79th Congress, 1st Session - - - - - House Document No. 172

REPORT ON THE COLUMBIA BASIN PROJECT ON THE COLUMBIA RIVER

LETTER

FROM

THE SECRETARY OF THE INTERIOR

TRANSMITTING

A REPORT ON THE COLUMBIA BASIN PROJECT ON THE COLUMBIA RIVER, DATED OCTOBER 30, 1944, PREPARED BY THE BUREAU OF RECLAMATION AND THE BONNEVILLE POWER ADMINISTRATION

MAY 10, 1945.—Referred to the Committee on Irrigation and Reclamation and ordered to be printed with illustrations

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DEPARTMENT OF THE INTERIOR,
Washington, D. C., May 8, 1945.

Hon. SAM RAYBURN,
Speaker of the House of Representatives.

MY DEAR MR. SPEAKER: Pursuant to the Reclamation Project Act of 1939, there is transmitted herewith a report, dated October 30, 1944, on the Columbia Basin project on the Columbia River.

This report, which was prepared by the Bureau of Reclamation and the Bonneville Power Administration, was approved by me on January 31, 1945. I transmitted it to President Roosevelt on March 27. A copy of my letter to President Roosevelt is enclosed. On April 21, President Truman informed me that he had no objections to my transmitting the joint report to the Congress at this time. A copy of the President's letter of April 21 is enclosed.

Sincerely yours,

HAROLD L. ICKES,
Secretary of the Interior.

DEPARTMENT OF THE INTERIOR,
Washington, D. C., March 27, 1945.

THE PRESIDENT,
The White House.

MY DEAR MR. PRESIDENT: There is transmitted herewith, pursuant to the Reclamation Project Act of 1939, a report on the Columbia Basin project on the Columbia River dated October 30, 1944, prepared by the Bureau of Reclamation and the Bonneville Power Administration. It was approved and adopted by me on January 31, 1945.

The report concerns the engineering feasibility of the project, the proper allocation of the estimated construction costs attributable to each of the several purposes of the project, and the part of the Government's investment that is to be returned from various revenue-yielding sources. The allocation of costs to the various project purposes bears directly on the establishment of rates for the sale of power to be produced at the Grand Coulee Dam power plant and the amount that the prospective irrigation farmers must pay for water for irrigation purposes.

The project comprises as its principal features the Grand Coulee Dam and Reservoir, the Grand Coulee Dam power plant, and the irrigation system. The dam was completed in 1941. The power plant, with a capacity rated at 823,000 kilovolt-amperes and an ultimate capacity rated at 1,969,000 kilovolt-amperes, is now in operation. The engineering feasibility of the dam and power plant is a demonstrated fact. The importance of their contribution to the winning of the war is a matter of record. The principal features of

the irrigation system remain to be constructed. The system will serve a net irrigable area of 1,029,000 acres. The report indicates that the engineering feasibility of this system is beyond question.

The project (earlier designated as the Grand Coulee Dam project) was initiated as a public works undertaking by an allocation of funds pursuant to title II of the act of June 16, 1933 (48 Stat. 195, 200). The project was later specifically authorized by the Rivers and Harbors Act of 1935 (49 Stat. 1029, 1039). Pursuant to the authority of that act, you designated the Secretary of the Interior, acting through the Bureau of Reclamation, as your agent to continue the construction and to operate and maintain the project. More recently, the project was reauthorized by the Columbia Basin Project Act (57 Stat. 14) and was thereby specifically recognized as being governed by the Reclamation Project Act of 1939 (53 Stat. 1187). The latter act controls the establishment of power rates and the terms for the repayment by the irrigation farmers of the amount of the construction cost allocated to be repaid by them.

In aid of the provisions concerning power rates and the water users' obligation, section 9 of the Reclamation Project Act of 1939 provides that the Secretary of the Interior shall make findings on, among other things—

> the part of the estimated cost which can properly be allocated to irrigation and probably be repaid by the water users; the part of the estimated cost which can properly be allocated to power and probably be returned to the United States in net power revenues; the part of the estimated cost which can properly be allocated to municipal water supply and other miscellaneous purposes and probably be returned to the United States.

Section 9 provides also that the Secretary of the Interior, after consultation with the Chief of Engineers and the Secretary of War, may make nonreimbursable allocations to flood control and navigation.

The actual expenditures toward the construction of the project through June 30, 1944, were $175,005,533. The estimated cost of the completed project, figured at the estimated average prices as of January 1940, is $487,030,228.

A most thorough analysis of several possible bases for the allocation of costs to the various purposes to be served by the project was made. The allocation I have approved and adopted is as follows:

To irrigation	$341, 929, 994
To commercial power	113, 827, 243
To downstream river regulation	30, 272, 991
To flood control and navigation	1, 000, 000

All costs which could be associated with only one purpose were treated as the direct costs assignable to that purpose. The expenditures made and to be made in connection with features of the project serving multiple purposes were allocated among the several purposes to be served thereby on the basis of an analysis as to the alternative justifiable expenditure. A full discussion of the analysis and references to all requisite basic data appear in the report.

The Federal reclamation laws require that all expenditures in the construction of the project, except those allocated to flood control and navigation, must be returned to the United States. It has been determined tentatively that the irrigation water users will be able

to pay directly approximately $87,465,000. It is expected that they will, in addition, pay $50,500,000 through the use of power for irrigation pumping during the repayment period. They will also pay all the operating expenses of the irrigation system. Commercial power is the only other dependable source of return. Therefore, in order to meet the requirement of reimbursability, power must bear construction costs totaling $348,065,228. Power revenues will be required also to meet during the repayment period all operating expenses of the dam and reservoir and the power plant and to provide necessary replacements.

Careful estimates have been made of the revenues that may be expected during the repayment period from the sale of commercial power at present rates through the Bonneville Power Administration. It is estimated that these will be more than sufficient to return all the costs herein enumerated as returnable by power, in addition to meeting all estimated obligations chargeable to the sale of Grand Coulee power in connection with the Bonneville project and the Bonneville-Coulee transmission system. Accordingly, I have found that all the estimated reimbursable construction costs of the project which are allocated to power, to downstream river regulation and to irrigation (less the portion to be repaid by the water users), can probably be returned to the United States in net power revenues; and that the returnable and repayable allocations, together with the allocation to flood control and navigation, equal the total estimated project cost.

