hearing, differ in certain important aspects from those expressed initially. At initial hearings and meetings, immediately following the flood of 1955, local emphasis was on flood-control needs. Irrigation, hydroelectric power development, and recreation developments also were indicated to be needed. Proponents of flood control, including some representatives of sportsmen's groups, indicated a desire for flood control even at the expense of the fishery resource. Fisheries agencies and sportsmen's and conservation groups, however, strongly opposed any actions which would be detrimental to the fishery resource. It appeared at that time that those differences would not be reconcilable and that the key storage unit or units of any effective project plan would be at least controversial.

c. After passage of Public Law 85-624, the revised Fish and Wildlife Coordination Act, the decision was made to plan for fishery enhancement as well as other functions. At that time, a change in concensus began to become apparent. Desire for flood control was not abated. Desire for improved low-water conditions and fishery enhancement became apparent, however, and appeared to be concurred in by a majority of the proponents of flood control and other functions.

d. Current desires are for a comprehensive basin plan to include existing irrigation developments; irrigation developments recommended and under study by the Bureau of Reclamation; multiple-purpose projects as proposed herein for flood control and conservation of water for irrigation, water supply, fish and wildlife enhancement, power generation, and water quality control; supplemental local works; development of recreation potentials at reservoir projects; and possible future projects to serve basin needs which will develop in the future. The foregoing desires were expressed at informal meetings and at a public hearing in September 1961 by the Rogue Basin Flood Control and Water Resources Association, which represents a majority of groups in the basin; by Federal and State fisheries agencies; by representatives of sportsmen's groups; and by residents of the Gold Beach area who are

vitally concerned with the fishery resource but have little or no direct interest in other phases of the basin plan. In addition to the desires of residents of the basin and interested Federal and State fish and wildlife agencies, there appears to be a nationwide desire, among sportsmen's and conservation organizations, for preservation and enhancement of the fish resources of Rogue River Basin.

40. PUBLIC HEARINGS

a. Joint hearing, 19 October 1956. - This hearing, by representatives of the Senate Committees on Public Works and Interior and Insular Affairs, was held in Medford. Purpose of the hearing was to acquaint the Committees with the problems of the basin. The minutes of that hearing, including statements by Federal and State agencies and individuals and organizations, are contained in a document printed by the U. S. Government Printing Office in 1956 for the use of the two Committees.

b. Public hearing, 15 November 1956. - The initial hearing for this report was held in Grants Pass by the Corps of Engineers. Attendance was about 130, consisting of landowners, businessmen, sportsmen, and farmers, ranchers, etc., from the entire basin. All interested local, State, and Federal agencies were represented. Prevention of flood damages was the chief concern along with attendant benefits to irrigation, power generation, and recreation. However, it was emphasized that any plan of improvement for flood control which would be detrimental to the fishery would be unacceptable to a large component of those present. Transcript of the hearing is on file with the Corps of Engineers.

c. Public hearing, 25 September 1961. - The final hearing for this report was held in Grants Pass by the Corps of Engineers. Practically all occupations and interests of the basin were represented by more than 400 in attendance, including individuals and all interested local, State, and Federal agencies. The proposed plan of improvement was described and a record was made of the views of all concerned. A transcript of oral presentations and copies of all written materials submitted for inclusion in the record are on file with the Corps of Engineers. Almost all those who presented oral testimony favored the entire plan as proposed. Of the more than 1,300 individuals whose names appeared on petitions, letters, and resolutions submitted for the record, a substantial majority favored the plan. The ratio between support for and opposition to the projects, as indicated by those signatures, is about as follows:

Lost Creek Reservoir	130 to 1
Elk Creek Reservoir	200 to 1
Applegate Reservoir	11 to 1

The smaller ratio of support for Applegate was due in part to the lesser extent of interest in the Applegate as compared to Rogue River proper and, apparently, to the mistaken belief on the part of a few that project construction would result in loss of present State-granted rights to free

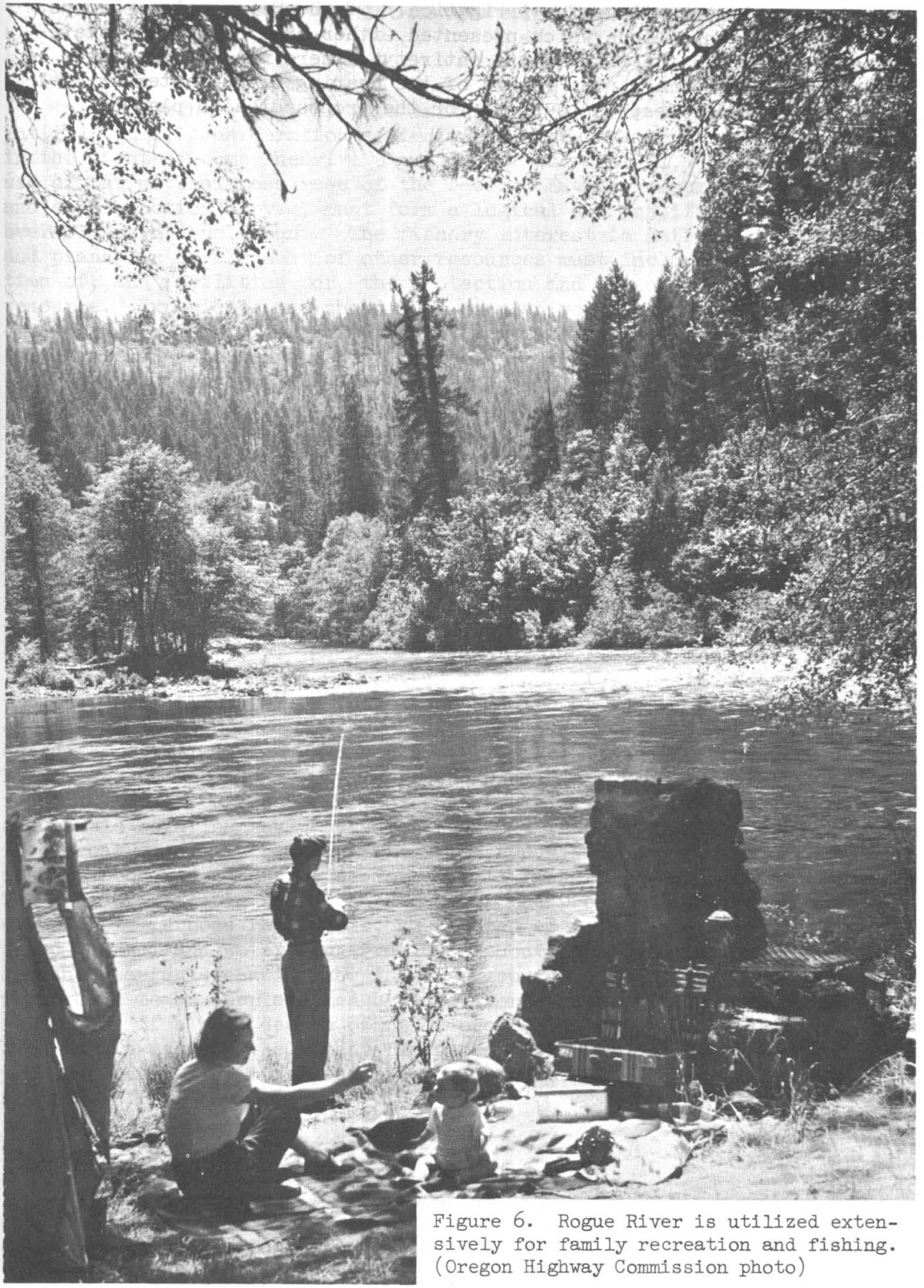


Figure 6. Rogue River is utilized extensively for family recreation and fishing. (Oregon Highway Commission photo)

use of natural streamflows for irrigation. Of the 80 agencies, groups, cities, and organizations which presented either oral or written statements, all favored the plan in its entirety. There was no organized opposition. In summary, the record of the hearing of 25 September 1961 shows strong and widespread support for the proposed basin plan.

CHAPTER VIII - PROBLEMS AND SOLUTIONS CONSIDERED

41. GENERAL

a. Rogue River Basin, to a marked degree, is a separate economic entity. Thus, consideration of individual problems and projects must be in the light of comprehensive planning for the control, development, and use of the natural resources of the basin. Each development proposed, and each function served, must form a logical and justifiable part of the overall basin development. The fishery interest is national in character and plans for development of other resources must include full consideration of, and facilities for, the protection and enhancement of that resource. Experience has shown that no plan would be acceptable which did not include full consideration of the fishery resource and provisions for maintenance and enhancement thereof.

b. Consideration must be given to all existing and potential future projects in the formulation of an overall comprehensive plan into which those units can be integrated as future developments and needs may warrant. The topography and stream pattern of the basin facilitate step-by-step development. Each properly formulated unit of such a plan would merge into the system of units already available to expand another segment of the basin's economy. Work already done by the U. S. Bureau of Reclamation in developing certain irrigation projects can be incorporated in an overall basin water-resource development plan, the key units of which are proposed herein for early construction.

c. The water resource problems of Rogue River Basin generally are those of seasonal distribution, as aggravated by increasing development and use of land and water resources. Total water supply generally is adequate for all uses programmed by the Oregon State Water Resources Board (see paragraph 3c), but works to equalize seasonal distribution by reducing flood peaks and increasing low-water flows are needed. Any acceptable solution would have to provide a reasonably high degree of flood control, satisfy known irrigation needs, involve a minimum of fishery problems, and provide for overall fishery resource enhancement. The most practicable solution to most of the problems would be a system of multiple-purpose reservoirs, so located as to provide a maximum of flood control and water conservation without serious detriment to spawning and rearing areas for the fishery resource. Such a reservoir system would have to be supplemented by local works such as levees and bank revetments if a high degree of flood protection were to be obtained. Even so, it is not likely that flood protection could be provided for all problem areas, even if engineering or project feasibility were to be ignored.

42. FLOOD PROBLEMS AND SOLUTIONS

a. Flood problems. - Flood problems along Rogue River proper are confined principally to the 50-mile reach from the community of Trail downstream to Robertsons Bridge, below Grants Pass. Because of topography,

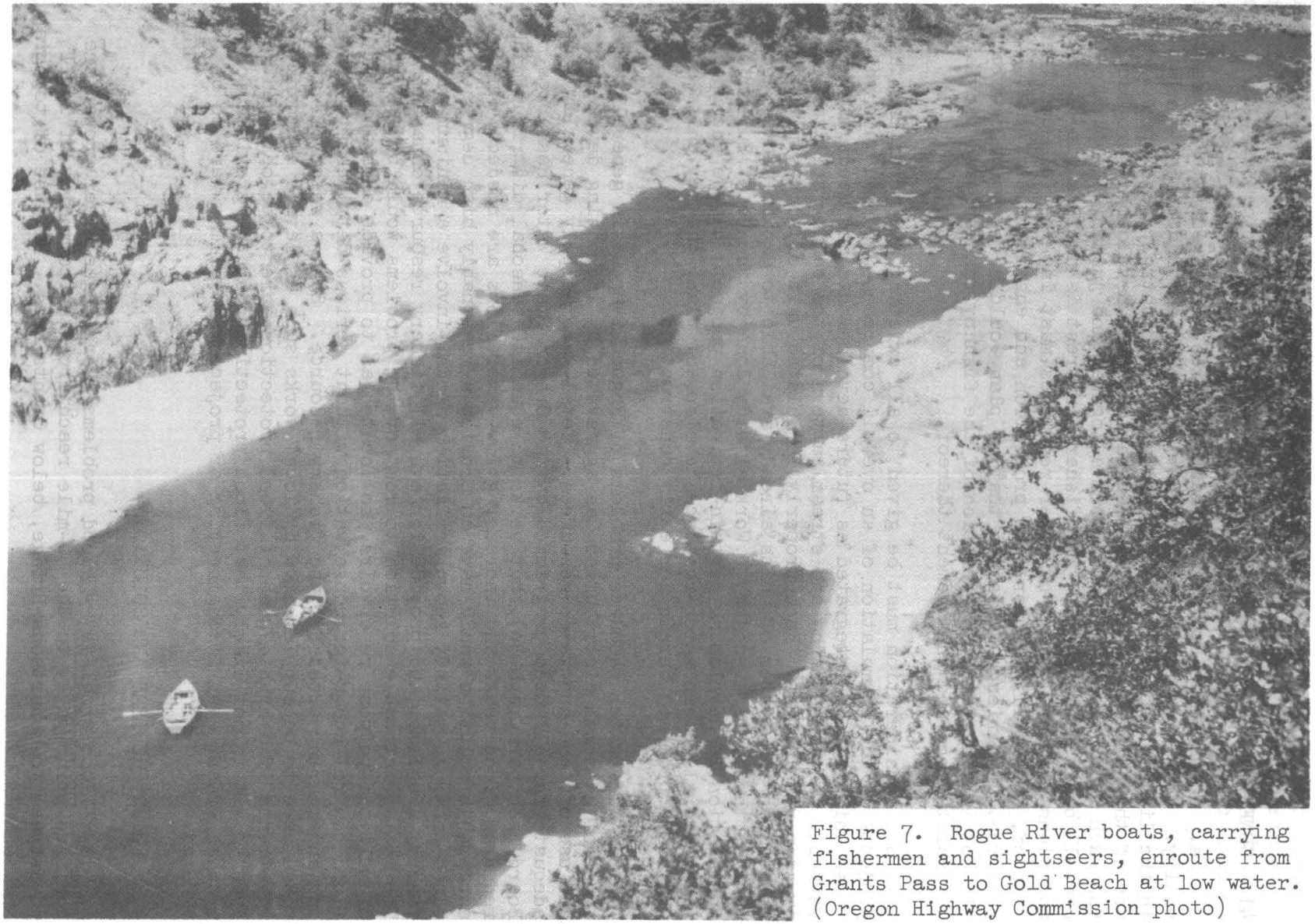


Figure 7. Rogue River boats, carrying fishermen and sightseers, enroute from Grants Pass to Gold Beach at low water. (Oregon Highway Commission photo)

channel capacities, and extent of development, little or no flood damages now occur along many portions of that reach. Upstream and downstream from that reach, the stream flows generally through deep canyons in mountainous terrain and causes no evaluable monetary damage, except for a very short reach immediately upstream from the mouth of the stream at Gold Beach. Damages also occur along portions of tributary streams, such as Big and Little Butte Creeks, Bear Creek, Evans Creek, Applegate River, Grave Creek, and upper Illinois River.

b. Solutions considered. - Solutions considered include the following:

(1) Flood plain evacuation. - Flood plain evacuation would not be feasible because of the magnitude of the existing improvements and facilities. A large percentage of the best arable land is located within the flood plain. Reentry could be prevented effectively only by purchase in fee of the entire area, and removal of this land from production would severely injure the agricultural economy of the basin. Such action would be prohibitively expensive, not economically justifiable, and unacceptable to a majority of local interests as it would not solve other equally pressing water-resource problems.

(2) Regulation. - Regulation could be partially effected by local ordinances to prohibit construction within the flood plain of major improvements susceptible to flood damage. However, the nature of the rural areas and type of damages usually sustained therein do not lend themselves to effective mass regulation. Although regulation might be considered as a supplemental measure, it would not be a solution to the flood problem and would not assist in solving other water-resource problems.

(3) Levees and local works. - Except in a few isolated locations, levee construction would not be practicable. The flood plain generally is narrow and residential developments subject to damage usually are located on the only practical levee alignment. Further, levee construction would not offer a solution to the water conservation needs of the basin.

(4) Reservoirs. - For flood control alone, the best and most effective solution would be a major reservoir immediately upstream from the first principal damage area, on Rogue River and on each major tributary. Because fishery considerations require that dams be located as far upstream as practicable, and because damaging floods could originate downstream from reservoirs so located, complete control of floods would not be effected by any practicable combination of reservoirs. Further, the estimated average annual flood-control benefits, either now or in the future, would not be sufficient alone to justify provision of storage. Also, consideration must be given to the needs of irrigation and fishery enhancement if an acceptable plan is to be developed. On that basis, it appears that the best solution to the flood problem would

be a system of multiple-purpose reservoirs, supplemented by local works. For maximum flood control, the reservoirs should be as far downstream as would be consistent with recognized needs for preservation and enhancement of the fishery resource.

43. IRRIGATION

Inadequate rainfall during the growing season makes irrigation a necessity for successful agriculture. A large segment of the gross product of the basin is dependent on agriculture, which has declined as to rate of development in the past few years. (paragraph 14b.) The decline is caused by several factors: The inability of the present water distribution systems to supply the requirements for maximum production; encroachment on the most productive areas in the valley by urban and industrial developments; and the continued trend of farm owners and workers to seek the more lucrative employment offered by other industries. Only the water-resources problem is considered herein. The seriousness of the water problem is shown by the fact that natural flows in Rogue River and its tributaries are inadequate to satisfy existing water rights in many years and that large areas of arable land are available but unusable for crop production because of lack of water supply. The Jackson County Water Resources Committee states that provision of an adequate water supply would triple the gross crop value from irrigated lands in that county. The cost of installation and operation of pumping facilities, and lack of an adequate underground supply, preclude the use of wells for irrigation. The gross water yield of the basin, which is produced by precipitation occurring principally in the winter and spring, is adequate for foreseeable demands. The problem resolves to one of storage and seasonal distribution. The reservoirs proposed for early construction would provide water for more than 39,000 acres of new land and additional water for about 25,000 acres now being inadequately served.

44. POWER GENERATION

a. The existing electrical power-generating installations in Rogue River Basin (paragraph 17) are inadequate to supply the present demand on the private power system serving the basin. Additional requirements are satisfied by importation of power from plants outside of Rogue River Basin. Economic developments and population growth are expected to triple regional power demands by 1980. Information in that regard is contained in Exhibit 1. The increased requirements in Rogue River Basin and the decreased surplus of Columbia River Basin power which will result from such development and growth emphasize the need for development of Rogue River Basin potentials at storage projects under consideration.

b. Of the three storage projects under consideration for early development, only Lost Creek offers the possibility of economical power generation. At that project, power could be developed by utilizing natural flows and releases from storage for irrigation, water supply, and fishery enhancement. It would be necessary, in order to insure realization of subsequently discussed fishery enhancement benefits, that no

Figure 8. Railroad bridge at Grants Pass, destroyed by 1955 flood, shortly after peak stage.

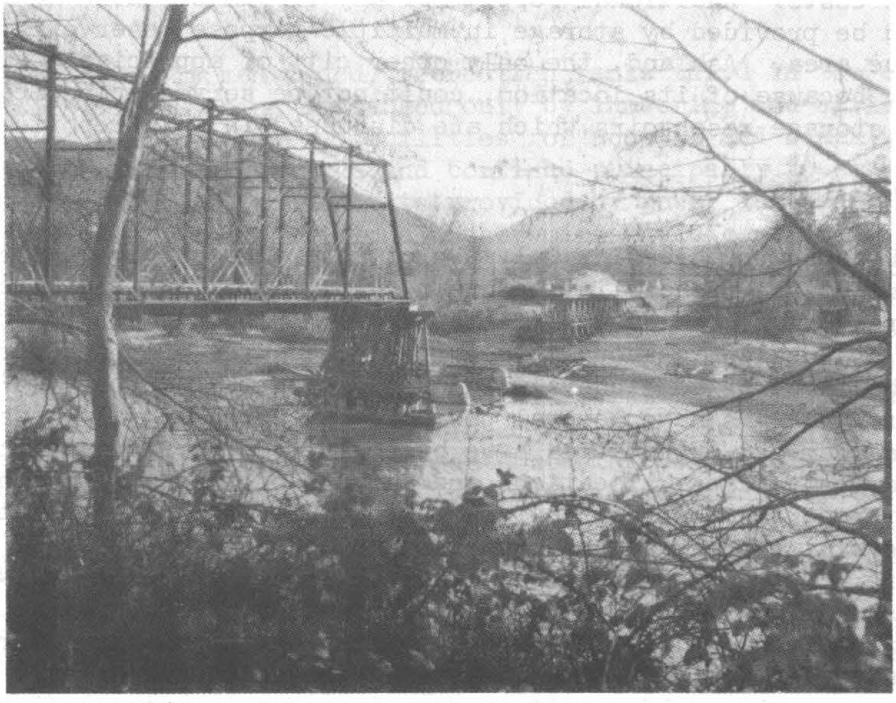


Figure 9. Railroad bridge at Grants Pass, after flood stage had receded.

89588 O-62—6

fluctuating releases be made for power generation. Similarly, no reregulating reservoir should be constructed in fish spawning areas downstream from Lost Creek Dam.

45. WATER SUPPLY

a. At present, there is relatively little industrial development in Rogue River Basin. Moreover, the 1949 Legislature enacted ORS 538.270 which, subject to existing rights, withdrew the waters of Rogue River downstream from a point near Shady Cove for domestic, stock, irrigation, and municipal purposes. As recent State legislative actions to permit direct diversion for industrial usage have failed of passage, it must be assumed that such use will not be developed in the foreseeable future, except as supplied through municipal systems. Thus, the principal demands for water supply within the immediate future can be expected to be for municipal use, which apparently could include sale of water to any industries which would be satisfied by water in amounts and at costs consistent with such service.

b. Water supply studies by the U. S. Public Health Service are included as Appendix B to this report. Those studies show that the city of Medford is the only municipality in the basin, within a reasonable distance from the stream, which has a reasonably adequate assured source of additional water supply. Grants Pass, Gold Hill, and Rogue River, however, are using available sources and water rights to about the maximum degree and apparently lack sources which could be developed at reasonable costs. Additional supply for any or all of those municipalities could be provided by storage in multiple-purpose reservoirs in the upper Rogue area. Ashland, the only other city of appreciable size in the basin, because of its location, could not be served economically from potential storage reservoirs which are discussed in this report.

46. FISHERY

a. Existing problems. - Only two of several possible reasons for the decline of the fishery in the basin, viz., low flows and high water temperatures, were considered in this report. Flood damage to spawning areas and spawn also is known to occur, and measures proposed for flood control should be of some unevaluated benefit in that respect. Flow and temperature problems have several possible causes. Natural flows from the main stream and tributaries have been diverted for irrigation and other consumptive uses. Locations and amounts of these diversions are known, but records of streamflow and temperature are inadequate to properly evaluate other causes of depletion and concurrent rises in temperature. It is known, however, that water temperatures below Grants Pass occasionally exceed 80 degrees Fahrenheit during the summer months, causing extensive loss of fish life. Logging of certain areas probably has decreased the summer water supply. Watershed management and related activities probably could result in some increase in natural flows. Such increases, however, would be of little value to the fishery.

In critical low-water years much, if not all, of any increased flow so provided would be diverted to satisfy existing rights to natural flow upstream from that portion of the Rogue in which the most severe temperature problems exist. The apparent solution to the low-flow problems would be storage and subsequent release, during the low-water season, of an amount of water sufficient to insure adequate minimum flows. If such increased flows were of good quality, and released at sufficiently low temperatures, considerable improvement in stream conditions would be achieved. Provision of storage specifically for fishery enhancement purposes appears to be practicable and economically feasible at two reservoirs subsequently described herein. The Oregon State Water Resources Board has the authority to establish minimum flows, classify unappropriated waters, and otherwise protect increased flows made available from storage for fish.

b. New problems. - New problems would be created by construction of dams which would inundate or block access to spawning areas. In order to minimize the new problems, sites selected should be as far upstream as possible. This consideration, together with the expressed desires of fish and wildlife agencies and conservation groups, apparently would preclude development of storage at the Lewis Creek site on Rogue River and at the Ruch site on Applegate River. Developments at the sites proposed herein would have to include provisions for mitigation of loss caused by inundation of spawning areas. Further, for Elk Creek and Applegate Reservoirs, passage facilities would be required to prevent isolation of upstream spawning and rearing areas.

47. RECREATION

a. As previously mentioned, recreation ranks third in the economy of Rogue River Basin, being outranked only by lumbering and agriculture. (See paragraph 20b.) However, facilities for aquatic and slack-water sports and recreation are scarce and confined principally to small natural lakes and small impoundments provided by power dams and irrigation storage reservoirs. Additional reservoirs would contribute materially to the recreational potential and would afford opportunity for much needed expansion of slack-water recreation, day-use, and camping facilities. The operational schedule of the reservoirs (paragraph 56) would provide a substantial use potential during the recreation season. The strategic location of Lost Creek and Elk Creek projects on the main traffic route between Crater Lake National Park and Oregon Caves National Monument and the redwood forests of north coastal California indicates that thousands of visitors would be in proximity to the reservoir areas each year. Applegate Reservoir would be somewhat less strategically located, and would develop less rapidly, but would get considerable usage.

b. It is estimated that 150,000 people live within a 2-hour driving distance of the projects, and that the population of the same area 50 and 100 years hence would be 375,000 and 675,000, respectively. The trend for outdoor recreation should continue to increase proportionally, and any

Figure 10. The 1955 flood destroyed many homes and tourist cabins. This one was moved from its foundation and severely damaged.

accommodating facilities would be fully utilized. Development of boat launching, parking, picnicking, camping and day-use facilities, access roads, etc., at the proposed reservoir sites would help to satisfy a growing recreational demand.

48. NAVIGATION

The existing project for a harbor at Gold Beach provides the only economically feasible facilities in the basin for oceangoing barges and vessels. The only other commercial navigation on the stream is that provided by the Rogue Boat Service which presently has a contract to provide mail service between Wedderburn, near the mouth of the Rogue, and Agness, at about river mile 23. A substantial tourist trade is also carried on during the summer when as many as seven and eight boats make daily round trips. The boats used have capacities of from 20 to 35 persons and are specially designed and constructed for operation in the shallow, tortuous, and swiftly flowing channel. In spite of the special nature of the boats used, difficulties are experienced in navigating during the low-water season. Dredging and provision of temporary contraction works generally are necessary annually to maintain adequate depths across certain shoals and riffles. This work has been done by the boat service. Because of the apparent imminence of completion of forest access roads connecting the Wedderburn-Gold Beach and Agness areas, it appears unlikely that continuation of mail-boat operations will be necessary. Nonetheless, there is a strong probability that present usage of the Agness-Wedderburn reach of channel for tourist trips will be continued. The increased low-water flows mentioned as a solution to the existing fishery problem would improve conditions for shallow-draft navigation of the lower Rogue.

CHAPTER IX - PLAN OF IMPROVEMENT

49. PROJECT FORMULATION

a. Comprehensive basin planning. - Comprehensive basin planning was the goal in studies leading up to project formulation. Consideration was given to all purposes, both present and foreseeable future, which a plan of improvement might serve. Detailed studies for proposed projects were based on maximum development of the potential at each site to serve known and foreseeable basin needs. Consideration was given to the growth and development of the basin and the timing of basin needs as related to the extent to which a plan of improvement might be justifiable at this time. Further, consideration was given to including in a basin plan the existing Bureau of Reclamation irrigation projects and the projects for irrigation and related uses now under study by that agency. As a result, a basin plan was formulated which consists of the following basic items:

(1) Existing water-resource developments, as summarized in Chapter VI.

(2) New irrigation and related developments now recommended and under consideration by the Bureau of Reclamation as described briefly in paragraph 3.

(3) A system of three multiple-purpose reservoirs to be developed at an early date, as subsequently described.

(4) Supplemental local works, as a part of the reservoir projects, to be constructed as needed and justifiable to alleviate remaining bank erosion problems on Rogue River proper, as subsequently described.

(5) Related works by others, such as might be accomplished under Public Law 566 or other Federal, State, or local programs.

(6) Possible future single- and multiple-purpose projects, including reservoirs and local works, to provide additional flood control and satisfy future needs for conservation and use of the water resources of the basin.

b. Special considerations. - The fishery resources of Rogue River Basin are of national significance, and no plan would be responsive to basin, state, and national needs unless it provided for irrigation, fishery enhancement, and flood control. Results of the studies and the hearing of 25 September 1961 confirm the validity of that approach.

c. Preliminary studies. - More than 30 potential storage sites were studied in preliminary fashion to determine which ones should be considered for possible development at this time, and studied in more detail. (Table 1.) The preliminary studies took into account the factors enumerated in Chapter VIII and preceding paragraph 49b, particularly as

related to national interest in the fishery resource. Little consideration was given to projects which obviously would have a serious adverse effect on the fishery. Included in the list of projects so eliminated were the Lewis Creek site on Rogue River near Trail and the Ruch site on Applegate River downstream from the confluence of Little Applegate River. Based on results of studies by the Bureau of of Reclamation it was known that opposition to those projects existed on a national scale. Also eliminated because of fishery and recreation considerations were potential single-purpose power projects on lower Rogue and lower Illinois Rivers, and similar projects on Rogue River upstream from Prospect.

d. Possibilities exist for development of storage on Big Butte Creek a short distance upstream from the Lewis Creek site and on McNeil Creek, a tributary to Big Butte Creek. Hydrologic data indicated that, while Big Butte Creek provides a fairly good sustained low-water flow, it is not a major contributor to flood peaks. Also, storage on Big Butte Creek apparently would create fishery problems of considerable magnitude, at least at this time. For those reasons, it was considered best to leave Big Butte Creek for possible future development at such time as conditions and needs of the basin might warrant.

e. Little Butte Creek is tributary to Rogue River downstream from Dodge Bridge. Consideration was given to two sites: Lakecreek and Brownsboro. The Lakecreek site, previously considered by the U. S. Bureau of Reclamation, appeared to be the better of the two. It was found, however, that annual runoff occasionally was so low that reservoir filling would not be possible if minimum flows essential to fish life were to be maintained during the filling season. Also, it appeared that irrigation needs could be satisfied from storage at the upstream sites already mentioned. For those reasons, and as potential flood-control benefits would be small, no further consideration was given to Little Butte Creek.

f. Consideration was given to provision of additional storage on Bear Creek, in the interests of flood control, water quality improvement, and other uses. It was found, however, that flood-control and irrigation effects of the existing Emigrant Reservoir, when enlarged, would be sufficient to preclude justification of additional storage at this time. Enlargement of Emigrant Reservoir, by the U. S. Bureau of Reclamation as a part of the Talent project, is substantially complete. There may be justification in the future for provision of additional storage in the Bear Creek watershed in the interest of increased low-water flows and improved water quality. Sites for such development appear to be available.

g. Consideration was given to four sites in Evans Creek Basin. Of those sites, the Meadows, or Hull Mountain, site was selected by the U. S. Bureau of Reclamation for possible development of a project to provide irrigation and incidental flood control. In consideration of all factors, including potential effect on the fishery resource, that site

appeared to be the best suited to development at this time. Because of the advanced stage of studies by the Bureau when this report was being prepared, and because of the limited flood-control potential, it was considered advisable to leave further study and possible recommendations for development to that agency. Any plan which might be so recommended would form an integral part of the overall plan proposed herein for Rogue River Basin, and no conflict could be anticipated.

h. For Illinois River, which is the largest single tributary in the Rogue River system, limited consideration was given to possible storage projects on Deer Creek near Selma and on Sucker Creek and Althouse Creek. Because agricultural lands and developments are limited to that part of the Illinois watershed upstream from Eight Dollar Mountain, and because storage on the Illinois would create no benefits on Rogue River proper, it was found that potential flood-control benefits would be very limited. It was considered appropriate to leave further studies and possible recommendations for storage development principally for irrigation to the U. S. Bureau of Reclamation, which has studies underway in that area. Any plan proposed by the Bureau for irrigation and related functions would be compatible with and a part of the overall basin plan proposed herein.

i. As a result of the preliminary studies described above, a plan for three multiple-purpose reservoirs and certain supplemental local works was selected for analysis for probable early development. Those projects, and other existing and possible future units of a comprehensive Rogue River Basin plan, are described in more detail in subsequent paragraphs and Appendix G.

50. STORAGE REQUIREMENTS

a. Storage requirements for flood control were determined, as a basic step in project formulation, for those projects selected for more detailed study. The U. S. Bureau of Reclamation furnished information as to diversion requirements for irrigation of lands which could be served from each site or combination of sites. Information was obtained from the Bureau of Sport Fisheries and Wildlife as to quantity and quality of increased flows for fishery enhancement. The U. S. Public Health Service furnished information as to probable future water supply demands, and assisted in determining the amount of storage to be provided for that purpose and the probable benefits to be realized.

b. As pointed out in Chapter VIII, it would not be practicable to provide complete flood protection by reservoir construction and operation. Supplemental works would be required for that purpose. Nonetheless, each storage site considered for development should be utilized to the maximum practicable extent for flood control as well as for other purposes. To determine the desirable extent of development at each site the storage requirements for at-site flood control were compared with total conservation uses, with consideration given to ability to make multiple use of

storage space. Total conservation requirements also were compared with available water supply at each site.

c. Total water yields of the streams involved were found to be adequate to supply all foreseeable needs, as outlined above. Thus, so far as provisions for water use were concerned, the problem was one of storage and seasonal distribution. That problem could be solved by developing sites to their physical limits from the standpoint of geology, topography or water yield, whichever might be controlling. In all cases, the geologic and topographic limits were such that full advantage could be taken of average annual runoff and that carryover storage could be provided for dry years. Studies of reservoir operation for water conservation purposes showed that operation for those purposes would result in the annual availability of sufficient storage space to provide a high degree of at-site flood control. As discussed in Appendix F, some additional storage space could be made available by additional evacuation in years of abnormal flood potential when the snowpack on the tributary area would insure ability to refill. However, very little additional flood-control effect could be obtained by provision of additional storage space for that purpose. Further flood control for the basin would have to be achieved by development of possible future projects which would provide control of additional drainage area.

d. Thus, total storage requirements at each site proposed for early development are the amounts necessary to satisfy foreseeable requirements for conservation and use of the water resource. By multiple-purpose use of storage space, a high degree of at-site flood control can be provided. Because of the relatively small portion of total basin drainage area from which runoff can be controlled, however, it is obvious that flood problems will be only reduced, not eliminated.

51. SPILLWAY DESIGN

Spillway would be designed to insure that extreme flood runoff would not endanger the structure. Studies were made to determine the maximum-possible flood at each reservoir area. The peak discharges so determined are from 2 to 2.4 times the peak discharge of the maximum historical flood of 1861. Peak discharges of the 1861 flood at the damsites were about 30 to 70 percent greater than peak discharges of the 1927 and 1955 floods at the same sites. Appendix F contains details of spillway design flood derivation.

52. PROPOSED PLAN FOR EARLY DEVELOPMENT

The Lost Creek, Elk Creek, and Applegate Dam and Reservoir projects and possibly some supplemental local works are economically feasible for construction at this time. Future projects might be justified and developed as warranted by economic expansion. There would be no known conflict between existing water resource developments, developments now under consideration by others, and projects proposed herein.

53. LOST CREEK DAM AND RESERVOIR

a. Project functions. - Lost Creek Reservoir would be operated, with Elk Creek Reservoir, to provide flood control, irrigation, future water supply, fish and wildlife enhancement, water quality control, hydroelectric power generation, and recreation benefits. Irrigation and wildlife enhancement benefits would depend on construction of the related irrigation distribution system to serve lands in the Medford Division as proposed by the Bureau of Reclamation. Future water supply benefits would depend on provision by the user of facilities for taking water under appropriate repayment contract. Power-generation benefits would depend on provision by a purchaser or distributor of necessary connections and transmission facilities. Flood control, fishery enhancement, water quality control, and recreation benefits would be realized by virtue of construction and planned operation of the project as described herein.

b. Project location. - Lost Creek Dam would be located on upper Rogue River at river mile (from mouth) 154.7, about 26.5 miles northeasterly from Medford, Oregon, in sections 25 and 26, Township 33 South, Range 1 East, Willamette Meridian, as shown on plate 1. The project would control runoff from a drainage area of 674 square miles. Reservoir area and project layout are shown on plates 4 and 5. For a more detailed description of the project see Appendix G.

c. Dam. - As shown on plate 5, the dam would be a rock and gravel embankment, about 360 feet in height from foundation to crest, with an overall length of about 8,130 feet. The top width would be 24 feet at crest elevation 1,920. Gross embankment would be about 21,670,000 cubic yards.

d. Spillway. - The spillway would be a concrete ogee section with a net length of 95 feet, located on the right abutment. Discharges would be controlled by two electrically operated radial gates. The design discharge would be 102,000 cubic feet per second at 45-foot head with the pool at elevation 1,915. A channel excavated in rock would lead spillway discharge across the right abutment and to a side canyon leading to Rogue River. All erodable material would be removed to avoid possible siltation of salmon spawning beds.

e. Outlet. - The outlet tunnel through the right abutment would have a design discharge of 10,000 cubic feet per second at pool elevation 1,878. Outlet discharge would be regulated by slide gates at the base of an intake tower about 320 feet in height. Lightweight bulkhead gates in sets of three at each of six equally spaced intake ports between full pool and bottom of reservoir would be used to select the depth from which water would be drawn for water temperature regulation. Outlet discharge energy would be dissipated in a stilling basin.

f. Power generation. - A powerhouse located on the right abutment at downstream toe of dam would house two Francis-type turbines with installed capacity of 26,000 kilowatts each. Water at temperatures selected for fishery enhancement would be supplied to the turbines from the intake tower through a penstock about 1,650 feet in length.

g. Reservoir. - The reservoir at full pool elevation 1,915 feet would store 465,000 acre-feet, 315,000 acre-feet of which would be usable. The pool would be 10 miles in length, and would have a shoreline length of 26.5 miles and a surface area of 3,100 acres. See plate 4. At minimum pool (elevation 1,776) the shoreline length would be 18.2 miles and the area would be 1,570 acres. Total land requirements would be about 6,040 acres, including about 1,700 acres of public lands. Inquiries directed to the Oregon State Department of Geology and Mineral Industries divulged no record of mineralization or mining activity in the reservoir area. One large gravel deposit in the area would be used in construction of the dam. The distribution of the small pumice deposits and the present potential market do not favor continuous or large scale exploitation.

h. Relocations. - About 5.9 miles of Highway 62 (Crater Lake Highway) would have to be relocated. The relocated road, along the north shore of the reservoir, would be about 7.5 miles in length, have 24-foot paved roadway surface plus an 11-foot passing lane on grades over 3 percent. About 1 mile of the upper end (including bridge) of the existing gravel-surfaced Laurelhurst Road would be abandoned. The lower mile, which would be in the reservoir area, would be replaced with 2 miles of the same standard gravel-surfaced road about 18 feet in width. Relocations would be in accordance with Section 207b of Public Law 86-645. In addition, about 4.5 miles of power distribution line and a high-tension transmission line would require relocation.

i. Fishery provisions. - Fishery provisions would include storage and temperature regulating facilities for releases in the interest of fishery enhancement, and facilities for restitution of loss of spawning and rearing areas in and upstream from the pool. Fishery enhancement facilities are discussed in paragraphs 53e and 56. Restitution facilities would consist of fish-production facilities such as a fish hatchery or possibly spawning channels and related works, as might be found necessary upon completion of detailed studies in cooperation with Federal and State fish and wildlife agencies following project authorization. The hatchery also would be used to provide trout for the reservoir fishery. No provision would be made for fish passage.

j. Recreation development. - Because of a favorable plan of operation, no substantial drawdown would be expected prior to July. Water surface areas generally would be adequate for water-associated activities throughout the recreation season. Proposed recreation improvements for the initial 10-year period would include about 1 mile of access road, two boat-launching ramps, and about 360 camping and picnic units with

appurtenant water supply and sanitary facilities. About 165 acres of land would be acquired specifically for recreation purposes.

54. ELK CREEK DAM AND RESERVOIR

a. Project functions. - Elk Creek Reservoir would be operated, with Lost Creek Reservoir, in the interests of flood control, irrigation, future water supply, fish and wildlife enhancement, water quality control, hydroelectric power generation, and recreation. No specific facilities would be provided at Elk Creek for fishery enhancement or power generation, but planned operation would permit realization of those benefits at Lost Creek. Irrigation and wildlife enhancement benefits would depend on construction of the related irrigation distribution system to serve lands in the Medford Division as designated by the Bureau of Reclamation. Future water supply benefits would depend on provision by the user for taking water under appropriate repayment contract. Flood-control and recreation benefits would be realized by virtue of construction and planned operation of the project as described herein.

b. Project location. - Elk Creek Dam would be located on Elk Creek about 3 miles above the mouth, in section 20, Township 33 South, Range 1 East, Willamette Meridian, about 26.5 miles northerly from Medford, Oregon, as shown on plate 1. The project would control runoff from a drainage area of 127 square miles. Reservoir area and project layout are shown on plates 6 and 7. For a more detailed description of the project see Appendix G.

c. Dam. - As shown on plate 7, the dam would be a rock and gravel embankment structure about 235 feet in height from foundation to crest with an overall length of about 2,670 feet. Top width would be 24 feet at elevation 1,765 feet. Gross embankment would be about 3,726,000 cubic yards.

d. Spillway. - The spillway would be a concrete ogee section, located on the right abutment. Discharges would be controlled by two electrically operated radial gates. Design discharge would be 38,700 cubic feet per second at 28-foot head (pool elevation 1,760). An excavated channel in a natural draw would lead discharge down the right abutment to the stream. All erodable material would be removed from the channel to avoid possible siltation of salmon spawning beds.

e. Outlet. - The outlet tunnel through the right abutment would have a discharge capacity of 4,500 cubic feet per second with pool elevation at 1,665 feet. Outlet discharge would be regulated by slide gates at the base of an intake tower about 215 feet in height. Lightweight bulkhead gates in sets of two at each of five equally spaced intake ports between full pool and bottom of reservoir would be used to select the depth from which water would be drawn for water temperature regulation. The outlet would discharge in a rock cut and no stilling basin would be provided.

f. Reservoir. - The reservoir at full pool elevation of 1,760 feet would be 5.5 miles in length, would have an area of 1,275 acres, and a shoreline length of 16.8 miles. See plate 6. Storage capacity would be 101,000 acre-feet, 95,000 acre-feet of which would be usable. At minimum pool elevation 1,624 feet, the pool would have an area of 205 acres. Total land requirements would be 1,950 acres, including about 250 acres of public lands. The reservoir area shows no record nor indication of metallic mineralization or mining activity.

g. Relocations. - About 6 miles of the existing 16-foot oil surface Elk Creek Highway would have to be relocated. The relocated road, along the west edge of the reservoir, would be about 8.5 miles in length and would be built to similar standards as for the existing road. A low-standard, 12-foot forest access road would extend across the dam and upstream along the left (east) bank of the reservoir about 1 mile to provide access to Federal and private timber in that area. This road would be constructed at project cost. Relocations would be in compliance with Section 207b of Public Law 86-645. Power distribution and communication facilities which are located along the existing Elk Creek Highway would be relocated along the new highway location.

h. Fishery provisions. - Fishery provisions would be principally for restitution for loss of spawning and rearing areas in the pool area and mitigation of losses associated with blocking of natural migration routes. Restitution and mitigation facilities would consist of a temperature-regulating device, as described for the outlet works; fish-passage facilities; fish-production facilities such as hatchery, or possibly spawning channels and related works, as might be found necessary upon completion of detailed studies in cooperation with Federal and State fisheries agencies following project authorization. The hatchery also would be used to provide trout for the reservoir fishery.

i. Recreation development. - Several benched areas lying between the relocated road and the reservoir would have a favorable reservoir frontage and good tree cover conducive to recreational development. A stub road extending about 1 mile above the dam would provide access to areas on the east (left) bank. Other areas accessible by boat could be developed if needed. Anticipated usage during the first 10 years of operation would require the provision of 60 camping or picnic units with water supply and sanitary facilities, two boat-launching ramps, and about 1 mile of access road. About 30 acres of land would be acquired for recreational use.