A situation with respect to requirements of law as to return of the cost and as to minimum commercial power rates needs to be noted. The Reclamation Project Act of 1939 provides the rate formula. The Bureau of Reclamation has heretofore taken the position that this act requires the return from power revenues of operation and maintenance costs, and of the project construction costs properly allocated to power plus the reimbursable construction costs allocated to other purposes but which have been assigned to be returned from power revenues, and, in addition, interest at 3 percent per annum on the construction costs properly allocated to power. Rates under that act have been established heretofore consistently in conformity with this position, and the Congress has been informed at various times concerning the practice. In connection with the attached report, however, the requirements of the law were fully considered and the conclusion reached that this position was more stringent than the law requires. In an opinion which I approved September 29, 1944 (M–33473), my Solicitor concluded that minimum rates for power need be—

> such as to produce revenues sufficient only to meet in addition to the return for operation and maintenance cost, an amount equal to 3 percent of the power construction costs with the proviso that if total revenues thus produced are insufficient to repay all costs allocated to power to be repaid by power revenues, "other fixed charges" must be included in the rate schedule to produce revenues sufficient to repay such costs.

It is estimated that the present effective rates of the Bonneville Power Administration would produce revenues more than sufficient to meet all the costs allocated to power, plus interest on them amounting to $70,786,815 and also $244,000,000 of costs for irrigation works.

The $244,000,000 contribution by power to irrigation amounts to 155 percent of the total power allocation. In other words, the present effective rates of the Bonneville Power Administration will produce, in addition to returns adequate to meet the rate requirements of the act, an amount of $70,786,815, which it is proposed to use for the purposes described below. Under the earlier procedure described in the preceding paragraph this amount would not have been so distributed.

While not required by law, it is planned for the present to maintain the Bonneville power rates at a level sufficient, if maintained over the entire repayment period, to return the costs and this sum of $70,786,815. Since this amount would be in excess of the required return, it is proposed that it be earmarked to be available for these purposes:

(1) A reduction, if and when circumstances warrant and within stated limits, of the total obligation for construction charges which the water users are required to assume under the Columbia Basin Project Act.

(2) A reduction in power rates in an amount equal to the total sum available for reduction in the water users' obligation.

(3) To be taken into account in determining the financial feasibility of various irrigation and power projects that may be undertaken in the Columbia River Basin.

The accomplishment of the third purpose may require additional legislation. To give ample time for consideration to such legislation, it is proposed to continue the accumulations of surplus funds for this purpose until December 31, 1960.

Section 9 of the Reclamation Project Act of 1939 authorizes the concurrent submission of this report to you and to the Congress. I have thought it desirable to present the matter to you first. I expect, however, to present it and a copy of this letter to the Congress promptly, unless you have objections.

Sincerely yours,

HAROLD L. ICKES,
Secretary of the Interior.

THE WHITE HOUSE,
Washington D. C., April 21, 1945.

The honorable the SECRETARY OF THE INTERIOR.

MY DEAR MR. SECRETARY: I have no objections to the transmittal to the Congress at this time of the joint report on the Columbia Basin project, submitted to me with your letter of March 27. I understand that this report has a special significance, in that it is the first of several that will be required in connection with the development of the river basins of the Western States.

The allocations of costs and the proposed distribution of revenues will seemingly protect the interests of the United States and meet the requirements of law governing the return of project reimbursable expenditures. There are certain omissions and proposals in the report, however, which I am advised should be overcome or supported by legislation. The more important of these are:

(*a*) The failure to allocate part of the costs to fish, wildlife, and recreation benefits;

(*b*) The proposal to secure return of benefits from future downstream plant construction and operation;

(*c*) The proposal to set aside a portion of the revenues in a special account in the Treasury; and

d. The proposal to utilize the earmarked fund for certain specific purposes.

Because of the precedent importance of these matters, I suggest that you prepare them in legislative form for early presentation through regular channels for the consideration of the Congress.

I would also suggest that you include with your transmittal of the present report to Congress a copy of my letter to you of this date.

Sincerely yours,

HARRY S. TRUMAN.

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JOINT REPORT ON ALLOCATION AND REPAYMENT OF THE COSTS OF THE COLUMBIA BASIN PROJECT

(By the Bureau of Reclamation and Bonneville Power Administration)

(Approved by the Secretary of the Interior, U. S. Department of the Interior, on January 31, 1945)

This report deals with the engineering feasibility of the Columbia Basin project, a Federal reclamation project located in the State of Washington. The project includes Grand Coulee Dam, reservoir, power plant, and irrigation works. The report also covers the allocation of the cost of this multipurpose project to the various functions which it serves and the return or repayment of such cost.

Legislative Background

Construction of a multipurpose project at Grand Coulee on the Columbia River has been the subject of numerous investigations and reports by private, State, and Federal agencies over a long period of years. In 1932 these culminated in a detailed report by the Corps of Engineers, United States Army, and the Bureau of Reclamation, Department of the Interior, which was published as House Document No. 103, volumes 1 and 2, Seventy-third Congress, first session. The following year, construction of the project was begun by the Bureau of Reclamation with money allotted by the Administrator of Public Works, pursuant to the authority of title II of the act of June 16, 1933 (48 Stat. 195, 200). An additional allocation of funds was made pursuant to the act of April 8, 1935 (49 Stat. 115).

The Rivers and Harbors Act of 1935 (49 Stat. 1028, 1039) subsequently specifically authorized construction, operation, and maintenance of the Grand Coulee Dam project by the President through such agents as he might designate. Pursuant thereto the President, on January 29, 1936, designated the Secretary of the Interior, acting through the Bureau of Reclamation, to act as his agent. Subsequent work on the project was financed principally with moneys appropriated from the general fund for the Bureau of Reclamation, those moneys expressly being made reimbursable under reclamation law, although after authorization under the rivers and harbors act an additional allocation of public works moneys was made pursuant to the act of June 21, 1938 (52 Stat. 809, 816).

On August 26, 1940, the President issued Executive Order No. 8526, designating the Bonneville Power Administrator as marketing agent for power and energy produced at Grand Coulee Dam in excess of the requirements for the operation of that project, including its irrigation features, and providing that the Secretary of the Interior should compute the returns to be made to the Bureau for power and energy to be available thereunder to the Administrator. Pursuant to this

order the Administrator has been marketing Coulee power over the Bonneville-Coulee transmission system, constructed with funds appropriated for the Bonneville Power Administration. Pending allocation of costs, rates charged for all power sold by the Administrator have been those approved by the Federal Power Commission for power produced at the Bonneville project.

In 1943 the Columbia Basin Project Act (57 Stat. 14) was enacted. This act recognized the purposes for which the project was authorized by the 1935 act, renamed the project "the Columbia Basin project," reauthorized it as a project subject to the Reclamation Project Act of 1939 (53 Stat. 1187), and provided that the repayment of expenses of construction, operation, and maintenance should be governed by the act of 1935, the Reclamation Project Act of 1939, and the Columbia Basin Project Act. The project is one that was under construction when the 1939 act was passed and in connection with which repayment contracts have not yet been made. Hence, it is within the scope of section 7 (b) of the 1939 act, permitting the making of allocations of cost under section 9 thereof.

Part I. Description of Project

The Columbia Basin project is a multiple-purpose project having as its purposes control of floods, improvement of navigation, regulation of stream flow, provision for storage and for delivery of stored waters for the reclamation of lands, and other beneficial uses, and the generation of electric energy as a means of financially aiding and assisting in the carrying out of such purposes.

The project comprises the following principal features:

DAM AND POWER PLANT

(1) *Grand Coulee Dam and Columbia River Reservoir* are located at a point on the Columbia River near the head of the Grand Coulee, an ancient channel of the river, 74 miles westerly of Spokane. Now substantially completed, the dam is 4,173 feet long, 550 feet high, and contains 9,926,005 cubic yards of concrete.

The reservoir created by the dam extends 151 miles up the river to the Canadian boundary, and up the Spokane River, a tributary of the Columbia, to within 37 miles of Spokane. The capacity of the reservoir at elevation 1,290 is approximately 10,000,000 acre-feet of water, of which about 5,200,000 acre-feet are usable during the periods of low-water flow for power generation at the Grand Coulee Dam power plant and at downstream plants, both present and future. Features were incorporated in the construction of the dam so that water may be released for the benefit of downstream power plants.

(2) *The power plant at Grand Coulee Dam.*—The present hydroelectric power installation consists of six permanent generating units, each of 108,000 kilovolt-amperes name-plate rating; two temporary generating units, borrowed for the duration of the war from the Shasta power plant of the Central Valley project in California, each of which has a name-plate rating of 75,000 kilovolt-amperes; and two permanent station-service generating units, each rated at 12,500 kilovolt-amperes. This equipment, having an aggregate name-plate rating of 823,000 kilovolt-amperes, is installed in the left powerhouse adjacent to the left end of the dam.

The ultimate power installation will consist of 18 main generating units, each rated at 108,000 kilovolt-amperes, and 3 station-service units of 12,500 kilovolt-amperes each. Nine of the main units will be installed in the right powerhouse adjacent to the right end of the dam. Due to the fact that the generating units have a continuous capacity of 120,000 kilowatts, and the load factor is expected to be much higher than originally anticipated, only 15 units are required to generate the potential energy in the stream modified by present storage, and the cost estimates used herein are based on an installation of 15 units.

The power plant is presently connected through suitable transformation and switching equipment to the high-voltage power network of the Bonneville Power Administration.

IRRIGATION SYSTEM

(1) *The primary pumping plant.*—This is the pumping plant at Grand Coulee Dam. The anticipated installation is 10 motor-driven pumps, each of 1,600 cubic feet per second capacity, with space for 2 additional pumps if these are found to be needed.

(2) *Feeder canal.*—This canal will extend from the upper end of the pump discharge conduits to the Grand Coulee equalizing reservoir.

(3) *Grand Coulee equalizing reservoir.*—This reservoir will be created by construction of dams at each end of the Grand Coulee and will have an active capacity of 700,000 acre-feet below elevation 1,570.

(4) *Main canal.*—The main canal will take water out of Grand Coulee equalizing reservoir near Coulee City, Wash. It will consist of the necessary canals, siphons, tunnels, and related works to regulate and carry the water from the equalizing resevoir to Long Lake, a lake that will be formed by the construction of Long Lake Dam, and a canal from Long Lake to the bifurcation works for the east low and west canals. The works are designed so that a drop power plant can ultimately be installed at the head of Long Lake, but the cost estimates appearing in this report do not cover such a plant. About 6,400 acres will be served directly from the main canal.

(5) *East high canal.*—This canal will divert water from the forebay site of the Long Lake power plant and will serve the higher east-side lands north of Washtucna Coulee, comprising about 215,000 acres.

(6) *East low canal.*—This canal will serve the lower east-side lands, including the area adjacent to the Snake River, east of Pasco, comprising about 252,000 acres.

(7) *West canal.*—This canal will serve the west-side lands, comprising about 281,000 acres.

(8) *Potholes Reservoir.*—This reservoir will have an active capacity of about 350,000 acre-feet. It will serve about 267,600 acres of lands lying to the south thereof. The water will be distributed thereto through—

(*a*) The Potholes east canal, which will serve about 254,000 acres.

(*b*) The Potholes west canal, which will serve about 13,600 acres.

(9) *A secondary pumping plant* on the Columbia River northwest of Pasco. This pumping plant will serve about 6,000 acres until such time as the lands can be served by a gravity canal from the Potholes Reservoir.

(10) *One or more secondary pumping plants* on the south side of the Snake River, which will serve an area of about 7,000 acres, or such lesser area as may be available above the backwater of the proposed Umatilla Dam, such area being known as the Burbank division.

(11) *A secondary pumping plant* in the Lower Grand Coulee to recapture seepage and return flow.

(12) *Motor-driven secondary pumping plants* at suitable places along the canals to repump water to lands adjacent to, but higher than, the canals. The area to be served by such supplemental pumping is estimated to comprise 262,000 acres, this area being included, however, in the acreages above stated in connection with the canals.

(13) *Laterals and sublaterals* sufficient to provide for delivery of water to each farm unit.

(14) *A drainage system* to carry off waste and seepage of water resulting from the irrigation of project lands. This system will be built as the need therefor develops.

(15) *Telephone and power lines, buildings, and all facilities and structures and lands and interests in lands* required in the construction, operation, and maintenance of the irrigation features of the project.