55. APPLEGATE DAM AND RESERVOIR

a. Project functions. - Applegate Reservoir would be operated in the interest of flood control, irrigation, fishery and wildlife enhancement, water quality control, and recreation in Applegate Valley. It would have no appreciable effect on problems on Rogue River proper. Irrigation and possible unevaluated wildlife benefits would depend on

construction of the related irrigation distribution system to serve lands in Applegate Valley. Flood control, fishery enhancement, water quality control, and recreation benefits would be realized by virtue of construction and planned operation of the project described herein.

b. Project location. - Applegate Dam would be located on upper Applegate River at river mile 46.5 (measured from mouth) about 23.5 airline miles southwest of Medford, Oregon, in section 36, Township 40 South, Range 4 West, Willamette Meridian, as shown on plate 1. The project would control runoff from a drainage area of 217 square miles. Reservoir area and project layout are shown on plates 8 and 9. For a more detailed description of the project see Appendix G.

c. Dam. - As shown on plate 9, Applegate Dam would be an earth and gravel embankment about 230 feet in height from foundation to crest with an overall length of about 1,325 feet. Top width would be 24 feet at elevation of 2,001 feet. Gross embankment would be about 1,829,000 cubic yards.

d. Spillway. - The spillway would be a concrete ogee section located on the right abutment. Discharge would be controlled by two electrically operated radial gates. Design discharge would be 75,300 cubic feet per second at 35-foot head (pool elevation 1,996). A channel excavated in rock would lead from spillway crest to river. All erodable material would be removed from the channel to avoid possible siltation of salmon spawning beds.

e. Outlet. - The outlet tunnel through the right abutment would be converted from the diversion tunnel used during construction. Outlet capacity would be 4,500 cubic feet per second at pool elevation 1,914. Outlet discharge would be regulated by slide gates at the base of an intake tower about 220 feet in height. Light bulkhead gates in sets of two at each of five equally spaced intake ports between bottom of reservoir and full pool elevation would be used to select the depth from which water would be drawn for water temperature regulation. The outlet tunnel would be on a flat grade and no stilling basin would be required.

f. Reservoir. - The reservoir at full pool elevation of 1,996 feet would store 72,000 acre-feet, 65,000 acre-feet of which would be usable. The full pool length would be 4 miles, with a shoreline length of 16 miles and an area of 945 acres. See plate 8. At minimum pool, elevation 1,874 feet, the pool would have an area of 228 acres and a shoreline length of 8 miles. Total land requirements would be about 4,485 acres, of which about 2,000 acres are Government-owned. All private land between the pool and surrounding Federal lands would be acquired to permit management and development for recreational use. The area shows some metallic mineralization, mostly in California, and a potential limestone quarry in sections 2, 10, and 11, Township 41 South, Range 4 West, Willamette Meridian. Some of the limestone deposits and metallic mineral prospects would be inundated. Placer gold deposits, prevalent elsewhere in the basin, appear to be limited, and inundation would be no problem.

g. Relocations. - About 4 miles of the existing Applegate Highway which follows the right bank of the river through the reservoir area would have to be relocated. The relocated road would lie along the left bank of the reservoir, and additional roads would be constructed to provide a complete perimeter system. From Carberry Creek to a junction with the existing road 1 mile below the dam, about 5.2 miles, the relocated road would have a 20-foot wide, asphalt-paved surface. The remaining perimeter roads would be built to various lesser standards as required to satisfy anticipated usage. Location and standards for relocated roads were worked out in coordination with the U. S. Forest Service, in consideration of needs for timber haul and potentials for recreation development on project lands. All road relocations, including an estimated $200,000 betterment for the Squaw Creek Road, as described in Appendix G, would be project costs. Relocations would be in compliance with Section 207b of Public Law 86-645. Power and communications facilities within the reservoir area apparently serve only the area which would be evacuated, and would be abandoned unless required by future developments.

h. Fishery provisions. - Fishery provisions would include storage and temperature regulating facilities for releases in the interest of fishery enhancement, facilities for restitution for loss of inundated spawning and rearing areas, and facilities to mitigate losses associated with blocking of natural migration routes. Fishery enhancement facilities also are discussed in paragraphs 55e and 56. Restitution and mitigation facilities would consist of fish-passage facilities, and fish-production facilities such as a hatchery or possibly spawning channels and related works as might be found necessary upon completion of detailed studies in cooperation with Federal and State fisheries agencies following project authorization. The hatchery also would be used to provide trout for the reservoir fishery.

i. Recreation development. - Applegate River flows through a narrow, steep-walled canyon in the reservoir area, and the surrounding areas are covered with a dense stand of second-growth fir of moderate size. Generally, topography at shoreline would be steep with slopes of 20 to 30 percent precluding development of extensive recreation areas. However, there are a number of small to medium-sized areas which would afford access to the reservoir and development of day-use and camping facilities. The anticipated usage during the first 10 years of operation would require 90 camping or picnic units (including water supply and sanitary facilities), two boat ramps, and 1.5 miles of access road. The U. S. Forest Service has expressed a desire to assume responsibility for maintenance, administration, and future expansion of the proposed recreation installation and project lands not needed for safety or operational purposes, and has requested an expanded taking line which includes acquisition of about 900 acres of private land, to consolidate Government holdings necessary for protection and management, and for development of the recreational potential. (Appendix C.) Both the initial development and the requested additional land acquisition would be accomplished with

project funds. The reservoir area is completely surrounded by Federally owned lands (plate 8).

56. OPERATION

a. General. - The proposed projects would be operated to provide maximum gross benefits from flood control, irrigation, provision of future water supply, and fishery enhancement. As noted in Chapter VIII, this would not entail use of single-purpose storage for flood control. It would, however, necessitate consideration of irrigation, future water supply, and fishery enhancement as functions of equal status so that each function would receive the same percentage of full supply in infrequent years of water shortage. There would be no storage specifically for wildlife enhancement, power generation, water quality control, or recreation. Of these latter four functions, the first three would utilize flows released specifically for other purposes. Recreation would depend on use of facilities provided and on availability of water areas which would result from operation for other purposes. Appendix F contains additional detail as to reservoir operation summarized in the following subparagraphs.

b. Flood control. - It is recognized that the proposed projects would not satisfy all flood-control needs of the basin. Nonetheless, each reservoir would be regulated to provide a high degree of control, at the site, consistent with physical and economic limitations.

c. In general, withdrawal of stored water for conservation purposes would insure that a normal reservation of storage space would be available for flood control from about 15 November to about 31 January. In years when abnormal flood potential existed, because of a heavy snowpack on the watershed, refilling capability would be available and additional space could be evacuated for flood-control use. It is anticipated that this would result in a maximum of flood-control storage space being available when required for regulation of the larger and less frequent floods. In no case, however, would enough storage space be available to permit control of floods such as the historical flood of 1861. Normal and maximum flood-control reservations would be as follows:

Reservoir	Flood-control storage, acre-feet	
	Normal	Maximum
Lost Creek	105,000	165,000
Elk Creek	45,000	60,000
Applegate	55,000	55,000

d. Storage of flood waters would be initiated in advance of predicted occurrence of flood stages at downstream control points. For Applegate Reservoir, storage would be initiated about 6 hours in advance of predicted flood stages at Applegate. For Lost Creek and Elk Creek, a period of 12 hours in advance of predicted flood stages at Grants Pass would be used. These time allowances are based on relative time of occurrence of flood peaks at the damsites and the downstream control stations. Release of stored flood waters following a flood peak would be accomplished as rapidly as possible without exceeding bankfull stages at the downstream control station.

e. Filling. - When conservation releases would result in drawdown below flood control levels as noted above, the pools would be filled to the indicated levels from the first available runoff in excess of required minimum flows for the fishery. Filling after the major flood season would be scheduled for accomplishment at a uniform rate from about 1 February to about 1 May, as flows in excess of minimum fishery requirements would permit.

f. Fishery. - Fishery enhancement would depend on provision of increased flows, at reduced temperatures, throughout the entire reach of stream from each damsite to the mouth. Studies by Federal and State fisheries agencies resulted in selection of criteria as to quantity and temperature of reservoir releases for the fishery. Such releases would be over and above releases for irrigation and water supply. The State of Oregon, acting through the Oregon State Water Resources Board under Oregon Revised Statutes 536.310, 536.340, and 536.410, has legal authority to insure that flows released for the fishery would remain in the stream for that purpose. (See Exhibit 2.) Changes in flows would have to be gradual, so as not to strand fish at times when flows would be reduced. It should be noted that, during regulation of floods when local inflows would result in rapid increase in flows downstream from the damsites, the releases would be reduced below the minimums shown below. Further study of the extent and effect of such short-term reductions would be desirable following project authorization. It also should be noted that project operation plans must be sufficiently flexible to permit desirable modifications in scheduled fishery releases, within the limits of storage provided therefor, if experience and further study indicates such action to be desirable for overall project benefits. Presently scheduled releases and release temperatures in the interest of the fishery are summarized for each project in the following subparagraphs and detailed in Appendix A.

(1) Lost Creek. - About 125,000 acre-feet would be withdrawn in an average year for fishery enhancement. Scheduled fishery releases and release temperatures would be as follows:

89588 O-62--7

Dates	Minimum release, cubic feet per second	Maximum release temperature, degrees F.
1 May - 15 May	1,000	52
16 May - 31 May	1,300	52
1 June - 10 June	1,500	52
11 June - 30 June	1,800	45
1 July - 20 August	2,000	45
21 August - 7 September	1,500	52
8 September - 31 January	1,000	52
1 February - 30 April	700	52

The above July through September flows are 2 to 3 times natural minimum flows at Grants Pass.

(2) Elk Creek. - A minimum flow of 25 cubic feet per second would be maintained at all times downstream from the reservoir. Release temperatures would be regulated so as not to exceed 60 degrees F. except during infrequent periods of extreme low water. No storage would be provided specifically for fishery benefits and no releases would be made for that purpose. Because of the relatively high temperature of Elk Creek releases during the irrigation season, diversion would have to be made at the mouth of Elk Creek to prevent possible warming of the waters of Rogue River. This would be accomplished by specially designed diversion works which would be a part of the irrigation distribution system.

(3) Applegate. - About 30,000 acre-feet of storage would be used annually to maintain increased low-water flows for fishery enhancement. Flows at a temperature not to exceed 60 degrees F. would be provided as follows:

1 January - 28 February	120
1 March - 30 June	100
1 July - 31 October	120
1 November - 31 December	Natural flow, as regulated for flood control

These flows would represent an increase of from 200 to 900 percent over present minimums.

g. Irrigation. - Withdrawals for irrigation normally would begin in about June. For the Lost Creek-Elk Creek Reservoir combination, initial irrigation withdrawals would be made from Lost Creek so as to reduce the surface area exposed to heating. Irrigation withdrawals after early July normally would be from Elk Creek Reservoir. This would conserve a maximum of cold water in Lost Creek Reservoir for fishery enhancement purposes. In years of low supply, use would be made of stored water

Figure 11. Fish on! Rogue River salmon and steelhead are nationally known and esteemed. (Oregon State Game Commission photo)

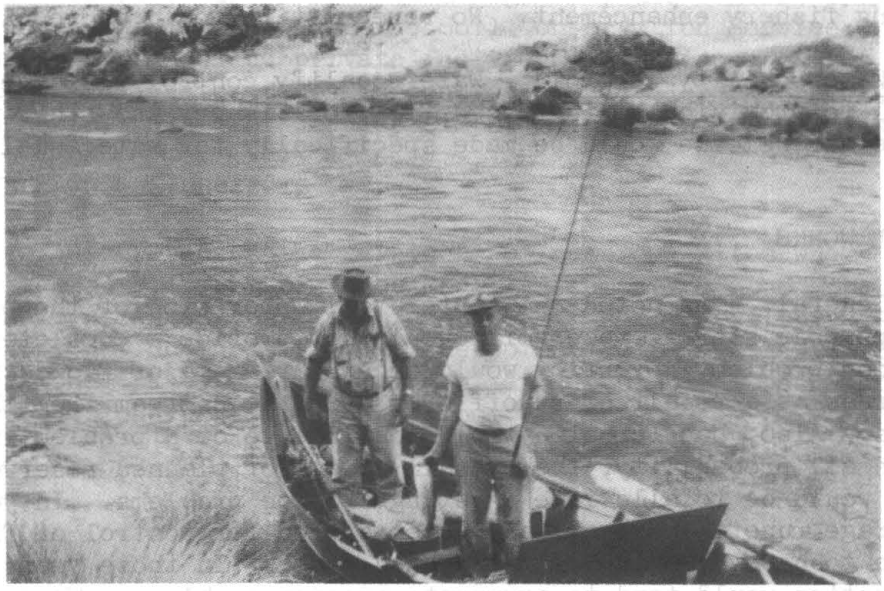


Figure 12. Rogue River steelhead can be taken on flies as well as on lures. (Oregon State Game Commission photo)

carried over from previous years. Details of withdrawal schedules would be provided by the water users' association through the Bureau of Reclamation, the agency which would construct the distribution system. The following amounts of water normally would be used from storage for irrigation:

Reservoir	Irrigation storage (acre-feet)
Lost Creek-Elk Creek	88,000
Applegate	26,000

h. Future water supply. - Lost Creek and Elk Creek Reservoirs would be designed and operated to provide a total of about 20,000 acre-feet of water for future domestic and municipal use. It is anticipated that stored water would be released into Rogue River for withdrawal at appropriate downstream points. No special outlet would be required for that purpose. About one-half of the total supply would be provided from each reservoir.

i. Power generation. - The Lost Creek power-generating installation of about 52,000 kilowatts would be operated to best utilize releases made for flood control, irrigation, fishery enhancement, and water supply. Daily stage fluctuation would be only that acceptable from the standpoint of insuring fishery enhancement. No reregulation would be required.

j. Water quality control. - Water quality control would be attained incidental to provision of increased flow for fishery and other purposes. No storage nor release would be made specifically for water quality control.

57. LOCAL WORKS

a. General. - As noted in Chapter VIII, provision of the proposed multiple-purpose storage reservoirs would not provide a complete solution to the flood problem. Overflow would occur during major floods in several areas as a result of runoff from areas downstream from the proposed dams. Also, bank erosion would continue to be a problem in many areas. In all probability, the overall effect of planned reservoir operation would be to alleviate existing erosion problems. In years of above-average runoff, however, all water stored for control of floods would have to be evacuated following each flood. In those years, reservoir evacuation would tend to aggravate erosion problems. The overall Rogue River Basin plan includes certain provisions for local works to alleviate overflow remaining after construction of reservoirs proposed herein and any bank erosion problems which would be aggravated by reservoir operation.

b. Bank protection. - The proposed plan includes provision for a limited amount of bank revetment as a supplement to storage control. Such work would be done only when, and to the extent, determined to be necessary on the basis of experience as to possible aggravation of bank erosion following initiation of reservoir operation. Funds of $350,000 and $150,000 are included in estimated costs for Lost Creek and Elk Creek Reservoirs, respectively, to cover the cost of such work as may be found necessary. Revetment would consist of dumped stone, laid on a gravel filter on a prepared slope and extending from about 2 feet below top of bank down to a toe trench about 5 feet below riverbed.

c. Levees. - If experience shows that the remaining overflow problem in any areas could be solved by construction of levees, consideration would be given to accomplishing any justifiable work under the general continuing authority of Public Law 685 of the 84th Congress. Present indications are that such work would be within statutory limitations of Public Law 685. That approach would be more expeditious and more practical than inclusion of necessarily conditional recommendations in this report.

58. RELATED WORKS BY OTHERS

Related works under programs of other agencies would form an integral part of the overall basin plan. Included would be works which would be accomplished under the Small Watersheds Act of 1956 (Public Law 566 of the 83rd Congress); land and forest management programs under the U. S. Forest Service, Bureau of Land Management, and others; programs and practices under the direction of the Soil Conservation Service; and similar works by groups and private individuals. Because of the magnitude of the overall water resource control and development problem, there is need and opportunity for development of all such types of work.

59. POSSIBLE FUTURE PROJECTS

Studies have revealed the existence of numerous sites where additional storage development could be made. A summary of the apparently most desirable sites is contained in table 3. While development at those sites is not now justifiable, the potential is available for providing additional water resource control and development when future needs and conditions warrant such action.

CHAPTER X - ESTIMATED COSTS

60. GENERAL

Estimated costs include all initial expenditures associated with construction of the project based on price levels of July 1961. Contingencies were figured for each feature and subfeature in the cost estimate and were varied according to the adequacy and dependability of basic data. The costs of all diversion works and distribution systems for irrigation, of diversion and pumping for water supply, and of power transmission systems would be borne by others. A detailed estimate for each proposed project is contained in Appendix G.

61. COST ESTIMATES

Estimated initial cost for the three reservoir projects proposed herein for early construction, including bank stabilization appurtenant to Lost Creek and Elk Creek Reservoirs, is summarized as follows:

Item	Estimated cost		
	Lost Creek	Elk Creek	Applegate
Lands and damages	$1,584,000	$511,000	$535,000
Relocations:			
Forest access roads	--	314,000	3,550,000[1]
Other	3,913,000	2,190,000	57,000
Reservoir	1,480,000	537,000	509,000
Dam	45,045,000	9,663,000	6,978,000
Fish facilities	2,820,000	1,440,000	540,000
Power facilities	9,500,000	--	--
Recreation facilities	688,000	211,000	447,000
Bank stabilization	350,000	150,000	--
Buildings, grounds, and utilities	430,000	96,000	104,000
Permanent operating equipment	200,000	30,000	25,000
Subtotal	66,010,000	15,142,000	12,745,000
Preauthorization studies	60,000	33,000	32,000
Engineering and design	3,140,000	1,045,000	862,000
Supervision and administration	5,390,000	1,280,000	1,061,000
Total cost	$74,600,000	$17,500,000	$14,700,000

1 Includes an estimated $200,000 for betterments to Forest Service roads.

62. ANNUAL COSTS

a. General. - Annual financial costs include interest on and amortization of the total Federal investment; average annual cost of operation and maintenance; and the equivalent average annual value of major replacement costs. Taxes foregone, for Lost Creek only; the economic loss associated with removing Federal timberlands from production in areas to be acquired; and the cost or benefit associated with changed conditions for log haul from Federal forest lands are economic costs which must be added to the financial costs for economic analysis of proposed projects. An interest rate of 2-5/8 percent was used in computing interest during construction, present worth of future replacements, and annual amounts for interest and amortization. For purposes of project analysis, an economic life of 100 years was selected. The actual useful life of the proposed projects would be far in excess of 100 years. Estimated average annual maintenance and replacement expenditures would insure the continued full effectiveness of structures and moving parts. Siltation, as discussed in Appendixes F and G, would be no problem. Operation, maintenance, and major replacement costs were estimated on the basis of actual costs for such work at similar existing Corps of Engineer projects in Willamette and Columbia River Basins.

b. Lost Creek-Elk Creek combination. - As stated in Chapter IX, Lost Creek and Elk Creek Reservoirs would have to be operated as an integral unit to provide planned benefits to all functions. In order to permit economic analysis of the combined project, annual charges were computed on the basis of tentatively programmed expenditures for most economical simultaneous construction of the two projects. On that basis, computed average annual costs would be:

Financial costs:	
Interest and amortization	$2,754,500
Major replacements	138,200
Operation and maintenance	605,100
Total equivalent annual financial costs	$3,497,800
Economic costs, including $57,700 taxes foregone	83,900
Total equivalent annual economic costs	$3,581,700

c. Applegate Reservoir. - Applegate Reservoir would be operated in the interest of Applegate Valley, and no reason exists for analysis in combination with either of the other two reservoir projects. Estimated average annual costs would be:

Financial costs:	
Interest and amortization	$436,500
Major replacements	6,700
Operation and maintenance	52,400
Total equivalent annual financial costs	$495,600
Economic costs	-5,100
Total equivalent annual economic costs	$490,500

d. Alternative individual analyses. - In order to provide a check on the economic feasibility of Lost Creek and Elk Creek as individual projects, estimates were made of average annual charges for each project, on the basis of tentatively programmed expenditures for efficient construction. Under those conditions, total annual charges would be substantially the same as shown above for the two projects combined. Estimated amounts would be about $2,812,800 for Lost Creek and $685,400 for Elk Creek, for a total of $3,498,200, as compared to $3,497,800 for the combination.

CHAPTER XI - ESTIMATED BENEFITS

63. BENEFIT STUDIES

a. General. - As for other phases of project studies, determination of average annual benefits was cooperated in by, and coordinated with, other Federal and State agencies. Final benefit computations were based on operation of the project as described herein, considering Lost Creek and Elk Creek Reservoirs to be operated as an integral unit for upper Rogue River Basin. As a check on economic feasibility of individual projects, individual benefits also were determined for Lost Creek and Elk Creek Reservoirs. All benefits are expressed as the annual equivalent of the present worth of future benefits over a 100-year period, except that water supply benefits are the annual equivalent of the cost of constructing, at this time, a single-purpose reservoir as an alternative source of supply. Benefit computations are discussed in detail in Appendix D and summarized as follows:

b. Flood-control benefits. - Flood-control benefits are the difference between average annual flood damages which could be expected with and without the projects proposed for early construction. Average annual damages without the project were estimated by use of damage-discharge-frequency data based on actual evaluation of damages during the floods of 1953, 1955, and 1956. Average annual damages which would remain with the project in operation were computed on the basis of hydrological studies described in Appendix F, which show the effect of storage reservoirs on flood stages and frequencies. Studies by experienced real estate personnel indicated that project operation would result in little or no enhancement benefits. Planned reservoir operation would reduce stages of a flood such as that of 1955, with a natural frequency of once in about 40 years, from about 32.6 feet to about 26.7 feet at Grants Pass, in the area of most severe damage. Further, the duration of flood stages in excess of bankfull capacity at Grants Pass would have been reduced from about 2 days to about 1 day. On Applegate River, where runoff from a smaller percentage of total drainage area would have been controlled, 1955 flood stage at Applegate gage would have been reduced from 18 feet to about 15.7 feet.

c. Irrigation benefits. - Gross benefits for irrigation of areas which could be served by Lost Creek-Elk Creek and Applegate Reservoirs were obtained from the U. S. Bureau of Reclamation (see Exhibit 3). Those benefits then were apportioned to proposed storage projects and required Federal irrigation distribution systems. The apportionment was accomplished so as to provide substantially equal benefit-to-cost ratios to the distribution system and the reservoirs (see Exhibit 5). Areas to be irrigated, based on data supplied by the Bureau of Reclamation, would be about as follows:

Reservoir	Acreage	
	New lands	Supplemental water
Lost Creek and Elk Creek	34,410[1]	15,570[1]
Applegate	5,000	9,400

1 Designated Medford Division by Bureau of Reclamation.

d. Power benefits. - The Federal Power Commission furnished information as to benefit values for energy and capacity which could be provided at potential power-generating installations in Rogue River Basin. (See Exhibit 6.) Those values, established in consideration of the relationship between Rogue River Basin and the Pacific Northwest market area, are equivalent to the estimated cost of public non-Federal steam-electric power delivered to a load center in the Medford area. Information also was furnished as to the amount of taxes included in those benefit values so that previously shown annual costs for taxes foregone could be evaluated. Average annual power generation at Lost Creek is estimated to be about 336,822,000 kilowatt-hours.

e. Fish and wildlife enhancement benefits. - Data as to requirements for optimum fishery conditions in Rogue and Applegate Rivers were provided by the Bureau of Sport Fisheries and Wildlife, on the basis of studies coordinated with the Oregon State Game Commission and the Fish Commission of Oregon. It was found that the proposed projects could be designed and operated to satisfy those requirements. Details as to requirements and corresponding fishery benefits for streams and reservoirs are shown in Appendix A. The provision and use of water from Lost Creek and Elk Creek Reservoirs for irrigation of lands in the Medford Division also would provide some wildlife enhancement benefits, as detailed in Appendix A. It should be noted that fishery and wildlife benefits so shown have been reduced to the annual equivalent of the present worth of future benefits, and that wildlife benefits have been apportioned between reservoirs and distribution systems as for irrigation benefits.

f. Water supply benefits. - In cooperation with the U. S. Public Health Service, as shown in Appendix B, it was determined that the desirable amount of storage to be provided at this time for future water supply would be 20,000 acre-feet. The cost of an alternative source of supply would be the measure of water supply benefits. As shown in Appendix D, a site on McNeil Creek, tributary to Big Butte Creek, was selected as representative of the least costly location for development of such storage.

g. General recreation benefits. - Estimates of recreation benefits are based on forecasts of probable usage for each reservoir. In the case of Applegate Reservoir, where the U. S. Forest Service desires to provide administration and continued development, forecasts of recreational usage were made by the Service (see Exhibit 7) and checked by the Corps of Engineers. Benefits were evaluated at $1.50 per visitor day, with consideration given to eliminating possible duplication between reservoir fishery benefits, as evaluated by the Bureau of Sport Fisheries and Wildlife, and general recreation benefits.

h. Water quality control. - No benefits have been evaluated for water quality control as such. Increased flows at reduced temperatures which would be provided for fishery enhancement, however, would provide a fairly high degree of quality control. (See supplement to Appendix B.) Low-water flows, which are most critical as regards pollution, would be increased by several hundred percent. The increased flow would be substantially cooler throughout the length of the stream, with resulting increase in potential for oxygen content.

i. Intangible benefits. - Items which might be included in that category include probable prevention of loss of life during floods and reduction in the possibility of unsanitary stream conditions and the attendant possibility of epidemic water-borne disease. None of these conditions are known to have occurred in the past. A recurrence of a major flood such as that of 1890, however, might cause loss of life if no control were provided. This would be particularly true if the flood crest occurred late at night, as the rapid rise would trap many persons in their homes. There have been no occasions of gross pollution of Rogue River proper, and none are anticipated. Nonetheless, the assurance of sustained substantial low-water flows of good quality should assist in improvement of the general economy, particularly as regards recreational developments and uses of Rogue River.

64. PROJECT BENEFITS

a. Average annual benefits which would accrue to each project, on the basis of an assumed economic life of 100 years, are summarized as follows:

Item	Benefits creditable to	
	Lost Creek-Elk Creek	Applegate
Flood control	$1,200,000	$160,000
Irrigation	750,000	175,000
Water supply	322,700	--
Fish and wildlife enhancement	808,000	322,200
Power generation	1,881,700	--
Recreation	430,000	98,000
Total benefits	$5,392,400	$755,200

b. For a check on individual economic feasibility, benefits creditable to the Lost Creek-Elk Creek combination were assigned to each project on the basis of project capability to serve each function. Those benefits are summarized as follows:

Item	Benefits creditable to	
	Lost Creek	Elk Creek
Flood control	$876,000	$324,000
Irrigation	308,000	442,000
Water supply	161,400	161,300
Fish and wildlife enhancement	768,400	39,600
Power generation	1,881,700	--
Recreation	356,000	74,000
Total benefits	$4,351,500	$1,040,900

65. OTHER ECONOMIC EFFECTS

Evaluated adverse effects include loss of timber production on Federal lands in the reservoir area and increased haul cost for Federal timber which would move to market over relocated roads of greater length than the existing roads. Exhibits 8 and 10 show summaries, by the U. S. Forest Service and the Bureau of Land Management, of the evaluation of those adverse effects. Economic costs reflecting these conditions are

included in the annual costs summarized in paragraph 62. Mitigation and restitution facilities are provided to offset possible adverse effects of inundation of fish spawning and rearing areas. Creation of reservoirs is anticipated to have little or no adverse effect on wildlife, and irrigation canals will include facilities to mitigate possible adverse effects on deer herds. Continued presentation, in the basin, of information as to the overall degree of flood protection provided would tend to offset any false sense of security which might develop in downstream areas as a result of the relatively high degree of at-site control of floods.

66. ECONOMIC JUSTIFICATION

a. Based on the foregoing, the economic analysis for each project proposed for early construction may be summarized as follows:

Item	Values assigned to	
	Lost Creek-Elk Creek	Applegate
Average annual benefits	$5,392,400	$755,200
Average annual economic costs	3,581,700	490,500
Benefit-to-cost ratio	1.5 to 1	1.5 to 1

b. Analysis of Lost Creek and Elk Creek Reservoirs as separate projects shows that each would have a favorable benefit-to-cost ratio.

c. Benefit-to-cost ratios for each function for Lost Creek-Elk Creek and for Applegate Reservoir are shown in table 4.

CHAPTER XII - LOCAL COOPERATION AND REPAYMENT

67. GENERAL

Benefits anticipated to be provided by the reservoir projects proposed for early construction would be widespread and general, accruing to all parts of the basin and, to a certain extent, to the State and the Nation. Benefits from proposed supplemental works, however, would be generally local in nature. In consideration of those broad general conditions, and certain specific conditions and requirements as discussed below, local cooperation and repayment requirements would be as follows for the various functions proposed to be served.

a. Flood control. - Benefits from flood control by reservoirs would be general. Provision of bank revetment is proposed to be a part of the Lost Creek and Elk Creek Reservoir projects, on the basis that the need therefor would be attributable to reservoir operation. Accordingly, no local cooperation is proposed to be required.

b. Irrigation. - Information furnished by the Bureau of Reclamation indicates that reservoir costs allocated to irrigation for the three reservoirs proposed herein for early construction would become reimbursable costs of the potential Federal Reclamation divisions which would utilize the irrigation water supplies developed by these reservoirs. Repayment provisions established under reclamation law and policy would apply to expenditures for both irrigation distribution and storage facilities. The following general principles would be applicable:

(1) All construction costs allocated to irrigation would be reimbursable without interest in 50 years exclusive of whatever development period up to 10 years the Secretary of Interior determines to be appropriate.

(2) The irrigation cost assigned for repayment by water users would be based on estimates of payment capacity developed by the Bureau of Reclamation in the feasibility investigations which are yet to be completed by that agency. The payment capacity estimates would take into account the classes of land, type of farm, and other factors affecting water user's ability to pay the cost of irrigation service.

(3) Before construction would be undertaken, definite arrangements would have to be made with a properly constituted water users' organization for the repayment of an appropriate amount of the irrigation construction cost.

(4) Irrigation construction costs in excess of the amount that the water users could repay in a 50-year repayment period would be assigned for repayment from power revenues from some Federal source.

c. The Bureau of Reclamation currently is making a detailed appraisal of farm income potential and of irrigation distribution costs for the Medford Division, which consists of lands which could be irrigated from the Lost Creek-Elk Creek project. Similar studies are scheduled to be made for the Applegate Division. The studies would be completed prior to initiation of construction. Based on preliminary reconnaissance level appraisal the Bureau has provided the following tentative appraisal of irrigation repayment information.

(1) Lost Creek and Elk Creek Reservoirs. - The Bureau of Reclamation tentatively establishes the estimated water users' payment capacity in the Medford Division at a level which would support water charges of approximately $15.00 per acre for new land provided full irrigation service and of approximately $5.00 per acre-foot for additional irrigation water furnished to presently irrigated land requiring supplemental supplies. Under this level of water charges and assumed irrigation distribution and storage costs, water users in the Medford Division would be able to pay the annual operating cost associated with both the irrigation distribution and storage facilities and to repay about 15 percent of the irrigation construction allocation for the combined distribution and storage facilities.

(2) Applegate Reservoir. - The Bureau of Reclamation tentatively establishes water users' payment capacity in the Applegate Division at a level which would support water charges of approximately $12.00 per acre for new land and of approximately $4.00 per acre-foot for supplemental water furnished to presently irrigated land. At this level of water charges water users in the Applegate Division would be able to meet a prospective annual operating charge for both irrigation distribution and storage facilities and to repay approximately 25 percent of the irrigation construction charges allocated to this division.

d. Future water supply. - In accordance with Title III to Public Law 85-500, users of future water supply would be required to contract to pay, with interest, for waters used for municipal and industrial purposes. Such contracts might be with one of the existing municipalities, with an existing industry, or with a new organization or industry not now located in the basin. It should be noted that no contracts for industrial use would be possible unless present State law would be amended or repealed. All costs for taking of water from Rogue River, and of transportation and distribution, would be a local responsibility. Informal assurances as to repayment are contained in letter from Oregon State Water Resources Board (see Exhibit 4).

e. Fish and wildlife enhancement. - Because of the national character of, and interest in, the Rogue River fishery, all costs allocated thereto are considered to be nonreimbursable. The anadromous fish runs which would be enhanced contribute to the offshore commercial troll and sport fisheries and provide stream sport fishing for residents of the basin, the State, and other States. The sport fishery, in both reservoirs

and streams, would be utilized by resident and out-of-state fishermen, particularly since the sport fishing season coincides with the full tourist season when persons from all States of the Nation visit Rogue River Basin. Wildlife benefits would be realized without project expenditures, and no reimbursement is considered appropriate. Restitution and mitigation costs are treated as joint costs, and allocated to all functions. Local cooperation in such costs would be as described for individual functions.

f. Power generation. - In accordance with Federal law, power generated at Lost Creek Reservoir in excess of the needs of the project would be disposed of by the Secretary of the Interior. Studies by the Corps of Engineers, U. S. Bureau of Reclamation, and Bonneville Power Administration indicate that the latter agency of the Department of Interior could best serve as marketing agency. (See Exhibit 11.) Bonneville Power Administration could integrate Lost Creek generation into the existing Federal Northwest power system, sell the power at system rates, and provide repayment on a system basis. It is proposed that payout would be with interest, and would be accomplished in 50 years from date of first use of power.

g. Recreation. - Recreation benefits would be widespread and general, and no reimbursement would be required. The joint costs allocated to recreation, as subsequently shown, would be less than 15 percent of total project construction costs. There would be no specific requirement for local cooperation. Responsible local agencies, however, might desire to accept responsibility for administration and continued development of recreation facilities.

h. Water quality control. - No benefits have been evaluated and no costs allocated. There would be no local cooperation involved.

68. SUMMARY

No specific items of local cooperation would be required for projects as proposed herein for early construction. Repayment of costs allocated to irrigation would be handled by the Bureau of Reclamation under Federal Reclamation law. Costs allocated to future water supply would be repaid in accordance with Title III to Public Law 85-500. Informal assurances as to repayment are contained in letter from Oregon State Water Resources Board (see Exhibit 4). Costs allocated to power would be repaid on a system basis from revenues available to Bonneville Power Administration after integration of Lost Creek power output into the Federal Northwest power system. No repayment would be required for flood control, fishery and wildlife enhancement, recreation, or water quality control.

CHAPTER XIII - ALLOCATION AND APPORTIONMENT

69. ALLOCATION OF COSTS

a. The costs of the multiple-purpose reservoir projects proposed in this report for early construction were allocated by the separable costs-remaining benefits method. Each of the three projects, Lost Creek Reservoir, Elk Creek Reservoir, and Applegate Reservoir, was examined, and it was found that in every case separable annual costs chargeable to any function were equaled or exceeded by the equivalent annual benefits creditable to that function, and the total annual financial costs for each of the projects were exceeded by the total of the equivalent annual benefits for that project.

b. It is desirable to combine Lost Creek Reservoir and Elk Creek Reservoir into a Lost Creek-Elk Creek project. For the purposes of cost allocation an examination was made to prove that, had the allocation been made separately, the sum of the allocations to the various functions would have been substantially the same as the allocations made of the combination. An office study based on cost, hydrological, and other data indicated that in no case, except for water supply, was there an economically justifiable single-purpose project available to use as an alternative. The estimated costs of alternative multiple-purpose projects from which a function had been omitted for the purpose of determining separable costs were based on cost data obtained during the formulation of the multiple-purpose projects. (See Appendix D.)

c. Since functions from which benefits would be derived - namely flood control, fishery and wildlife enhancement, future water supply, power, irrigation, and recreation - are considered project purposes, joint costs have been allocated to all. Inasmuch as neither the project facilities nor the functions involved any unusual circumstances from the standpoint of cost allocation, the allocations were made by the normal procedure under the separable costs-remaining benefits method. The results of the allocations for the two projects - that is, the Lost Creek-Elk Creek project and the Applegate project - are shown in table 4.

70. APPORTIONMENT OF COSTS AMONG AGENCIES AND INTERESTS

a. All preauthorization costs and costs of initial construction of projects recommended herein for early construction would be borne by the Federal Government, with ultimate reimbursement responsibilities for certain functions as outlined in Chapter XII.

b. Irrigation. - Provision of diversions and distribution systems for irrigation would be the responsibility of the Bureau of Reclamation, as stipulated in Federal law. As shown in Exhibit 3, the annual equivalent cost of irrigation distribution systems would be about as follows, subject to further refinement upon completion of feasibility studies now underway or scheduled.

89588 O-62—8

Reservoir and irrigation division	Annual equivalent distribution system costs
Lost Creek-Elk Creek (Medford Division)	$993,000
Applegate (Applegate Division)	180,000
Total	$1,073,000

Inasmuch as the costs allocated to irrigation apparently would exceed the amounts that could be repaid by the water users, special authorization would be required by Congress to permit financial assistance from other sources.

c. Future water supply. - All costs of construction, maintenance, and operation of facilities for taking stored water for future water supply uses would be borne by the user.

d. Relocated roads and utilities. - All facilities, relocated incidental to project construction, would be maintained and operated at the expense of the owners. The cost of all forest access roads would be a project cost, as would an estimated $200,000 betterment cost for Squaw Creek Road as part of Applegate project.

CHAPTER XIV - COORDINATION WITH OTHER AGENCIES

71. GENERAL

Studies of the recommended plan of improvement presented herein were cooperated in by, or coordinated with, all Federal, State, and local agencies which were known to be interested in any phase of Rogue River Basin water resource development. Many formal and informal meetings were held with members of other organizations and agencies throughout the course of these studies. Much of the basic information presented herein was furnished by other agencies and much was obtained through cooperative efforts. Good working relations were maintained with other agencies and the resident population throughout the course of the studies. Several agencies advocate construction of the projects in order to realize varying degrees of benefits to their interests. Some indicated that the projects would have no adverse effects. Their comments are contained in hearing transcripts or shown in exhibits attached hereto, and are summarized in following paragraphs. There is no known opposition to the proposed projects from any agency or organization. Many of the problems were discussed by the Rogue Technical Coordinating Subcommittee of the Columbia Basin Interagency Committee. The Subcommittee is composed of members from Federal and State agencies which have interests in the development of Rogue River Basin, and its actions assisted in maintaining coordination.

72. U. S. DEPARTMENT OF INTERIOR

a. Bureau of Reclamation. - The Bureau furnished information as to water requirements for proposed irrigation developments which would be a part of the project and could be supplied from reservoirs proposed for early construction; as to the estimated cost of distribution systems; and as to expected gross benefits to be derived from irrigation. (Exhibit 3.) The Bureau also furnished preliminary figures on probable repayment capacity and cooperated in apportioning gross irrigation benefits between reservoir storage and irrigation distribution systems. It was determined that no foreseeable conflict would be encountered by integrating the proposed improvements, irrigation projects under study or proposed by the Bureau, and the existing irrigation systems now operated by the Bureau and private enterprises into an overall basin plan. The Hull Mountain, Agate, Merlin, and Illinois Valley Division irrigation and multiple-purpose projects, all at various study stages by the Bureau, would not be affected adversely by the recommendations herein. The Bureau of Reclamation also considered the possibility of serving as marketing agency for power which could be developed at Lost Creek. As subsequently discussed, however, it was informally determined that Bonneville Power Administration might best serve that purpose.

b. Bureau of Sport Fisheries and Wildlife. - This Bureau of the U. S. Fish and Wildlife Service provided extensive and essential cooperation in developing the plan proposed for early development, and in acquainting local interests with the fish and wildlife aspects thereof.

Without their aid and willing cooperation, it would have been impossible to develop the proposed plan or to have obtained public understanding and acceptance as indicated by results of the public hearing of 25 September 1961. The Bureau directed and provided most of the financing for a cooperative data collection program and study of flow and temperature conditions in Rogue River and tributaries as related to the fishery resource. Cooperating agencies included the Oregon State Water Resources Board, the Oregon State Game Commission, the Fish Commission of Oregon, Oregon State University, the Corps of Engineers, and local interests. Their total contribution included confirming studies of reservoir temperatures and downstream temperature predictions performed under consultant contract by the Department of Oceanography of Oregon State University. As a result of the coordinated studies, the Bureau was able to provide a set of criteria for quantity and temperature of releases of water for improvement of fish habitat in Rogue and Applegate Rivers, an evaluation of average annual fishery benefits to be derived thereby, and specific recommendations as to project design and operation in the interest of fish and wildlife enhancement. Those recommendations are detailed in Appendix A. Project plans and operation procedure set forth herein are consistent with those recommendations.

c. Bonneville Power Administration. - In cooperation with the Corps of Engineers and the Bureau of Reclamation, Bonneville Power Administration assisted in arriving at informal decision as to marketability of and marketing agency for power which could be produced at Lost Creek project. Their letter setting forth information in regard to those matters is attached hereto as Exhibit 11.

d. Bureau of Land Management. - Timberlands under the jurisdiction of the Bureau of Land Management would be affected by reservoir construction and relocation of roads. The Bureau furnished information as to resulting loss of timber production and increase in cost of timber harvest. (See Exhibits 9 and 10.)

e. Geological Survey, Water Resources Division. - Data as to the water resources of Rogue River Basin were obtained from publications of, and by consultation with representatives of, this agency.

f. National Park Service. - Because of the proximity of Lost Creek Reservoir site to Crater Lake National Park, the possible impact on the park of reservoir construction and related recreational development was discussed with the Service. Potential recreational attendance at reservoir projects also was discussed with the Service, and full consideration was given to their 1954 report on Recreation Resources of the Rogue River Basin.

73. U. S. DEPARTMENT OF AGRICULTURE

a. U. S. Forest Service. - The Service furnished information as to loss of timber production on Federal lands in reservoir areas, as to the change in haul costs for Federal timber which would be moved over relocated roads, and as to present and future timber production and use of the forest resources of the basin. In addition, they made extensive cooperative studies of the recreational potentials of Applegate Reservoir, the need for acquisition of project lands adequate to permit proper management of Federal lands for recreational purposes, and the desirability of Forest Service administration and continued development of recreation facilities at that site. Their report on those matters is attached hereto as Exhibit 7.

b. Soil Conservation Service. - The Soil Conservation Service was kept informed of plans under consideration. It anticipates no conflict between its program in Rogue River Basin and the proposed developments. (See Exhibit 12.)

74. U. S. DEPARTMENT OF COMMERCE

Bureau of Public Roads. - In cooperation with the Oregon State Highway Department, the Bureau has deferred any further relocation surveys or major improvements on the Crater Lake Highway in and adjacent to the Lost Creek Reservoir area pending decision as to action on the recommendations herein. (See Exhibit 13.) If early authorization and appropriation are obtained, a considerable saving may be obtained thereby.

75. U. S. DEPARTMENT OF HEALTH, EDUCATION AND WELFARE

Public Health Service. - Under provisions of Title III to Public Law 85-500 the U. S. Public Health Service analyzed present water supply use and availability, estimated future needs for domestic and industrial water supply, and assisted in determination of benefits for provision of water supply. Also, under provisions of Public Law 87-88, they made an analysis of water quality control as related to planned project operation. Their report on these matters is contained in Appendix B.

76. FEDERAL POWER COMMISSION

Throughout the study, the Commission assisted by furnishing information as to probable demands for power and up-to-date information as to the probable benefit values for power which could be produced at Lost Creek project. Exhibits 1 and 6 summarize their findings in these matters.

77. HOUSING AND HOME FINANCING AGENCY

Urban Renewal Administration. - In order to insure coordination with any urban renewal programs which might be underway or planned, the Housing and Home Financing Agency was informed of project plans. The Regional Director of Urban Renewal states that the city of Grants Pass is receiving Urban Planning Assistance, and has arranged for continued coordination. (See Exhibit 14.)

78. STATE OF OREGON

a. Oregon State Water Resources Board. - This agency, representing the State of Oregon as a whole under provisions of Oregon laws, and including the State Engineer of Oregon, cooperated in many ways throughout the preparation of this report. The Board prepared a separate report to the Oregon Legislature on Rogue River, under date of January 1959, which contains extensive basic data as to the water resources and problems of the basin, existing State laws and state-granted water rights pertaining thereto, and related findings and recommendations for actions at State level in the interest of proper control, development, and conservation of those resources. Data contained in their report were used extensively in preparation of studies and text for this report. Members of the Board and its staff cooperated wholeheartedly on all occasions, and assisted materially at public meetings when information as to project plans and potentials was presented to local groups. A statement by the Board indicating concurrence in the proposed plan is included in the transcript of public hearing held on 25 September 1961, and their statement as to utilization of and repayment for water supply is contained in Exhibit 4.

b. Oregon State Game Commission. - The Game Commission cooperated in all studies previously discussed in connection with the Bureau of Sport Fisheries and Wildlife, and furnished information on request as needed throughout the course of the study. Joint recommendations of the Game Commission and the Fish Commission of Oregon, as to project construction and operation, were presented at the public hearing of 25 September 1961 and are contained in the transcript thereof. Their recommendations, as made at that time and as included in Appendix A, are considered to be comparable to or consistent with those of the Bureau of Sport Fisheries and Wildlife, except that recommendations are made that Lost Creek and Applegate Reservoirs be constructed simultaneously and that, if any project is to be delayed, Elk Creek Reservoir be constructed last.

c. Fish Commission of Oregon. - Coordination with the Fish Commission of Oregon was similar to that described for Oregon State Game Commission. The Fish Commission participated in all activities pertaining to studies of the fishery resource of Rogue River Basin.

CHAPTER XV - DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

79. DISCUSSION

a. General. - Rogue River Basin, in southwestern Oregon, is unique in many ways. Tributary to Pacific Ocean, its principal developments and population centers lie inland between the Coast and Cascade Ranges. It is nationally, and even internationally, known and esteemed for its fishery, scenic, and recreation resources. It is mostly rugged, mountainous terrain, and sparsely populated overall. Although it is traversed by main highways and a railroad, and served by scheduled airlines, much of the basin is relatively little developed. Agricultural lands, populations, and developments are situated along parts of the main stream and certain tributaries. Much of its area is accessible only with some difficulty.

b. At the same time, it has a rapidly growing population, extensive areas of arid but arable land, a water supply suitable for development, and numerous other important natural resources. The population of the basin has the desire to develop, conserve, and utilize basin resources in the best interests of the basin, the State of Oregon, and the Nation.

c. Basin needs. - Present basin needs related to water resource development include flood control; storage of surplus winter and spring runoff for irrigation, water supply, fishery and wildlife enhancement, and water quality control; generation of hydroelectric power; provisions for increased recreational development and use; and utilization of available raw materials. Additional needs can be expected to be generated and increased by population growth and related conditions in areas outside, as well as within, the basin.

d. Studies. - A study has been made of a basin plan for flood control and comprehensive water resource development. The study has been cooperated in by, and coordinated with, other Federal and State agencies concerned with various phases of water resource control and development. It has been discussed with, and modified where necessary to suit the needs of, the people of the basin.

e. Flood control. - Studies have shown that single-purpose flood control storage projects would not be economically feasible, that construction of dams other than in the headwaters areas would not be acceptable because of conflict with nationally known fishery resources of the basin, and that damsites acceptable under that criterion are not available for provision of a high degree of flood control at this time. Additional flood control can be provided as needed in the future by local works under Public Law 685 of the 84th Congress and by possible-future projects enumerated herein as a part of the basin plan.

f. Water conservation. - The seasonal distribution of precipitation and runoff is such that multiple use can be made of flood-control storage

space for water conservation, or vice versa. Studies have shown that the total requirements for annual use of storage for water conservation for irrigation, future water supply, fishery and wildlife enhancement, and water quality control would be approximately equivalent to the amounts of storage space required to provide a fairly high degree of at-site flood control. Further, studies have shown that, by substantially maximum development of the potentials of the sites considered, adequate amounts of water for present and foreseeable conservation needs, including improvement of fish habitat, can be stored at sites far enough upstream to reduce greatly the fishery problems often associated with dam construction in this area. There is a demand for water supply for irrigation of large areas of arid but arable land. Studies show a need for provisions for future domestic and municipal water supply. Statements presented at the final public hearing, and cooperative studies by other agencies, support these findings.

g. Power generation. - Studies based on data supplied by the Federal Power Commission show that hydroelectric power generation would not be justifiable at Elk Creek or Applegate sites, but would be economically feasible at Lost Creek site. Data furnished by the Bonneville Power Administration, Department of the Interior, indicate that potential power output from Lost Creek could be integrated into the existing Columbia River Basin system output and marketed as a part of that system's output.

h. Recreation. - Studies show a need for recreational development and a considerable potential therefor in the basin. Each of the projects proposed herein has been found to afford an opportunity for development of recreation potential. Statements made at initial and final public hearings show local agreement with that concept. The U. S. Forest Service has a particular interest in development of recreation in connection with Applegate Reservoir.

i. Land acquisition and relocations. - Experience has shown that problems often arise in regard to timing of land acquisition and relocation of roads for reservoir projects. Landowners generally are unable to find private buyers for their property after a project is authorized. Also, they experience difficulty in borrowing money and refinancing existing mortgages. They are compelled to hold their lands and improvements for an indeterminate, but often extended, period pending appropriation of project funds for land acquisition. This enforced inability of landowners to plan operations in a completely normal manner often results in a hardship. Such hardships and resultant unfavorable public relations could be prevented by early acquisition of lands. In the case of relocations, the need for improvement of existing facilities often results in considerable change in conditions between project authorization and initiation of construction. For example, the Bureau of Public Roads has improved a stretch of the Crater Lake Highway upstream from and a short distance into the upper end of the Lost Creek Reservoir area. Further improvement in the reservoir area is temporarily deferred pending

decision on Lost Creek Reservoir authorization. Because of the pressing need for further highway improvement, such deferral can be only temporary. A considerable saving could be made if project funds could be made available as soon as possible after project authorization to permit the improved road to be constructed on the proper relocated alignment.

j. Fishery facilities. - The projects proposed herein include provisions for construction and operation of facilities for enhancement of fish and wildlife resources of the basin, and for mitigation of and restitution for losses occasioned by project construction. For economic analysis purposes, costs of construction, operation, and maintenance of facilities for enhancement, mitigation, and restitution are included in estimates herein as provided by the U. S. Fish and Wildlife Service. Because of complex interrelationship between the enhancement and mitigation features, no decision can be made at this time as to agency assignment for operation and maintenance of fish production facilities. Further detailed studies in cooperation with Federal and State fisheries agencies would be required for that purpose and could be accomplished after project authorization. In such studies, particular consideration should be given to the possibility that experienced fisheries agencies, Federal or State, would accept responsibility for operation and maintenance of fish production facilities which may be provided.

80. CONCLUSIONS

The District Engineer concludes, on the basis of data obtained by coordinated and cooperative studies and summarized herein, that:

a. A definite need and desire exists in Rogue River Basin for flood control and conservation of water resources for irrigation, future water supply, fish and wildlife enhancement, and water quality control.

b. Flood plain regulation or zoning would not be a solution to the flood problem, but would be a desirable adjunct to works proposed herein for reduction of flood damages.

c. The adoption of an overall comprehensive basin plan as proposed herein would be a prerequisite to satisfying needs and desires revealed by the study. The plan proposed includes existing water resource developments; projects, principally for irrigation, now under study by other agencies; additional multiple-purpose reservoirs and supplemental works which are justifiable at this time; related programs of other agencies; and possible-future single- and multiple-purpose projects, all as listed and described herein.

d. Such a plan is locally acceptable; responsive to foreseeable basin needs; and adaptable to accomplishment as warranted by needs and conditions in the basin and the requirements imposed by continuing development of the Nation as a whole.

e. The reservoirs proposed for early development, and provisions for all functions to be served thereby, are economically feasible at this time. Benefit-to-cost ratio for the Lost Creek-Elk Creek combination of reservoirs is 1.5 to 1, as is the ratio for Applegate Reservoir. Cooperating Federal and State agencies have given reasonable assurance that reimbursement would be available for all costs allocated to functions for which Federal law requires reimbursement.

f. The fishery resource of Rogue River Basin is of national interest; the enhancement of that resource would benefit the basin, the State, and the Nation; and that construction costs allocated to the fishery function should be considered nonreimbursable.

g. The recommendations of the Bureau of Sport Fisheries and Wildlife, U. S. Fish and Wildlife Service, as enumerated in their report, and the plan outlined herein for early development, are fully consistent. Maintenance in the streams of the flows proposed to be released for improvement of fish habitat would be essential to realization of fish enhancement benefits and project justification. Prior to project construction, the State of Oregon, acting through the Oregon State Water Resources Board, should take action under available Oregon law, to insure that flows released for the fishery would remain in the streams throughout their length.

h. Lost Creek Reservoir should be constructed either simultaneously with or in advance of Elk Creek Reservoir, and Applegate Reservoir could be constructed as a separate project at any appropriate time. This would not be inconsistent with the desires of the State fisheries agencies as stated in paragraph 77b.

i. Projects by other agencies; other programs, including land and forest management measures, removal or prevention of pollution loads, and conservation of ground and surface waters; and the possible-future projects outlined herein, should be developed by coordinated planning to be compatible with projects proposed herein and to satisfy further the needs of the basin.

j. Early appropriation of funds would hold overall and Federal costs to a minimum and eliminate or reduce local problems associated with ultimate acquisition of lands and relocation of highways and roads.

k. Allocated irrigation costs would become reimbursable costs of the potential Federal reclamation divisions which would utilize irrigation water. Repayment provisions established under reclamation law and policy would apply.

81. RECOMMENDATIONS

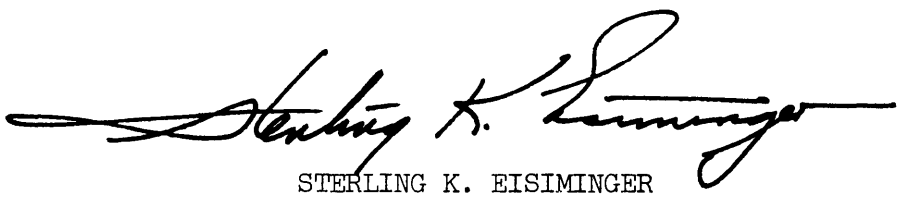
The District Engineer recommends:

a. Further developments for flood control and conservation of water resources in the interest of the basin, the State, and the Nation be in consonance with the general plan for comprehensive development as set forth in this report.

b. The authorization of the following multiple-purpose projects, as described and proposed herein as a part of the comprehensive plan, for early construction for flood control, irrigation, fish and wildlife enhancement, future water supply, water quality control, hydroelectric power generation, and recreation, all as outlined herein, at estimated first costs (exclusive of preauthorization costs) and annual costs of operation and maintenance as follows:

	Project	First cost, rounded	Annual cost of O&M
(1)	Lost Creek Reservoir	$74,500,000	$577,300
(2)	Elk Creek Reservoir	17,500,000	166,000
(3)	Applegate Reservoir	14,700,000	59,100

c. Provided that, prior to project construction, the State of Oregon take necessary action to insure maintenance, in the streams, of flows to be released for the fishery.



STERLING K. EISIMINGER
Colonel, Corps of Engineers
District Engineer

NPDGW (1 Dec 61)
SUBJECT: Rogue River Basin, Oregon, Survey Report for Flood Control and Comprehensive Water-Resource Development

U. S. Army Engr Div, Nor Pac, Portland, Oregon 8 December 1961

TO: Chief of Engineers, Department of the Army, Washington, D. C.

1. The basic report by the District Engineer has been carefully reviewed and I concur generally in the views and recommendations contained therein.

2. In addition to fish passage and storage and temperature regulating facilities, it is noted that the projects include fish production facilities such as hatcheries or possibly spawning channels and related works for restitution for losses occasioned by project construction and for stocking of the future reservoirs. Because of the complex interrelationship between the enhancement and mitigation features, the District Engineer is of the opinion that no decision can be made at this time as to an agency assignment for operation and maintenance of these fish production facilities. While I concur with the conclusion of the District Engineer, I believe that project planning studies should give concerted attention to the most suitable arrangements for operation and maintenance of these fish production facilities.

3. Accordingly, I recommend:

a. That further developments for flood control and conservation of water resources in the Rogue River Basin be in consonance with the general plan for comprehensive development as set forth in this report.

b. The authorization for construction of multiple-purpose reservoirs as described herein at the Lost Creek, Elk Creek and Applegate sites as a part of the comprehensive plan for flood control, irrigation, fish and wildlife enhancement, future water supply, water quality control, hydroelectric generation, and recreation at an estimated first cost of $106,700,000 and annual costs of operation and maintenance of $802,400.

c. That the foregoing be accomplished generally in accordance with the plans of the District Engineer, with such modifications thereof, including reasonable adjustments in storage capacity for water supply and other purposes, as in the discretion of the Chief of Engineers may be advisable; provided that, prior to construction, responsible non-Federal interests give assurances satisfactory to the Secretary of the Army that they will make demands for the use of water supply storage within a period of time which will permit repayment of the costs allocated to water supply within the life of the project, as determined by the Chief of Engineers, in accordance with the provisions of the Water Supply Act of 1958, as amended by the Federal Pollution Control Act Amendments of 1961; such costs, presently estimated at $5,977,000 for construction and $24,900 for

maintenance, operation and major replacements to be subject to modification as necessary at the time of construction to reflect adjustments in project plans and costs.

d. Provided further that, prior to project construction, the State of Oregon take necessary action to insure maintenance, in the streams, of flows to be released for fishery.

S. M. LIPTON
Colonel, Corps of Engineers
Acting Division Engineer

TABLE 1

SUMMARY OF PROJECTS INVESTIGATED

Reservoir	Stream	Location			Drainage area sq. mi.	Approximate usable storage, acre-feet	Purposes[1]	Remarks
		Section	TWP.	RN.				
Agate	Dry Cr. - Antelope Cr.	25	36S	1W	14	4,500	I	Recommended by USBR.
Althouse Creek	Althouse Creek	7 & 18	40S	7W	29	13,000	I	Considered by USBR, alternative to Sucker Creek.
Antelope	Antelope Creek	5	37S	1E	37	7,000	FC	Not justified at this time.
Ashland (Gaerky Creek)	Bear Creek	44	39S	1E	142[2]	15,000	FC	Not justified at this time.
Big Butte Creek	Big Butte Creek	14	34S	1E	237	40,000	I, FC, WS	Not justified at this time.
Brownsboro	Little Butte Creek	5	36S	1E	232	50,000	I, FC	Alternative to Lakecreek, elev. too low for effective irrig. Also, runoff inadequate for dependable filling.
Deer Creek	Deer Creek	18	38S	6W	24	10,000	I, FC	Not economically justified at this time.
Elk Glade	Beaver Dam Creek	27 & 28	33S	3E	21	Not determined	P, FC	Flood-control effect insignificant.
Evans Creek (Lower)	Evans Creek	26	34S	3W	107	45,000	I, FC	Alternative to Meadows.
Evans Creek (Upper)	Evans Creek	26	34S	3W	106	45,000	I, FC	Alternative to Meadows.
Evans Valley	Evans Creek	33	35S	4W	205	Not determined	FC	Not justified at this time.
Flat Creek	Elk Creek	27	32S	1E	100	Not determined	FC, I	Alternative to Elk Creek, required higher dam for less storage.
Homestead Gulch	Evans Creek	7	35S	3W	128	47,000	I, FC	Alternative to Meadows.
Indian Creek (Shady Cove)	Indian Creek	15	34S	1W	12	Not determined	FC	Flood control insignificant.
Indian Hill	Wood Creek, W. Fk. Illinois	19	40S	8W	7	25,000	I	Off-stream storage for irrigation only; alternative for Sucker Creek.
Lakecreek	Little Butte Creek	19	36S	2E	216	35,200	I, FC	Runoff inadequate for dependable filling.
Lewis Creek	Rogue River	2	34S	1W	1,082	224,000	I, FC, P, WS	Alternative for Lost Cr.-Elk Cr.-Big Butte Cr.
Little Applegate	Little Applegate	11 & 14	39S	3W	117	Not determined	I, FC	Not economically justifiable; fishery conflict.
Lone Mountain	West Fork Illinois	26	40S	9W	44	18,000	I, FC	Alternative for Sucker Creek. Very difficult to bring water to project lands.
Meadows (Hull Mtn)	East Fork Evans Creek	19	34S	2W	48	21,000	I, FC	Under restudy by USBR, Principally for irrigation.
McKee Bridge	Applegate River	33	39S	3W	369	Not determined	I, FC, F	Alternative for Applegate, less favorable location.
McNeil Creek	McNeil Creek	23	34S	1E	25	90,000	I, WS	Off-stream storage - alternate for Big Butte Creek.
Mt. Stella	Rogue River	26	30S	3E	156	50,000	I, FC, WS	Foundation conditions apparently unsatisfactory.
Needle Rock	Rogue River	17	33S	2E	643	Not determined	I, P, FC, WS	Alternative for Lost Creek; very small, narrow, steep reservoir.
Pease Bridge	Grave Creek	1	34S	5W	27	28,000	I, FC	Alternative for Sexton; minor FC; studied by USBR.
Reese Creek	Reese Creek	10	35S	1W	19	7,000	FC	Not economically feasible at this time.
Rough and Ready Creek	Rough and Ready Creek	14	40S	9W	29	Not determined	I, FC	Minor FC effect, less favorable irrig. than Lone Mtn.
Ruch	Applegate River	3	39S	3W	425	20,000	I, FC	Less favorable than Applegate
Sexton	Jump-Off-Joe Creek	36	34S	6W	33	30,000	I, FC	Recommended by USBR.
South Fork	South Fork Rogue River	18	33S	4E	83	Not determined	P, FC	Minor flood-control effect. Poor reservoir.
Sucker Creek	Sucker Creek	23	39S	7W	85	33,300	I, FC	Being studied by USBR.
Top Creek	Rogue River	19	31S	3E	291	Not determined	I, FC	Foundation conditions apparently unsatisfactory.
Trail Creek	Trail Creek	33	33S	1W	53	Not determined	FC	Very high relocations cost; minor benefits.
Trail Diversion	Rogue River	10	34S	1W	--	Pondage	P, I	Part of Lewis Creek project.
Williams Creek	Williams Creek	13	38S	5W	50	17,000	FC, I	Minor flood-control effect, too far downstream for irrigation, would flood out good agr. lands.
Yale Creek	Little Applegate	29	39S	2W	84	Not determined	FC, I	Not justified at this time.

[1] Purposes originally considered. Meaning of symbols is as follows: I = irrigation; FC = flood control; P = power generation; WS = municipal and industrial water supply; F = fish-life benefits. Other uses may become apparent in the future.

[2] Includes 64 square miles controlled by Emigrant Reservoir.

TABLE 2

PERTINENT DATA - PROPOSED STORAGE PROJECTS

Item	Lost Creek Dam	Elk Creek Dam	Applegate Dam
General:			
Purposes[1]	FC, I, WS, F, WL, WQC, P, R	FC, I, WS, F, WL, WQC, R	FC, I, F, WL, WQC, R
Stream	Rogue River	Elk Creek	Applegate River
Location	S 25 & 26, T 33 S, R 1 E, W.M.	S 20, T 33 S, R 1 E, W.M.	S 36, T 40 S, R 4 W, W.M.
River mile	154.7	3	46.5
Airline distance from Medford	26.5 miles north	26.5 miles north	23.5 miles southwest
Drainage area controlled, sq. mi.	674	127	217
Mean stream discharge, c.f.s.	1,823	255	445
Construction time, years	6	4	4
Dam:			
Type	Rock and gravel embankment	Rock and gravel embankment	Earth and gravel embankment
Crest elevation, feet	1,920	1,765	2,001
Maximum height, foundation to crest, feet	360	235	230
Freeboard above maximum pool, feet	5	5	5
Crest length, feet	8,130	2,670	1,325
Top width, feet	24	24	24
Gross embankment, cu. yds.	21,670,000	3,726,000	1,829,000
Reservoir:			
Pool elevations, feet:			
Maximum pool	1,915	1,760	1,996
Minimum pool (normal annual)	1,870	1,670	1,908
Minimum pool	1,776	1,624	1,874
Area, acres:			
Maximum pool	3,100	1,275	945
Minimum pool (normal annual)	2,470	520	420
Minimum pool	1,570	205	228
Storage:			
Usable, acre-feet	315,000	95,000	65,000
Dead, acre-feet	150,000	6,000	7,000
Total, acre-feet	465,000	101,000	72,000
Usable, inches over drainage area	8.8	14	5.6
Length at full pool, miles	10.0	5.5	4.0
Shoreline length, miles:			
Full pool	26.5	16.8	16.0
Minimum pool	18.2	5.5	8.0
Area to be acquired, acres:			
Public lands	1,700	250	2,485
Private lands	4,340	1,700	2,000
Total	6,040	1,950	4,485
Spillway:			
Type	Gate controlled ogee	Gate controlled ogee	Gate controlled ogee
Crest length, feet:			
Gross	105	79	108
Net	95	71	98
Crest elevation, m.s.l.	1,870	1,732	1,961
Maximum head on crest, feet	45	28	35
Design discharge, c.f.s.	90,900	38,700	75,300
Spillway gates:			
Type	Radial	Radial	Radial
Number	2	2	2
Size (width and height), feet	47.5 x 45	35.5 x 28	49 x 35
Outlet works:			
Capacity, c.f.s.	10,000 at elev. 1878	4,500 at elev. 1665	4,500 at elev. 1914
Type	Tower, tunnel, chute and stilling basin	Tower, tunnel and chute	Tower, tunnel
Outlet tunnel, horseshoe shaped:			
Diameter, feet	13.5	10	17[2]
Length, feet	1,250	1,000	1,200
Operating controls - slide gates	2 sets, 7.5' x 12'	2 sets, 5' x 9'	2 sets, 5' x 7'
Outlet tower	Rectangular, concrete	Horseshoe shaped, concrete	Horseshoe shaped, concrete
Height, feet	320	215	221
Temperature control	Multilevel intake	Multilevel intake	Multilevel intake
Openings	At 6 levels	At 5 levels	At 5 levels
Number and size (each level)	3 - 8' x 12.5'	2 - 6' x 7'	2 - 6' x 8'
Power facilities:	2 at 26,000 KW	None	None
Relocated lengths, miles:			
Roads	9.5	10.0	15.4
Power lines	7.5	8.5	7.0
Telephone lines	7.5	8.5	7.0
High voltage transmission	4.0	--	--

1 FC = flood control; I = irrigation; WS = water supply; F = fishery enhancement; WL = wildlife enhancement; WQC = water quality control; P = power generation; R = recreation.

2 Diversion tunnel converted to two 5-foot by 7-foot outlets.

TABLE 3

POSSIBLE FUTURE PROJECTS

Reservoir	Stream	Location			Drainage area, sq. mi.	Approximate usable storage, acre-feet	Purposes[1]	Remarks
		Section	TWP.	RN.				
Althouse Creek	Althouse Creek	7 & 18	40S	7W	29	13,000	I	Considered by USBR, alternative to Sucker Creek.
Antelope	Antelope Creek	5	37S	1E	37	7,000	FC	Not justified for flood control.
Ashland (Gaerky Creek)	Bear Creek	44	39S	1E	142[2]	15,000	FC	Not justified for flood control.
Big Butte Creek	Big Butte Creek	14	34S	1E	237	40,000	I, FC, WS	Not justified at this time.
Brownsboro	Little Butte Creek	5	36S	1E	232	50,000	I, FC	Alternative to Lakecreek, elev. too low for effective irrig. Also, runoff inadequate for dependable filling.
Deer Creek	Deer Creek	18	38S	6W	24	10,000	I, FC	Not economically justified at this time.
Elk Glade	Beaver Dam Creek	27 & 28	33S	3E	21	Not determined	P, FC	Flood-control effect insignificant.
Evans Creek (Lower)	Evans Creek	26	34S	3W	107	45,000	I, FC	Alternative to Meadows; not economically justifiable.
Evans Creek (Upper)	Evans Creek	26	34S	3W	106	45,000	I, FC	Alternative to Meadows; not economically justifiable.
Evans Valley	Evans Creek	33	35S	4W	205	Not determined	FC	Not justifiable at this time.
Homestead Gulch	Evans Creek	7	35S	3W	128	47,000	I, FC	Alternative to Meadows; not economically justifiable.
Indian Creek (Shady Cove)	Indian Creek	15	34S	1W	12	Not determined	FC	Flood control insignificant.
Indian Hill	Wood Creek, W. Fk. Illinois	19	40S	8W	7	25,000	I	Off-stream storage for irrigation only; alternative for Sucker Creek.
Lakecreek	Little Butte Creek	19	36S	2E	216	35,200	I, FC	Runoff inadequate for dependable filling.
Little Applegate	Little Applegate	11 & 14	39S	3W	117	Not determined	I, FC	Not economically justifiable.
Lone Mountain	West Fork Illinois	26	40S	9W	44	18,000	I, FC	Alternative for Sucker Creek. Very difficult to bring water to project lands.
McNeil Creek	McNeil Creek	23	34S	1E	25	90,000	I, WS	Off-stream storage - alternate for Big Butte Creek.
Pease Bridge	Grave Creek	1	34S	5W	27	28,000	I, FC	Alternative for Sexton; minor FC; studied by USBR.
Reese Creek	Reese Creek	10	35S	1W	19	7,000	FC	Not economically feasible.
Rough and Ready Creek	Rough and Ready Creek	14	40S	9W	29	Not determined	I, FC	Minor FC effect, less favorable irrig. than Lone Mtn.
South Fork	South Fork Rogue River	18	33S	4E	83	Not determined	P, FC	Minor flood-control effect. Poor reservoir.
Trail Creek	Trail Creek	33	33S	1W	53	Not determined	FC	Very high relocations cost; minor benefits.
Williams Creek	Williams Creek	13	38S	5W	50	17,000	FC, I	Minor flood-control effect, too far downstream for irrigation, would flood out good agr. lands.
Yale Creek	Little Applegate	29	39S	2W	84	Not determined	FC, I	Not justified for flood control.

[1] Purposes originally considered. Meaning of symbols is as follows: I = irrigation; FC = flood control; P = power generation; WS = municipal and industrial water supply; F = fish-life benefits. Other uses may become apparent in the future.

[2] Includes 64 square miles controlled by Emigrant Reservoir.

TABLE 4

SUMMARY OF COST ALLOCATION

LOST CREEK - EIK CREEK

	Flood control	Fish	Water supply	Power	Irrigation	Recreation	Total
			(Thousands of dollars)				
Construction Cost:							
Specific	570.0	1,634.0		10,865.0		890.0	13,959.0
Joint	19,570.0	12,788.0	5,977.0	21,247.0	13,007.0	5,552.0	78,141.0
Total	20,140.0	14,422.0	5,977.0	32,112.0	13,007.0	6,442.0	92,100.0
Investment:							
Specific	570.0	1,706.0		11,457.0		899.0	14,632.0
Joint	20,639.0	13,487.0	6,304.0	22,434.0	13,718.0	5,856.0	82,438.0
Total	21,209.0	15,193.0	6,304.0	33,891.0	13,718.0	6,755.0	97,070.0
Annual Costs:							
Operation and Maintenance:							
Specific	9.0	36.9		178.0	5.0	60.2	289.1
Joint	87.6	51.3	21.4	78.2	52.9	24.6	316.0
Total	96.6	88.2	21.4	256.2	57.9	84.8	605.1
Major Replacements:							
Specific		0.2		72.0		12.4	84.6
Joint	14.2	8.2	3.5	15.1	8.6	4.0	53.6
Total	14.2	8.4	3.5	87.1	8.6	16.4	138.2
Interest & Amortization	601.9	431.1	178.9	961.7	389.2	191.7	2,754.5
Financial Cost	712.7	527.7	203.8	1,305.0	455.7	292.9	3,497.8
B/C Ratio	1.68 to 1.00	1.53 to 1.00	1.58 to 1.00	1.44 to 1.00	1.65 to 1.00	1.47 to 1.00	1.54 to 1.00
Taxes foregone				57.7			57.7
Other Joint Economic Costs							26.2
Total Costs (econ.)							3,581.7
B/C Ratio, Justification							1.51 to 1.00
Annual benefits	1,200.0	808.0	322.7	1,881.7	750.0	430.0	5,392.4

TABLE 4.1

89588 O-62—9

TABLE 4

SUMMARY OF COST ALLOCATION

APPLEGATE RESERVOIR

	Flood control	Fish	Irrigation	Recreation	Total
		(Thousands of dollars)			
Construction Cost:					
Specific		476.0		385.0	861.0
Joint	2,886.0	6,062.0	3,585.0	1,306.0	13,839.0
Total	2,886.0	6,538.0	3,585.0	1,691.0	14.700.0
Investment:					
Specific		504.0		396.0	900.0
Joint	3,020.0	6,344.0	3,751.0	1,367.0	14,482.0
Total	3,020.0	6,848.0	3,751.0	1,763.0	15,382.0
Annual Costs:					
Operation and Maintenance:					
Specific				12.4	12.4
Joint	9.8	16.9	9.0	4.3	40.0
Total	9.8	16.9	9.0	16.7	52.4
Major Replacements:					
Specific				2.8	2.8
Joint	1.0	1.6	0.9	0.4	3.9
Total	1.0	1.6	0.9	3.2	6.7
Interest & Amortization	85.7	194.3	106.5	50.0	436.5
Taxes Foregone					
Financial Cost	96.5	212.8	116.4	69.9	495.6
B/C Ratio	1.66 to 1.00	1.51 to 1.00	1.50 to 1.00	1.40 to 1.00	1.52 to 1.00
Other Joint Economic Costs					-5.1
Total Costs (econ.)					490.5
B/C Ratio, Justification					1.54 to 1.00
Annual Benefits	160.0	322.2	175.0	98.0	755.2

ROGUE RIVER BASIN, OREGON

Information called for by
Senate Resolution 148, 85th Congress
Adopted 28 January 1958

1. General. - The comprehensive plan proposed for Rogue River Basin includes existing water resource developments, principally for irrigation; projects for irrigation and related uses now recommended or under study by the Bureau of Reclamation; three multiple-purpose reservoirs, the basic elements of any basin plan, which are economically justifiable and recommended for construction at this time; possible-future single- and multiple-purpose projects; and related programs of other agencies. Data in this supplement are for those projects now justifiable and recommended for construction. All data are for an economic life of 100 years.

2. Project description and economic life. - The reservoirs recommended for early construction are as follows:

Dam and reservoir	Features		
	Height, feet	Usable storage, acre-feet	Total storage, acre-feet
Lost Creek	360	315,000	465,000
Elk Creek	235	95,000	101,000
Applegate	230	65,000	72,000

Lost Creek Dam would be a rock and gravel fill structure with an impervious core; gate-controlled spillway on the right abutment; a combined intake tower, with provisions for release of water from selected depths to control temperature of releases through both outlet tunnel and power penstocks; and a two-unit power-generating installation with installed capacity of 52,000 kilowatts. Elk Creek Dam would be a rock and gravel embankment with an impervious core, gate-controlled spillway on the right abutment, and an intake tower with provisions for release of water from selected depths to control temperature of flows through an outlet tunnel. Applegate Dam would be an earth and gravel structure with an impervious core, gate-controlled spillway on the right abutment, and an intake tower with provisions for release of water from selected depths to control temperature of flows through an outlet tunnel. Each project would include lands and facilities for recreational development. Lost Creek and Elk Creek projects, which would be operated as an integral unit for upper Rogue River Basin, include supplemental works for prevention of bank erosion which might be aggravated by flood-control operation. The related irrigation divisions under study by the Bureau of Reclamation are essential parts of each project. Although physical life would be

substantially longer, economic life has been assumed to be 100 years for purposes of project analysis.

3. Project costs. - Estimated construction costs and average annual costs of operation, maintenance, and replacements, are as follows:

Dam and reservoir	Construction cost	Average annual O&M & R cost
Lost Creek	$74,600,000	$577,300
Elk Creek	17,500,000	166,000
Applegate	14,700,000	59,100

Details of the above estimates are shown in Chapter X of the main report and in Appendix G.

4. Benefit-to-cost ratios. - A summary of costs, annual charges, annual benefits, and benefit-to-cost ratios for the recommended projects are shown in the following tabulation. Because of the integrated manner of operation mentioned in paragraph 2, Lost Creek and Elk Creek Reservoirs are analyzed as a single project.

Item	Data for 100-year economic life	
	Lost Creek-Elk Creek	Applegate
Project cost	$92,100,000	$14,700,000
Interest during construction	4,970,000	682,000
Investment	97,070,000	15,382,000
Economic analysis		
Annual costs:		
Interest	2,548,100	403,800
Amortization	206,400	32,700
Operation and maintenance	605,100	52,400
Replacements	138,200	6,700
Economic costs	83,900[1]	-5,100[2]
Totals	3,581,700	490,500
Annual benefits:		
Flood control	1,200,000	160,000
Irrigation	750,000	175,000
Future water supply	322,700	--
Fish and wildlife	808,000	322,200
At-site power	1,881,700	--
Recreation	430,000	98,000
Totals	$5,392,400	$755,200
Benefit-to-cost ratios	1.5 to 1	1.5 to 1

1 Includes $57,700 taxes foregone.
2 Savings on cost of haul for Federal timber.

5. Benefits not evaluated. - Other local, regional, and national benefits, not evaluated, would result from construction and planned operation of the project. These include prevention of loss of life during floods; reduction in the possibility of unsanitary stream conditions on Rogue and Applegate Rivers; increased economic security; expansion of industrial, commercial, and residential areas; enlargement of the tax base; increased farm markets because of increased population; reduction of soil erosion losses; increase of national wealth; and improved opportunity for recreational use of the streams involved.

6. Physical feasibility and cost of providing for future needs. - The recommended basin plan was prepared in consideration of the fact that needs would remain for additional water resource development, and that those needs would increase in the future with population growth and additional economic development. Each of the three sites where storage projects are recommended for early construction would be developed to physical limits. Insofar as can be determined, it would be impracticable to serve additional needs by any higher degree of development at those sites. The basin plan, however, includes a number of possible-future storage projects which can be evaluated and developed as future needs and conditions may warrant. Also, some local areas may be protected by projects under Public Law 685 of the 84th Congress if conditions following initiation of storage control warrant such action. Although no demand now exists, provision for taking of stored water at reservoir heads for water supply purposes could be made in accordance with Title III of Public Law 85-500 if proper assurance were to be furnished, prior to construction, that the Government would be reimbursed for the costs involved.