The works comprising the project as above described may have to be modified, added to, or parts thereof omitted as the necessity for such changes develops in the course of construction. Such changes as may be found to be necessary are expected, however, to be within the framework above described. They would not be of such character as to result in any substantial increase in the area of lands to be served, nor otherwise to result in a substantial change in the ultimate objectives of the project.

The irrigation features of the project have been planned so as to provide a water supply for the irrigation of a total of approximately 1,029,000 acres of irrigable lands lying in central Washington. These lands lie in part in each of the counties of Grant, Adams, Franklin, and Walla Walla. The lands comprise those arable lands, within the boundaries of the three existing Columbia Basin irrigation districts, which it has been determined tentatively may be supplied with water from the project works, and which are required to be included in the project in order to provide for its sound development and operation, being therefore "lands within the project" as that phrase is defined in the Columbia Basin Project Act.

There is attached a map showing the location and principal features of the project, particularly its irrigation features, and the general location of the area to be irrigated.

The over-all plan of the project and its individual principal features have been the subject of painstaking and thorough engineering investigation and planning over a period of several years by both the Corps of Engineers and the Bureau of Reclamation. The engineering feasibility of the key features of the entire plan, the Grand Coulee Dam and power plant, is already demonstrated. The principal features of the irrigation plan remain to be built. Based on the thorough investigations that have been made and the careful planning and design that have gone into study of these features to date, engineers of the Bureau of Reclamation have concluded that the engineering feasibility of their construction and operation is beyond question.

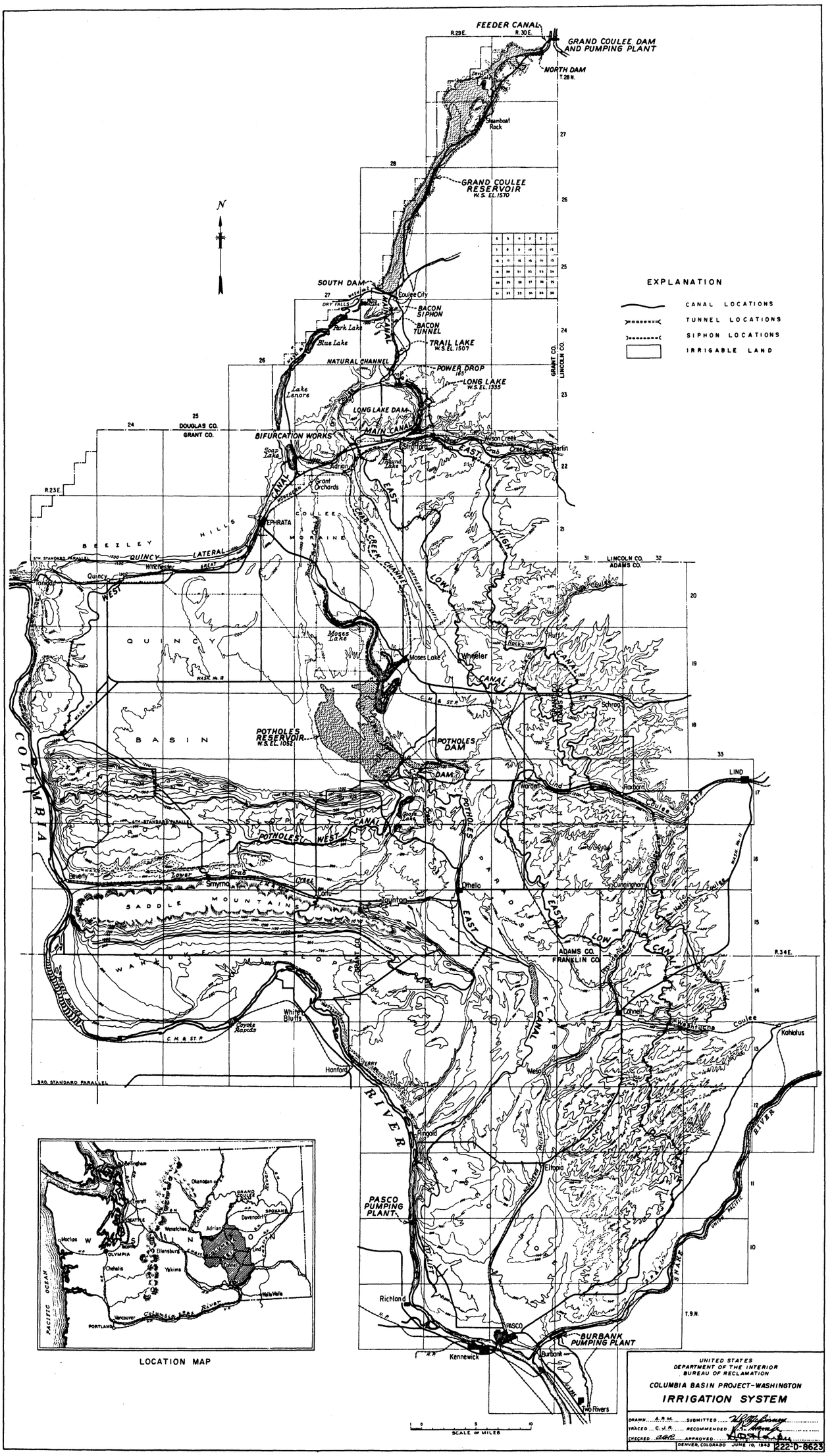

FIGURE 1

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ESTIMATED COSTS OF PROJECT

The present and estimated final costs of the Columbia Basin project are as follows:

Actual cost to June 30, 1944	[1] $175, 005, 533
Estimated final cost	487, 030, 228

[1] Not including the cost of the Shasta units and other miscellaneous undistributed amounts totaling together $5,807,656. Of this, $3,810,810 represents the cost of 2 Shasta units temporarily charged to the Columbia Basin project. It also includes a donation by the State of Washington of $49,528 and an adjustment of work relief clearing costs of $1,947,318.

The actual and estimated final costs are divided among project features approximately as follows:

	Costs to June 30, 1944	Estimated final costs [1]
Dam and reservoir	$122, 138, 945	$126, 354, 000
Power plant and facilities	45, 072, 283	79, 894, 048
Irrigation works	7, 794, 305	280, 782, 180
Total	175, 005, 533	487, 030, 228

[1] Estimated average prices January 1940.