7. Allocation of costs. - Cost allocations by the separable costs-remaining benefits method, the priority of use method, and the incremental cost method, all for 100-year periods of amortization, are summarized in the following tabulations:

SUMMARY OF COST ALLOCATIONS

Function and cost item	Lost Creek - Elk Creek Project			Applegate Reservoir		
	Separable cost-remaining benefits	Priority of use	Incremental cost	Separable cost-remaining benefits	Priority of use	Incremental cost
	Allocated amounts					
Flood Control						
Construction cost	$20,140,000	$34,458,000	$74,270,000	$2,886,000	$4,866,000	$11,789,000
Average annual costs						
Operation, maintenance and replacements	110,800	169,300	392,600	10,800	15,500	43,900
Total	712,700	1,200,000	2,613,800	96,500	160,000	394,000
Fish & Wildlife Enhancement						
Construction cost	14,422,000	22,474,000	3,170,000	6,538,000	9,449,000	1,576,000
Average annual costs						
Operation, maintenance and replacements	96,600	135,700	38,100	18,500	28,400	-
Total	527,700	808,000	132,900	212,800	309,200	46,800
Recreation						
Construction cost	6,442,000	10,463,000	909,000	1,691,000	385,000	922,000
Average annual costs						
Operation, maintenance, and replacements	101,200	117,900	72,600	19,900	15,200	-
Total	292,900	430,000	99,800	69,900	26,400	27,400
Water Supply						
Construction cost	5,977,000	9,310,000	1,208,000	-	-	-
Average annual costs						
Operation, maintenance and replacements	24,900	44,000	-	-	-	-
Total[1]	203,800	322,700	36,200	-	-	-
Irrigation						
Construction cost	13,007,000	4,530,000	1,208,000	3,585,000	-	413,000
Average annual costs						
Operation, maintenance and replacements	66,500	26,400	5,000	9,900	-	15,200
Total	455,700	162,000	41,100	116,400	-	27,400
Power						
Construction cost	32,112,000	10,865,000	11,335,000	-	-	-
Average annual costs						
Operation, maintenance and replacements	343,300	250,000	235,000	-	-	-
Taxes foregone	57,700	57,700	57,700	-	-	-
Total[1]	1,362,700	632,800	574,000	-	-	-
Total Project						
Construction cost	92,100,000	92,100,000	92,100,000	14,700,000	14,700,000	14,700,000
Average annual costs						
Operation, maintenance and replacements	743,300	743,300	743,300	59,100	59,100	59,100
Taxes foregone	57,700	57,700	57,700	-	-	-
Total[1]	$3,555,500	$3,555,500	$3,497,800	$495,600	$495,600	$495,600

1 Including taxes foregone.

COST ALLOCATION DATA
LOST CREEK - ELK CREEK PROJECT

ALLOCATION BY SEPARABLE COSTS - REMAINING BENEFITS METHOD

Item	Function						
	Flood Control	Fish and Wildlife			Irrigation	Recreation	Total
	DOLLARS, unless otherwise noted						
Allocation of annual costs:							
a. Average annual benefits	1'200'000	808'000	322'700	1'881'700	750'000	430'000	5'392'400
b. Alternate costs			384'000				384'000
c. Limited benefits	1'200'000	808'000	322'700	1'881'700	750'000	430'000	5'392'400
d. Separable costs	26'018	132'907	36'129	631'702	41'129	99'786	967'671
e. Remaining benefits							
(1) Amount	1'173'982	675'093	286'571	1'249'998	708'871	330'214	4'424'729
(2) Percent of total	26.5322915	15.2572733	6.4765774	28.2502725	16.0206647	7.4629203	100.0000000
f. Allocated joint costs	686'606	394'829	167'601	731'064	414'585	193'126	2'587'814
g. Total allocation	712'624	527'736	203'730	1'362'766	455'714	292'912	3'555'485
h. Taxes foregone				57'700			57'700
i. Total less taxes foregone	712'624	527'736	203'730	1'305'066	455'714	292'912	3'497'785
Allocation of operation and maintenance costs:							
a. Separable costs	9'000	37'900		163'000	5'000	60'200	275'100
b. Allocated joint costs	87'556	50'349	21'372	93'225	52'868	24'627	330'000
c. Total allocation	96'556	88'249	21'372	256'225	57'868	84'827	605'100
Allocation of major replacements:							
a. Separable costs		200		72'000		12'400	84'600
b. Allocated joint costs	14'221	8'177	3'471	15'142	8'587	4'000	53'600
c. Total allocation	14'221	8'377	3'471	87'142	8'587	16'400	138'200
Allocation of investment:							
a. Annual investment cost	601'847	431'110	178'887	961'699	389'259	191'685	2'754'485
b. Allocated investment	21'209'421	15'192'555	6'304'076	33'890'805	13'717'702	6'755'085	97'069'576
Allocation of construction expenditures:							
a. Specific investment	570'000	1'706'127		11'456'370		899'213	14'631'710
b. Investment in conventional joint use facilities	20'639'421	13'486'428	6'304'076	22'434'435	13'717'702	5'855'872	82'437'866
c. Interest during construction on conventional joint use facilities	1'069'700	698'974	326'727	1'187'007	710'961	303'498	4'296'866
d. Construction expenditures in conventional joint use facilities	19'569'721	12'787'454	5'977'349	21'247'428	13'006'741	5'552'374	78'141'000
e. Percent of construction expenditures in conventional joint use facilities	25.0441138	16.3645896	7.6494401	27.1911390	16.6452195	7.1055834	100.0000000
f. Construction expenditures in specific facilities	570'000	1'634'000		10'865'000		890'000	13'959'000
g. Total construction expenditures	20'139'721	14'421'454	5'977'349	32'112'428	13'006'741	6'442'374	92'100'000

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

COST ALLOCATION DATA
APPLEGATE RESERVOIR

ALLOCATION BY SEPARABLE COSTS - REMAINING BENEFITS METHOD

Item	Function				
	Flood Control	Fish and Wildlife	Irrigation	Recreation	Total
	DOLLARS, unless otherwise noted				
Allocation of annual costs:					
a. Average annual benefits	160,000	322,200	175,000	98,000	755,200
b. Alternate costs					
c. Limited benefits	160,000	322,200	175,000	98,000	755,200
d. Separable costs		46,795	27,376	27,463	101,634
e. Remaining benefits	160,000	275,405	147,624	70,537	653,566
(1) Amount	24.4810776	42.1388199	22.5874663	10.7926360	100.0000000
(2) Percent of total	96,442	166,004	88,982	42,517	393,946
f. Allocated joint costs	96,442	212,799	116,358	69,980	495,580
g. Total allocation					
h. Taxes foregone	96,442	212,799	116,358	69,980	495,580
i. Total less taxes foregone				12,400	12,400
Allocation of operation and maintenance costs:					
a. Separable costs	9,792	16,855	9,034	4,317	40,000
b. Allocated joint costs	9,792	16,855	9,034	16,717	52,400
c. Total allocation				2,800	2,800
Allocation of major replacements:					
a. Separable costs	954	1,643	880	420	3,900
b. Allocated joint costs	954	1,643	880	3,220	6,700
c. Total allocation	85,696	194,301	106,444	50,043	436,480
Allocation of investment:					
a. Annual investment cost	3,019,980	6,847,287	3,751,152	1,763,546	15,381,826
b. Allocated investment		503,642		396,349	899,991
Allocation of construction expenditures:					
a. Specific investment	3,019,980	6,343,645	3,751,152	1,367,197	14,481,835
b. Investment in conventional joint use facilities	134,054	281,588	166,510	60,688	642,835
c. Interest during construction on conventional joint use facilities	2,885,926	6,062,057	3,584,642	1,306,509	13,839,000
d. Construction expenditures in conventional joint use facilities	20.8535732	43.8041549	25.9024640	9.4407760	100.0000000
e. Percent of construction expenditures in conventional joint use facilities		476,000		385,000	861,000
f. Construction expenditures in specific facilities	2,885,926	6,538,057	3,584,642	1,691,509	14,700,000
g. Total construction expenditures					

Apparent minor discrepancies are caused by electronic data processing equipment being programmed to drop all the digits to the right of the units column in computed values instead of rounding and adjusting the number in the units column.

LOST CREEK - ELK CREEK PROJECT

COST ALLOCATION BY PRIORITY OF USE METHOD

Priority of use function	Flood control	Fish and wildlife enhancement	Recreation	Water supply	Irrigation	Power	Total
			(Thousands of dollars)				
1. Allocation of average annual costs							
a. Average annual benefits	1,200.0	808.0	430.0	322.7	750.0	1,881.7	5,392.4
b. Alternate cost	-	-	-	384.0	-	-	384.0
c. Limited benefits	1,200.0	808.0	430.0	322.7	750.0	1,881.7	5,392.4
d. Specific costs	25.2	85.5	98.1	-	5.0	632.8[1]	846.6[1]
e. Remaining justifiable expenditure (c-d)	1,174.8	722.5	331.9	322.7	745.0	1,248.9	4,545.8
f. Assigned joint costs							
(1) Amount	1,174.8	722.5	331.9	322.7	157.0	-	2,708.9
(2) Percent	43.37	26.67	12.25	11.91	5.80	-	100.0
g. Allocated average annual cost (d+f(1))	1,200.0	808.0	430.0	322.7	162.0	632.8	3,555.5
h. Taxes foregone	-	-	-	-	-	57.7	57.7
i. Allocated average annual cost w/o taxes foregone	1,200.0	808.0	430.0	322.7	162.0	575.1	3,497.8
2. Allocation of ordinary operation and maintenance							
a. Specific costs	9.0	36.9	60.2	-	5.0	178.0	289.1
b. Joint costs (% from 1f (2))	137.1	84.3	38.7	37.6	18.3	-	316.0
c. Allocated O & M costs	146.1	121.2	98.9	37.6	23.3	178.0	605.1
3. Allocation of major replacement costs							
a. Specific costs	-	0.2	12.4	-	-	72.0	84.6
b. Joint costs (% from 1f (2))	23.2	14.3	6.6	6.4	3.1	-	53.6
c. Allocated rep. cost	3.2	14.5	19.0	6.4	3.1	72.0	138.2
4. Allocation of investment							
a. Investment cost (11-(2c+3c))	1,030.7	672.3	312.1	278.7	135.6	325.1	2,754.5
b. Allocated investment a/R [2]	36,322.0	23,692.0	10,998.0	9,822.0	4,779.0	11,457.0	97,070.0
5. Allocation of construction cost							
a. Specific investment	570.0	1,706.0	899.0	-	-	11,457.0	14,632.0
b. Investment in joint use facilities (4b-5a)	35,752.0	21,986.0	10,099.0	9,822.0	4,779.0	-	82,438.0
c. Int.dur.const., joint use facilities (proportionate to b)	1,864.0	1,146.0	526.0	512.0	249.0	-	4,297.0
d. Const.cost, joint use facilities b-c							
(1) Amount	33,888.0	20,840.0	9,573.0	9,310.0	4,530.0	-	78,141.0
(2) Percent	43.37	26.67	12.25	11.91	5.80	-	100.0
e. Const.cost, specific facilities	570.0	1,634.0	890.0	-	-	10,865.0	13,959.0
f. Allocated constr. cost	34,458.0	22,474.0	10,463.0	9,310.0	4,530.0	10,865.0	92,100.0

1 Includes taxes foregone.
2 R = 0.0283764

APPLEGATE PROJECT

COST ALLOCATION BY PRIORITY OF USE METHOD

Priority of use Function	Flood control	Fish and wildlife enhance-ment	Recreation	Irrigation	Total
		(Thousands of dollars)			
1. Allocation of average annual costs					
a. Average annual benefits	160.0	322.2	98.0	175.0	755.2
b. Alternate cost	-	-	-	-	-
c. Limited benefits	160.0	322.2	98.0	175.0	755.2
d. Specific costs	-	14.3	26.4	-	40.7
e. Remaining justifiable expenditure (c-d)	160.0	307.9	71.6	175.0	714.5
f. Assigned joint costs					
(1) Amount	160.0	294.9	-	-	454.9
(2) Percent	35.17	64.83	-	-	100.0
g. Allocated average annual cost (d+f(1))	160.0	309.2	26.4	-	495.6
2. Allocation of ordinary operation & maintenance					
a. Specific costs	-	-	12.4	-	12.4
b. Joint cost (% from 1f(2))	14.1	25.9	-	-	40.0
c. Allocated O & M costs	14.1	25.9	12.4	-	52.4
3. Allocation of major replacement costs					
a. Specific costs	-	-	2.8	-	2.8
b. Joint cost (% from 1f (2))	1.4	2.5	-	-	3.9
c. Allocated rep. cost	1.4	2.5	2.8	-	6.7
4. Allocation of investment					
a. Investment cost (1i-(2c+3c))	144.5	280.8	11.2	-	436.5
b. Allocated investment a/R [1]	5,092.0	9,894.0	396.0	-	15,382.0
5. Allocation of construction cost					
a. Specific investment	-	504.0	396.0	-	900.0
b. Investment in joint use facilities (4b-5a)	5,092.0	9,390.0	-	-	14,482.0
c. Int.dur.const., joint use facilities (proportionate to b)	226.0	417.0	-	-	643.0
d. Const. cost, joint use facilities b-c					
(1) Amount	4,866.0	8,973.0	-	-	13,839.0
(2) Percent	35.16	64.84	-	-	100.0
e. Cost., specific facil.	-	476.0	385.0	-	861.0
f. Allocated constr. cost	4,866.0	9,449.0	385.0	-	14,700.0

[1] R= 0.0283764

LOST CREEK - ELK CREEK PROJECT

ALLOCATION BY INCREMENTAL COST METHOD

	Purposes						
	Basic flood control	Other					Total
		Fish and wildlife enhancement	Water supply	Power	Irrigation	Recreation	
	(Thousands of dollars)						
1. Allocation of annual charges							
a. Separable costs	26.0	132.9	36.2	631.7	41.1	99.8	967.7
b. Allocated joint costs	2,587.8	-	-	-	-	-	2,587.8
c. Total allocation	2,613.8	132.9	36.2	631.7	41.1	99.8	3,555.5
d. Taxes foregone	-	-	-	57.7	-	-	57.7
e. Total less taxes foregone	2,613.8	132.9	36.2	574.0	41.1	99.8	3,497.8
2. Allocation of O & M costs							
a. Separable costs	9.0	37.9	-	163.0	5.0	60.2	275.1
b. Allocated joint costs	330.0	-	-	-	-	-	330.0
c. Total allocation	339.0	37.9	-	163.0	5.0	60.2	605.1
3. Allocation of major replacements							
a. Separable costs	-	0.2	-	72.0	-	12.4	84.6
b. Allocated joint costs	53.6	-	-	-	-	-	53.6
c. Total allocation	53.6	0.2	-	72.0	-	12.4	138.2
4. Investment cost							
a. Separable costs	17.1	94.8	36.1	339.0	36.1	27.2	550.3
b. Allocated joint costs	2,204.2	-	-	-	-	-	2,204.2
c. Total allocation	2,221.3	94.8	36.1	339.0	36.1	27.2	2,754.5
5. Allocated investment							
a. Separable costs	599.7	3,341.0	1,273.2	11,946.6	1,273.2	958.1	19,391.8
b. Allocated joint costs	77,677.8	-	-	-	-	-	77,677.8
c. Total allocation	78,277.5	3,341.0	1,273.2	11,946.6	1,273.2	958.1	97,069.6
6. Interest during construction							
a. Separable costs	30.7	171.0	65.2	611.6	65.2	49.1	992.8
b. Allocated joint costs	3,976.8	-	-	-	-	-	3,976.8
c. Total allocation	4,007.5	171.0	65.2	611.6	65.2	49.1	4,969.6
7. Construction cost							
a. Separable costs	569.0	3,170.0	1,208.0	11,335.0	1,208.0	909.0	18,399.0
b. Allocated joint costs	73,701.0	-	-	-	-	-	73,701.0
c. Total allocation	74,270.0	3,170.0	1,208.0	11,335.0	1,208.0	909.0	92,100.0

APPLEGATE PROJECT

ALLOCATION BY INCREMENTAL COST METHOD

	Purposes				
	Basic flood control	Other			Total
		Fish and wildlife enhancement	Irrigation	Recreation	
	(Thousands of dollars)				
1. Allocation of annual charges					
a. Separable costs	-	46.8	27.4	27.4	101.6
b. Allocated joint costs	394.0	-	-	-	394.0
c. Total allocation	394.0	46.8	27.4	27.4	495.6
d. Taxes foregone	-	-	-	-	-
e. Total less taxes foregone	394.0	46.8	27.4	27.4	495.6
2. Allocation of O & M costs					
a. Separable costs	-	-	-	12.4	12.4
b. Allocated joint costs	40.0	-	-	-	40.0
c. Total allocation	40.0	-	-	12.4	52.4
3. Allocation of major replacements					
a. Separable costs	-	-	-	2.8	2.8
b. Allocated joint costs	3.9	-	-	-	3.9
c. Total allocation	3.9	-	-	2.8	6.7
4. Investment cost					
a. Separable costs	-	46.8	27.4	12.3	86.5
b. Allocated joint costs	350.0	-	-	-	350.0
c. Total allocation	350.0	46.8	27.4	12.3	436.5
5. Allocated investment					
a. Separable costs	-	1,649.1	964.8	432.1	3,046.0
b. Allocated joint costs	12,335.8	-	-	-	12,335.8
c. Total allocation	12,335.8	1,649.1	964.8	432.1	15,381.8
6. Interest during construction					
a. Separable costs	-	73.1	42.8	19.1	135.0
b. Allocated joint cost	546.8	-	-	-	546.8
c. Total allocation	546.8	73.1	42.8	19.1	681.8
7. Construction cost					
a. Separable costs	-	1,576.0	922.0	413.0	2,911.0
b. Allocated joint costs	11,789.0	-	-	-	11,789.0
c. Total allocation	11,789.0	1,576.0	922.0	413.0	14,700.0

8. Extent of interest in projects. - Local interests and organizations and groups outside the basin are interested in the project and strongly desirous of obtaining planned project benefits. Chapter VII of the main report summarizes interest in the project.

9. Repayment of costs allocated to reimbursable features. - Repayment would be required for costs allocated to irrigation, future water supply, and power.

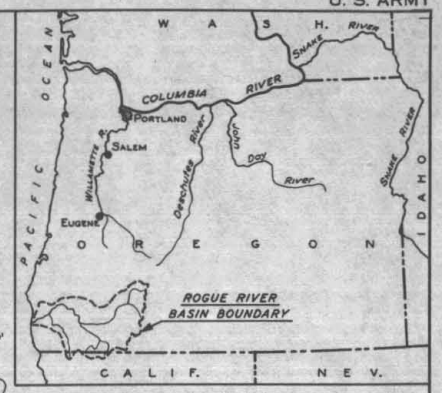
a. Irrigation. - According to the Bureau of Reclamation, reservoir costs allocated to irrigation for the three recommended reservoirs would become reimbursable costs of the Federal Reclamation divisions which would utilize stored water for irrigation. Repayment provisions established under reclamation law and policy would apply. Since costs allocated to irrigation apparently would exceed the amounts that could be repaid by water users, authorization would be required by Congress to permit financial assistance from other sources. Paragraphs 67b and 70b of the main report discuss irrigation repayment.

b. Future water supply. - In accordance with Title III to Public Law 85-500, repayment with interest would be required for costs allocated to water supply and interest would accumulate on any balance of cost for water supply storage not under contract beginning 10 years from the date of first availability of storage for water supply use. As all provisions are for future water supply, the users are not known at this time. Exhibit 4 in the main report is a letter from Oregon State Water Resources Board as to the probability of use and repayment for water supply. Appendix B is a report by the U. S. Public Health Service as to water supply needs.

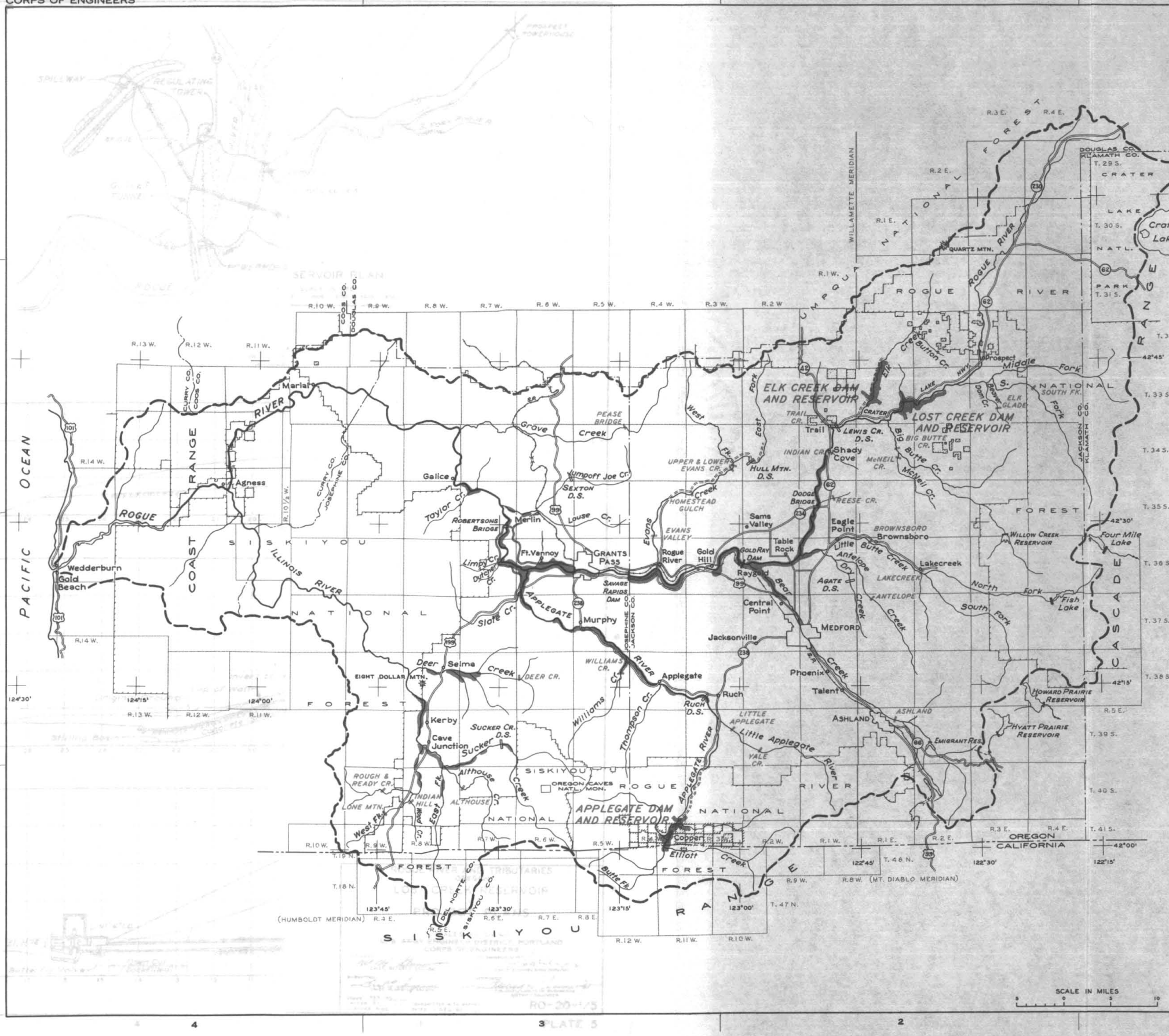
c. Power. - Costs allocated to power would be repaid with interest. Exhibit 11 of the main report is a letter from Bonneville Power Administration which shows that the Lost Creek power output could be integrated into the existing Federal Northwest power system. The power would be sold at system rates and repayment would be on a system basis. See paragraph 67f of the main report for additional detail.

10. Alternative projects. - As shown in the main report, paragraphs 42 and 49b and c, and in Appendix A, sites alternative to those recommended for early development would not be acceptable because of adverse effect on fish resources of the basin. Projects shown in the main report for possible future development as needs may warrant are not alternative but are supplemental to the projects now recommended.

CORPS OF ENGINEERS U. S. ARMY



VICINITY MAP
SCALE IN MILES
50 0 50 100 150 200



LEGEND
- PROPOSED RESERVOIRS
- EXISTING RESERVOIRS
- POSSIBLE FUTURE DAMSITES
- 1955 FLOOD PLAIN

SCALE IN MILES
5 0 5 10

ROGUE RIVER AND TRIBUTARIES
OREGON

BASIN MAP

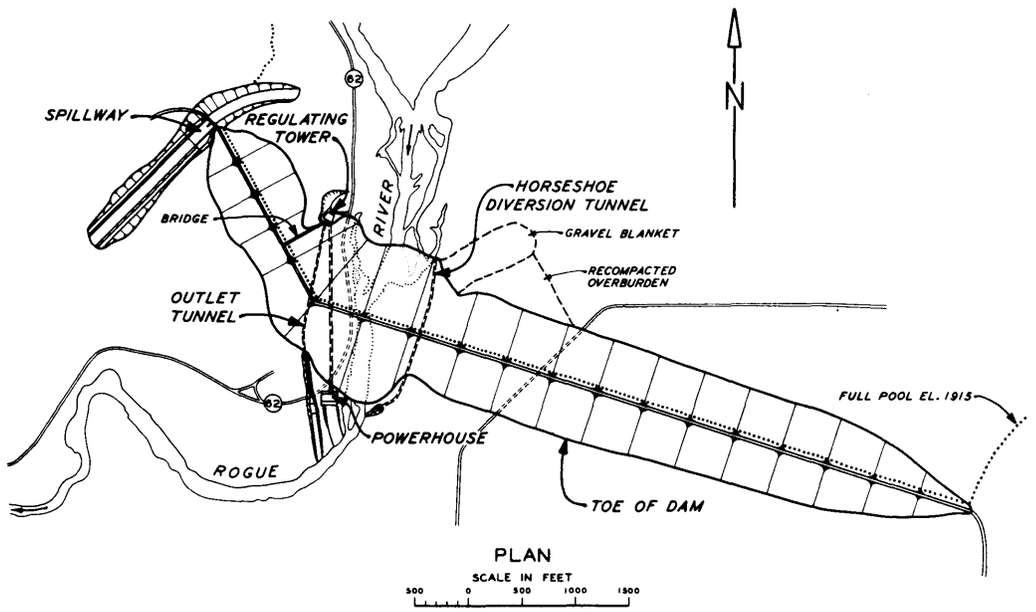
SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED _____ CHIEF, REPORTS SECTION
RECOMMENDED _____ CHIEF, ENGINEERING DIVISION
SUBMITTED _____ CHIEF, PLANNING BRANCH
APPROVED _____ COLONEL, CORPS OF ENGINEERS DISTRICT ENGINEER

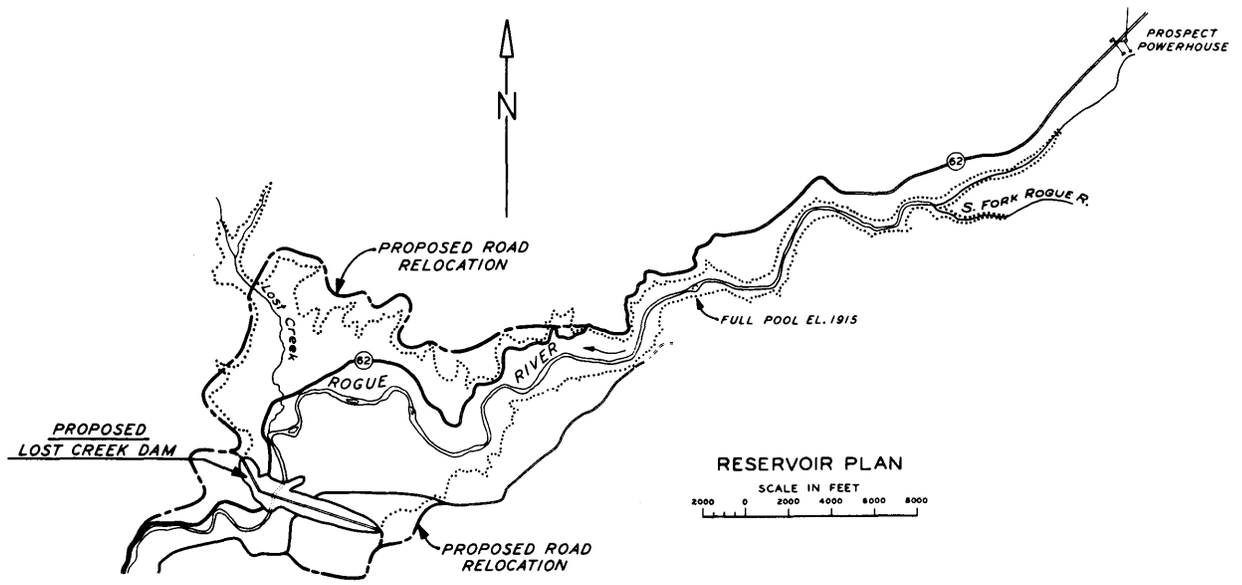
DRAWN BY WHO
TRACED BY
CHECKED WMS
TRANSMITTED WITH REPORT DATED 1 DEC 61

RO-20-1/1

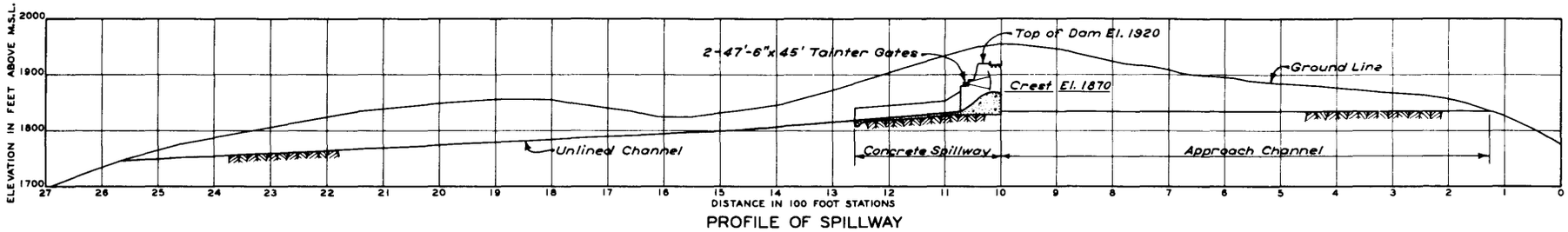
PLATE 1



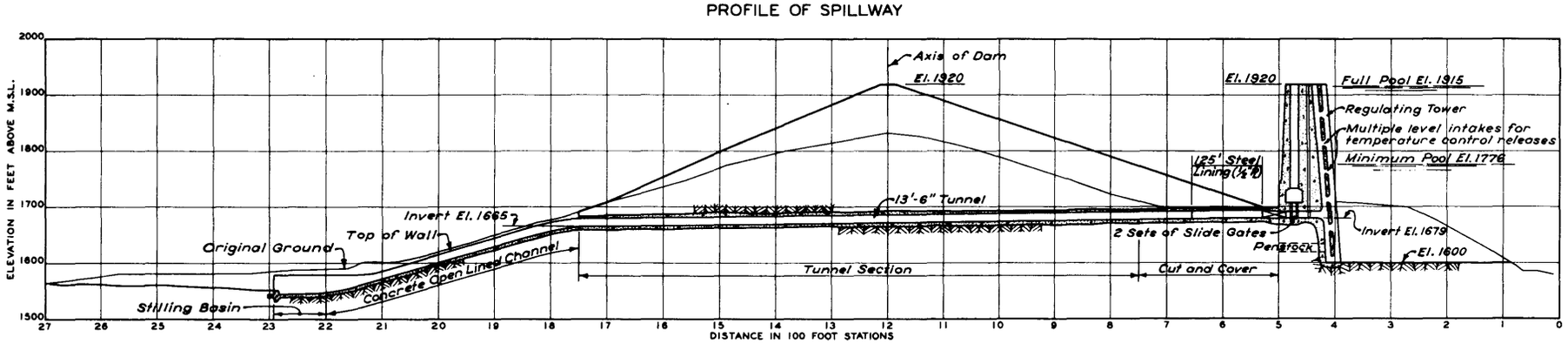
PLAN
SCALE IN FEET
500 0 500 1000 1500



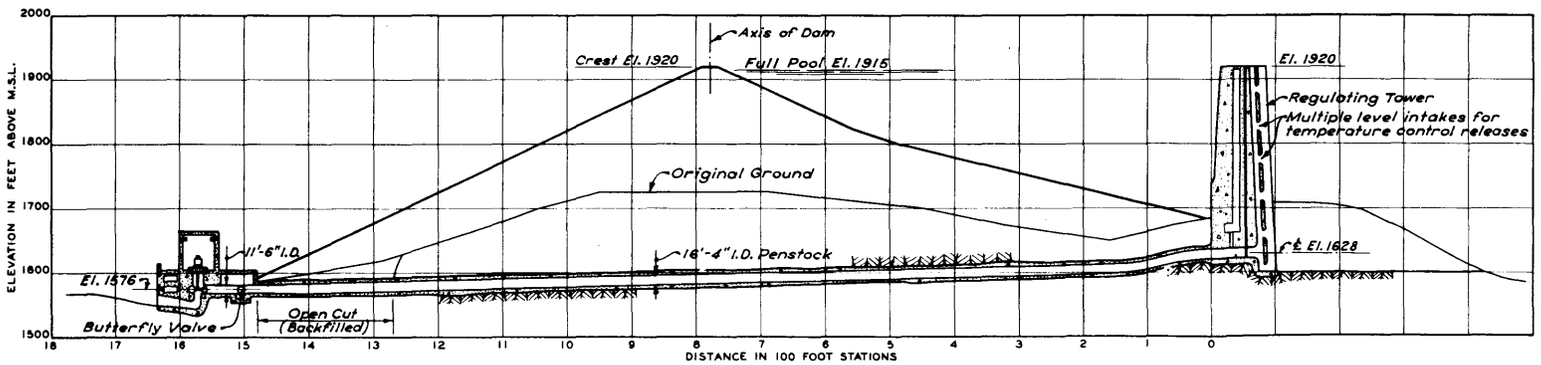
RESERVOIR PLAN
SCALE IN FEET
2000 0 2000 4000 6000 8000



PROFILE OF SPILLWAY



PROFILE OF REGULATING OUTLET



PROFILE OF PENSTOCK

ROGUE RIVER AND TRIBUTARIES
OREGON
LOST CREEK RESERVOIR

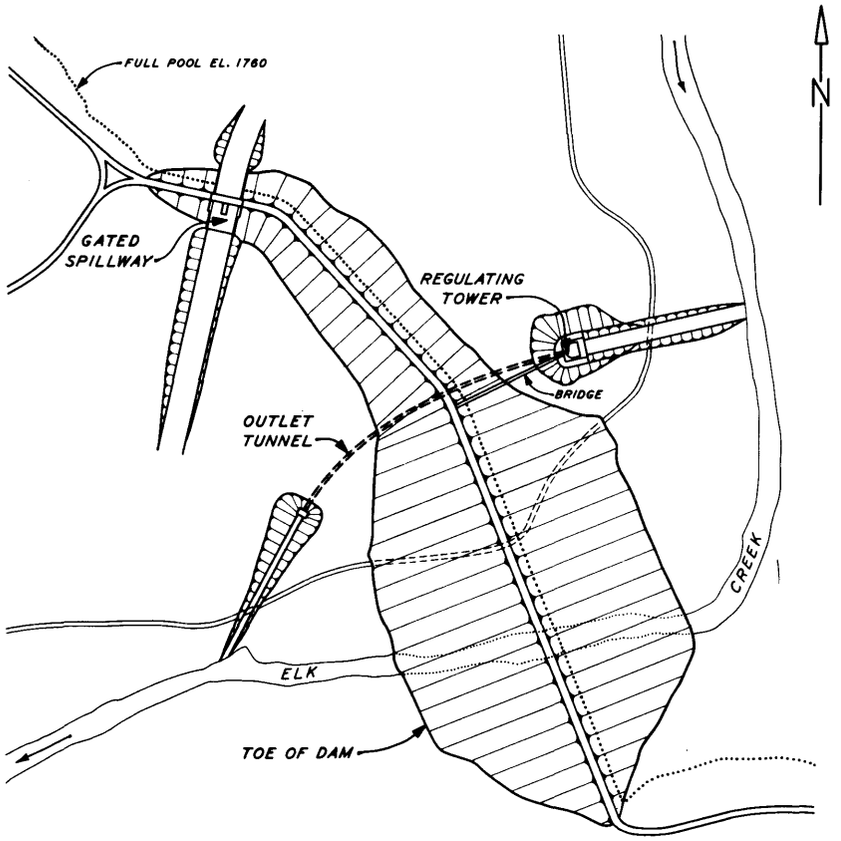
PROJECT PLANS

SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED _____ CHIEF, REPORTS SECTION
RECOMMENDED _____ CHIEF, ENGINEERING DIVISION
SUBMITTED _____ CHIEF, PLANNING BRANCH
APPROVED _____ COLONEL, CORPS OF ENGINEERS DISTRICT ENGINEER

DRAWN AES-NL
TRACED BY
CHECKED WHB
TRANSMITTED WITH REPORT DATED 1 DEC 61

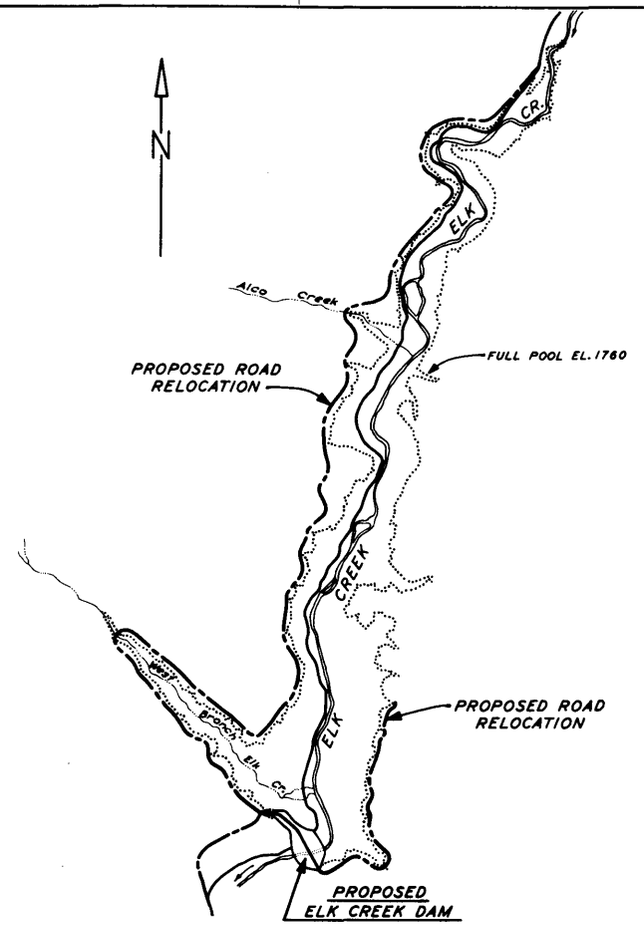
RO-20-1/5



PLAN

SCALE IN FEET

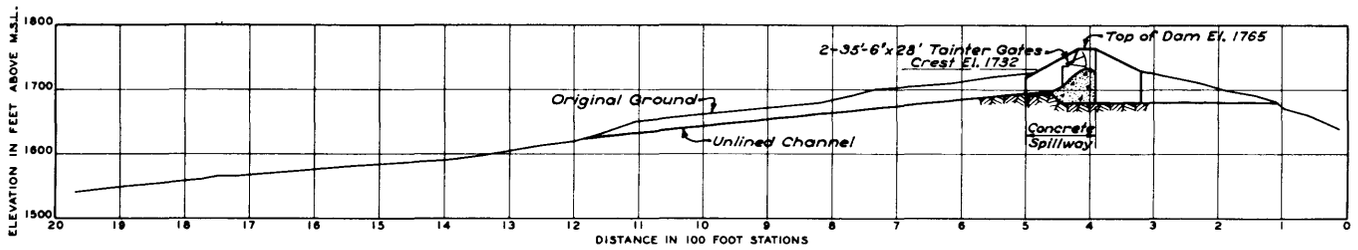
200 0 200 400 600



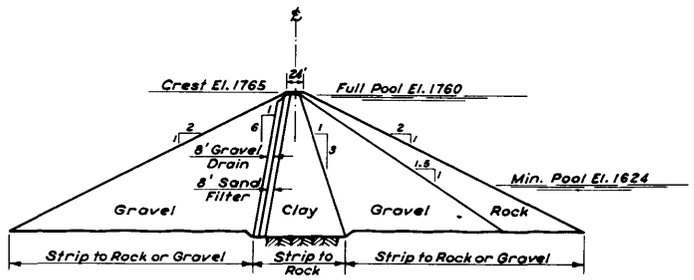
RESERVOIR PLAN

SCALE IN FEET

2000 0 2000 4000 6000



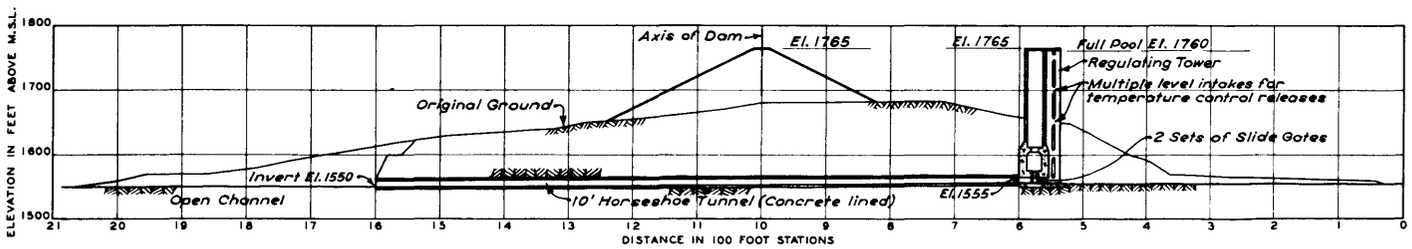
DEVELOPED PROFILE OF SPILLWAY



TYPICAL EMBANKMENT SECTION

SCALE IN FEET

100 0 100 200



DEVELOPED PROFILE OF OUTLET WORKS

ROGUE RIVER AND TRIBUTARIES
OREGON

ELK CREEK RESERVOIR

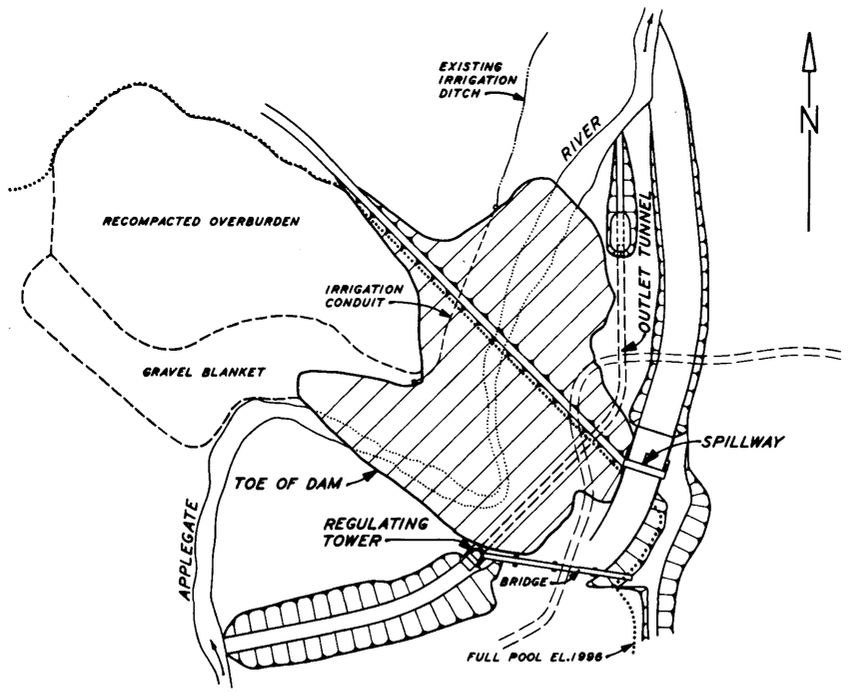
PROJECT PLANS

SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED _____ CHIEF, REPORTS SECTION
RECOMMENDED _____ CHIEF, ENGINEERING DIVISION
SUBMITTED _____ CHIEF, PLANNING BRANCH
APPROVED _____ COLONEL, CORPS OF ENGINEERS DISTRICT ENGINEER