PART II. ALLOCATIONS OF COST

Part II of this report is directed to the allocation of project construction costs among various purposes. The analysis proceeds as follows: First, with a consideration of the need for and purposes to be served by making the allocation and the statutory requirements relating thereto; second, with a consideration of what costs are directly assignable and what are costs of multiple-use features requiring allocation; third, the basis for the allocation of multiple-purpose costs; and finally, the recommended allocation of all project costs.

1. NEED AND PURPOSES OF ALLOCATION

In addition to the finding of engineering feasibility referred to at the end of part I, the statutes referred to above and Executive Order No. 8526 require the Secretary of the Interior to make two additional basic determinations. First to be determined is the proper share of the total estimated construction cost attributable to each of the several purposes of the project. Second, there is the determination of whether the project will be self-liquidating in the manner and to the extent provided by law. The finding as to self-liquidation can be made only after the proper allocation of costs is ascertained. Accordingly, this part II is concerned with the allocation to the several purposes of the total estimated construction cost as provided for by law, which is necessarily precedent to the determination with respect to the return and payment of costs. Possible sources of returns and the establishment of reimbursement obligations are the subject of part III.

The Reclamation Project Act of 1939 provides that a project which is brought within the scope of section 9 thereof is feasible and therefore authorized if its estimated cost, excluding any allocation properly made to flood control and navigation, is found probably to be returnable to the United States from various sources. It requires also that allocations be made to various purposes and that findings as to the

probable source of returns be made. The statute has been interpreted as permitting the making of allocations to functions in excess of the ability of those functions to repay, if another source of return for such excess appears to be available and able to effect the return. This interpretation has been followed in connection with the allocations of project cost to the various purposes as permitted by section 9 and with the findings as to the probable source of returns of the various reimbursable allocations.

2. DIRECT AND MULTIPLE-USE COSTS

Of the total investment in the project, the only definite portion that can be associated with any one purpose is the added cost made necessary by the inclusion of that purpose. However, a substantial portion of this project serves various multiple purposes. The dam and reservoir are useful for flood control and navigation, for power including downstream river regulation, and for irrigation. Allocation of total project cost requires the division of the cost of these jointly used facilities among the purposes served.

Two of these purposes, i. e., power and irrigation, are expected to produce returns to the Government. Power by itself might be considered self-supporting if its revenues were just sufficient to cover a proper share of the costs of jointly used facilities and the additional facilities incident to the generation of power. However, since the whole project, except for the portion allocated to flood control and navigation, must be self-supporting, and since the revenues from the other purposes will not even cover the cost of the additional facilities necessary for their realization, let alone any part of the costs of jointly used facilities, the revenues from power must cover far more than power costs.

The total cost of the irrigation works, consisting of the pumping plant, equalizing reservoir, and distribution system, is estimated to be $280,782,180 for irrigating 1,029,000 acres. Those works will serve only one function, irrigation, and their cost is not subject to apportionment. It must be assigned directly to irrigation.

The total cost of the power plant and facilities, comprising 15 main generating units, is estimated to be $79,894,048. By providing pumping power, a portion of this serves irrigation. The remainder may properly be assigned to power.

The total cost of the dam and reservoir is estimated to be $126,354,000. A portion of this serves flood-control and navigation purposes. A portion of the remainder serves irrigation by providing head which decreases the amount of pumping power required. The remainder serves for production of power at Grand Coulee and for firming up power at the present and future downstream plants.

It thus appears that both the power plant and the dam and reservoir serve multiple purposes and, strictly construed, the costs thereof would constitute joint investment to be allocated. However, in the case of the power plant, the two purposes are served by the same means, namely, production of power. The investment can, therefore, be readily divided between the two purposes on a use basis, as set forth on page 9.

The allocation of the dam and reservoir to the several purposes is the major problem. To attempt to include the power plant in the

same allocation would greatly and unnecessarily complicate the problem. Therefore, in the following discussion, the power-plant investment is considered to be a direct investment, partly for commercial power and partly for irrigation (pumping power).

3. BASIS FOR ALLOCATION OF MULTIPLE PURPOSES COSTS

The alternative justifiable expenditure approach

This approach was relied upon largely in allocating the costs of Norris, Wheeler, and Wilson Dams by the Tennessee Valley Authority among flood control, navigation, and power (H. Doc. 709, 75th Cong., 3d sess.). It is a form of benefit division, the benefits from jointly used facilities being determined by the ratio of costs of providing alternative means of securing from separate single-purpose projects the same benefits as those provided by the joint facilities. Such costs are determined as the difference, in the case of each alternative, between the total alternative cost and the cost in the joint project of the facilities devoted directly to the particular purpose involved. By constructing projects which serve multiple purposes through jointly used facilities, savings in expenditures may be achieved for singly used facilities over those which would have been necessary for several single-purpose projects. The savings so determined, which are a form of benefit, are directly ascertainable for each purpose. The relation between such savings or benefits determines the allocation of the multiple-use investment to the several purposes.

On account of the lack of available similar sites, the construction of a single-purpose project may make impossible the achievement of other purposes for which the given site is likewise necessary. This practical difficulty does not prevent the use of calculated alternative costs of single-purpose projects for allocation of multiple-purpose investment. The concept of alternative cost is generally premised on the assumption that the expenditure in single-purpose projects would be justified by the benefits obtainable. Therefore, the alternative cost for a stated purpose may be taken as a measure of the investment in a joint venture which would be justified for that purpose. In applying this method, the lowest cost alternative must be used for comparable results.

Navigation.—Operation of Grand Coulee Dam will benefit navigation by increasing flow during low water due to release of stored water and return flow from irrigated lands. In addition, it will afford a minor reduction of flood stages with accompanying reduction in velocities. The extent of the increased flows and their effect on gage heights has been studied. It is estimated that the ordinary plane of low water is raised 1.8 feet at Bonneville and 0.6 foot at Vancouver, tapering off to zero at St. Helens. This reduces the annual cost of maintenance dredging previously necessary to maintain the channel by $40,000. The value of this saving capitalized at 3.89 percent (3 percent in 50 years in accordance with War Department practice) is approximately $1,000,000.

Between Bonneville and Celilo storage releases would not result in improved navigation conditions due to the existence of the Bonneville pool and the Celilo canal.