DRAWN ACS-NL
TRACED BY _____
CHECKED WHS
TRANSMITTED WITH REPORT DATED 1 DEC 61

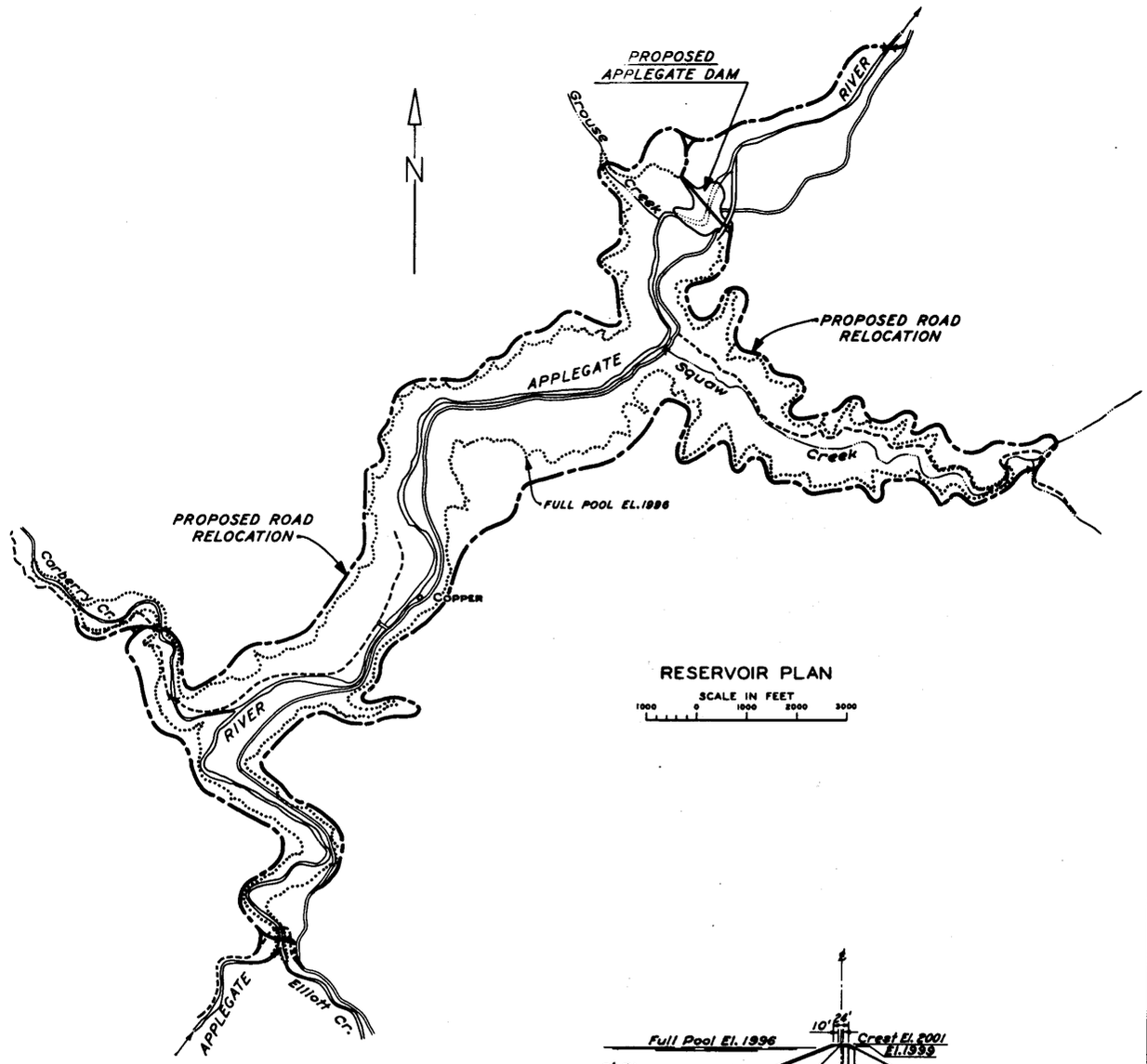
RO-20-1/7



PLAN

SCALE IN FEET

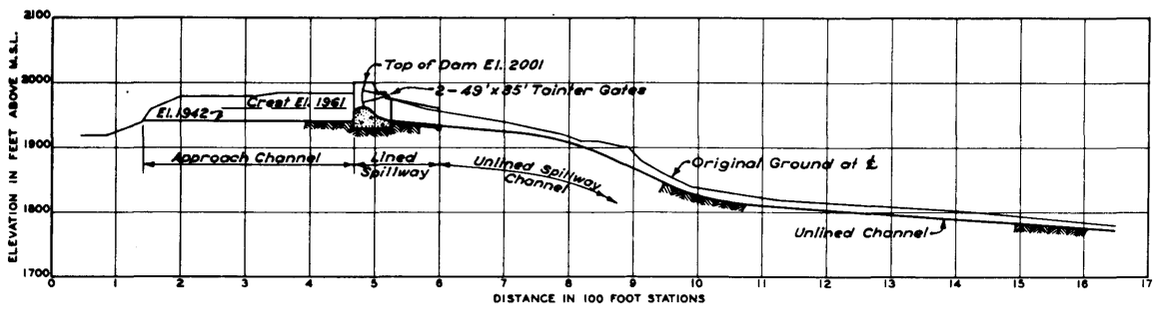
200 0 200 400 600



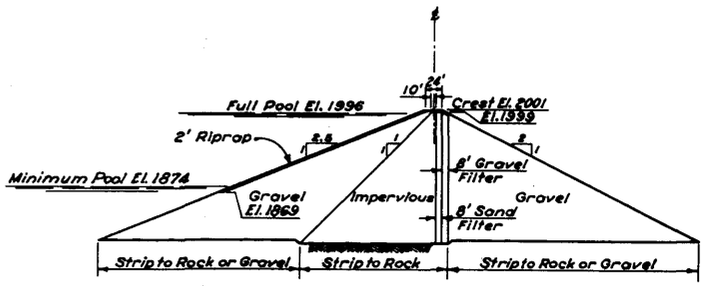
RESERVOIR PLAN

SCALE IN FEET

1000 0 1000 2000 3000



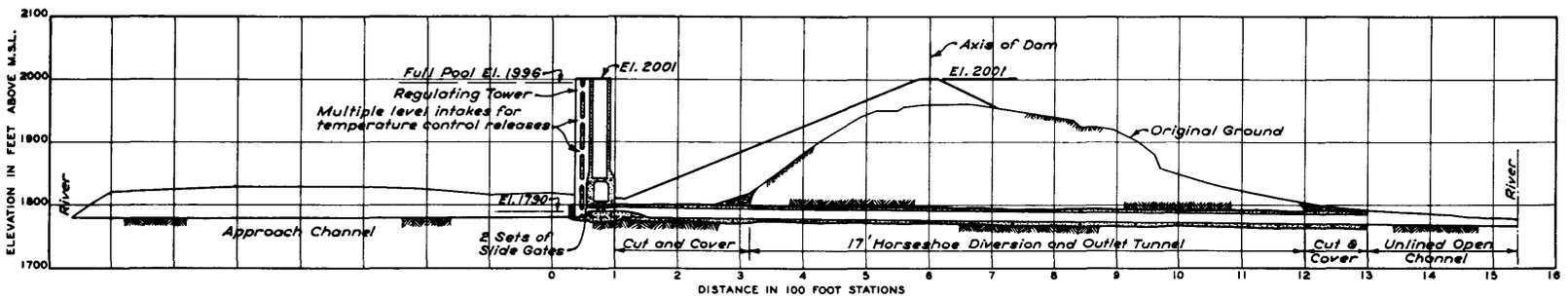
DEVELOPED PROFILE OF SPILLWAY



TYPICAL EMBANKMENT SECTION

SCALE IN FEET

100 0 100 200



DEVELOPED PROFILE OF DIVERSION AND OUTLET TUNNEL

ROGUE RIVER AND TRIBUTARIES
OREGON
APPLEGATE RESERVOIR

PROJECT PLANS

SCALES AS SHOWN
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS

PREPARED — CHIEF, REPORTS SECTION
RECOMMENDED — CHIEF, ENGINEERING DIVISION
SUBMITTED — CHIEF, PLANNING BRANCH
APPROVED — COLONEL, CORPS OF ENGINEERS, DISTRICT ENGINEER

DRAWN AES-HL
TRACED BV
CHECKED WMB
TRANSMITTED WITH REPORT DATED 1 DEC 61

RO-20-1/9

PLATE 9

DACW57-62-C-0062 (Face p. 108) No. 4

FEDERAL POWER COMMISSION
REGIONAL OFFICE
UNITED STATES CUSTOMHOUSE
555 BATTERY STREET
SAN FRANCISCO 11, CALIF.

January 6, 1959

Colonel W. L. Winegar
District Engineer
U. S. Army Engineer District, Portland
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Winegar:

We regret the delay in answering your letter of October 30, 1958 (your reference NPPGW-5). We found it necessary to make studies of power benefits in the Rogue River area before giving you our conclusions.

The Lewis Creek and Lost Creek sites lie within about 25 or 30 miles of Medford -- a major load center for The California Oregon Power Company. It appears therefore that power values for these plants should be based on the cost to COPCO of obtaining power from an alternative source. The alternative source that we are using in connection with the Company's license applications is a steam-electric plant located in the Medford area.

We estimate that the value of hydroelectric power delivered at the Medford market is $29.78 per kilowatt-year plus 5.41 mills per kilowatt-hour. This figure is, we believe, suitable for use in economic feasibility studies which are based on long-term conditions. However, since a considerable amount of hydro power can still be developed in this vicinity at costs below those of steam-electric power, it is unlikely that power from the proposed developments could be marketed at this price at the present time.

Based on the "value" given above and assuming that the transmission line between the hydro plants and Medford is constructed by the Federal Government, the value at the hydro site would be $28.62 plus 5.37 mills per kilowatt-hour.

The at-site value includes taxes amounting to $8.10 per kilowatt-year. Consequently in benefit-cost analysis this amount per kilowatt of at-site dependable hydro capacity should be added to the annual hydroelectric costs.

EXHIBIT 1

We have not prepared estimates of the future power requirements in the Rogue River Basin as our studies are on a system-wide or Power Supply Area basis. If you need the data for the basin, we shall make an effort to estimate it; however, we feel that for purposes of demonstrating a market, the area considered should be at least the service area of the major utility. Table 1 attached, shows our estimates through 1980 of the power requirements of the COPCO system and of PSA 45 as a whole.

If we can be of further assistance, please let us know.

Very truly yours,

Lesher S. Wing

Lesher S. Wing
Regional Engineer

Attachment: Table 1

Table No. 1

Power Requirements of Power Supply Area 45 and California Oregon Power Company (1957 Actual; 1960-80 Estimated)

Year	Power Supply Area 45		California Oregon Power Company	
	Energy (Million KWH)	Peak Demand (MW)	Energy (Million KWH)	Peak Demand (MW)
1957	4,222	791	1,917	391
1960	6,032	1,187	2,189	430
1965	8,621	1,654	2,961	591
1970	11,811	2,232	3,829	790
1975	15,524	2,915	4,873	1,028
1980	19,402	3,625	6,115	1,295

89588 O-62—10

STATE OF OREGON
STATE WATER RESOURCES BOARD
270 FINANCE BUILDING
SALEM

June 29, 1961

District Engineer
Corps of Engineers
U. S. Army
Portland District
628 Pittock Block
Portland 5, Oregon

Dear Sir:

Your letter of May 23, 1961 requesting information as to the nature and extent of actions which would be necessary or appropriate at the state level to insure continued availability to the fisheries of any flows which might be provided for that purpose under a federal storage project; was considered by the State Water Resources Board at its meeting June 27, 1961.

The board appreciates the interest of your office in attempting to determine if storage will be beneficial to fish life.

The board has full legal authority under ORS 536.310 to establish minimum flows for unappropriated waters and, under the authority of ORS 536.340, to classify unappropriated waters as to preference of use. The establishment of minimum flows and classification of waters, when formalized by a program adopted by the board, becomes the official policy of the state and is binding on all state agencies. ORS 536.360 states, "In the exercise of any power, duty or privilege affecting the water resources of this state, every state agency or public corporation of this state shall give due regard to the statements of the board and shall conform thereto. No exercise of any such power, duty or privilege by any such state agency or public corporation which would tend to derogate from or interfere with the state water resources policy, shall be lawful."

The board has further authority, under ORS 536.410, to withdraw unappropriated waters, including unappropriated waters released from storage into the natural flow of a stream, in order to insure compliance with the state water

resources policy or otherwise necessary in the public interest to conserve the water resources of this state for maximum beneficial use and control.

The board will carefully review reports of the Corps of Engineers wherein benefits are assigned to downstream uses and will take such action as it feels appropriate under the circumstances and in the public interest.

Very truly yours,

Donel J. Lane
Secretary

DJL/jc

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION 1
BOX 937, BOISE, IDAHO

IN REPLY
REFER TO: 740

July 7, 1961

District Engineer
U.S. Army Engineer District, Portland
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Sir:

The information relating to potential irrigation developments in the Rogue River Basin furnished you previously has been re-evaluated since receipt of your letter of March 6, 1961. As you were advised at the time of our original transmittal to you, the information available to the Bureau of Reclamation on the potential irrigation developments associated with the storage reservoirs under investigation by your agency was based on reconnaissance grade studies made by this agency during the mid-40's. We have not made any feasibility studies of potential irrigation developments in the Medford and Applegate Divisions since that time. Therefore, we have no basis for updating the information on the proposed plan of development, the land areas to be served or the water requirements that were provided you previously. However, additional information on irrigation distribution costs in other areas of the Rogue River Basin has been obtained through recent feasibility investigations of the Evans Valley, Merlin and Illinois Valley Divisions of the Rogue River Project and from recent experience in constructing irrigation facilities for the Talent Division. The irrigation distribution costs for the Medford and Applegate Divisions furnished you previously have been re-examined in light of this additional information. We find that the costs of irrigation distribution facilities presented in the original transmittal to you were low by present-day standards. The costs of the irrigation distribution facilities for these two divisions have been adjusted accordingly.

Farm budget studies prepared in connection with the feasibility grade investigations for Agate Dam and Reservoir, with appropriate modifications, were utilized in developing the estimates of irrigation for the Medford Division furnished you previously. The irrigation benefits for Applegate Division have now been evaluated on a comparable basis. Therefore, our present estimates of irrigation benefits for these two divisions reflect procedures and farm price projections currently in

EXHIBIT 3

use by the Bureau in project investigations elsewhere in the Rogue River Basin. However, in the absence of detailed project investigations, the irrigation benefit determinations must be considered to be of reconnaissance level of accuracy.

The foregoing comments relate specifically to the Medford and Applegate Divisions. Detailed information is now available for the Evans Valley Division from our recently completed feasibility investigations.

The attached statement summarizes current information on project service areas, water requirements, irrigation distribution costs, and irrigation benefits for the Applegate, Medford, and Evans Valley Divisions, which are associated with the four potential storage reservoirs under investigation by your agency. These data supersede all previous information furnished to you.

As requested by your office, irrigation benefits are given for both a 50-year and a 100-year period of analysis. The apportionment of irrigation benefits between irrigation distribution facilities and irrigation storage cannot be completed until the costs of your potential storage developments have been established and the benefits to all functions are known. Please advise us when you have reached this point in your investigations and we will assist in making the apportionment of irrigation benefits creditable to irrigation storage.

The total irrigation benefits have been broken down into direct and indirect components. It is our understanding that you are considering using both components in your economic studies. It is the policy of the Bureau of Reclamation to include both direct and indirect benefits in project formulation, project justification and cost allocation studies. The indirect irrigation benefits evaluated for the Applegate, Evans Valley and Medford Divisions account for 38.5 percent of the total irrigation benefits. The indirect benefits were evaluated as (1) the estimated increase in net income accruing to nonproject beneficiaries from the processing and marketing of the increased agricultural production attributable to irrigation development and from the increased local business activity associated with the increased purchases of goods and services by project farmers, (2) the national benefits arising from the creation of new farming opportunities and (3) the public benefits arising from the improvement in community facilities in the closely settled irrigated areas.

As we have advised you previously, it will be necessary, where reimbursable irrigation allocations are involved in multipurpose projects, to have the irrigation use and repayment arrangements worked out finally before the start of construction. This is the policy that has been

followed by the Bureau of Reclamation for many years and is necessary to insure that orderly development takes place in accordance with the plans authorized by the Congress.

Sincerely yours,

M. B. Austin

Acting Regional Director

Enclosure

POTENTIAL IRRIGATION DEVELOPMENTS ASSOCIATED WITH ROGUE RIVER BASIN STORAGE DEVELOPMENTS UNDER INVESTIGATION BY THE CORPS OF ENGINEERS

This statement summarizes the information on potential irrigation developments in the Rogue River Basin requested by the Corps of Engineers.

Potential Irrigation Developments

The potential irrigation developments associated with the four Rogue River Basin storage developments under investigation by the Corps of Engineers are located in the Medford, Applegate, and Evans Valley Divisions of the Bureau of Reclamation's Rogue River Basin Project. The storage reservoir associated with each of these irrigation developments is as follows:

Storage Reservoir	Irrigation Division
Applegate	Applegate
Lost Creek	Medford
Elk Creek	Medford
Hull Mountain (Meadows)	Evans Valley

Medford Division

The Medford Division comprises 50,180 acres of land located along both sides of the Rogue River downstream from Lost Creek and Elk Creek reservoir sites. Storage water from these reservoirs could be utilized in providing supplemental irrigation supplies for 15,770 acres of presently irrigated lands in the Medford and Rogue River Valley Irrigation Districts and in irrigating an estimated 34,410 acres of new land. Part of the new lands are located within the boundaries of existing irrigation districts (Medford, Rogue River Valley, and Eagle Point.) The largest block of new land is located in the Sams Valley area. Development of new land in the vicinity of Gold Hill also is contemplated.

The potential plan of development reflects the use of irrigation storage releases from Elk Creek reservoir without permitting them to comingle with flows in the Rogue River. Irrigation releases would also be made from Lost Creek reservoir as required.

Water would be diverted to the Medford Supply Canal from the Rogue River at its confluence with Elk Creek. The Medford supply canal would deliver water to the Sams Valley canal, which serves new land on the west side of the river. The Medford supply canal would continue

downstream through the Eagle Point Irrigation District supplying supplemental water as required and would terminate at and deliver water to the Rogue River Valley Irrigation District's Hopkins canal. A pumping plant at this point would deliver water to the Medford Irrigation District to permit delivery of supplemental supplies to the presently irrigated lands and a full supply to about 9,700 acres of new land. The Medford Irrigation District's canal system would be extended to serve the new land outside of the district in the Gold Hill area.

Applegate Division

The plan of development for the Applegate Division is designed to provide supplemental water for 9,400 acres of presently irrigated land and a full supply for 5,000 acres of land located in the Applegate River Valley downstream from the site of the potential Applegate Reservoir.

The distribution system would comprise an enlargement, rehabilitation, and extension of the present systems. A diversion dam would be required at the upper end of the project area just below the confluence of the Applegate and Little Applegate Rivers. Three existing canals would be served by this proposed diversion dam. Two additional diversion dams would be required along the reach of river downstream to the mouth of Williams Coulee. These diversion dams would serve existing canals, some of which would be combined or extended to serve new land. The new Berryman Ditch, which diverts on the south side of the river, would be enlarged and extended to serve lands on lower Williams Creek. Williams Creek water, now used on land along lower Williams Creek would be transferred to the lands in the Upper Williams Basin. On the north side of the river the Kubli Ditch would be enlarged and extended to supply new land in the Kubli area. The North Side Ditch would also be enlarged and extended beyond Murphy to serve land in the New Hope area and across the saddle northward to serve land in the Allen Creek and Sands Creek area. From the headworks of the present Murphy Ditch, which diverts on the north bank of the Applegate River at Murphy, downstream to the mouth of the Applegate River, present diversion works would be retained.

Evans Valley Division

The potential development would store runoff of East Fork of Evans Creek in the proposed Hull Mountain reservoir. Other proposed improvements would include a diversion dam located six miles downstream from the reservoir, which would divert storage releases and available natural flows into a main canal. This canal would serve lands on the right side of Evans Creek. East canal would divert from the main canal three miles downstream from the diversion dam and would cross Evans Creek to serve all lands on the left side of the creek.

The primary purpose of the development would be to furnish a firm irrigation water supply for 2,800 acres now dry. In addition a supplemental water supply would be provided to 420 acres in the Pleasant Valley Irrigation District. Important flood control would result from storage in Hull Mountain Reservoir and benefits would also accrue to fish and wildlife and recreation.

Summary of Information

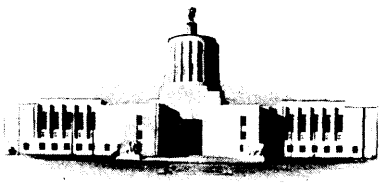
Information on project acreages, irrigation diversion requirements, irrigation distribution costs, and irrigation benefits for the Medford, Applegate, and Evans Valley Divisions are summarized in the tabulation which follows.

Summary of Information for Potential Irrigation Development

Rogue River Basin 1/

Item	Potential Reservoirs		
	Lost Creek and Elk Creek	Applegate	Bull Mountain (Meadows)
Irrigation Division	Medford	Applegate	Evans Valley
Service Area	acres	acres	acres
Supplemental	15,570	9,400	420
New	34,410	5,000	2,800
Total	50,180	14,400	3,220
Irrigation Diversion Requirements	1,000 ac.-ft.	1,000 ac.-ft.	1,000 ac.-ft.
April	4.1	5.2	0.7
May	21.0	9.2	1.9
June	30.1	12.7	2.8
July	33.3	12.1	3.6
August	30.4	10.9	3.3
September	19.7	5.8	1.5
October	1.2	1.7	--
Total	139.8	57.6	13.8
Cost of Irrigation Distribution Facilities	dollars	dollars	dollars
Annual equivalent cost - 50 yrs	1,177,000	226,000	337,000
Annual equivalent cost - 100 yrs.	993,000	180,000	274,000
Total Irrigation Benefits			
Annual equivalent benefits - 50 years			
Direct	1,353,000	286,000	82,900
Indirect	847,000	179,000	96,500
Total	2,200,000	465,000	179,400
Annual equivalent benefits - 100 years			
Direct	1,402,000	293,000	85,500
Indirect	877,000	183,000	99,700
Total	2,279,000	476,000	185,200
Irrigation Storage Benefits			
(To be developed when costs and benefits of the potential storage developments have been established)			

1/ The information summarized below is based on reconnaissance-grade data for the Medford and Applegate Divisions and feasibility-grade data for Evans Valley Division.



STATE OF OREGON
STATE WATER RESOURCES BOARD
500 PUBLIC SERVICE BUILDING
SALEM 10

November 9, 1961

District Engineer
Corps of Engineers
U. S. Army
Portland District
628 Pittock Block
Portland 5, Oregon

Dear Sir:

Your letter of 18 September 1961 requesting comments with respect to inclusion of 20,000 acre-feet of stored water for future domestic and municipal use, potential multiple-purpose storage project, Rogue River Basin; was reviewed by the State Water Resources Board at its meeting October 26, 1961.

The board in its Rogue River Basin Report, January, 1959, showed estimated 2007 municipal populations in excess of 160,000 people, Rogue River Basin, as compared with the current municipal population of approximately 50,000. Expected additional growth in the suburban areas of the Rogue Basin cities will materially increase municipal population estimates by the year 2007. It is anticipated that a major portion of the suburban area population will be served by municipal water systems.

While we are unable to specifically confirm the need for 20,000 acre-feet of stored water for domestic and municipal uses, as contemplated in your plan, it is the opinion of the board that provision of storage for future municipal and domestic use is a desirable feature of the plan. In our opinion, there should be no difficulty in obtaining reimbursement of allocated costs at such time as the storage might be utilized for water supply.

We would further point out that while existing state law prohibits utilization of waters of the Rogue River for industrial purposes, this board is on record as favoring the use of Rogue River water for industrial purposes. In the event that state law is amended to permit utilization of these waters for industry, major expansion of municipal water requirements in excess of that currently estimated is anticipated.

Very truly yours,

Donel J. Lane
Secretary

DJL/jc

EXHIBIT 4

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
REGIONAL OFFICE, REGION 1
BOX 937, BOISE, IDAHO

IN REPLY
REFER TO: 740

August 3, 1961

District Engineer
U. S. Army Engineer District, Portland
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Sir:

The apportionment of total irrigation benefits for the Applegate and Medford Divisions between irrigation storage facilities and irrigation distribution facilities has now been completed. The irrigation benefits creditable to your potential storage developments are as follow:

	Annual Benefit
Applegate Reservoir	
50-year analysis	$223,000
100-year analysis	175,000
Lost Creek-Elk Creek Reservoirs	
50-year analysis	$870,000
100-year analysis	750,000

As pointed out in our letter of July 7, the apportionment of total irrigation benefits between irrigation distribution facilities and irrigation storage facilities could not be accomplished until the costs of your potential storage developments had been established and the benefits to all functions determined. The information needed to complete this apportionment was furnished by Mr. Kenneth Case when he visited this office today.

Mr. Case worked directly with Mr. Street of my staff in completing this analysis. The approach followed in making the apportionment provides an equitable distribution of the total benefits between the potential storage developments and the associated irrigation divisions. In each case the total costs and benefits of the combined storage and irrigation development were determined and the overall ratio of benefits to costs was established. The total irrigation benefits were then distributed between storage and distribution using the benefit-cost ratio so established. The benefit-cost ratios used in making this apportionment are based on the information

on irrigation benefits and costs presented in our letter to you dated July 7, 1961, and the information on costs of your potential storage developments and associated benefits for all functions other than irrigation provided by Mr. Case. This information is summarized in the attached tabulation.

Sincerely yours,

H. T. Nelson

Regional Director

Attachment

Benefits and Costs Used in Apportioning Total Irrigation Benefits between Storage and Irrigation Distribution Facilities

Rogue River Basin
August 3, 1961

Item	Annual Equivalents	
	50 Years	100 Years
Applegate		
Benefits:		
Flood Control	$ 97,000	$ 160,000
Fish and Wildlife	220,000	345,000
Irrigation (total)	465,000	476,000
Recreation	82,000	98,000
Total	864,000	$1,079,000
Project Costs:		
Storage Development	580,000	468,000
Applegate Division	226,000	180,000
Total	806,000	648,000
Benefit-cost ratio	1.07	1.67
Lost Creek-Elk Creek		
Benefits:		
Flood Control	$ 745,000	$1,215,000
Fish and Wildlife	632,000	871,000
M&I Water	300,000	300,000
Power	1,915,000	1,915,000
Recreation	366,000	430,000
Irrigation (total)	2,200,000	2,279,000
Total	$6,158,000	$7,010,000
Project Costs:		
Storage Development	$4,285,000	$3,559,000
Medford Division	1,177,000	993,000
Total	$5,462,000	$4,552,000
Benefit-cost ratio	1.13	1.54

FEDERAL POWER COMMISSION
REGIONAL OFFICE
555 BATTERY STREET, ROOM 415
SAN FRANCISCO 11, CALIF.

July 21, 1961

AIR MAIL

Colonel W. L. Winegar
District Engineer
U. S. Army Engineer District, Portland
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Winegar:

This is in reply to your letter of 5 July 1961 (reference NPPGW-3) requesting our comments on the power value that should be used in your long-term studies of the Lost Creek site on upper Rogue River.

We have reviewed our previous studies relating to power values in the southern Oregon area, which were discussed in our letters to you of January 6 and February 24, 1959.

As mentioned in previous correspondence, there is still a substantial amount of undeveloped hydro power in the southern Oregon area and throughout the Pacific Northwest region. The cost of power from many of these developments is well below the present cost of steam-electric power; consequently it is unlikely that hydro power could be sold at a price equivalent to that of fuel-electric power for several years.

In the past we have assumed that the market for the project power would be limited to that of California Oregon Power Company service area. Had the company's resources been integrated with Pacific Northwest resources to enable interchanges of power to be freely made, the opportunities to market southern Oregon power over a larger area would have been feasible. However, with the restricted market area assumed, we believed that the use of privately financed steam-electric power costs as the measure of our value of federal hydro power was indicated.

EXHIBIT 6

The recent merger of California Oregon Power Company with the Pacific Power and Light Company, whose operations are well established in the Pacific Northwest area, results in an expansion of the former Pacific Northwest market area. The possibility of common carrier intertie facilities between Pacific Northwest-Pacific Southwest systems, and the possibility that within the next decade low-cost nuclear power sources will be built, have given us sufficient reason to reconsider the basis on which the value of federal hydro power in southwest Oregon should be determined. We now conclude that a fair measure of the market value of federal power from hydro developments in the upper Rogue River area would be the cost of public nonfederal steam-electric power delivered to a Medford, Oregon load center. The use in this area of a value based on public nonfederal steam-electric cost is consistent with the procedure followed in the Pacific Northwest area.

On this basis the market value of Lost Creek Project power is estimated to be $21.90 per kilowatt-year plus 4.36 mills per kilowatt-hour. The at-site value of project power would be $20.75 per kilowatt-year plus 4.33 mills per kilowatt-hour. The at-site value was determined on the assumption that project power would be transmitted to the Medford market load center via transmission facilities constructed by the federal government. The at-site capacity component of value includes taxes in the amount of $2.83 per kilowatt-year. There are no taxes included in the energy component. We believe these values suitable for economic analyses for both 50-year and 100-year conditions.

If additional information is desired, we shall be pleased to supply it.

Sincerely yours,

Lesher S. Wing

Lesher S. Wing
Regional Engineer

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PACIFIC NORTHWEST REGION
POST OFFICE BOX 4137
PORTLAND 8, OREGON

IN REPLY REFER TO

2510

November 21, 1961

Col. Sterling K. Eisiminger
District Engineer
Corps of Engineers
Portland District
Portland, Oregon

Attention: Mr. Henry Stewart

Dear Sir:

Reference your request of March 27, 1961, our preliminary impact report of July 19, 1961 and our joint meeting of August 11, 1961.

Enclosed is our revised impact report and supporting map for the Applegate Dam and Reservoir occupying lands within the Rogue River National Forest.

The revised report reflects changes indicated after joint study on the ground of the proposed replacement transportation system and possible future recreation development.

Please note on the attached map accompanying our impact report that we recommend certain modifications in the location of replacement roads around the reservoir. We feel the locations as modified will provide the best possible replacement of transportation services to users of national-forest resources. In addition, the road position shown is necessary to provide for the future development of the outstanding recreational potential of this reservoir.

We would appreciate being called upon to update this report when project planning for construction is undertaken to correctly reflect the changes in national-forest uses and values at that time. Until such time as detailed planning information becomes available, it will be impossible to accurately estimate the facilities needed to provide for the initial increase in public use during the first ten years after construction of this project.

Your cooperation in furnishing needed additional information for the completion of this revised report is very much appreciated.

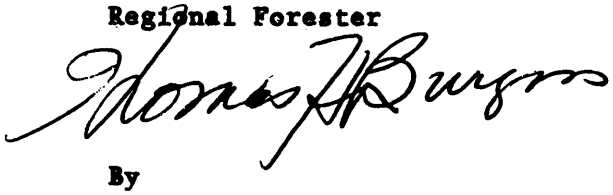
EXHIBIT 7

89588 O-62—11

If this office can be of assistance in providing further information concerning the impacts of this project on national-forest lands and resources, please feel free to call upon us at your convenience.

Sincerely yours,

J. HERBERT STONE
Regional Forester



By
Thomas H. Burgess

Enclosures -
1 Report
1 Res. Area Impact Map

cc: Chief w/report
Rogue River "

AN IMPACT REPORT
FOR THE
APPLEGATE DAM AND RESERVOIR

I. Introduction

This project is under the jurisdiction of the U. S. Corps of Engineers, Portland District, North Pacific Division, and is in the feasibility study stage.

The impacts imposed upon the lands of the Rogue River National Forest by the construction of the proposed Applegate Dam and Reservoir are discussed in the following paragraphs. This report is the result of general extensive survey, intensive survey of small areas, and multiple use planning on the Applegate Ranger District.

No effort will be made herein to describe the project other than to point up the features which will affect national-forest administration and resources.

II. Proposed Project

The project proposes an earth-filled dam located on the Applegate River in the SE¼NW¼, Sec. 36, T. 40 S., R. 4 W., W. M. The dam will be approximately 222 feet high, will create a reservoir of about 945 acres at maximum flow line and about 420 surface acres at extreme drawdown. The maximum perimeter of the lake will be about 16 miles.

Both Federal and private lands will be inundated. About 37 acres of national-forest land will be flooded and an additional 4 acres needed for clearing above the flow line. The private land needed comprises about 1006 acres, of which 908 will be flooded and 98 within the cleared strip around the flow line.

The elevation at full pool is 1996 ft. and minimum pool will be 1908 feet; a drawdown of 88 feet. Total water storage would be 72,000 acre feet of which 17,000 acre feet would be dead storage below minimum pool.

Inasmuch as the flow line has not been definitely established, all acreage figures were estimated from contour maps and the projected flow line.

III. Landownership

As noted above, most of the land needed for the reservoir is in private ownership. Additional adjacent land should be acquired to

protect the aesthetic features and to allow further future recreation development. Unless adequate land is acquired, it will be impossible to develop the full recreational potential of the reservoir area. Comparable adjacent national-forest land under multiple use management should have prescriptions denoting recreation as the key value.

A. Project Boundary

Due to the considerable amount of private land involved and the location of the roads necessary to serve the area, it would be advisable to acquire the private land by land lines rather than by topographic or other features. Acquisition of about 900 acres of private land within the proposed project boundary as a project cost will be required to consolidate Government holding necessary to provide for protection of the project area, and ultimate development of the recreation resource.

The parcel of land in the S½ of Sec. 17, T. 48 N., R. 12 W., M. D. M. should be acquired to provide needed recreation area for overflow crowds in the future.

About 1200 acres of national-forest land and 300 acres of public domain (administered by Bureau of Land Management) should be managed with recreation as the key value.

Many unpatented mining claims are located on the public lands. Several of these claims occupy sites which are planned for campgrounds or other recreation developments. The attached map shows the proposed boundaries of the project.

Due to the high recreation values, it would be desirable not to disturb the land above the buffer strip. Access for the dam construction and basin cleanup is available within the area to be flooded.

B. In the event the project boundaries do not extend to the recommended lands, it is imperative that the Corps of Engineers acquire nonrestrictive rights-of-way to ensure unencumbered use of all roads.

C. Established campgrounds must be reserved for the general public. Within or adjacent to the dam basin, there are many suitable living areas for those engaged in the project construction.

IV. Clearing Requirements

The clearing within the project area is considered light to moderate. Most of the land has been either cleared and cultivated or logged and relogged leaving light timber stands and brush. Most of the remaining timber is less than 16" D. B. H.

In order to prevent damage to residual stands above the flow line and provide a buffer for hydraulic wave action, clearing should extend 5' in elevation above flow line on slopes of 25% or greater. That land under 25% slope should be cleared for 25' horizontally from the flow line.

If, during the clearing phase, it is evident that an area may slide due to the impoundment of water it may be necessary to clear such an area prior to filling the basin. At present it is impossible to determine if any of these exist and therefore the possibility should be kept in mind in future reconnaissance and planning.

There should be 100% cleanup within the basin and buffer strip. This includes:

A. All floatable material.

B. Grubbing out all stumps in front of and within 200 feet of the exterior limits of each site on all major recreation areas. These should be removed to a depth of 5' below the extreme drawdown level of the reservoir.

The reasons for the above are to provide for safety and aesthetics for forest users.

All timber must be felled into the area to be cleared. All telephone lines, fences, or other metal lines which will be covered by less than 20' of water at any time should be gathered and buried or removed. All other wire lines may be left flat on the ground. Fence posts, telephone poles, power poles, etc. should be pulled out rather than cut off to prevent "popping up" in the pool. This will reduce hazards to recreationists, the dam structure, and irrigation facilities.

V. Timber Values

The impact on national-forest timber will be practically nonexistent because very little national-forest land will be flooded. Restricted timber harvesting is already the policy on areas that could be visible from the reservoir. The growing capacity of the national-forest land is medium site IV and estimated values are as follows:

ITEM	UNIT	VALUE	TOTAL VALUE
Merchantable timber	400 M board ft.	$25.00/M	$10,000
Young growth	20 acres	10.00/acre	200
Bare soil	37 acres	5.00/acre	185
		Total - - -	$10,385

The annual loss of growing capacity is about 420 board feet per acre which amounts to approximately $388 annually.

The impact on timber resource harvest costs will be beneficial, comparing the location and standard of existing roads with that of the planned system. The new road system will present the following savings:

A. Carberry-Cougar Creek Area - $0.23/m.b.f./mile for an annual allowable cut of 1.25 m.m.b.f.

B. Elliott Creek-Middle Fork Area - $0.51/m.b.f./mile for an annual allowable cut of 10.0 m.m.b.f.

C. There will be no appreciable change in hauling costs of 2.5 m.m.b.f./year from Squaw Creek Area.

The total annual savings will be approximately $5900, of which 25% will reflect as increased revenue to county governments. These savings are predicted on the county road being replaced on the west side and being constructed to State highway standards as shown on the attached map.

The Forest Service will dispose of national-forest timber by competitive bid, unless other conditions make timber settlements necessary.

VI. Fire Protection

A. Responsibilities

The dam, reservoir, and adjacent lands are within the national-forest protective area, and therefore, the Forest Service must have full responsibility and authority for all fire protection and related problems. This includes, but is not limited to, fire prevention, presuppression, and suppression. Compliance with State and Federal fire laws and regulations will be mandatory and in the event of fire in the vicinity of the project area all project construction personnel and construction resources must be available to the Forest Service for fire suppression upon request.

B. Hazard Evaluation and Disposal Requirements

The proposed project will, during construction, increase the risk and hazard of fire occurrence considerably. The clearing will create over 600 acres of slash which must be protected until it can be burned. There is a high risk both in protecting the slash and in the burning. This risk is caused by lightning and

people. Occasionally lightning storms sweep the basin area from south to north along the Applegate River. These storms are usually dry and set many fires. The risk resulting from people in the area is due to the approximately 30,000 individual trips per year into the area for mining, residences, recreation, logging and other uses. The project will undoubtedly result in a greater use and the risk will be increased proportionately.

In view of the above and because of the steep topography, narrow canyons, and severe burning conditions, the Forest Service must have complete authority over the timing and conditions of the contractor's burning operations.

All material to be burned should be piled, preferably in existing fields and openings, and burned in safe weather. Climatic conditions are such that satisfactory and safe burning can be accomplished in normal years from October to May.

C. Extra Protection Needed Because of Hazard and Risk Caused By This Project

During the entire fire season and any time that burning is contemplated the contractor must have one fully qualified man whose sole responsibility will be fire prevention, presuppression, and suppression. The contractor must also have a patrolman with radio and vehicle from April 1 through September 30 for the purpose of detection.

In addition to this, to provide adequate protection during clearing operations, it will be necessary to have a trained five man "hot shot" suppression crew in the area whose duty will be fire suppression from June 15 through September 30. Their transportation should be a radio equipped tank truck with a high pressure pump.

The requirements in the above three paragraphs should be financed by the project.

The Applegate Ranger District will need one man of at least GS-9 grade to act as liaison between the Corps and Forest Service. His duties will be to be certain all phases of forest management are being recognized and evaluated and then to negotiate with the Corps to achieve these aims. It is estimated that he will spend 7 months per year working on this project.

After the project has been completed, the impacts will be such that the Forest Service will need the following manning and equipment to meet fire responsibilities:

1. One three-man patrol and suppression crew.

2. One 18 foot boat furnished with one 35 H.P. and one 10 H.P. outboard motor, one high pressure fire pump, 1500 feet of 1½ hose, fire tools for 5 men, and a radio.

3. One one-ton tanker with a 175 gallon slipon unit, hand tools for 5 men and a radio.

The men would be stationed at Star Ranger Station.

VII. Recreation

A. This survey only attempts to evaluate the potential recreation use in a broad sense. It cannot be detailed nor can it reflect final planning. The detailed planning must be done later, after the project becomes authorized and planning funds are available.

B. Generally, the ground above flow line within sight of the reservoir is very steep and rugged. However, there are many small to medium sized areas of fairly level ground with slopes of 10 to 25%. These areas are well-suited to recreation development. The soil is generally shallow and rocky on the slopes and deep sandy loam in the valley bottoms.

C. The climate is ideally suited to recreation purposes. It is rather hot and dry during the summer and fall, and in winter it is moderately cold and yet dry. Precipitation ranges from 18 to 30 inches per year. Daytime temperatures in summer vary from 70 to 105 degrees with an average of about 78. During the winter the daytime temperature will vary from 20 to 70 degrees. There is no fog, little rain, and the sun usually shines for prolonged periods throughout the year.

D. There are no known archaeological or historical features of significance within the project. A more thorough investigation should be made later when the recreation resources of the reservoir area are studied in detail.

E. Although the general zone of influence comprises a population of about 100,000 the present recreation use of the area is rather small. This is mainly due to the large amount of private land and many unpatented mining claims adjacent to the river. Despite this, there is considerable fishing and swimming use in addition to hunting, picnicking, and sightseeing. Present use of the project area is estimated to be about 1,850 fishing and hunting days and 10,700 general recreation days. Principal activities are estimated as follows:

Activity	Visitor Days
Fishing and Hunting	
Fishing	1,400
Hunting	500
Total - - -	1,900
General Recreation	
Picnicking and camping	1,100
Sight-seeing	9,000
Swimming	600
Total - - -	10,700

There are no developed campgrounds within the project, however, there are several developments in the vicinity of the reservoir. These consist of 5 public campgrounds and one private development which is located at Squaw Lakes. All of these installations receive very heavy use from April through September each year and the campgrounds below the dam are used by the public the entire year.

Construction of the reservoir will create a lake which will be a major attraction to many people. Due to climate and easy access it will be one of the few lakes which will be open and desirable for use the entire year. The estimated recreation use which will probably develop on national-forest land and other proposed acquisition as a result of the project, will in the year 1976 include 20,000 fishing days and 60,700 general recreation days. Estimated usage in the year 2,000 includes 40,000 fishing days and 202,800 general recreation days. Principal activities for the two periods are as follows:

Activity	Visitor Days	
	Year 1976	Year 2000*
Fishing and Hunting		
Totals - fishing	20,000	40,000
General Recreation		
Picnicking and camping	20,000	80,000
Sight-seeing	30,000	80,000
Boating	8,500	84,000

Activity	Visitor Days Year 1976	Year 2000*
General Recreation		
Swimming	2,200	8,800
Totals - General Recreation - -	60,700	202,800

If these predictions are valid, steps must be taken immediately to preserve sufficient sites to help meet the recreation need in the year 2000 and beyond. To meet this foreseeable need, the following recreation sites were investigated:

USE (Year 2000)	ACRES	NUMBER, OR MILES
Camp and picnic grounds (339 units)	180	19
Boat launching sites	10	3
Swimming sites	25	5
Organization sites	60	2
Access Roads	24	4
Bridle trails	12	3
Vista points	2	2

The costs involved to construct the above needed developments will be approximately as follows:

USE (Year 2000)	COST
Camp and picnic grounds (339 units)	$762,500
Boat launching facilities	150,000
Swimming sites	25,000
Organization sites	6,000
Access roads	48,000
Bridle trails	3,000
Vista points	10,000
Boating safety installations	5,000
Stump removal fronting major recreation areas	85,000
Total - - -	$1,094,500

Annual costs of the proposed developments:

Annual equivalent of construction costs: ($1,094,500 amortized @ 2½% for 50 years - 0.035)	$38,308
Annual operating and maintenance charge: (3% of construction costs + $0.10/visitor day)	57,115
Total - - -	$95,423

*National forest recreational survey data projected to the year 2000. Recreation use will undoubtedly increase substantially beyond 2000.

Monetary recreation benefits:

Without the project	12,550 visitor days	@$1.60	$21,080
With the project	242,800 " "	@$1.60	388,480
Net annual recreation benefit			$367,400

These costs are only those which will be incurred in building the recreation facilities. They do not reflect the cost of land acquisition.

The initial basic facilities necessary for preservation of project resources and for public access and safety should be with project funds. Since the Forest Service will be responsible for management of the project area for recreation and other uses, consideration should be given to making funds available for initial recreation facilities sufficient to meet the needs during the first ten years of operation. Additional facilities beyond this initial period which may be required because of increased public use of Federal land caused by construction of the project will be financed from funds requested in regular Forest Service appropriations as the need arises.

F. Due to the great recreation potential and demand and the close proximity of large populations, several things must be closely considered which will result from the dam construction and resultant lake.

1. Public safety and welfare must be assured. This includes constructing sufficient campgrounds and picnic areas to meet demand as much as possible. The sanitation and drinking water facilities must be clean and easily maintained. Boat launching sites must be safe and operable at all phases of drawdown. Swimming areas must be buoyed or boomed to prohibit boating in these waters. The same is true for fishing and water skiing areas. Lanes for water skiing use should be marked on the lake.

   Since two of the most important recreation sites are to be disturbed during the dam construction, it is recommended that the contractor be required to strip the top soil from these areas, stock pile it and later spread it back on the disturbed borrow areas. One site is located north of the dam, and will be used as a staging and borrow area, and the other is at the west end of the dam and will be used for borrow and keying in the dam. Borrow should as much as possible be restricted to areas within the minimum pool.

2. Fishing use downstream from the dam is very heavy in May, June, and July. Much of the Applegate River in this area is in a rough canyon which makes foot travel almost impossible. Because of this, sudden large volumes of discharge from the dam would create a serious hazard to fishermen and other recreation users. Consequently increased discharge should be slow and even as the demand requires.

3. Free and unrestricted public access to and use of the reservoir and surrounding land is necessary.

4. The Upper Applegate County highway is now experiencing almost its maximum safe use. Increased traffic due to the dam construction will create an untenable hazard. It is therefore imperative that both the west and east side roads be constructed as soon as possible.

5. Signing for safety, traffic regulation, etc. should be the responsibility of the contractor in conjunction with Forest Service, county, and State recommendations.

6. Road access into the area above the dam should not be blocked to public use for more than two hours at any one time. This is needed because of the many residences above the dam and the heavy recreation, logging, and administrative use the area receives. In case of fire, immediate access must be afforded regardless of the impact on construction.

VIII. Sedimentation and Stream Damage

It is difficult in this type of operation to regulate the movement of soil. However, there are several things which can be done which will minimize soil movement and resultant stream damage. They are:

A. Disturbance of soil above the flow line should be kept to a minimum to maintain site quality, land productivity, and aesthetics.

B. If possible, borrow areas should be kept within the minimum pool area. However, if this cannot be accomplished, the Forest Service requests that future recreation be given consideration by land treatment that will allow the areas to become reforested.

C. To prevent sedimentation, with its adverse effect upon human, animal, and fish life utilizing the water, vehicles should not be permitted to ford the Applegate River. During most of the year an inexpensive temporary bridge will suffice to haul logs, fill dirt or rock, and provide access for clearing operations and administration.

IX. Fish and Game Resources

The proposed dam will block access to approximately 50 miles of tributary streams now used by anadromous fish for spawning purposes. This amounts to approximately 65 percent of the steelhead spawning area on national-forest land in the Applegate River drainage.

The maintenance of minimum flow releases for downstream fish habitat and fishing conditions for recreation purposes is of great importance. If operation of the reservoir results in

substantially increased downstream flows to benefit fishlife, upstream losses would be offset to some degree. However, daily fluctuations of releases from the reservoir may result in further losses to fish habitat.

Big game will be adversely affected by loss of important streamside habitat now used by black-tailed deer. Small game species would be adversely affected by fluctuating water levels in the reservoir and by the loss of habitat for streambank-dwelling furbearers.

X. Range Management

Detailed values cannot be presented until the land is acquired. On the basis of present information it is reasonable to assume that about five existing permits will have to be adjusted. The reservoir will inundate the commensurable property upon which the permits are based. If the permittees cannot relocate their base property, the permits will have to be cancelled.

XI. Improvements

A. Buildings

There is one residence, estimated value $2000, under special use permit. Replacement is not necessary.

B. Communications

About 2¼ miles of full metallic and 3¼ miles of ground telephone line will be lost. All these lines are main trunk and necessary for administration of national-forest land. The metallic line should be replaced on the upper side of the new west side road. The ground return line should be located above the south end road from Carberry Creek to Elliott Creek.

C. Road and Transportation Improvement

Bridge #1912-0.1 across the Middle Fork of the Applegate River on Forest Development Road No. 1912 is the only Forest Service bridge affected by the impoundment. The value of this bridge is approximately $30,000 of which we can probably salvage $10,000 in the form of re-usable materials. The bridge is constructed of glue-lam girders with lumber laminated deck. There are four additional bridges on the affected roads under county jurisdiction and maintenance. Construction of replacement roads, as discussed later in this section will, of course, eliminate request for bridge replacement as such.

The transportation system now in existence for Applegate Ranger District is barely adequate. Creation of the reservoir with the resulting recreation impact, in addition to the present use, makes a larger and more extensive system necessary.

The major road that will be affected by this project is the Upper Applegate Highway, now maintained by Jackson County, but designated as proposed Route No. 14 on the Forest Highway System. The replacement for this highway should be located on the west side of the reservoir as shown on the attached map. Its termini are defined as being from a junction with the existing county road below the project to a connection with the existing Carberry Creek Road (FD #3900) above the project. The two-lane bituminous replacement road proposed by the Corps of Engineers (20' paved plus shoulders) will be adequate for national-forest needs, though final approval for this standard rests with the State of Oregon or Jackson County. The Forest Service is, however, vitally concerned with the position of this replacement highway in relation to the reservoir shoreline.

Existing Forest Development Routes No. 193 and No. 1912 serve an area having an estimated annual allowable timber harvest of ten million board feet. This will mean annual logging truck and associated timber harvest traffic of approximately 2200 vehicles, plus additional traffic associated with other forest uses and administration.

The replacement road constructed from Elliott Creek (Forest Development Road No. 193) to the county road near Carberry Creek must be to an adequate standard to safely carry the traffic from Routes No. 193 and No. 1912, plus additional anticipated recreation traffic. Anticipated recreation visitor days of 80,700 will mean that this road and others around the reservoir may be subjected to use by 27,000 vehicles annually by 1976. The majority of this use will be concentrated during the parallel logging and recreation seasons.

The replacement road constructed from Elliott Creek (FD Road #193) to the county road near Carberry Creek should be to double-lane, heavy duty standard with 20-foot gravelled surface width. Heavy logging trucks should be able to travel at 30-40 miles per hour. Double-lane bridges should be 26 feet wide, inside of curbs, and designed for an H20-S16 loading.

The project will necessitate another major road along the east side of the reservoir, as shown on the attached map. The Forest Service transportation plan includes a planned road down Squaw Creek, (Road #4136) as a facility to serve recreation, grazing, timber, and administration, including the harvest of 2.5 MMBF

annually from that area. Because of the additional heavy recreational use anticipated around the reservoir, the road from Squaw Creek to the county road should be a double-lane, normal duty standard with 20-foot gravelled surface width. Passenger vehicles should be able to travel at 30-40 mph. There should be a minimum sight distance of 300 feet.

The road from Squaw Creek to Elliott Creek (FD #4101) will be used predominately by recreation traffic. For this route, a single-lane road with turnouts is adequate as a project replacement responsibility to provide recreation access for traffic needs as presently foreseen. This should conform to the SN standard for normal traffic at a design speed of 15-30 mph. Width of gravelled surface should be a minimum of 14 feet. All bridges on this route should, however, be designed for H20=S16 loading and minimum two-lane width of 22 feet for safety of public traffic and for economical conversion of the road to a double-lane standard when traffic volumes warrant. Because of the predominant recreation use, all bridges should be constructed with sidewalks on the downstream side.

A short piece of the Watkins (Collings Mountain Trail No. 944) that would be flooded is of no consequence; however, the remainder of the trail should be tied into the replacement of Forest Highway No. 14.

Information signs, direction signs, and section line markers will be lost. Most of these will have to be replaced at a probable cost of about $1000.

Summaries of values of losses, and estimated costs of replacements (exclusive of roads) are as follows:

ITEM	AMOUNT	VALUE
Metallic phone line	2.25 miles	$3,150
Grounded phone line	3.25 "	3,250
Residence	1	2,000
SH-12 Forest Service Rd.	0.50 "	12,500
Forest Service Bridge	1	18,500
Signs		1,000
Trail	0.25 "	300
	Total - - - - - -	$40,700

Replacement Costs:

ITEM	EST. AMOUNT	EST. COST
Metallic Phone Line	4.75 Miles	$6,650
Grounded Phone Line	2.20 "	3,000
Signs		4,000

ITEM	EST. AMOUNT	EST. COST
Roads *		
a. East of reservoir to FDR No. 193	11½ Miles	Unestimated
b. West side of reservoir from replacement of FH 14 to FDR No. 193	2 "	Unestimated

We recommend that facilities and service inundated or impaired as a result of project construction be replaced so that a level of service equivalent to that existing prior to construction will be provided when the project is completed. This phase of the program should be done in advance of or concurrently with project construction so that there will be little or no interruption in Forest Service administration and public use. For those improvements which will be on national-forest lands, the Forest Service should approve locations, designs, and standards.

Close liaison between agencies is essential if interference with current forest administration and services is to be kept to a minimum during the construction period. Memorandums of agreement between the agencies concerned are necessary to provide for detailed planning, for reconstruction and replacement of facilities and services, and for increased management needs during the construction period.

It is essential that all replacement roads, including the Upper Applegate Highway, be located at the approximate elevation as shown on the attached map. Recreation benefits as listed herein are contingent upon replacement road position being such that maximum utilization of the recreation resource potential

* For Forest Service improvements only. Replacement of Forest Highway No. 14 is a project obligation to Jackson County, Oregon; Siskiyou County, California and to the State of Oregon.

We have made no estimate of replacement costs for the Forest Service roads inasmuch as the Corps of Engineers is estimating these costs independently. Our concern is their replacement to the standards described above.

may be realized. This will require very close cooperation between the Corps of Engineers and Forest Service in route selection, location surveys, final design, and recreation planning.

XII. Summary of Presently Known Project Imposed Losses

A. Timber

1. Annual productive capacity	$388.00
2. Young growth	200.00
3. Bare soil	185.00
	$773.00

The value of the merchantable timber will be recovered by timber sales or settlement, and, therefore, is not considered as a loss.

B. Forage

The effect on big game range will be adverse. Some ranches will lose base property and this will affect grazing permits.

C. Improvements - including roads

Improvements are not considered a loss inasmuch as they will be replaced with other facilities.

D. Soil Loss

Soil erosion, slides, and general mass movement cannot be properly evaluated at this time. Because of the geology, past history of the area, and nature of the terrain, erosion prevention and soil stabilization will be an important and significant part of logging, transportation planning, road design, and subsequent continuing maintenance.

XIII. General Summary of Recommendations

A. Boundaries

To best serve the public's need and promote multiple use management the "taking line" should be as shown on the attached map.

89588 O-62—12

B. Facilities and Services

Existing facilities and services should be replaced in a manner that will not adversely affect the level and intensity of management. Roads, communications, etc. must provide for use and protection of resources available in and adjacent to the project area.

C. Developments and facilities needed

The items discussed under Fire Protection, Recreation, and Improvements are needed to manage and protect the land as well as meet the impact and serve the needs of the public. The Applegate Reservoir will be one of the major attractions in southern Oregon.

D. In order to meet project-created demands, the Forest Service will need information concerning the taking line, flow line, road locations, and project construction time schedule.

E. Because of the tremendous recreation impact, it will be necessary to reinventory the recreation resource and revise the multiple use plan in regard to key values.

F. The project will create some problems in administration and management. As explained in the text, extra personnel and vehicles will be needed for liaison and fire control.

G. Intensified fire protection will be of extreme importance. The extreme burning conditions coupled with the slash make necessary the measures discussed under Fire Protection. All construction contracts should contain appropriate clauses for fire protection and liability.

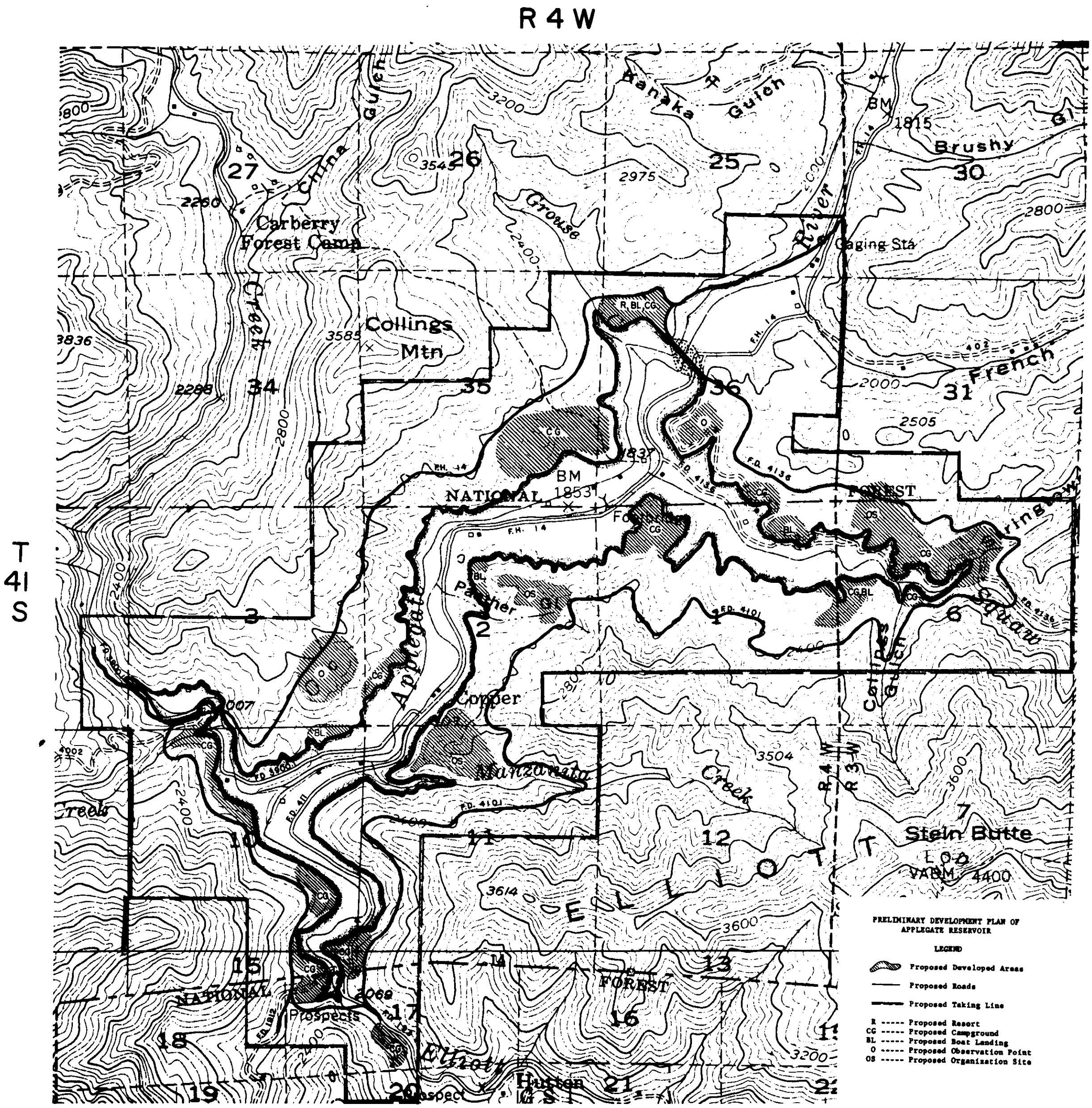
H. The losses in resource values will be minor whereas the gains will be great. The tremendous gain in recreation potential far outweighs the small loss in timber.

I. There will be a very limited adverse effect on the local timber industry. In fact, the road around the reservoir may be beneficial. The recreation and tourist industry will benefit.

J. The main effect on Forest Service relationship will be with stockmen whose preferences are based upon lands that will be flooded. We can expect problems here.

K. When the project is approved, a cooperative agreement should be made with the Corps of Engineers covering improvements, timber, fire protection, recreation, and other impacts.

L. If an appreciable period of time elapses between this report and the commencement of detailed project planning for construction, this impact report should be reviewed and revised to correctly reflect the impacts at that time.


R 4 W
T 41 S
Carberry Forest Camp
China Gulch
Banaka Gulch
Brushy Gl
Grouse
River
Gaging Sta
Collings Mtn
French
NATIONAL
FOREST
BM 1853
BM 1815
Applegate
Panther Gl
Copper
Manzanita
Creek
Stein Butte
VABM 4400
ELLIOTT
Squaw
Prospects
Elliott
Hutton
PRELIMINARY DEVELOPMENT PLAN OF APPLEGATE RESERVOIR
LEGEND
Proposed Developed Areas
Proposed Roads
Proposed Taking Line
R ----- Proposed Resort
CG ----- Proposed Campground
BL ----- Proposed Boat Landing
O ----- Proposed Observation Point
OS ----- Proposed Organization Site

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
PACIFIC NORTHWEST REGION
POST OFFICE BOX 4137
PORTLAND 8, OREGON

IN REPLY REFER TO
2510

July 26, 1961

Col. Sterling K. Eisiminger
District Engineer
Portland District
628 Pittock Block
Portland, Oregon

Dear Sir:

Reference your request of July 12, 1961, (NPPGW-6).

We have reviewed the 1959 hauling cost data for Lost Creek and Elk Creek Reservoirs. With little or no change in the length, alignment, or grade of replacement roads from that selected in 1959, the data given at that time for Lost Creek Reservoir is still applicable.

An error was discovered in the 1959 data for Elk Creek Reservoir. For an increase in haul distance of about 2½ miles, an annual total haulage of approximately 10 million board feet and a hauling cost of about $0.30 per thousand board feet per mile, the total increase in haul cost is about $7,500 annually for this reservoir.

The revised total approximate increase in haul cost for Lost Creek Reservoir is $14,000 annually, and for Elk Creek Reservoir $7,500 annually.

We very much appreciate your continuing close cooperation in analyzing the impacts which these projects will have on national-forest resources, uses, and administration.

Very truly yours,

J. HERBERT STONE
Regional Forester

By Kermit W. Linstedt
Kermit W. Linstedt

EXHIBIT 8

IN REPLY REFER TO:

JAT

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
District Office
1133 S. Riverside
Medford, Oregon

July 20, 1961

Colonel W. L. Winegar,
District Engineer
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Winegar:

We have reviewed the effect that increasing the capicity of both Elk Creek and Lost Creek Reservoirs would have on timber harvest and loss of timber production on Bureau of Land Management lands.

It appears that the data furnished to you on December 9, 1959 would not change appreciably as a result of increasing the capacity of these reservoirs. Consequently, we do not recommend any changes in the data.

John A Carnegie

ACTING District Manager

EXHIBIT 9

IN REPLY REFER TO:

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
District Forestry Office
P.O. Box 1106
Medford, Oregon

December 9, 1959

Col. W. L. Winegar, District Engineer
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Col. Winegar:

In view of the indefinite postponement of the previously scheduled public hearing on potential flood control and multiple purpose projects in the Rogue River Basin, the following cost estimates may be sufficiently timely to be of value to you. They relate to the proposed Lost Creek, Elk Creek, Meadows, Lakecreek, and Copper reservoirs which were mentioned in your letter of June 30, 1959.

The greatest effects of construction of the reservoirs, insofar as they affect the Bureau of Land Management, are the removal of approximately 220 acres of timberland from production and the increase in the transportation distance over which forest products must be hauled. Minor effects include the possible enhancement of recreational values on adjacent BLM land, the increased liklihood of man-caused fires resulting from greater public use of the localities, greater availability of electrical power for local forest products industries, and the possible effect of altered downstream temperatures on fish life where the Rogue River and its tributaries pass through BLM lands.

A summary of land value and increased haul cost estimates follow:

RESERVOIRS	ACRES OF BLM LAND INUNDATED	ROUGH ESTIMATE OF VALUE PER ACRE	TOTAL	ANNUAL LOSS*
Lost Creek	80	$30.00	$2,400	$720.00
Elk Creek	70	30.00	2,100	630.00
Meadows	20	30.00	600	180.00
Lakecreek	30	30.00	900	270.00
Copper	20	30.00	600	180.00
	220		$6,600	$1980.00

*Annual loss of revenue from timber production is computed at 300 board feet per acre per year valued at $30 per thousand board feet.

EXHIBIT 10

RESERVOIR	MILES OF EXTRA HAUL	MBF OF TIMBER TRIBUTARY	TOTAL* EXTRA COST	ANNUAL** EXTRA COST
Lost Creek	4	60,000	$38,400	$768.00
Elk Creek	3	60,000	28,800	576.00
Meadows	0	60,000	0	0
Lakecreek	2	30,000	9,600	192.00
Copper	3	2,000	960	19.00
		212,000	$77,760	$1555.00

*Computed at $0.16 per thousand board feet per mile.

**The total costs of transporting the presently mature timber the extra distance necessitated by the construction of the reservoirs was converted to an annual basis by dividing the totals by the 50 year period of time calculated to be required to harvest it on the Jackson Master Unit. The cost of building the relocated roads is not included here since that cost will be borne by the Corps of Engineers.

These estimates are furnished as you requested merely to indicate the general impact of the projects. They cannot be construed to be factual measures of the specific elements involved.

Sincerely yours,

Robert S. Hostetter

Acting District Manager

UNITED STATES
DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PORTLAND 8, OREGON

OFFICE OF
THE ADMINISTRATOR

September 18, 1961

Colonel S. K. Eisminger
District Engineer
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Eisminger:

As requested in your letter dated August 16, 1961, we have made a preliminary analysis of the Lost Creek project with regard to integration of the project with the Federal system. This analysis made use of data on Lost Creek furnished us by the Corps of Engineers in correspondence directed to our office, including your letter dated August 18, 1961, as well as pertinent data from our files.

Inclusion of the Lost Creek project within the purview of the U. S. Columbia River Power System as presently constituted could be accomplished. The Bonneville Power Administration has no plans at present for transmission lines traversing the area in the vicinity of the Lost Creek site. Since there are presently no non-Federal public agencies in the area capable of absorbing the energy generated at Lost Creek, the power production would probably be disposed of by sale to the area's principal utility, Pacific Power and Light Company. Bonneville Power Administration presently serves Pacific Power and Light Company at a number of locations throughout the Pacific Northwest; therefore, the incorporation of Lost Creek generation into the Federal system would have the effect of serving the area by displacement of imports.

Data furnished by the Corps of Engineers indicates a project prime power of 20,400 kilowatts during a 31-month critical period when operated as an isolated system. As the U. S. Columbia River Power System develops, the system critical storage release period evolves ultimately to a 43-month period. This would permit utilizing project nominal prime power of 22,100 kilowatts for this period. Other interim critical periods of 9-months and 20-months would provide 21,900 kilowatts and 32,600 kilowatts of prime power respectively. Thus, incorporating the Lost Creek project with the U. S. Columbia River Power System would enhance its prime power capabilities over the payout period.

According to a Corps of Engineers allocation furnished in your letter dated August 18, 1961, the total investment costs of $95,377,000 includes $35,899,000 allocated to power. Of this total allocation to power, $24,443,000 represents a 30 percent share of the joint costs and

EXHIBIT 11

$11,456,000 represents specific costs. Average annual costs including interest and amortization, operations and maintenance, and major replacements are estimated to be $1,648,800 based on a 50-year repayment period. Feasibility of the project is based on at-site power values for the Rogue River Valley area of $20.75 per kilowatt-year plus 4.33 mills per kilowatt-hour. These values were supplied by the Federal Power Commission by letter of July 21, 1961 to the Corps of Engineers, and are slightly higher than the values included in the Columbia River Review Report of June 1958.

As previously indicated, the prime power capability of the Lost Creek Project as part of the Federal system would be enhanced. First, the 43-month critical period average capability of 22,100 kilowatts would prevail over most of the project payout period. Then, assuming an estimated 70 percent load factor on the Federal system, the project firm power would be increased to about 31,600 kilowatts by supplying capacity from Federal sources other than the Lost Creek Project to supplement its strict 100 percent daily load factor operation. Also, as part of the Federal system, secondary power from the project would become usable for steam displacement during a major part of an assumed 50-year payout period. Nevertheless, considering all of these factors, the project would have a lower benefit to cost ratio, as far as power is concerned, than other projects currently being considered.

In conclusion, we believe that for power purposes, the construction of the Lost Creek Project should be scheduled subsequent to projects currently authorized or recommended for Federal construction which have a more favorable benefit to cost ratio. However, other beneficial uses might justify earlier construction. Any reduction in allocation of joint costs to power would improve the Lost Creek Project relationship to other projects currently being considered. The Bonneville Power Administration could assume marketing responsibility for the Lost Creek Project with little or no adverse effect upon Federal system payout if constructed in the proper sequence of regional development.

Sincerely yours,

Charles F. Luce

Administrator

cc: Regional Director
Bureau of Reclamation
Boise, Idaho

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
OREGON STATE OFFICE
209 S.W. 5th Avenue
Portland 4, Oregon

August 10, 1961

Col. Sterling K. Eisiminger
District Engineer
U.S. Army Engineers, Dist. Portland
628 Pittock Block
Portland 5, Oregon

Dear Col. Eisiminger:

We appreciate your sending us the potential Rogue River Basin Plan for our comments. We do not see anything in the proposal that would conflict or complicate the work we are doing or hope to do in the Basin. It should, in fact, substantially aid in the solution of the problem of protecting farm lands along the river from bank cutting and overflow that causes erosion and debris damage.

We would anticipate that the addition of 64,580 acres of irrigated land in the basin would require more technical assistance from the Soil Conservation Service to the Soil Conservation Districts.

We have received one application from the Bear Creek Watershed for assistance under P.L. 566. There has been some discussion among local groups on submitting a watershed application on Little Butte Creek under P.L. 566.

There have been a number of individual and group type of multipurpose reservoirs for irrigation, recreation, etc., constructed and planned in the area under the Soil Conservation District program.

Based on past experience we can forsee no difficulty in coordinating protective work along the river, in which we may be involved, with the proposed project plans and installations.

Sincerely yours,

L. P. Helseth
State Conservationist

EXHIBIT 12

FORM CD-321 (9-?-59)

UNITED STATE OVERNMENT

Memorandum

U.S. PARTMENT OF COMMERCE
BUREAU OF PUBLIC ROADS
R. 740 Morgan Bldg.
Portland 5, Ore.

TO : Col. Sterling K. Eisiminger
District Engineer
Corps of Engineers
620 Pittock Block, Portland 5, Oregon

DATE: August 10, 1961

FROM : B. M. French, Regional Engineer
Portland, Ore. By: N. B. Wood, Federal Hwy. Projects Engineer

08-71.8

SUBJECT: Oregon FH Route 17 - Crater Lake Hwy. (Lost Creek Reservoir)

Reference is made to your letter of July 28, 1961, advising us of tentative plans for reservoirs and local works for the Rogue River Basin.

The information now furnished indicates an apparent change in the proposed maximum pool elevation for Lost Creek Reservoir. The quadrangle maps sent us with your letter of July 24, 1959 indicated a proposed maximum pool level for Lost Creek Reservoir of 1820 mean sea level. On the basis of this information the recently completed project on the Crater Lake highway was terminated on the southerly end at grade elevation 1834, in the W 1/2 of NE 1/4 of Section 19, township 33 South, Range 2 East, WM. Therefore the now indicated pool level of 1915 will inundate approximately 7300 feet of the recently improved portion of the highway.

As we advised in our letter to the District Engineer, dated July 17, 1959, we, in cooperation with the Oregon State Highway Department, have deferred any location surveys or major improvements on the Crater Lake highway south of approximate grade elevation 1835 pending the outcome of Corps of Engineers plans for the Lost Creek Reservoir. As you may know, the State Highway Department has made temporary improvements on the route between the south end of the recently completed project and trail. We would therefore anticipate no further improvements on this route within the proposed pool area until definite action is taken on the Lost Creek Reservoir plan, provided such action is possible within a reasonable time.

With respect to your comment that project cost estimates have taken into account highway "replacement in kind", it is our understanding that the Corps is now authorized to replace an existing highway to standards adequate for existing traffic, regardless of whether the existing facility was to such standards.

At such time as the Lost Creek project may be authorized by the Congress, or as you may otherwise deem appropriate, we shall be pleased to discuss with you the possibilities of a cooperative arrangement

EXHIBIT 13

for the survey, design and preparation of estimate of cost for that portion of the Crater Lake (Forest) Highway which would be affected by the proposed pool area. This would be an arrangement such as is now in effect between the Bureau and Corps (Seattle District) on the Libby Dam project in Montana.

- C O P Y -

HOUSING AND HOME FINANCE AGENCY
Office of the Regional Administrators
989 Market Street
San Francisco 3, California

July 21, 1961

Colonel W. L. Winegar
District Engineer
Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Winegar:

Re: Coordination of Flood-Control Activities with Urban Renewal Programs

In reply to your letter of July 14 (your ref. NPPGW-6), as you may be aware, there are two principal types of programs under the Urban Renewal Administration which may be concerned with flood-control activities. These are the Urban Renewal Program, which deals with elimination of blighted areas, and the Urban Planning Assistance Program, which furnishes financial assistance for general planning to small municipalities and counties, metropolitan areas, urban regions, and States for state-wide planning.

At the present time, we have Urban Renewal projects in the following Oregon cities: Portland, Springfield, Coos Bay, Monmouth, and Eugene. Flooding is not a problem in any of these project areas, so far as we know.

The Urban Planning Assistance Program is administered in two ways. In furnishing planning assistance for metropolitan areas, urban regions and state-wide planning, this Agency may deal directly with the official planning agency for the area. At present, there is no such situation in the State of Oregon, all urban planning assistance being administered by the Bureau of Municipal Research and Service, State Board of Higher Education, University of Oregon, Eugene, under Mr. Herman Kehrli, Director of the Bureau.

Inasmuch as Mr. Kehrli's staff does most of the actual planning work assisted by our program, and, therefore, is in a better position to know where coordination between your flood-control activities and planning is needed, we are forwarding a copy of your letter to him with the request that he get in touch with both you and our office concerning any such area. I may mention that Grants Pass is

EXHIBIT 14

one of the cities receiving Urban Planning Assistance which apparently would be affected by the flood control measures being studies for the Rogue River Basin. I imagine that Mr. Kehrli's staff has familiarized itself with the potential results of that study, and is taking them into account in the urban planning studies under way for Grants Pass.

In the event that we receive applications directly from other planning agencies in the State of Oregon, we will advise you.

Sincerely,

John C. Hill

for Robert E. McCabe
Regional Director of Urban Renewal

ROGUE RIVER BASIN

OREGON

APPENDIX A

REPORT OF U. S. FISH AND WILDLIFE SERVICE

89588 O-62—13

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
CLARENCE F. PAUTZKE, COMMISSIONER

A DETAILED REPORT ON FISH AND WILDLIFE RESOURCES

AFFECTED BY

CORPS OF ENGINEERS'

WATER DEVELOPMENT PLAN

ROGUE RIVER BASIN

OREGON --- CALIFORNIA

Portland, Oregon
December 1961

Rogue River is internationally known for its runs of chinook and coho salmon, and steelhead trout. These fish provide excellent sport and commercial fisheries. A highly attractive sport during many seasons of each year is that of angling for these fish as they move from Pacific Ocean into this stream during their spawning migrations.

REPORT OF THE REGIONAL DIRECTOR

(1-RB)

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE
1002 N. E. HOLLADAY STREET
P. O. BOX 3737
PORTLAND 8, OREGON

PACIFIC REGION
(REGION 1)
CALIFORNIA
IDAHO
MONTANA
NEVADA
OREGON
WASHINGTON

ADDRESS ONLY THE
REGIONAL DIRECTOR

December 4, 1961

Colonel Sterling K. Eisiminger, District Engineer
Portland District, Corps of Engineers
628 Pittock Block
Portland 5, Oregon

Dear Colonel Eisiminger:

This is our Bureau's report on effects your water development plan for Rogue River basin would have on fish and wildlife resources. It has been prepared in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.). Our analysis is based on project data provided by the Corps of Engineers through August 1961.

This report has been reviewed by Oregon State Game Commission, Fish Commission of Oregon, and California Department of Fish and Game. Copies of letters indicating review by these agencies are attached to the substantiating report. Oregon State Game Commission and Fish Commission of Oregon are in general agreement with this report as indicated in letters from Director P. W. Schneider, dated October 24, 1961 and Director R. W. Schoning, dated October 11, 1961. In addition to requirements included in this report both Commissions recommend that construction of Lost Creek and Applegate Dams be undertaken simultaneously and if there is any part to be delayed, the Elk Creek Dam should be the last to be constructed. We concur with this recommendation. General concurrence with the report is indicated in two letters from California Department of Fish and Game. Deputy Director Harry Anderson, in a letter dated October 2, 1961, indicates concurrence. In a supplemental letter, dated October 9, 1961, Mr. Walter T. Shannon, Director of California Department of Fish and Game, suggests that development of adjacent deer range to mitigate losses of range in Applegate Reservoir might be needed. This interstate herd ranges into California and any losses of deer caused by the reservoir might be reflected in hunting and harvest of deer in that State. Mr. Shannon further states that these losses could be determined by additional study. Although present information does not appear to justify development of supplemental range, we concur that additional studies to determine this would be desirable. Benefits assigned to

wildlife in this report would not be altered as a result of the above, since these values are associated with the Lost Creek-Elk Creek development only. This report has been reviewed by Bureau of Commercial Fisheries.

Rogue River basin encompasses an area of over 5,000 square miles in southwestern Oregon and northwestern California. The scenic beauty and abundant natural resources of this area are widely recognized. The fish resources in particular have attracted national and international attention. Anglers travel great distances to fish in the renowned Rogue River. Chinook salmon, coho salmon, steelhead trout, and other anadromous fish spawn in the mainstem and in the many tributary streams. These fish provide an outstanding sport fishery, and also contribute to the large commercial and sport troll fisheries in Pacific Ocean. Rainbow and cutthroat trout are resident in the basin. Rogue River with its many tributaries, abundance of cool, clear water, and large amounts of spawning gravel has provided good conditions for spawning and rearing of anadromous and resident fishes. However, high water temperatures which occur in some years are associated with losses of juvenile and adult salmon and trout.

Wildlife resources of Rogue River basin are represented by black-tailed deer, black bears, many species of upland-game birds, fur animals, and waterfowl.

The need to conserve and develop natural resources of Rogue River basin for the benefit of both local and national interests has existed for many years. During this period several plans have been proposed for developing the area's water resources, but many of these developments would have seriously damaged fish habitat and fishing. Such plans have been vigorously opposed by conservation agencies. On August 12, 1958, the new Fish and Wildlife Coordination Act was approved. One of the major provisions of the new act states that fish and wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs. Approval of the Fish and Wildlife Coordination Act initiated a new era in planning for fish and wildlife as part of our national water development program. Now fish and wildlife conservation with such projects might be realized through effectual and harmonious planning between the conservation and construction agencies. This type of cooperation has been prevalent in planning for development of Rogue River basin. During the planning period our Bureau, working in cooperation with State Fish and Game agencies, has provided information concerning quality and quantities of water needed to conserve and develop fish resources in the basin. Other requirements for conservation of fish and wildlife have been

provided to your agency as an aid to project planning. We are gratified that the present basin-wide plans proposed by your agency include fish and wildlife conservation and development as a primary purpose of the project. We have been pleased to cooperate with members of your staff and other interested agencies and groups in developing project plans for improvement of conditions for fish and wildlife resources.

The plan proposed by your agency for development of Rogue River basin provides for dams at Lost Creek site on mainstem Rogue River, Elk Creek site on Elk Creek, and Applegate site on Applegate River. Lost Creek and Elk Creek Reservoirs would be operated as an integral unit to provide storage for flood control, irrigation, municipal water supply, and improvement of fish habitat and fishing. Releases for fish would also provide water quality control as contemplated in the 1961 amendments of the Federal Water Pollution Control Act. In addition, power-generating facilities would be provided at Lost Creek Dam and Reservoir. A total of about 225,000 acre-feet of storage space in Lost Creek and Elk Creek Reservoirs would be allocated for flood control. To facilitate temperature control of water which would be provided for fish, initial demands for irrigation and municipal water supply would be met by Lost Creek Reservoir. Lost Creek and Elk Creek Reservoirs would supply irrigation water to 34,410 acres of new land and 15,570 acres of land which now receive an inadequate supply of irrigation water. Irrigation releases from the two reservoirs would be diverted by a low diversion structure on Rogue River at the mouth of Elk Creek. Water releases totaling about 20,000 acre-feet would be made for municipal purposes. It is anticipated that a substantial part of this water would remain in the stream until diverted for use in the Gold Hill-Grants Pass area. The presently proposed plans for Lost Creek-Elk Creek project would also include provisions for fish production facilities, fish-passage facilities at Elk Creek Dam, multiple-level outlets at Lost Creek Dam for temperature control of water releases made from Lost Creek Reservoir for fish, and screening of the irrigation diversion to prevent fish from entering the irrigation system. Specific project requirements for providing improvements to fish and fishing in Rogue River are described in detail in the substantiating report. These criteria were developed from a water temperature and flow correlation study supervised by the Bureau of Sport Fisheries and Wildlife. Cooperating agencies included Oregon State Game Commission, Fish Commission of Oregon, Oregon Water Resources Board, Oregon State University, and Corps of Engineers. Local organizations and many private individuals also participated in this phase of our investigation.

Applegate Reservoir would be operated to provide storage space for flood control and irrigation, and for improvement of fish habitat.

Provisions would be made for development of recreation potentials. About 55,000 acre-feet of storage space would be allocated for flood control. Irrigation water would be provided for about 5,000 acres of new land and supplemental water provided for about 9,400 acres of land now receiving an inadequate supply. Water releases for fish in downstream areas would be provided even in low water years and control of temperatures of these water releases would be facilitated by use of multiple outlet facilities arranged vertically so as to permit water withdrawal from various levels in the reservoir. Permanent facilities would be included at Applegate Dam to pass migrant fish utilizing the stream in the project area. Canal intakes would be screened to prevent diversion of fish from Applegate River into the project canals.

Fish resources of the basin would be greatly affected by Lost Creek-Elk Creek and Applegate projects. Salmon and trout spawning habitat, and stream fishing areas would be destroyed within the three reservoir sites. Some spawning habitat upstream from Elk Creek and Applegate Reservoirs would remain accessible for anadromous fish, since passage facilities would be provided at Elk Creek and Applegate Dams. The proposed fish production facility would be designed to mitigate loss of spawning habitat presently used by coho and chinook salmon, and steelhead trout within Elk Creek, Lost Creek, and Applegate Reservoir sites. It would also serve to reduce losses associated with handling and delays at the passage facility, and loss of downstream migrants in the reservoir due to residualism and predation. Populations of resident trout in the headwater areas upstream from the three reservoirs would be relatively unaffected. It is expected that Lost Creek and Applegate Reservoirs would provide good habitat for resident trout and good fisheries. However, the scheduled operation of Elk Creek Reservoir would inhibit development of good trout habitat and a trout fishery.