Between Celilo and Pasco increased depths in the improved channel as a result of storage releases will permit increases in barge loads for

a period of about 5 months during the low-water season of ordinary water years during which barge loads are limited by present channel conditions. The estimated annual tonnage to be benefited by increased depths in various stretches of this section of the river, the percent of benefit, the benefit in tonnage, the length of each stretch in miles, and the dollar benefit at 8 mills per ton-mile is shown in the following table:

Stretch	Annual tonnage	Percent benefit	Tons benefit	Miles	Benefit at 8 mills per ton-mile
Celilo-Umatilla	1,500,000	3.37	50,600	88	$35,600
Umatilla-Attalia	200,000	4.65	9,300	28	2,100
Umatilla-Pasco	950,000	4.80	45,600	39	14,200
Total					51,900

As the construction of the Umatilla Dam would eliminate navigation benefits between Umatilla and Pasco, due to storage releases, a summary of all navigation benefits below Bonneville and from Celilo to Pasco with and without the benefit of Umatilla Dam, capitalized at 3.89 percent (3 percent in 50 years), is indicated below:

Stretch	Benefit	
	Without Umatilla Dam	With Umatilla Dam
Below Bonneville	$40,000	$40,000
Celilo to Pasco	51,900	35,600
Total	91,900	75,600
Capitalized	2,362,000	1,943,000

The Secretary of War and the Chief of Engineers have advised that the full measure of these benefits to navigation can be realized only when 5,000,000 acre-feet of storage at Grand Coulee Dam are released in the interests of navigation. As the release of this storage can be more beneficially utilized for the production of electrical power and energy than for the improvement of navigation, it will be used primarily for the former and secondarily for the latter.

The creation of slack water behind the Grand Coulee Dam for over 100 miles makes a decided improvement in navigation in this stretch of the river at all contemplated water elevations in the reservoir, and already the towing of logs and operation of barges to connect with a dock recently established at Kettle Falls by the Great Northern Railroad are direct results of this improvement. The traffic has not yet reached the point where its future can be determined, and the benefits have consequently not been evaluated; but they should be given some weight in the determination of the entire navigation benefit due to the construction of the Grand Coulee Dam. The extent of these benefits is not reflected in the figures above stated, which were worked out in consultation with the Corps of Engineers.

Since the exact manner in which the water will be released cannot be determined in advance, and since there is difficulty in evaluating all the beneficial results, the allocation to flood control and navigation, which is nonreimbursable, has been limited to $1,000,000.

Irrigation alternative.—As an alternative to the present Columbia Basin project, the original gravity plan was considered. This would consist of the Albeni Falls Dam on the Pend Oreille River, near the Washington-Idaho boundary, to store 2,000,000 acre-feet of water in Lake Pend Oreille and divert the water supply into the main waterway, which would pass through a tunnel under the city of Spokane and extend in a southwesterly direction a total distance of about 130 miles to a point near Lind, Wash. Here the main waterway would divide into two branches and distribute the water supply over the irrigable area of the gravity project in much the same manner as is proposed for the present project. Approximately the same amount of land would be covered by this alternative project as by the Columbia Basin project. The cost of this project, as estimated by the staff of the regional director at Coulee Dam, would be $369,912,620. The dams and main waterway of this alternative project would cost $143,650,000. The distribution system would cost $226,262,620.

The cost of the proposed irrigation works of the Columbia Basin project is $280,782,180. However, part of the power plant at Grand Coulee Dam is chargeable to irrigation because of its use for the production of pumping power. On a use basis, this pumping power requires approximately 13 percent of the energy produced. However, taking into account the relative value of power for various uses, the value for irrigation pumping has been determined to be 7½ percent [1] of the cost of the power plant ($79,894,048) or $5,992,054. Adding this sum to the direct irrigation cost gives a total cost of irrigation facilities at the Columbia Basin project of $286,774,234, not including the value of the dam and reservoir to irrigation. The cost of the gravity alternative is greater by $38,138,386 than this cost of the irrigation works at the Columbia Basin project.

Although the operating expenses of the alternative gravity flow project are estimated by the regional director to be somewhat higher than the corresponding costs of the irrigation features of the present Columbia Basin project, the difference is not sufficient to require their inclusion in these computations.

Power alternative.—It is practically impossible to develop a power alternative which does not also include flood control, navigation, and downstream river regulation benefits, but an alternative project could be developed to provide all of these benefits. Since the allocation to flood control and navigation has already been determined substantially on the alternative cost basis, it is necessary at this point merely to obtain a basis for an allocation between (*a*) irrigation and (*b*) power, including downstream benefits. The estimates of alternative

[1] 7.5 percent is the approximate weighted ratio of megawatt-hours used for irrigation pumping to total megawatt-hours of output over the 75-year period, the megawatt-hours of prime power being given a weight of 2, and the commercial secondary and irrigation pumping power being given a weight of 1.