Temperature and flow conditions to be provided by joint operation of Lost Creek and Elk Creek Reservoirs would be of major benefit to fish populations of downstream Rogue River. Increased flows downstream from Lost Creek and Applegate Dams would provide increased spawning habitat for salmon and steelhead trout. Cooler water to be provided during the summer months would improve rearing conditions for salmon and trout in mainstem Rogue River from Lost Creek Dam to Marial, and in Applegate River downstream from Applegate Dam to the mouth of Applegate River. General improvement of flow conditions would provide opportunity for increased use of Rogue River by boat fishermen during low-flow periods. Benefits would also accrue to fish habitat from control of floods, but these benefits would offset, only to a minor degree, losses which the project, without planned mitigative measures, would cause to fish and wildlife.

The three proposed reservoirs would destroy habitat utilized by big game, upland game, and fur animals. Fur animals, such as minks and raccoons, would continue to inhabit the reservoir shores, but numbers would be smaller than those expected without the development. Although nesting habitat for mallards, wood ducks, and mergansers would be destroyed by these reservoirs, some waterfowl resting areas would be provided.

In the proposed irrigation areas, wildlife resources would derive considerable incidental benefit from irrigation of presently non-irrigated land. Little change in big-game harvest is expected. It is possible, however, that deer drowning losses may occur in project canals, particularly if concrete-lined sections of the larger canals significantly exceed one-quarter mile in length. Increased crop depredations by deer would occur with the project. Incidental benefits to upland-game birds which would occur through improvement of habitat in the irrigation areas would be reflected in increased hunter use. Annual benefits to fur animals resulting from newly developed irrigation would be moderate. Some increase in waterfowl nesting and migrant use is expected in the irrigation area. With the project, number of days expended in pursuit of waterfowl would increase somewhat in irrigation areas.

Project fish facilities and flow releases proposed for Lost Creek, Elk Creek, and Applegate Dams and Reservoirs would produce planned benefits of $270,000 annually to the commercial fisheries and $946,000 annually to the sport fisheries. Incidental benefits to wildlife would total about $25,000 annually. These wildlife benefits would be assignable in part to irrigation storage as provided by Corps of Engineers, and in part to development of the irrigation system as proposed by Bureau of Reclamation. Benefits to fish and wildlife are based on an assumed economic life of 100 years for the project. In order that these benefits can be realized, the project would have to be constructed and operated as presently planned. It would be necessary that specific stipulations for conservation and development of fish and wildlife be included in any document presented to Congress for authorization of this proposed Rogue River basin development. These requirements are set forth in the discussion which follows.

Evaluation of fish and wildlife resources in this report is based upon dam and reservoir data contained in "Potential Rogue River Basin Projects, Project Data Sheets for Consideration Prior to Public Hearing," dated August 23, 1961, a publication of the Portland District, Corps of Engineers. Any alteration in these data would alter mitigation measures and fish and wildlife benefits discussed in this report. This

is particularly true in the case of dam locations which we recommend not be farther downstream than those indicated in the above-described data sheets.

Project costs allocated to fish and wildlife enhancement should be recognized as being in the public interest and should be nonreimbursable.

Fishery benefits would accrue only if the proposed water releases are set aside specifically for fish and the flows resulting from these releases can be guaranteed from the project dams to the mouth of Rogue River. In addition, the requested temperature requirements must be provided as contained in your proposed development plan. It is also necessary that all changes in water releases as prescribed by the schedule which has been established by Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife be made gradually and over an extended period. This is necessary to prevent stranding of fish due to changing water levels. Such changes would also have adverse influences on spawning fish and their progeny.

Fish-passage facilities are included in your plans for Elk Creek and Applegate Dams. Fish production facilities are proposed to compensate for loss of spawning areas rendered unusable by the reservoirs, losses of fish associated with handling and delays at the passage facility, and losses of downstream migrants in the reservoir. These facilities would also provide trout for sustaining populations of resident trout in all three reservoirs. Specific requirements as to the type of fish-passage and artificial propagation facilities have not been precisely determined at the present time. Research on fish-passage facilities and fish production facilities such as spawning channels, rearing ponds and hatcheries is presently being conducted by the U.S. Fish and Wildlife Service and State conservation agencies. At the appropriate stage in project planning, facility requirements will be determined jointly by Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife. Estimated cost of fish-passage and production facilities for Lost Creek, Elk Creek, and Applegate Dams and Reservoirs is $4,400,000. Estimated annual cost of operation and maintenance of these facilities is $220,000. Screening of all proposed irrigation diversion intakes is planned by the U.S. Bureau of Reclamation to prevent resident trout and downstream migrating anadromous fish from entering irrigation systems. Such screens should be of the self-cleaning type and should meet established design criteria of Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife.

Fish populations and aquatic habitat in Rogue River, Elk Creek, and Applegate River downstream from project dams could be adversely affected unless construction operations were accomplished in a manner that would minimize siltation of the streambed and muddying of the streams.

A problem of concern to wildlife resources would be deer drowning losses in project canals. Project information available at this time does not specify the extent of concrete-lined canal sections for Lost Creek-Elk Creek and Applegate projects. If, however, there are lined canal sections of at least one-quarter mile in length, and canals have flow velocities exceeding 3 feet per second and/or water depths exceeding 18 inches, losses could be expected to occur to both adult and young deer which enter the canal systems. Losses could also occur in any unscreened canal siphons. Devices would be needed to either prevent the animals from entering canals or to enable animals trapped in canals to escape with as little injury as possible. These facilities could consist of bridges, escape ramps, fences, dirt-lined sections or other protective devices.

Designs and locations of deer protective facilities should meet established criteria determined by Oregon State Game Commission and Bureau of Sport Fisheries and Wildlife. Actual costs of protective structures cannot be determined until more information is available on water distribution systems for the project. It is our understanding that project funds would include provision for these facilities.

A zoning plan would be necessary for Lost Creek, Elk Creek, and Applegate Reservoirs to insure that certain sections of the reservoirs or periods of time would be available for fishing and hunting, and for other fish and wildlife purposes without undue interference from general recreational activities.

Recommendations:

In the preceding discussion we have described measures needed to mitigate losses to fish and wildlife. We have discussed means by which the fish resource could be enhanced. As a result of previous cooperation between us during planning of the project you have included many of these measures in your current plans. To reemphasize the importance of these measures which we have agreed to at field level, and to insure future consideration of these measures, we are reiterating in this report all recommendations which we have previously made to you. These are in addition to recommendations not previously made. To conserve and develop fish and wildlife resources of Rogue River basin it is recommended:

1. That the report of the District Engineer, Corps of Engineers, include conservation and development of fish and wildlife resources among the purposes for which this Rogue River basin development is to be authorized.

2. That location of Lost Creek and Applegate Dams not be farther downstream than that indicated in the following descriptions:

Lost Creek Dam -- Secs. 25 and 26, T. 33 S., R. 1 E.,
Willamette meridian

Applegate Dam -- Sec. 36, T. 40 S., R. 4 W.,
Willamette meridian

3. That project costs allocated to fish and wildlife enhancement be nonreimbursable.

4. That the following flow releases be made for fish life and that flows resulting from these releases be guaranteed against withdrawal for other uses from points of release to the mouth of Rogue River:

a. A minimum flow of not less than 25 second-feet be maintained at all times in Elk Creek downstream from Elk Creek Reservoir and that temperature of water releases would not exceed 60°F. except for short periods during late summer in dry years.

b. Flow releases and schedules and quality of releases as tabulated in the following be made from Lost Creek Reservoir:

Dates	Minimum Flow Releases (second-feet)	Maximum Water Temperature of Releases (Degrees F.)
May 1 - May 15	1,000	52
May 16 - May 31	1,300	52
June 1 - June 10	1,500	52
June 11 - June 30	1,800	45
July 1 - Aug. 20	2,000	45
Aug. 21 - Sept. 7	1,500	52
Sept. 8 - Jan. 31	1,000	52
Feb. 1 - April 30	700	52

c. Temperature of releases from Applegate Reservoir would not exceed 60°F., and releases from that reservoir and flows in Applegate River would be as follows:

(1) A minimum release of 50 second-feet be made from Applegate Reservoir to provide a flow of that amount from the Applegate Dam to the mouth of Little Applegate River.

(2) Flows of not less than those indicated below should be maintained from mouth of Little Applegate River downstream to the mouth of Applegate River:

(a)	January 1	-	February 28	120 second-feet
(b)	March 1	-	June 30	100 second-feet
(c)	July 1	-	October 31	120 second-feet
(d)	November 1	-	December 31	natural flow as regulated for flood control

5. That fish-passage and fish production facilities be provided with Lost Creek-Elk Creek and Applegate River developments and that the type and design of these facilities be determined jointly by Oregon State Game Commission, Fish Commission of Oregon, Bureau of Sport Fisheries and Wildlife, and the Corps of Engineers. California Department of Fish and Game would participate where facilities for the Applegate development are concerned. Estimated cost of these facilities is $4,400,000. Estimated annual cost of operation and maintenance of these facilities is $220,000.

6. That construction activities in connection with all proposed structures be accomplished in a manner to avoid siltation of streambeds or muddying of basin streams.

7. That projects provide for construction and annual maintenance of deer-protective facilities to prevent big-game losses in concrete-lined canals. Designs and locations of facilities should meet criteria established by Oregon State Game Commission and Bureau of Sport Fisheries and Wildlife. Cost of these facilities would be determined when project engineering data are developed sufficiently to more accurately indicate extent of concrete-lined canal sections and canal capacities.

8. That consideration be given to reservoir zoning plans in connection with overall planning for Lost Creek, Elk Creek, and Applegate Reservoirs to insure that certain areas of the reservoirs or periods of time would be available for fishing, hunting, and other fish and

wildlife purposes without conflicting use from general recreation. Such a plan would be developed cooperatively by Fish Commission of Oregon, Oregon State Game Commission, California Department of Fish and Game, Corps of Engineers, and Bureau of Sport Fisheries and Wildlife for recommendation to the appropriate regulatory agencies.

9. That the following language be incorporated in the recommendations of the report of the District Engineer, Corps of Engineers:

a. "That such reasonable modifications be made in the authorized project facilities and operation as may be agreed upon by the Directors of Oregon State Game Commission, Fish Commission of Oregon, and California Department of Fish and Game; the Director, Bureau of Sport Fisheries and Wildlife, and the Chief of Engineers, Corps of Engineers, for conservation and development of fish and wildlife resources."

b. "That Federal land and project waters in the project areas be open to free use for hunting and fishing so long as titles to the lands and structures remain in the Federal Government, except for sections reserved for safety, efficient operation, or protection of public property."

c. "That leases of Federal land in the project area reserve the right of free public access for hunting and fishing."

Sincerely yours,

Richard E. Griffith

Acting Regional Director

SUBSTANTIATING REPORT

89588 O-62—14

TABLE OF CONTENTS

LIST OF TABLES

ILLUSTRATIONS

PREFACE

The Portland District, Corps of Engineers has undertaken study of Rogue River and tributaries under authority of Section 6 of the 1936 Flood Control Act and Section 206 of the 1958 Flood Control Act (Public Law 85-500). At the outset of the study it was apparent that some storage projects under consideration would create problems of appreciable magnitude to fish and other basin resources. For this reason a number of municipal, State and Federal agencies have expressed interest in this basin study and have cooperated closely to develop a desirable plan to protect and improve the valuable resources of the basin. In an attempt to devise measures for conservation and development of the internationally famous Rogue River fish resources, the Bureau of Sport Fisheries and Wildlife in cooperation with Oregon State Game Commission, Fish Commission of Oregon, Oregon State Water Resources Board, Oregon State University, and interested Federal agencies has sponsored and supervised a temperature-flow correlation study. Field studies commencing in September 1959 and terminating in November 1960 were centered on the operation of 24 recording thermometers stationed on the mainstem and principal tributaries of Rogue River (plate II). Thermographs used in this operation were 7-day recording type, operated by cooperating residents under the supervision of Bureau of Sport Fisheries and Wildlife biologists. Records were also kept of temperature readings taken manually and periodically at numerous stations including water level gaging stations located on minor tributaries throughout the basin. Data collected during this field study were analyzed by the hydrology staff

of Oregon State University and correlated with streamflow data to determine effectiveness proposed water developments would have in protecting and developing fish resources of Rogue River basin in accordance with criteria set forth by Federal and State conservation agencies. After completion of this study temperature and flow requirements and other criteria for protecting and improving fish resources were provided to the Corps of Engineers by the Bureau of Sport Fisheries and Wildlife. The Corps of Engineers has analyzed these requirements during project planning and has considered them in its plans for development of Rogue River basin.

This report has been prepared in accordance with the Fish and Wildlife Coordination Act (48 Stat. 401 as amended; 16 U.S.C. 661 et seq.). Project information and engineering data on which this report is based were supplied prior to September 1961 by Portland District, Corps of Engineers.

Previous reports prepared by the U.S. Fish and Wildlife Service on the Rogue River basin include the following:

1. An Interim Report on the Fish and Wildlife Resources in Relation to Plan A, Rogue River Project, Oregon, January 1950.
2. A Preliminary Report on Fish and Wildlife Resources Affected by Illinois Valley Division, Rogue River Basin Project, Oregon, November 1955.
3. Fish and Wildlife Resources of the Rogue River Basin, Oregon, April 1956.

4. Letter Report on Merlin Division, Rogue River Basin Project, Oregon, June 30, 1958.

5. Letter Report on Evans Valley Division, Rogue River Basin Project, Oregon, March 17, 1961.

Assistance and cooperation provided by the following organizations and individuals have been invaluable in the preparation of this report on fish and wildlife evaluation of the Rogue River basin: Portland District, Corps of Engineers; Bureau of Reclamation's Salem Area Planning Office; Oregon State Water Resources Board; Oregon State Game Commission; Fish Commission of Oregon; California Department of Fish and Game; City of Grants Pass; Jackson County Court; and Dr. Wayne V. Burt and Mr. Bruce McAlister of Oregon State University. In addition, local residents of the basin have provided considerable assistance in collection of temperature and flow data.

INTRODUCTION

Purpose of the Project

Several proposals were studied by the Corps of Engineers to determine a feasible plan of development for providing flood control, irrigation needs, municipal water supplies, fish requirements, hydoelectric power and recreation needs.

Location of the Project

The present project plans under consideration consist of multipurpose reservoirs at Lost Creek site on Rogue River, Elk Creek site on Elk Creek, and Applegate site on Applegate River. All sites are located in Jackson County in southwestern Oregon (plate I).

DESCRIPTION OF AREA

Physical Features

Rogue River basin comprises an area of over 5,000 square miles. It includes nearly all of Jackson and Josephine Counties, a large part of Curry County, and portions of Douglas and Klamath Counties in Oregon. A small part of the basin lies in Siskiyou and Del Norte Counties in California.

Rogue River basin is bordered on the north by the Umpqua Mountains, on the east by the Cascades, and on the south by the Siskiyou Range. The main river flows westerly through the Coast Range and some of the Rogue River drainage is located in this range.

Rogue River is approximately 210 miles in length. It originates in the northwestern corner of Crater Lake National Park and flows southwest to Grants Pass, then generally westward to the Pacific Ocean. Principal tributaries of the Rogue River are Illinois River, Grave Creek, Applegate River, Evans Creek, Bear Creek, Little Butte Creek, Big Butte Creek, Elk Creek, and South Fork Rogue River. Rogue River in its upper reaches has a considerably steeper gradient averaging about 60 feet per mile from the river's source downstream to the town of Trail, Oregon.

The majority of basin streams are swift flowing, but not excessively turbulent, and have gravel bottoms interspersed occasionally with areas of solid rock and large boulders. Streamflow is typified by high flows from December to June. Low flows normally occur from July to November and are generally accompanied by high water temperatures during July and August.

Seven hydroelectric powerplants operate in the basin. Six of these are privately owned. Some of the existing reservoirs constructed by private irrigation groups are Fish Lake Reservoir in the headwaters of the North Fork of Little Butte Creek; Savage Rapids Reservoir, 5 miles upstream from the city of Grants Pass, Oregon; and Emigrant Reservoir located 6 miles southeast of Ashland, Oregon on Emigrant Creek. Emigrant Reservoir was enlarged in 1960-61 by Bureau of Reclamation. Many other small impoundments are located throughout the basin.

Climate of the area is variable. On the coast, cool and humid weather prevails throughout the year. Inland, the climate gradually changes,

becoming semiarid in the central portion of the basin. Climate in the upper basin is characterized by cold winters and rather cool, dry summers. Mean annual precipitation varies from about 75 inches at the coast to about 16 inches near Medford. About 75 inches of precipitation falls annually in the mountainous area near the headwaters of Rogue River. Most of this precipitation occurs as snowfall.

Areas of outstanding scientific and geologic interest include Crater Lake National Park and Oregon Caves National Monument. The Umpqua, Siskiyou, and Rogue River National Forests are partly located within Rogue River basin.

Oregon State Game Commission operates Butte Falls Hatchery for production of chinook salmon and rainbow trout and in the past coho salmon have been produced there. Rogue Valley Wildlife Management Area is managed by the Commission primarily for upland birds and waterfowl.

Economic Features

The greatest single industry in the basin is lumbering which employs a large segment of the labor force. Current development of mineral resources is on a modest basis and chromium mining and sand and gravel operations constitute most of the present-day mining activity. The 1959 Agricultural Census shows that more than 3,000 farms exist within the basin and about 500,000 acres of land are in farms.

The scenic resources of the basin are outstanding and provide recreational values which are a major economic asset. Traffic records

indicate that 1,725,000 vacation-bound tourists visited Rogue River basin in 1953 and the numbers are known to have increased substantially since that time. Since most of these people are not from the immediate area, their expenditures are important additional contributions to the economy of the basin. The value of recreation to the economy of the Rogue River area is exceeded only by lumbering and agriculture.

Two major north-south highways pass through the basin. U.S. 99 (Interstate No. 5) follows an inland route and U.S. 101 follows the coast. Much of the mountainous, forested area is accessible by unsurfaced, graded roads constructed by U.S. Forest Service. Medford is served by three airlines, and Southern Pacific Company provides north and south rail transportation.

Fish and Wildlife Features

Basin Fish. Rogue River is internationally famous for its chinook salmon and steelhead trout fisheries (figure 1 and figure 2). Fish produced in Rogue River contributes substantially to a large commercial and sport troll fishery in Pacific Ocean and large numbers of anglers actively engage in sport fishing throughout the basin.

Fishes of Rogue basin streams are of two general groups, anadromous and resident. Anadromous fishes spend part of their lives at sea and return to fresh water for spawning. On Rogue River this group includes chinook and coho salmon, steelhead and sea-run cutthroat trout, green sturgeon, and American shad. Shad and sturgeon usually are found only in lower

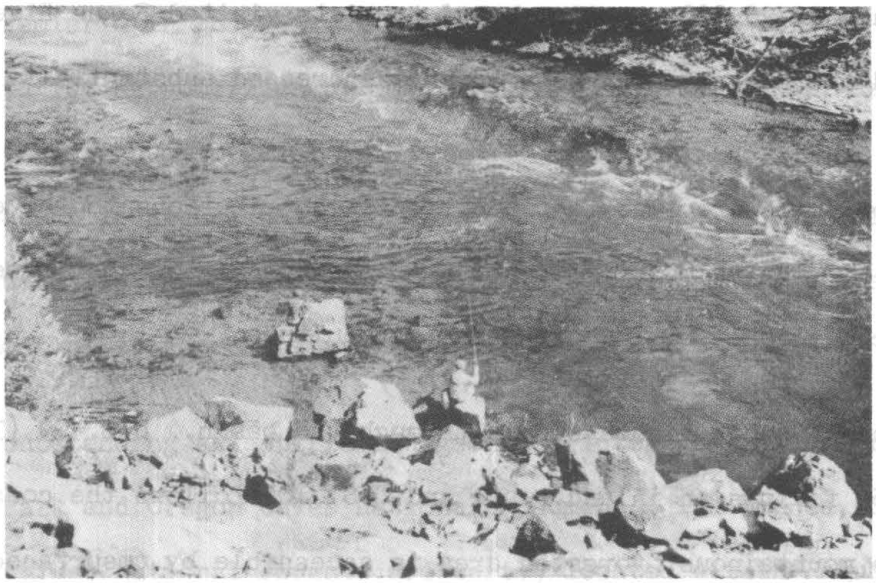


Figure 1. The Upper Rogue River with its interspersion of riffles and pools provides excellent fishing and habitat for salmon and resident trout. (Photo courtesy Oregon State Game Commission)

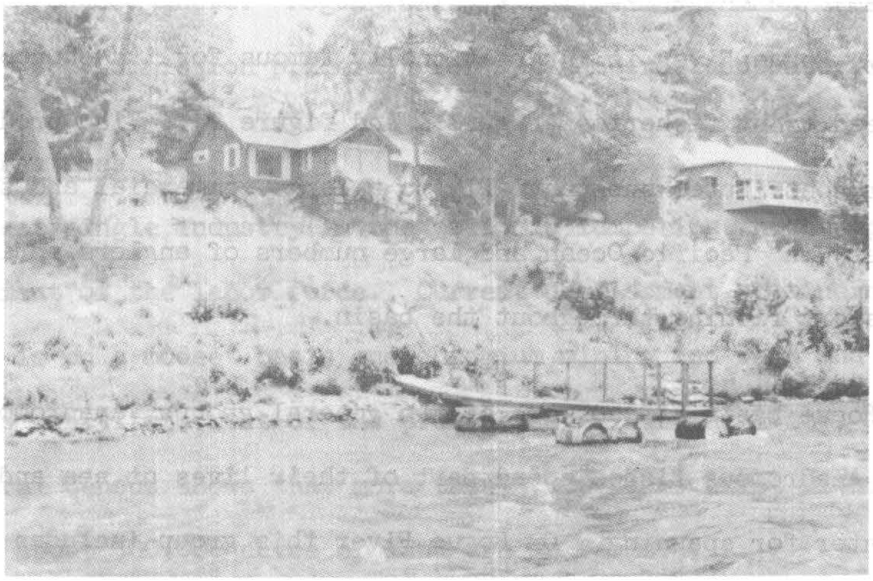


Figure 2. Much of Rogue River basin is highly developed. Many summer homes and permanent residences are present along the river and its tributaries. Here a salmon board is used to facilitate fishing for spring chinook salmon. (Photo courtesy Oregon State Game Commission)

reaches of the river, and at the present time few are caught. The shad is not native, but was introduced to the Pacific Coast prior to 1900. The Pacific lamprey also is found in Rogue River basin.

Resident fishes native to the basin include rainbow and cutthroat trout. In addition to native trout species, other trout and spiny-rayed fishes have been introduced. Although warm-water game fishes have become established in the basin, anglers expend most of their fishing efforts on native and introduced species of trout. Rogue River with its many tributaries, an abundance of clear, cool water, and large amounts of spawning gravels, has provided good conditions for spawning and rearing of anadromous and resident fishes. However, it is evident that high water temperatures, which occur in some years, are associated with losses of juvenile and adult salmon and trout (figure 3).

Basin Wildlife. Wildlife contributes greatly to the recreation values of Rogue River basin. Black-tailed deer are common throughout the drainages. Black bears still occupy much of their original range in the more inaccessible portions of the basin, but their numbers have been considerably reduced. Elk are present in the headwaters, but their range and numbers are quite limited. Deer make up the great majority of the big-game harvest.

Considerable hunting opportunities are provided by a variety of upland-game species, such as ring-necked pheasants, California and mountain quails, blue and ruffed grouse, band-tailed pigeons, mourning doves, and brush rabbits.

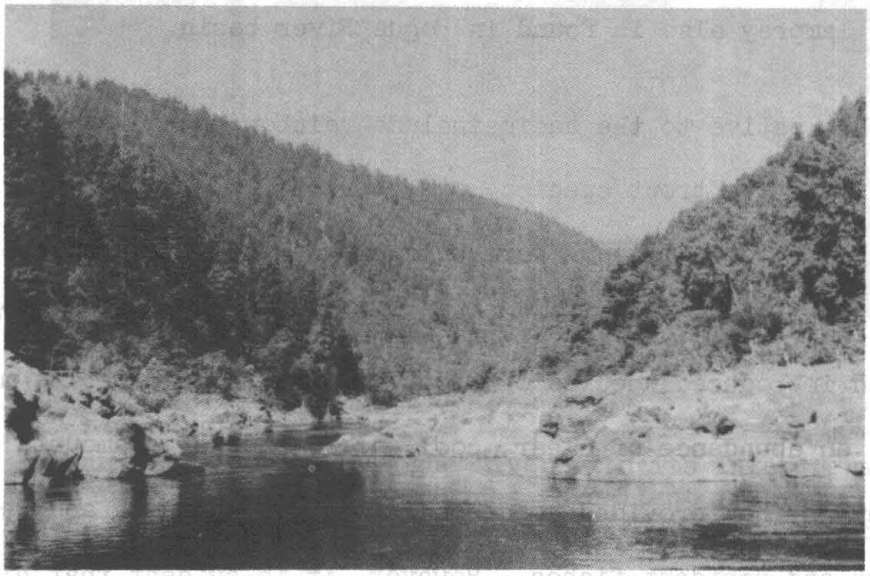


Figure 3. The downstream waters of Rogue River are subject to warming during periods of low flow, particularly when high air temperatures are prevalent. These warmed waters are associated with losses of juvenile and adult salmon and trout. (Photos courtesy Oregon State Game Commission)

A number of fur animals are common along many of the basin watercourses. Beavers, minks, river otters, raccoons, and skunks are the more abundant species. Remnant populations of ringtails occur in parts of the basin.

Waterfowl use of the basin is relatively low; however, swans, geese, and many species of ducks migrate through the Rogue Valley and along the Oregon coast near the mouth of Rogue River.

PLAN OF DEVELOPMENT

General

The present project plan under consideration consists of two multiple-purpose reservoirs in the upper Rogue River area, and a multiple-purpose reservoir on upper Applegate River. The plans include provisions for flood control, irrigation, power generation, water supply, fish and wildlife conservation, water quality control, and recreational benefits as appropriate at each site. A summary of the major aspects of each dam and reservoir is given in table 1.

Table 1. Summary of features proposed for Rogue River Basin development, Corps of Engineers.

	Lost Creek 1/ Dam and Reservoir	Elk Creek 1/ Dam and Reservoir	Applegate Dam and Reservoir
Dam Location 2/	Rogue River S25 & 26, T33S, R1E,	Elk Creek S20, T33S, R1E	Applegate R. S36, T40S, R4W
Dam Height (Ft. above stream)	350	215	222
Pool Elevation, m.s.l.			
Max. pool (ft.)	1,915	1,760	1,996
Norm. min. pool (ft.)	1,878	1,718	1,908
Min. pool (ft.)	1,776	1,624	1,874
Storage, Acre Feet			
Usable	315,000	95,000	65,000
Dead	150,000	6,000	7,000
Total	465,000	101,000	72,000
Surface Area, Acres			
Max. Pool	3,100	1,275	945
Normal Min. Pool	2,470	520	420
Extreme Min. Pool	1,570	205	228
Power Generating Installation, K.W.	52,000	---	---

1/ Lost Creek and Elk Creek Reservoirs would be operated as an integral unit to provide storage for flood control, irrigation, municipal water supply, and fish life.

2/ Willamette Meridian

Engineering Data

Lost Creek damsite is on Rogue River about 3 miles upstream from the mouth of Big Butte Creek. Height of the earth, rock, and gravel-fill dam would be 350 feet above streambed. Elk Creek damsite is on Elk Creek about 3 miles upstream from the creek's mouth. Elk Creek Dam would be an earth-and rock-fill structure 215 feet in height above the streambed.

Lost Creek and Elk Creek Reservoirs would be operated as an integral unit to provide storage for flood control, irrigation, municipal water supply, fish life and water quality control. Total usable storage space would be 410,000 acre-feet. A power generating installation of about 52,000 kilowatts would be an additional feature of Lost Creek Dam and Reservoir.

During the winter season of years of normal flood potential, Lost Creek pool level would be at an elevation not exceeding 1,878 feet (about 37 feet below full pool). This would provide 105,000 acre-feet of flood-control storage space from November 15 to January 31. Pool elevation would be reduced to 1,853 feet to provide 165,000 acre-feet of flood-control storage space in years of high flood potential.

Filling of Lost Creek Reservoir above elevation 1,878 would be accomplished gradually during the period February 1 to March 1. Minimum releases during the filling season would not be less than 700 second-feet,

89588 O-62—15

or whatever amount would be necessary to insure satisfaction of existing downstream water rights Evacuation of remaining storage space necessary for flood control would begin in September and would be accomplished gradually by November 15.

Elk Creek Reservoir during the winter season of years of normal flood potential, would be held at elevation 1,718 feet (about 42 feet below full pool) from November 15 to January 31 to provide 45,000 acre-feet of flood-control storage. Pool level would be lowered to elevation 1,699 feet during years of high flood potential to provide 60,000 acre-feet of flood-control storage.

Elk Creek Reservoir would be filled gradually from about February 1 to May 1. Minimum releases during the filling period would be 25 second-feet, or natural flow, whichever would be least.

The two reservoirs would be operated jointly so that about 20,000 acre-feet of storage could be used to provide future municipal water supplies. Initial annual supply demands for this purpose would be satisfied from Lost Creek Reservoir.

Lost Creek and Elk Creek Reservoirs combined would furnish irrigation water for 34,410 acres of new land and supplemental water for 15,570 acres of land now receiving an inadequate supply. As with municipal water, the initial annual irrigation demands would be supplied from Lost Creek Reservoir. Consequently, Elk Creek Reservoir would remain at or near maximum level until late July in most years. Irrigation water

released from these two reservoirs would be diverted by a low diversion structure on Rogue River at the mouth of Elk Creek. This structure would be less than 10 feet in height above streambed, and would be designed so that releases from Elk Creek Reservoir could be passed into the irrigation canal without affecting temperature of Rogue River flows. The structure would also permit diversion of irrigation water released from Lost Creek Reservoir.

The main irrigation canal would have a total capacity of about 780 second-feet. In addition to existing irrigation distribution systems which would be utilized, about 57 miles of canals and 220 miles of laterals would be provided. Canals and laterals would normally carry water during the months of April through October. Bureau of Reclamation would develop the irrigation facilities.

In addition to the two reservoirs, provision would be made in project plans for bank-protection works along Rogue River at isolated areas where experience might show problems to exist after completion of the planned reservoirs.

The present plan of development for Lost Creek-Elk Creek project would include the following provisions for fish. These provisions were developed by Bureau of Sport Fisheries and Wildlife in cooperation with Oregon State Game Commission, and Fish Commission of Oregon and recommendations to cover these are included in the preceding Report of the Regional Director.

(1) Facilities at Elk Creek Dam for upstream and downstream passage of coho salmon and steelhead trout.

(2) Production facilities for salmon and trout.

(3) Multiple-level outlets at Lost Creek Dam to permit temperature control of flow releases. Flow releases and temperature of these releases would be as follows:

Dates			Minimum Flow Releases (c.f.s.)	Maximum Water Temperature of Releases (Degrees F.)
May 1	-	May 15	1,000	52
May 16	-	May 31	1,300	52
June 1	-	June 10	1,500	52
June 11	-	June 30	1,800	45
July 1	-	August 20	2,000	45
August 21	-	September 7	1,500	52
September 8	-	January 31	1,000	52
February 1	-	April 30	700	52

Studies show that the flow criteria could have been met in all but three extremely low-water years of a period such as that which occurred from 1929 through 1959. Even in the most critical years, such as 1931, expected only once in about 50 years, a considerable improvement in low water flows could have been provided. Temperature criteria for releases could have been satisfied in all years studied. These predictions are based on the assumption that irrigation, water supply, and fish or fishing uses or functions would share equally in water shortages occuring during critical water years. Thus the maximum shortage during a year comparable to 1931 would be about 35 percent, 7 percent shortage in a year comparable to 1930, and 5 percent shortage in a year comparable to 1934.

It should be noted that flows released for water supply purposes would be at the same temperature as flows released for fish conservation and would remain in the stream until diverted at the point of use. It is assumed that all water supply flows would remain in Rogue River from Lost Creek Dam to Bybee Bridge and that about 50 percent would remain in the stream from Bybee Bridge to Grants Pass.

(4) Multiple-level outlets at Elk Creek Dam to assist in moving downstream migrant fish as well as permitting temperature control of water releases so that the constant 25-second-foot release of water for fish would not exceed 60°F. except for short periods during late summer in dry years. Temperature of water releases, however, would not exceed the natural temperatures of water in lower Elk Creek.

(5) Screening to prevent diversion of fish from Elk Creek or Rogue River into the irrigation system is proposed by Bureau of Reclamation.

Fish

Without the Project. The Rogue River drainage in Lost Creek and Elk Creek Reservoir sites supports populations of spring chinook salmon, coho salmon, and steelhead trout. In addition, cutthroat and resident rainbow trout are present. A few nongame fish, such as suckers, dace, and cottids occur both in Elk Creek and in Rogue River upstream from Lost Creek damsite.

Spring chinook salmon spawn predominantly in the mainstem Rogue River and Big Butte Creek, and of the entire Rogue River basin population, about

8 percent use the area above Lost Creek damsite. The spring chinook salmon spawning population upstream from Lost Creek damsite is estimated at about 1,500 fish. A few spring chinook salmon enter Elk Creek annually, and nearly all spawning occurs in the lower 1 to 2 miles of the creek. Approximately 3,600 coho salmon enter Elk Creek annually and spawn above Elk Creek damsite. These comprise more than one-third of the entire spawning population of coho salmon in Rogue River basin. Only a small number spawn above Lost Creek damsite. Spring chinook salmon support an annual sport fishery of approximately 200 angler-days in the area upstream from Lost Creek damsite. Coho salmon do not inhabit Lost Creek upstream from Lost Creek damsite. Elk Creek is closed to salmon fishing.

Approximately 500 steelhead trout spawn in tributaries upstream from Lost Creek damsite, and about 2,600 spawn in Elk Creek annually. Little steelhead trout spawning occurs in mainstem Rogue River. Steelhead trout are not present in Elk Creek during the open-angling season. The sport fishery for steelhead in the area upstream from Lost Creek damsite amounts to about 1,800 angler-days of use annually. Salmon and steelhead trout reared in the stream sections above the damsites contribute to large and important sport and commercial fisheries in the Rogue River basin and Pacific Ocean.

Both Lost Creek and Elk Creek project areas are stocked with rainbow trout by Oregon State Game Commission. In the Rogue River basin above Lost Creek damsite, between 50,000 and 60,000 rainbow trout are stocked

annually. In Elk Creek about 1,200 legally catchable rainbow trout were planted in 1959. These planted fish, along with resident rainbow and cutthroat trout, provide good sport fisheries in the project areas. Trout angling within Lost Creek Reservoir site totals about 350 angler-days of use annually. Within Elk Creek Reservoir site trout angling totals about 100 angler-days of use annually.

Rogue River downstream from Lost Creek damsite to the proposed diversion structure near the mouth of Elk Creek also provides good spawning habitat for spring chinook salmon. In addition, some spawning habitat for coho salmon, and steelhead trout is available. A substantial sport fishery for salmon and trout occurs in the stream section. It is estimated that about 3,200 angler-days are expended annually for salmon and steelhead trout in this stream section. About 6,000 angler-days are expended here annually for steelhead and other trout.

With the Project. Fish resources would be adversely affected by construction of Lost Creek-Elk Creek developments. Lost Creek Dam would block the upstream migration of about 1,500 spring chinook salmon, and about 500 steelhead trout. Only a few coho salmon would be affected. Seven miles of Rogue River are located within the Lost Creek Reservoir site. The reservoir would destroy the major portion of the spawning areas used by spring chinook salmon upstream from the damsite. The dam would block access of steelhead trout to upstream spawning areas. In addition, an important stream fishery for salmon and trout in this section of Rogue River would be lost.

Elk Creek Dam would affect upstream movement of virtually all of the coho salmon and steelhead trout using Elk Creek. The reservoir would destroy the stream habitat in about six miles of Elk Creek and the lower portions of several tributaries. Spawning area used by about 3,000 coho salmon and 450 steelhead trout would be lost. However, some important habitat would still be available above Elk Creek Reservoir to accommodate coho salmon and steelhead trout. Fish-passage facilities would be provided by the project so that these fish can use this available spawning habitat. To mitigate the loss of coho salmon and steelhead trout spawning habitat within the reservoir site fish production facilities would be provided by the project. Resident trout populations in the headwater areas upstream from the reservoir would be relatively unaffected by the project.

The provision of multiple level outlets at Elk Creek Dam would allow downstream migrant coho salmon and steelhead trout access to Rogue River. In addition the multiple level outlet structure would provide some temperature control of water releases to downstream areas. Because of the short distance from Elk Creek Dam to the diversion structure it is expected that altered flows in this reach would have little effect on the small numbers of chinook salmon using the area. To prevent any possibility of damage, however, a minimum flow of 25 second-feet of water is proposed with the project.

Lost Creek Reservoir would be relatively stable during most of the summer and would provide a good reservoir trout fishery. Game fish

expected to inhabit Lost Creek Reservoir are resident rainbow and cutthroat trout. Nongame fish such as suckers would also populate the impoundment. Because of its proximity to Grants Pass and Medford, and because of expected heavy use by tourists, the reservoir would probably provide about 144,000 angler-days of use annually, valued at $216,000.

The large annual drawdown of Elk Creek Reservoir for irrigation and flood control combined with the steep shoreline topography and predicted high temperatures of reservoir water would inhibit development of a good trout fishery. With the project, Elk Creek Reservoir is expected to provide about 30,000 angler-days of use annually, valued at $35,000.

Since Lost Creek Dam would prevent access of anadromous fish to upstream spawning areas, these fish would be concentrated in the remaining downstream areas, resulting in decreased spawning efficiency. Increased flows of good quality water downstream from the project at the onset of the spawning season would produce sufficient new spawning habitat to overcome the above-mentioned loss and in addition would increase spawning habitat for spring chinook salmon in downstream areas. Increased flows of cooler water from Lost Creek Reservoir during the summer months would improve rearing conditions in mainstem Rogue River as far downstream as Marial, a distance of about 110 miles. With the project, benefits to sport and commercial fisheries resulting from increased spring chinook salmon spawning habitat, controlling losses due to disease, and improving rearing habitat for coho salmon and steelhead trout would be about $257,000 annually for the commercial fishery, and $363,000 annually for the sport fishery.

Wildlife

Without the Project. Black-tailed deer frequent the bottom lands and hillsides adjacent to Lost Creek Reservoir site. Only a few black bears utilize this area. Big-game harvest is considered minor in Lost Creek Reservoir site. Much of the area is not open to hunting. Elk Creek Reservoir site supports black-tailed deer and a few black bears. Big-game harvest and hunter utilization is of little significance.

Upland-game species occurring in Lost Creek Reservoir site are California and mountain quails, blue grouse, and mourning doves. A few brush rabbits are present also. It is estimated that average upland-game hunter utilization expected throughout the life of the project probably would amount to about 75 man-days annually. In general, the same upland-game species occur in Elk Creek Reservoir site and harvest is slight. Both Lost Creek and Elk Creek Reservoir areas support populations of beavers, minks, muskrats, raccoons, and skunks. Only a few fur animals are taken in either reservoir site, due to currently low pelt values.

Few waterfowl utilize either reservoir site, and only a small amount of nesting by wood ducks and mallards occurs. Waterfowl harvest is negligible.

The proposed irrigation area which would be served by both Lost Creek and Elk Creek Reservoirs and comprising 49,980 acres is utilized by moderate numbers of black-tailed deer and a few black bears. Average

use by big-game hunters in this area expected without the project is estimated at 700 man-days annually. Close proximity of urban areas tends to limit this type of hunting.

The irrigation area supports populations of ring-necked pheasants, California and mountain quails, band-tailed pigeons, mourning doves, western gray squirrels, and brush rabbits. Presently irrigated portions of the proposed irrigation area sustain the largest amount of upland-game hunting, although some hunting for quails and brush rabbits occurs on the nonirrigated tracts. Average annual upland-game hunter use expected without the project is estimated at 10,800 man-days.

Fur animals in the area include a few beavers, minks, muskrats, raccoons, and skunks. Fur-animal harvest is somewhat restricted due to currently low pelt values, and its estimated value is about $4,000 annually.

Waterfowl use of the irrigation area occurs predominantly in the fall months by mallards, green-winged and cinnamon teals, wood ducks and American widgeons. Some nesting occurs along existing canals and ditches. Average annual hunter use without the project is estimated at 3,700 man-days.

With the Project. Lost Creek and Elk Creek Reservoirs would inundate habitat utilized by big game and upland game. The impoundments would adversely affect fur animals, since reservoir fluctuations would discourage use by muskrats and beavers. A few minks and raccoons would, however, still inhabit the area. Although nesting habitat for wood

ducks and mallard would be destroyed by Lost Creek and Elk Creek Reservoirs, these impoundments would provide resting area for waterfowl and a small amount of duck hunting would occur.

In general, wildlife resources with the project would derive considerable benefit from irrigation of 34,410 acres of land presently non-irrigated. Little change in wildlife is anticipated in the 15,570 acres of land to receive a supplemental supply of irrigation water. There would be little change in big-game harvest with the project on the irrigation area. It is possible that drowning losses would occur to black-tailed deer in project canals, particularly if concrete-lined sections of the larger canals exceed one-quarter mile in length. Extension of irrigation areas may cause increases in crop depredations by deer. Hunting for big game is expected to show little change with the project.

Since about 4,500 acres of land now supporting brush and trees would produce pasture and hay with the project, it is expected that upland game would be benefited considerably. Increases in ring-necked pheasant, California quail, mourning dove, and brush rabbit populations are anticipated. Upland game hunter use with the project is estimated to average about 17,000 man-days annually. This would produce an annual benefit of $18,600.