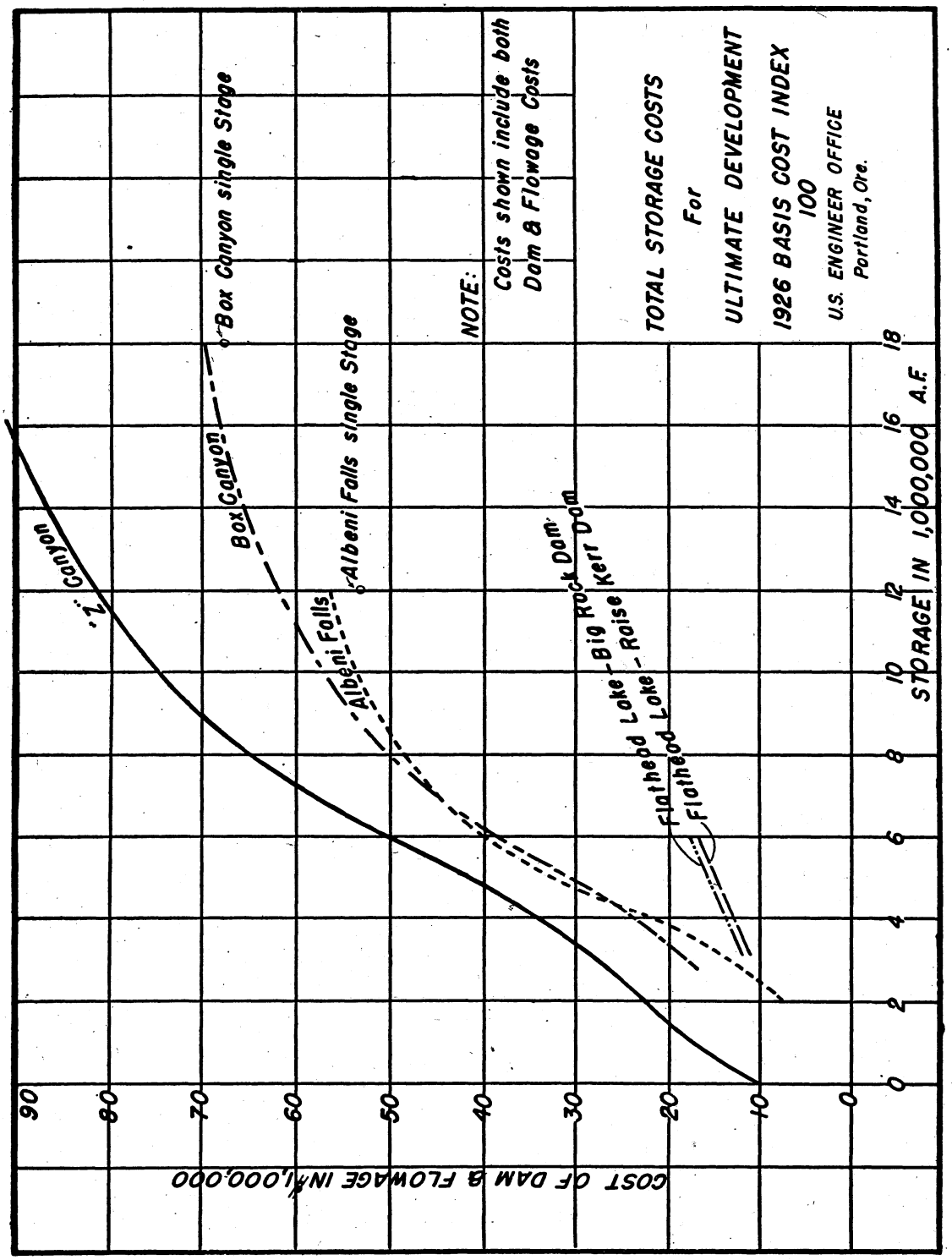
Prime power (565,000×2)	1,130,000
Commercial secondary (115,000×1)	115,000
Irrigation pumping including supplemental (101,000×1)	101,000
Total	1,346,000

$$\frac{101,000}{1,346,000}=7.5 \text{ percent}$$

costs, therefore, will be related only to those two purposes. Subsequently, the portion allocated to power and downstream regulation will be subdivided between those two purposes.

The Power Resources Section of the Bonneville Power Administration has made an estimate, based on previous studies by the Corps of Engineers, of a combination of three projects on the Columbia River which would produce substantially the same benefits to the purposes stated. The three projects would consist of a dam and power plant at Foster Creek, a dam and power plant at Priest Rapids, and a dam and reservoir upstream sufficient to provide 6,000,000 acre-feet of storage. The costs of the Foster Creek and Priest Rapids projects were estimated by trending to 1940 price levels a previous estimate by the Corps of Engineers (published in the so-called 308 Report) and adding thereto 10 percent for contingencies because latest reports indicate that required construction, especially at the Foster Creek site, may exceed the earlier estimates. The estimate of the cost of the Foster Creek project, before addition of the special 10 percent for contingencies, is $55,933,626, and the similar cost for Priest Rapids is $66,395,893, making a total for both of $122,329,519. Addition of 10 percent for contingencies raises this to $134,562,471. The estimate for 6,000,000 acre-feet of storage required to produce the same amount of prime power as at Grand Coulee Dam was obtained from a chart prepared on the basis of information supplied by the Corps of Engineers (see chart, p. 11), and is $39,000,000, resulting in a total cost of $173,562,471 for the alternative.

The Grand Coulee Dam power plant, due to larger installed capacity (necessary for pumping), will produce 1,905,000,000 kilowatt-hours annually of secondary energy available 80 percent of the time, annual revenues from the sale of which are estimated at $500,000. The alternative projects would produce only about 994,000,000 kilowatt-hours annually of similar secondary energy, or approximately 48 percent less. On the basis of revenues estimated for Grand Coulee secondary energy, this would amount to $240,000 less revenue per year, a sum which, capitalized on a 50-year 3-percent basis, has a present value of $6,175,142. This amount must be added to the cost of the three-part alternative project to make it equivalent to Grand Coulee. The total adjusted cost of the alternative thus becomes $179,737,613. The cost of direct-power facilities at the Columbia Basin project is $79,894,048. From this amount must be deducted 7.5 percent, or $5,992,054, which, as explained above, is chargeable to irrigation pumping power, leaving a balance chargeable to commercial power of $73,901,994. The costs of the alternative project for power, including downstream regulation, are thus $105,835,619 more than the costs of the direct commercial power facilities of the Columbia Basin project. Since the operating expenses and replacements for both power alternatives would be approximately the same, it is not necessary to include them in the consideration of alternative cost.


COST OF DAM & FLOWAGE IN $1,000,000
STORAGE IN 1,000,000 A.F.
0
2
4
6
8
10
12
14
16
18
10
20
30
40
50
60
70
80
90
TOTAL STORAGE COSTS
For
ULTIMATE DEVELOPMENT
1926 BASIS COST INDEX
100
U.S. ENGINEER OFFICE
Portland, Ore.
NOTE:
Costs shown include both
Dam & Flowage Costs
Box Canyon single Stage
Albeni Falls single Stage
Box Canyon
Albeni Falls
Big Rock Dam
Kerr Dam
Flathead Lake - Raise
Flathead Lake
1 Canyon

The total cost of the dam and reservoir may then be divided on the basis of the ratio of benefits measured by costs of securing similar benefits through the cheapest alternative means, such costs being determined as the difference, in the case of each alternative, between the total alternative cost and the cost in the joint project of the facilities devoted directly to the particular purpose involved. This ratio (table 1) is $83,138,386 for irrigation to $105,835,619 for power and downstream benefits, or 44 percent for the former and 56 percent for the latter. Applied to the joint costs of the dam and reservoir, after deducting the allocation of $1,000,000 to flood control and navigation, this would allocate to irrigation $55,155,760 of the cost of the dam and reservoir and $70,198,240 to power and downstream river regulation (table 2).