Fur animals would be benefited with the project. Annual benefits would amount to about $1,600. Some increase in waterfowl nesting and fall populations is anticipated in the irrigation area. Project canals and

laterals would provide some nesting habitat for mallards and teals. Irrigated lands would be attractive to fall migrant ducks. Average annual waterfowl hunter use with the project is expected to amount to about 5,000 man-days. Annual benefits to this resource would amount to $5,200.

Engineering Data

Applegate damsite is on Applegate River near the village of Copper, Oregon about 12.5 miles upstream from the mouth of the Little Applegate River. The reservoir would extend into the State of California. Height of the earth and gravel fill dam would be about 222 feet above stream level. The reservoir would be operated to provide storage for flood control, irrigation, recreation, fish life, and water quality control.

The reservoir level would be maintained at not more than elevation 1,908 feet from about November 15 to January 31. This would provide 55,000 acre-feet of storage space for flood control. Storage of floodwaters would be initiated 6 hours in advance of predicted flood stages at the town of Applegate. Stored flood water would be evacuated immediately following each flood in order to control any subsequent flood peak.

A total of 30,000 acre-feet of storage would be provided in Applegate Reservoir to maintain minimum flows for fish. Temperature of water releases would be regulated by use of multiple outlet facilities and would not exceed 60°F. Even in low-water years, releases would provide not less than the following minimum flows for fish:

(1) A minimum release of 50 second-feet to provide a flow of that amount from the Applegate damsite to the mouth of the Little Applegate River.

(2) At least the following flows, from mouth of Little Applegate River to the mouth of Applegate River:

(a)	January 1 -	February 28	120 second-feet
(b)	March 1 -	June 30	100 second-feet
(c)	July 1 -	October 31	120 second-feet
(d)	November 1 -	December 31	Natural flow, as regulated for flood control

Reservoir drawdown would occur after June 1 as necessary to provide the above listed flows plus added flows required for irrigation. The reservoir would be emptied by November 15 to provide storage space for control of floods. In years of extremely low runoff, an additional 10,000 acre-feet of stored water would be withdrawn as needed to supplement late season natural flows in the interest of fish life. Permanent facilities would be provided by the project to handle passage of upstream and downstream migrant fish.

Applegate Reservoir would provide irrigation water in Applegate Valley for about 5,000 acres of land presently unirrigated and supplemental water for about 9,400 acres of land now having an inadequate supply. Because of the nature of lands to be served, it is anticipated that several intakes and canals would be required. Diversion demands for irrigation storage from April through October would vary from 211 second-feet in June to 28 second-feet in October. These diversions would come in part from natural flows in excess of minimum requirements for fish. The balance would come from storage in Applegate Reservoir.

Presently there are 102 miles of canals and 63 miles of laterals serving irrigated lands in the proposed project area. With the project there would be an additional 38 miles of canals and 50 miles of laterals. Canal intakes would be screened to prevent diversion of fish from the stream into the canals. Irrigation features would be developed by Bureau of Reclamation.

Fish

Without the Project. Applegate River and its tributaries support populations of coho and fall chinook salmon, and steelhead trout. Resident rainbow and cutthroat trout are also present in the drainage. Nongame fish include suckers and cottids (figures 4 and 5).

Aquatic habitat is seriously affected by water diversions from Applegate River. Low flows resulting because of diversions for irrigation and other purposes are subject to warming which is harmful to fish (figures 6 and 7).

Fall chinook salmon spawn predominantly in mainstem Applegate River from its mouth to Williams Creek. At present this area, including Slate Creek and other tributaries, accommodates a spawning population of nearly 15,000 fall chinook salmon. Applegate River is closed to all salmon angling.

Because of the magnitude of winter flows in mainstem Applegate River, most coho salmon spawning occurs in tributaries downstream from Applegate damsite. These tributary streams support a population of about

Figure 4. Chinook salmon spawn in lower Applegate River but usually do not enter the stream until after the fall rains begin.

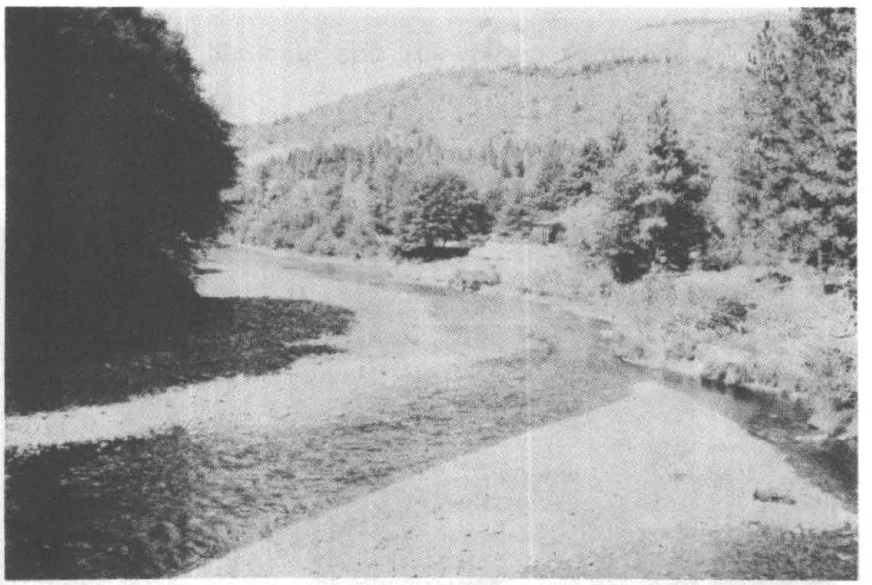


Figure 5. Applegate River provides good spawning habitat for coho salmon and steelhead trout. Sustained flow releases from proposed Applegate Reservoir would improve habitat for fish in downstream areas.

89588 O-62 16

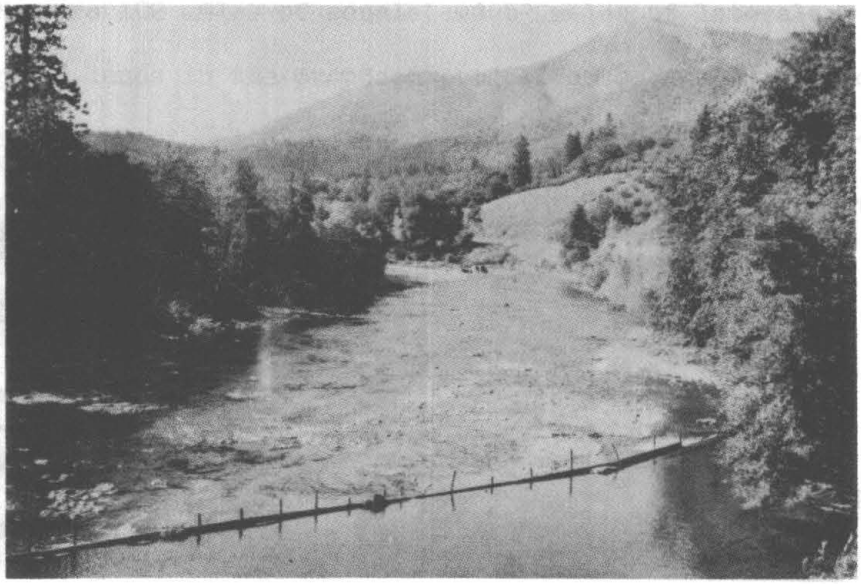


Figure 6. Aquatic habitat is seriously affected by diversions from Applegate River. This reach, downstream from Applegate damsite is occasionally dewatered.

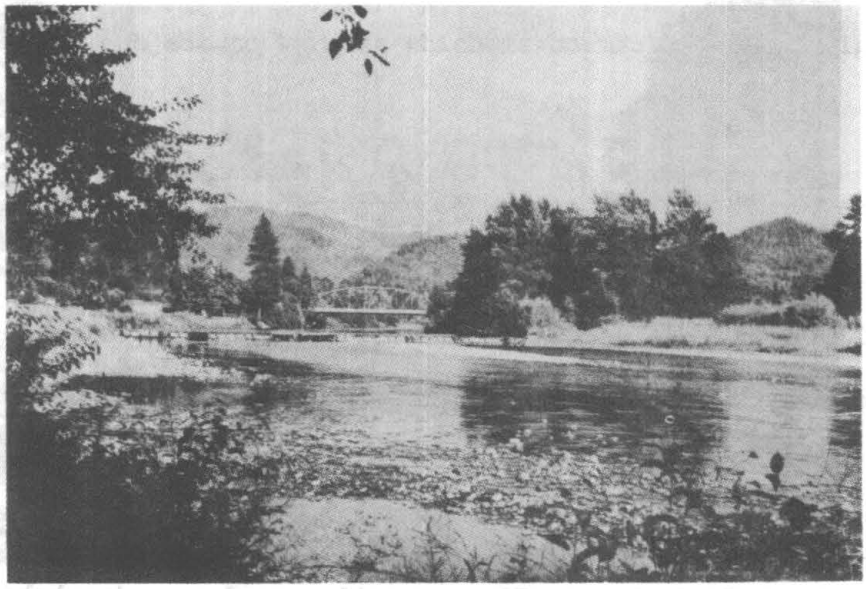


Figure 7. Irrigation depletions from lower Applegate River at the Murphy diversion dam result in low streamflow, shallow water, and high water temperatures that create at times a barrier to anadromous fish.

5,000 coho salmon. About 500 coho salmon spawn in Applegate Reservoir site but none spawn upstream from that point.

It is estimated that about 10,000 steelhead trout use Applegate River and tributaries for spawning purposes. A spawning population of about 2,000 steelhead trout use mainstem Applegate and its major tributaries upstream from the damsite. Winter angling for steelhead occurs in main Applegate River, exclusive of tributaries below mouth of Little Applegate River. Creel census data indicate that about 500 steelhead are caught annually. This provides approximately 3,500 angler-days of use.

About 10,000 legal sized rainbow trout are planted annually in the project area by Oregon State Game Commission. These planted fish, along with resident rainbow and cutthroat trout, provide a good sport fishery. Because of irrigation demands and low water flows, angling centers in headwater areas upstream from Little Applegate River. Major fishing pressure occurs in the spring and creel censuses show an annual fishery effort of about 13,100 angler-days.

With the Project. Applegate Dam would affect migration of about 2,000 steelhead trout which normally spawn in mainstem Applegate River and tributaries upstream from the damsite. Considerable habitat would remain accessible to fish above the reservoir through provision of fish-passage facilities proposed for this project. The reservoir would destroy present habitat in nearly 5 miles of Applegate River and the lower reaches of Squaw and Carberry Creeks which are utilized for spawning by resident and anadromous fish.

Applegate Reservoir, with its good tributary streams and favorable water temperatures, would provide favorable habitat for resident trout. Because of expected heavy fishing pressure, a trout stocking program would be necessary to maintain the fishery. With adequate stocking it is estimated that average angler use for the reservoir would amount to about 73,300 angler-days annually throughout the life of the project. This would provide an average annual benefit of $110,000 assignable to the reservoir fishery.

Controlled flows in mainstem Applegate River between the damsite and the mouth of Little Applegate River would provide additional salmon spawning habitat. This benefit would offset, only to a minor degree, losses which the project, without planned mitigative measures, would cause to fish and wildlife. Increased summer flows of good quality water would provide better rearing conditions for salmon and steelhead trout, resulting in increased production. Cool water releases from the reservoir would improve habitat for resident trout downstream from the dam for a distance of about 47 miles. Benefits to fish resulting from these features are estimated at $222,000 annually for the sport fishery and $13,000 annually for the commercial fishery.

Wildlife

Without the Project. Black-tailed deer and black bears use the Applegate Reservoir site. Big-game harvest in the reservoir area is minor. Upland game using the area are California and mountain quails, blue and ruffed grouse, band-tailed pigeons, and mourning doves. Fur animals include beavers, minks, muskrats, raccoons, skunks, and weasels. In addition, a

few ringtails utilize the area. Waterfowl use is minor; a few mallards, wood ducks, and American mergansers nest along streams in the reservoir site.

The proposed 14,400-acre irrigation area supports a good population of black-tailed deer. Without the project, hunting use for big game is estimated to be 580 man-days annually in the irrigation area.

Only a few ring-necked pheasants, mountain quails, ruffed grouse, western gray squirrels, and brush rabbits utilize the proposed irrigation area. California quails are abundant and band-tailed pigeon populations are of moderate density during the fall migration period. Upland-game hunting without the project is estimated to be 300 man-days annually.

Beavers, minks, muskrats, skunks, and raccoons are present in the area but harvest is comparatively minor due to present low market values for fur animals. Mallards, wood ducks, and American mergansers nest in the area. Waterfowl harvest is minor.

With the Project. Applegate Reservoir would destroy habitat used by big game, upland game, and fur animals. Some fur-animal use would occur in the reservoir, but numbers of fur animals would be smaller than that which presently occur in the reservoir site. Nesting habitat for mallards, wood ducks, and mergansers would be destroyed by Applegate Reservoir. However, the impoundment would provide resting area for waterfowl. Little increase in waterfowl hunting in the reservoir site is anticipated with the project.

Wildlife resources in the irrigation area would derive some benefit from irrigation of 5,000 acres of land presently nonirrigated. Little

change for wildlife is expected in the 9,400 acres of land to receive a supplemental irrigation water supply.

There would be little change in the amount of big-game hunting in the irrigation area with the project. It is likely that drowning losses would occur to black-tailed deer in project canals, particularly if there are concrete-lined sections exceeding one-quarter mile in length. Extension of irrigation areas may cause increases in crop depredations by deer.

It appears that 1,250 acres of land now supporting brush and trees would produce pasture and hay with the project. This change in land use would provide improved upland-game habitat which would result in increased populations of ring-necked pheasants, California quails, and mourning doves. Reduction in grain crops would partially offset this, however. With the project, man-days of upland-game hunting is estimated at about 875 man-days annually. This represents only a minor benefit to this group.

Fur animals in the irrigation area would be only slightly benefited with the project. Project canals and laterals which would carry water from April through October would provide some waterfowl nesting habitat. Irrigated lands would receive increased use by fall migrant ducks. Annual waterfowl hunter use would show a slight gain over conditions without the project. However, hunter use would still be at a low level.

FISH AND WILDLIFE DISCUSSION

Certain aspects of the three proposed dams and reservoirs discussed in this report require that specific stipulations be included in any document presented to Congress for project authorization to assure that benefits discussed herein can be realized. Total annual benefits accruing to sport and commercial fisheries as a result of planned flow releases and facilities proposed for Lost Creek, Elk Creek, and Applegate Dams and Reservoirs are estimated at $270,000 for commercial fisheries and $946,000 for sport fisheries. Estimated annual wildlife benefits would total about $25,000 as a result of improvement of wildlife habitat, particularly for upland-game birds and waterfowl. These wildlife benefits would be assignable in part to development of irrigation storage as provided by the Corps of Engineers and in part to development of the irrigation system as proposed by the Bureau of Reclamation. Fish and wildlife benefits are based on an assumed economic life of 100 years for the project.

Evaluation of fish and wildlife resources discussed in this report is based upon dam and reservoir data contained in "Potential Rogue River Basin Projects, Project Data Sheets for consideration Prior to Public Hearing" dated August 23, 1961. This is a publication of the Portland District, Corps of Engineers. Any alteration in these data would alter mitigation measures and fish and wildlife benefits discussed in this report. This is particularly true in the case of damsite locations

which we recommend not be farther downstream than those indicated in the above discussed data sheets.

Project costs allocated to fish and wildlife enhancement should be Federal costs and should be nonreimbursable.

Fishery benefits based on flow releases would accrue only if proposed water releases are set aside specifically for fish and if flows resulting from these releases can be guaranteed from the project dams to the mouth of Rogue River. In addition, the requested water temperature requirements must be provided as contained in proposed project plans in order that annual benefits of $585,000 to sport fisheries and $270,000 to commercial fisheries can be realized with the project. All changes in water releases as prescribed by the schedule established by Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife should be made gradually and over an extended period of time. This is necessary to prevent stranding of fish due to changing water levels and to prevent adverse influences on spawning fish and their progeny

Facilities have been proposed for insuring movement of fish past Elk Creek and Applegate Dams. Design of such facilities should meet established design criteria of Oregon State Game Commission, Fish Commission of Oregon, Bureau of Sport Fisheries and Wildlife, and California Department of Fish and Game where appropriate.

Mitigation of losses to coho and chinook salmon and steelhead trout caused by destruction of spawning habitat in Lost Creek, Elk Creek, and Applegate Reservoirs, losses associated with handling and delays at the passage facility, and loss of downstream migrants in the reservoir would require construction of fish production facilities or enlargement of present nearby State facilities. Hatchery facilities are proposed by the Corps of Engineers; however, location and specific requirements for production facilities would have to be determined jointly by Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife.

Benefits totaling $361,000 for reservoir trout fisheries in Lost Creek, Elk Creek, and Applegate Reservoirs are dependent upon provision of sufficient numbers of resident trout to maintain the anticipated fishing pressure. Therefore, the project should provide funds for fish production facilities to support the necessary stocking program. Location and size of the facilities would be determined cooperatively by Bureau of Sport Fisheries and Wildlife, Oregon State Game Commission, and where appropriate by California Department of Fish and Game.

Estimated cost of fish passage and fish production facilities for Lost Creek, Elk Creek, and Applegate Dams and Reservoirs is $4,400,000. Estimated annual cost of operation and maintenance is $220,000.

Screening of all proposed irrigation diversion intakes is planned by the U.S. Bureau of Reclamation to prevent resident trout and downstream migrant anadromous fish from entering the irrigation systems. Such

screening would be an absolute requirement if the resource is to be adequately protected. A fishway would be required at the diversion dam to facilitate passage of fish into upstream areas. The screens should be of the self-cleaning type and they and the fishway should meet established design criteria of Oregon State Game Commission, Fish Commission of Oregon, and Bureau of Sport Fisheries and Wildlife.

Angling, fish populations, and fish habitat in Rogue River, Elk Creek, and Applegate River downstream from project dams could be adversely affected unless construction operations were accomplished in a manner that would minimize siltation of the streambed and muddying of basin streams.

A problem of possible concern to wildlife resources would be deer drowning losses in project canals. Project information available at this time does not specify the extent of concrete-lined canal sections for Lost Creek-Elk Creek and Applegate projects. If, however, there are lined canal sections of at least one-quarter mile in length, and canals have flow velocities exceeding 3 feet per second and/or water depths exceeding 18 inches, losses could be expected to occur to both adult and young deer which enter the canal systems. Losses could also occur in any unscreened canal siphons. Devices would be needed to either prevent the animals from entering the canals or enable those trapped in the canals to escape with as little injury as possible. These devices could consist of bridges, escape ramps, fences, dirt-lined sections or other protective devices. Designs and locations of these deer protective facilities should meet established criteria

determined by Oregon State Game Commission, California Department of Fish and Game, and Bureau of Sport Fisheries and Wildlife. Actual costs of protective structures would depend upon criteria ultimately prescribed by the aforementioned agencies. Tentative appraisal of the devices needed to prevent big game losses in canals can be provided when studies have progressed sufficiently to indicate extent of lined canals, and canal capacities.

A zoning plan would be necessary for Lost Creek, Elk Creek, and Applegate Reservoirs to insure that certain sections or periods of time would be available for fishing and hunting and for other fish and wildlife uses without undue interference from general recreational activities.

APPENDED MATERIALS

Letters of the State Conservation Agencies

STATE OF OREGON
OREGON STATE GAME COMMISSION
1634 S. W. ALDER STREET
P. O. BOX 4136
PORTLAND 8, OREGON

October 24, 1961

Regional Supervisor
U. S. Fish and Wildlife Service
Bureau of Sport Fisheries and Wildlife
P. O. Box 3737
Portland 8, Oregon

Dear Sir:

We have reviewed your draft of A Detailed Report on the Fish and Wildlife Resources Affected by Corps of Engineers Proposed Development of Rogue River Basin, Oregon-California and are in general agreement with the principle provisions and recommendations of this report. It must be understood that our concurrence with your report does not constitute a delegation of responsibilities for the management of the resources under the jurisdiction of the State of Oregon.

This department, along with other state and federal agencies concerned with the proposed development, has completed a comprehensive temperature and flow study of the Rogue River Basin. Based upon the findings of that study, our commission, in concert with the Fish Commission of Oregon, concluded that to preserve and benefit the fish and wildlife resources of the basin and protect their values, the recommendations listed in the following subparagraphs must be included in the proposed project. Failure to accomplish any of these could mitigate the possibility of benefits and greatly harm the existing values. While your report makes similar recommendations, this matter is of vital importance to the State of Oregon, consequently, we are repeating our position as a matter of emphasis.

1. Fish mortalities due to disease probably can be reduced if water temperatures in the lower river canyons do not exceed the following average maximums:

Period	Maximum water temperatures (°F)
May 1 - 31	62
June 1 - 30	66
July 1 - Aug. 20	68
Aug. 21 - Sept. 30	62
Oct. 1 - April 30	56

Flow-temperature analyses indicate it is possible to attain this degree of water quality from regulated releases at the proposed Lost Creek Reservoir at temperatures and in quantities as follows:

Period	Minimum release volume (c.f.s.)	Maximum temperature of release (°F.)
May 1 - 15	1,000	52
May 16 - 31	1,300	52
June 1 - 10	1,500	52
June 11 - 30	1,800	45
July 1 - Aug. 20	2,000	45
Aug. 21 - Sept. 7	1,500	52
Sept. 8 - Jan. 31	1,000	52
Feb. 1 - April 30	700	52

By way of explanation, the transition in flow from 2,000 to 1,000 c.f.s. and in temperature from 45° to not more than 52° F. during the approximate period of August 21 through September 7 would have to be gradual. Actual period dates would depend upon seasonal conditions and the rate of maturation of spring chinook salmon. Frequently the necessary transitions would have to be completed no later than September 1. Flow-temperature manipulations at any time should be accomplished smoothly over a period of not less than 96 hours.

2. To meet basic fishery needs in connection with the project on Elk Creek, flow releases never less than 25 c.f.s. or more than 60° F. in temperature are required.

3. Flow releases at Applegate Dam need to be controlled so as to furnish water of a temperature never greater than 60° F. in the following quantities at the specified times of year:

Period	Minimum flow volume (c.f.s.)	Stream section
Jan. 1 - Oct. 31	50	Applegate damsite to mouth of Little Applegate River
Jan. 1 - Feb. 28	120	Mouth of Little Applegate to mouth of Applegate River
March 1 - June 30	100	"
July 1 - Oct. 31	120	"
Nov. 1 - Dec. 31	Natural flow with regulation flexibility for flood control	Applegate damsite to mouth of Applegate River

4. It is imperative that all water assigned to sustain or enhance fish production be guaranteed against future appropriations for other purposes. The language of the federal authorization act must be specific in this regard as well as preserve the full authority of the State of Oregon to guarantee the perpetual use of this water for the purposes assigned. Without such assurances there can be no assignment of fishery values to the projects. Failure to expressly provide at the outset for this continued assurance through appropriate state and federal legislation will require our commission to assume a position of vigorous opposition to the proposals.

5. The proposed damsites must not be located farther downstream than now planned. These locations are on the Rogue River, about three miles above the mouth of Big Butte Creek; on Elk Creek about three miles upstream from its mouth; and on the Applegate River, about twelve and one half miles upstream from the confluence of the Little Applegate River.

6. Further water use allocations must not be made so as to retain the maximum possible benefits to authorized purposes during the periods of adversity when storage shortages occur.

7. In years of short water supply all authorized water uses must share the available water in the same proportion they would share the total authorized storage.

8. Project construction and operation must be planned so as to guarantee against future changes which would adversely alter the quality of water set aside to sustain fish production. To illustrate, it appears possible that irrigation diversions presently planned for Elk Creek could be relocated to another point on the main stem of the Rogue River. If warm Elk Creek water were permitted to flow into the Rogue River before diversion, it would raise water temperatures above the critical maximums set to provide fishery benefits.

9. Flow release schedules for anadromous fish at each project must be sufficiently flexible to meet special requirements for successful holding, spawning, egg incubation, rearing, and passage as future needs develop.

10. Provision must be made for the cost of the full-time services of a qualified biologist to collect and correlate pertinent biological and hydrological data. Production success will depend on being able to accurately assess seasonal and annual variations in fish activity and optimum flow schedules.

11. Satisfactory fish passage facilities must be provided at the Elk Creek and Applegate Dams to make accessible the substantial amounts of fish production habitat upstream from each structure.

12. Adequate propagational facilities must be provided to compensate for the loss of anadromous fish sustained as a result of the construction of each dam.

13. All water diversions must be equipped with adequate screens, crossings, coverings, escape ramps, fences, and other protective devices as are determined to be necessary by the responsible management agencies to prevent losses to fish and wildlife.

14. Construction activities must be accomplished in a manner which will reduce the probability of fish and wildlife losses. Constant and diligent care will be necessary to minimize siltation, prevent fish handling losses at project sites, and avoid damage to the spawning beds and other habitat outside of the immediate construction area.

15. When scheduling the construction of these projects, we recommend and urge that the Lost Creek and Applegate Dams be undertaken simultaneously, and if there is any part to be delayed, the Elk Creek Dam be the last to be constructed.

We appreciate this opportunity to review your report and to submit these comments upon it.

Sincerely yours,

P. W. Schneider
Director

cc: Fish Commission of Oregon
U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, Portland District Office, River Basin Studies

89588 O-62—17

STATE OF OREGON
FISH COMMISSION OF OREGON
307 STATE OFFICE BLDG., 1400 S. W. 5TH AVENUE
PORTLAND 1

October 11, 1961

Mr. Ralph A. Imler, Acting Regional Supervisor
River Basin Studies
Bureau of Sport Fisheries and Wildlife
U. S. Fish and Wildlife Service
P.O. Box 3737
Portland 8, Oregon

Dear Mr. Imler:

We are in general agreement with the draft report "Corps of Engineers Proposed Developments of Rogue River Basin, Oregon-California" transmitted with your letter dated September 8, 1961. Our position in this matter is expressed in the statement "Rogue River Basin Water Development" prepared jointly with the Oregon State Game Commission and presented to the U. S. Army Corps of Engineers at a public hearing in Grants Pass, Oregon on September 25, 1961. Recommendations on preservation or enhancement of Rogue River fish production are reiterated herein to emphasize the need for complete recognition of major fishery problems by all interests involved in development of the proposed Lost Creek, Elk Creek, and Applegate River projects. We believe that failure to give adequate attention to any one of the recommendations, as outlined below, can quickly reduce or obviate all other efforts to sustain or benefit affected fishery resources:

1. Fish mortalities due to disease probably can be reduced if water temperatures in the lower canyon do not exceed the following average maximums:

Period	Maximum water temperatures (°F.)
May 1 - 31	62
June 1 - 30	66
July 1 - Aug. 20	68
Aug. 21 - Sept. 30	62
Oct. 1 - April 30	56

Flow-temperature analyses indicate it is possible to attain this degree of water quality from regulated releases at the proposed Lost Creek Reservoir at temperatures and in quantities as follows:

Period	Minimum Release volume (c.f.s.)	Maximum Temperature of release (°F.)
May 1 - 15	1,000	52
May 16 - 31	1,300	52
June 1 - 10	1,500	52
June 11 - 30	1,800	45

Period	Minimum release volume (c.f.s.)	Maximum Temperature of release (°F.)
July 1 - August 20	2,000	45
August 21 - Sept. 7	1,500	52
Sept. 8 - Jan. 31	1,000	52
Feb. 1 - April 30	700	52

By way of explanation, the transition in flow from 2,000 to 1,000 c.f.s. and in temperature from 45 to not more than 52° F. during the approximate period of August 21 through September 7 would have to be gradual. Actual period dates would depend upon seasonal conditions and the rate of maturation of spring chinook salmon. Frequently, the necessary transitions would have to be completed no later than September 1. Flow-temperature manipulations at any time should be accomplished smoothly over a period of not less than 96 hours.

To meet basic fishery needs in connection with the project on Elk Creek, flow releases never less than 25 c.f.s. or more than 60° F. in temperature are required.

Flow releases at Applegate Dam need to be controlled so as to furnish water of a temperature never greater than 60° F. in the following quantities at the specified times of year:

Period	Minimum flow volume (c.f.s.)	Stream section
Jan. 1 - Oct. 31	50	Applegate damsite to mouth of Little Applegate River
Jan. 1 - Feb. 28	120	Mouth of Little Applegate to mouth of Applegate River
March 1 - June 30	100	"
July 1 - Oct. 31	120	"
Nov. 1 - Dec. 31	Natural flow with regulation flexibility for flood control	Applegate damsite to mouth of Applegate River

2. It is imperative that all water assigned to sustain or enhance fish production be guaranteed against future appropriations for other purposes. The language of the federal authorization act must be specific in this regard as well as preserve the full authority of the State of Oregon to guarantee the perpetual use of this water for the purposes assigned. Without such assurances there can be no assignment of fishery values to the projects. Failure to expressly provide at the outset for this continued assurance through appropriate state and federal legislation will require our department to assume a position of vigorous opposition to the proposals.

3. That proposed damsites be located no farther downstream than now planned. These locations are on the Rogue River, about three miles above the mouth of Big Butte Creek; on Elk Creek, about three miles upstream from its mouth; and on the Applegate River, about twelve and one-half miles upstream from the confluence of the Little Applegate River.

4. That no further water-use allocations be made so as to retain the maximum possible benefits to authorized purposes during the periods of adversity when storage shortages occur.

5. That in years of short water supply all authorized water uses share the available water in the same proportion that they would share the total authorized storage.

6. That project construction and operation be planned so as to guarantee against future changes which would adversely alter the quality of water set aside to sustain fish production. To illustrate, it appears possible that irrigation diversions presently planned for Elk Creek could be relocated to another point on the main stem of the Rogue River. If warm Elk Creek water were permitted to flow into the Rogue River before diversion, it would raise water temperatures above the critical maximums set to provide fishery benefits.

7. That flow release schedules for anadromous fish at each project be sufficiently flexible to meet special requirements for successful holding, spawning, egg incubation, rearing, and passage as future needs develop.

8. That provision be made for the cost of the full-time services of a qualified biologist to collect and correlate pertinent biological and hydrological data. Production success will depend on being able to accurately assess seasonal and annual variations in fish activity and optimum flow schedules.

9. That satisfactory fish passage facilities be provided at the Elk Creek and Applegate Dams to make accessible the substantial amounts of fish production habitat upstream from each structure.

10. That adequate propagation facilities be provided to compensate for the loss of anadromous fish sustained as a result of the construction of each dam.

11. That all water diversions be equipped with adequate screens and other protective devices as are determined to be necessary by the responsible management agencies to prevent the loss of fish life.

12. That construction activities be accomplished in a manner which will reduce the probability of fish losses. Constant and diligent care will be necessary to minimize siltation, prevent fish handling losses at project sites, and avoid damage to the spawning beds and other habitat outside of the immediate construction area.

13. When scheduling the construction of these projects, we suggest the Lost Creek and Applegate Dams be undertaken simultaneously, and if there is any part to be delayed, the Elk Creek Dam be the last to be constructed.

We are appreciative of this opportunity to summarize our position in this extremely important matter.

Sincerely,

Robert W. Schoning

ROBERT W. SCHONING
STATE FISHERIES DIRECTOR

EDMUND G. BROWN
GOVERNOR

W. T. SHANNON
DIRECTOR

STATE OF CALIFORNIA
Department of Fish and Game
722 CAPITOL AVENUE
SACRAMENTO 14

October 2, 1961

Mr. Ralph H. Imler
Acting Regional Supervisor
River Basin Studies
U. S. Fish and Wildlife Service
P. O. Box 3737
Portland 8, California

Dear Mr. Imler:

Reference is made to your letter of September 8, 1961 requesting our comments on your report entitled "Corps of Engineers' Proposed Developments of Rogue River Basin, Oregon, California."

We have reviewed this report and concur with the findings therein.

We assume the reference to proposed facilities on Page 30, fourth paragraph, includes provisions to move both adult fish upstream and juvenile fish downstream past Applegate Dam.

Thank you for the opportunity to review this report.

Sincerely,

Deputy Director

cc: Region 1 (2)
Dan Slater

EDMUND G. BROWN
GOVERNOR

W. T. SHANNON
DIRECTOR

STATE OF CALIFORNIA
Department of Fish and Game
722 CAPITOL AVENUE
SACRAMENTO 14

October 9, 1961

Ralph H. Imler
Acting Regional Supervisor
River Basin Studies
United States Dept. of the Interior
Fish and Wildlife Service
1001 N. E. Lloyd Blvd.
Portland 8, Oregon

Dear Mr. Imler:

Reference is made to your letter of September 8, requesting this Department's comments on your proposed report on the Corps. of Engineers' Rogue River Basin development, Oregon and California.

This will supplement our letter of October 2, regarding the above cited project.

We have reviewed the report and have the following comments in regard to the Applegate River Project which includes roughly 100 square miles of the Applegate Drainage in California.

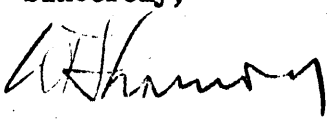
We concur with the recommendations made on Page 25 of your report which state, "considerable habitat would remain accessible to fish above the reservoir through provision of fish passage facilities proposed for this project". We also agree that the releases provided for fish life, as recommended in the report, will allow anadromous fishes passage upstream. If release temperatures of not more than 60 degrees Fahrenheit, as provided in a statement in the report, are maintained, it will provide suitable habitat for salmon and steelhead.

We also concur with the statements made on pages 28 and 32 referring to the possibility of the loss of deer in the canal system. Protective measures should be provided.

We anticipate that the loss of intermediate deer range would have some effect on the herd which winters in the Applegate drainage. A large portion of this herd spends the summer in California, and is hunted here

during the open season. The loss could be determined by further study. Steps should be taken to mitigate any loss, large or small, by developing adjacent deer range, chargeable to the project. This could conceivably alter the figure quoted on Page 29 ($18,000) regarding benefits to wildlife.

Sincerely,



Director

PLATES

LEGEND

- ▲ Active Primary Stream Gaging Stations
- □ Recording Thermograph Stations (Water)
- A□ Recording Thermograph Stations (Air & Water)
- ■ Hand Temperature Stations (Air & Water)

LOCATION MAP

COOS
DOUGLAS
CURRY
JOSEPHINE
JACKSON
KLAMATH
ILLINOIS
OCEAN
PACIFIC
OREGON
CALIFORNIA
BASIN BOUNDARY
ROGUE RIVER
APPLEGATE RIVER
CRATER LAKE NATIONAL PARK
CRATER LAKE
ELK CREEK DAMSITE
LOST CREEK DAMSITE
PROPOSED DIVERSION DAM
APPLEGATE DAMSITE
Agness
Marial
Galice
Robertson Bridge
Merlin
Grants Pass
Rogue River
Gold Hill
Wilderville
Selma
Kerby
Cave Junction
Takilma
Oregon Caves National Monument
Provolt
Applegate
Ruch
Williams
Copper
Trail
McLeod
Prospect
Eagle Point
Bybee Bridge
Medford
Ashland
Butte Falls
Fish Lake
Lake of the Woods
Four Mile Lake
Willow Creek Res.
Hyatt Res.
Emigrant Res.
Reader Res.
Wedderburn
Gold Beach
Indigo Creek
Silver Creek
Galice Cr.
Taylor Cr.
Jumpoff Joe Cr.
Ramey Falls
Grave Creek
Wolf Creek
Lobster Creek
Mule Creek
Sucker Creek
Deer Creek
Crooks Cr.
Williams Cr.
Althouse Creek
Wood Cr.
East Fork
West Fork
Evans Creek
Pickett Creek
Trail Creek
Elk Cr.
Lost Creek
Sevenmile Cr.
Middle Fork
South Fork
Butte Cr.
Little Butte Cr.
Antelope Creek
Bear Creek
Little Applegate River
Neil Cr.
Emigrant Cr.
Jenny Creek
Beaver Cr.
99
101

0 1 2 3 4 5 6 7 8 9 10 15
SCALE IN MILES

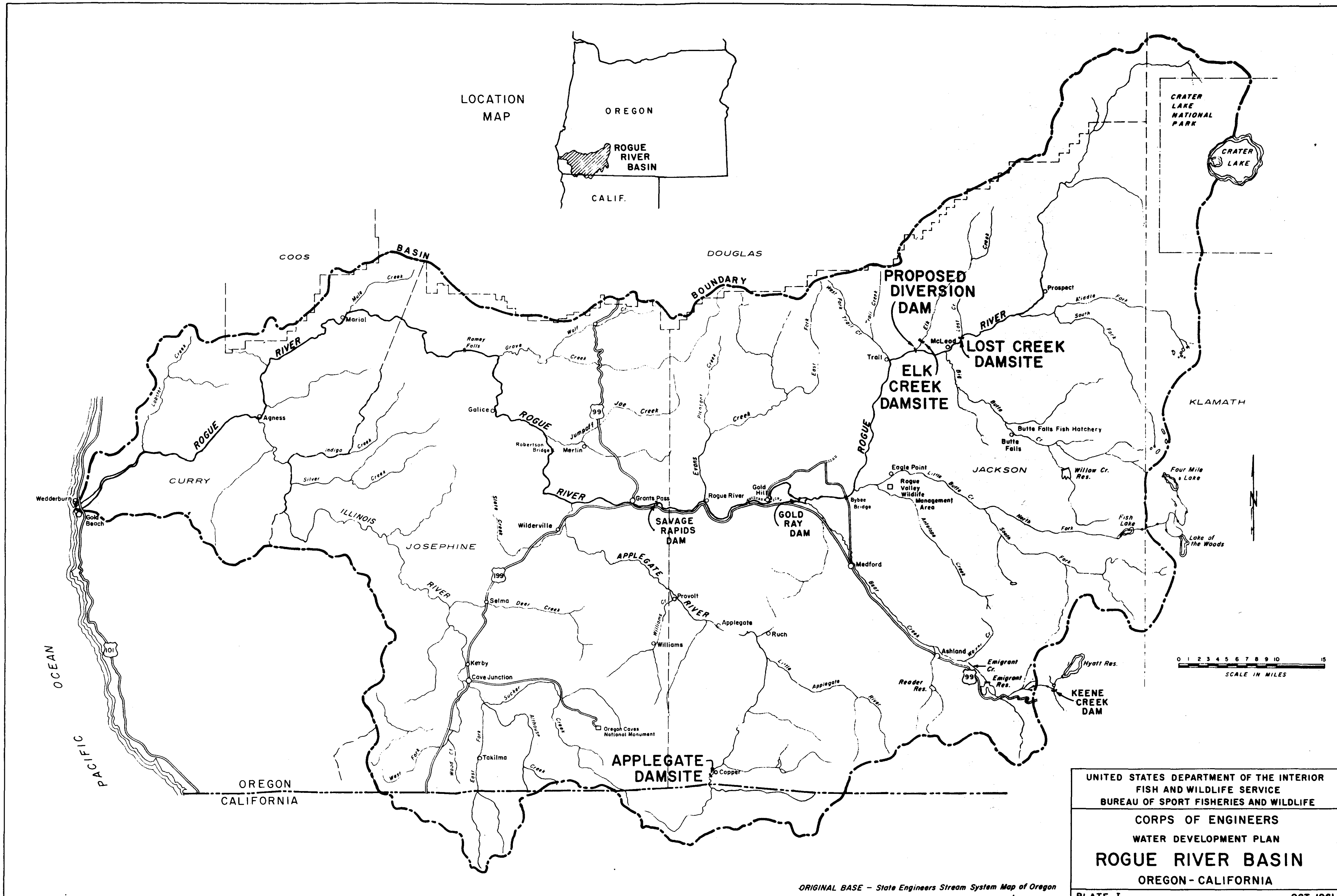
ORIGINAL BASE – State Engineers Stream System Map of Oregon

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

TEMPERATURE MEASUREMENT AND HYDROLOGICAL STATIONS ROGUE RIVER BASIN OREGON - CALIFORNIA

PLATE II — OCT. 1961

89588 O-62 (Face blank p. 232) No. 1


LOCATION MAP
OREGON
ROGUE RIVER BASIN
CALIF.
COOS
DOUGLAS
BASIN
BOUNDARY
CRATER LAKE NATIONAL PARK
CRATER LAKE
PROPOSED DIVERSION DAM
LOST CREEK DAMSITE
ELK CREEK DAMSITE
Prospect
McLeod
Trail
Marial
Ramey Falls
Galice
Agness
ROGUE
RIVER
Robertson Bridge
Merlin
Jumpoff
Joe Creek
CURRY
Wedderburn
Gold Beach
Grants Pass
Rogue River
Gold Hill
SAVAGE RAPIDS DAM
GOLD RAY DAM
Eagle Point
Rogue Valley Wildlife Management Area
Bybee Bridge
JACKSON
KLAMATH
Butte Falls Fish Hatchery
Butte Falls
Willow Cr. Res.
Four Mile Lake
Fish Lake
Lake of the Woods
Medford
JOSEPHINE
ILLINOIS
Wilderville
APPLEGATE
RIVER
Provolt
Applegate
Ruch
Williams
Selma
Deer Creek
Kerby
Cave Junction
Oregon Caves National Monument
Takilma
APPLEGATE DAMSITE
Copper
Ashland
Emigrant Cr.
Emigrant Res.
Reader Res.
Hyatt Res.
KEENE CREEK DAM
SCALE IN MILES
PACIFIC
OCEAN
OREGON
CALIFORNIA
199
99
101

ORIGINAL BASE – State Engineers Stream System Map of Oregon

UNITED STATES DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
BUREAU OF SPORT FISHERIES AND WILDLIFE

CORPS OF ENGINEERS
WATER DEVELOPMENT PLAN

ROGUE RIVER BASIN

OREGON - CALIFORNIA

PLATE I — OCT. 1961