TABLE 1.—*Alternative justifiable expenditure allocation (derivation of allocation percentages on basis of differences between costs of single-purpose projects and corresponding direct costs in multipurpose Columbia Basin project)*

Irrigation:	
(1) Alternative project (gravity)	$369, 912, 620
(2) Direct irrigation costs of Columbia Basin project	[1] 286, 774, 234
Difference	83, 138, 386
Power:	
(1) Alternative project	179, 737, 613
(2) Direct commercial power costs of Columbia Basin project	[2] 73, 901, 994
Difference	105, 835, 619
Total differences	188, 974, 005
Ratio of differences to total:	*Percent*
Irrigation	44
Power	56

[1] See the following:

Irrigation works (detailed estimate)	$280, 782, 180
Plus 7.5 percent of power plant (see footnote p. 9)	5, 992, 054
Total	286, 774, 234

[2] See the following:

Total power plant	79, 894, 048
Less 7.5 percent chargeable to irrigation pumping	5, 992, 054
Power plant chargeable to commercial power	73, 901, 994

TABLE 2.—*Alternative justifiable expenditure allocation (allocation of costs of Columbia Basin project to the several purposes)*

Total cost of dam and reservoir	$126, 354, 000	
Allocation to flood control and navigation	1, 000, 000	$1, 000, 000
Remaining joint costs	125, 354, 000	
Allocation to irrigation (44 percent)	55, 155, 760	
Allocation to power (56 percent)	70, 198, 240	
Total commercial power allocation:		
Power plant	73, 901, 994	
56 percent of dam and reservoir	70, 198, 240	
Total commercial power (table 5)		144, 100, 234
Total irrigation allocation:		
Irrigation works	$280, 782, 180	
44 percent of dam and reservoir	55, 155, 760	
7.5 percent of power plant	5, 992, 054	
Total irrigation costs		341, 929, 994
Total project costs		487, 030, 228

Downstream river regulation.—The dam and reservoir serve three primary functions in the production of power: They provide (1) head for production of power at Grand Coulee required to develop the firm power in the natural unregulated stream flow at that site in the approximate amount of 515,800 kilowatts; (2) storage water sufficient to increase the firm power production at the Grand Coulee site in the approximate amount of an additional 484,500 kilowatts; (3) river regulation, through storage and release of water, that is presently and potentially of value in the increased production of firm power at downstream hydro plants, existing and future, in the approximate amount of 1,297,500 kilowatts. The portion of the investment in dam and reservoir allocated to power, in the amount of $70,198,240, is therefore suballocated to these three functions.

In making this suballocation it is convenient to combine the first two functions in order to obtain a single allocation of common facilities investment for power production at Grand Coulee Dam, as compared with a single allocation of such investment for power production at all downstream hydro plants. The suballocation is made on the basis of two analyses of the problen which yield substantially the same results and which lead to the conclusion that an equitable division of investment in common facilities serving these purposes is an allocation of 50 percent, or $35,099,120, for power production at Grand Coulee Dam, and 50 per cent, or $35,099,120, for power production at downstream hydro plants.

The two analyses on which this suballocation is based consist primarily of (1) an evaluation of the benefits from this investment in financial terms to power production at Grand Coulee Dam, as compared to power production at downstream hydro plants, supported by (2) a comparison of firm power output at Grand Coulee Dam from both natural stream flow and storage water, with the increased firm power output of downstream hydro plants resulting from the Grand Coulee storage water. In both of these analyses it is necessary to take into account the time factor involved in the development of future downstream hydro plants and to reduce the benefits to be received by these plants from Grand Coulee storage water to a present value basis. The results of the two analyses are set forth in table 3 and table 4.

TABLE 3.—*Comparison of relative benefits of dam and reservoir to downstream plants and to Grand Coulee (weighted basis)*

DOWNSTREAM PLANTS

	Increase in prime power due to storage (average kilowatts)	Incremental cost per kilowatt of increase	Net benefit per kilowatt-year, assuming value of $8.50 per kilowatt-year	Annual benefits	Capitalized benefits (50 years at 3 percent)	Estimated date of full power sale[1]	Capitalized benefits discounted to 1943		Ratio of each total to their sum (percent)
							Amount	Percent of total	
Bonneville	150,100	$5.36	$3.14	$471,314	$12,126,796	1945	$11,430,718	13.75	
Rock Island	82,600	5.93	2.57	212,282	5,461,965	1949	4,574,286	5.50	
Umatilla	180,100	5.29	3.21	578,121	14,874,915	1953	11,068,276	13.31	
Foster Creek	272,400	3.83	4.67	1,272,108	32,731,034	1956	22,288,198	26.80	
Priest Rapids	215,600	4.65	3.85	830,060	21,357,245	1959	13,309,194	16.00	
The Dalles	172,500	4.21	4.29	740,025	19,040,666	1962	10,858,701	13.06	
John Day	122,700	5.50	3.00	368,100	9,471,125	1963	5,243,972	6.31	
Arlington	101,500	5.38	3.12	316,680	8,148,101	1964	4,380,012	5.27	
Total	1,297,500	------	------	4,788,690	----------	------	83,153,357	100.00	49.97

GRAND COULEE

Annual revenue from prime power, 1,000,300 kilowatts, at $8.50 per kilowatt-year	$8,502,550	
Annual revenue from secondary power	500,000	
Total revenues	9,002,550	
Cost of operation of commercial power facilities:		
Operating expenses	[2] 1,910,012	
Replacements	[2] 612,758	
	2,522,770	
Net revenues	6,479,780	
Capitalized net revenues (50 years at 3 percent)	166,723,186	
Capitalized net revenues discounted for 2 years	157,153,275	
Deduct cost of commercial power facilities	73,901,994	
Benefit of dam and reservoir for production of power at Grand Coulee	83,251,281	50.03

[1] Based on annual growth of approximately 6 percent after recovery from postwar recession in power load.
[2] $2,064,878 less 7.5 percent (allocation to irrigation pumping power); $662,441 less 7.5 percent (allocation to irrigation pumping power).

TABLE 4.—*Comparison of relative benefits of dam and reservoir to downstream plants and to Grand Coulee (kilowatt basis)*

DOWNSTREAM PLANTS

	Increase in prime power due to storage (average kilowatts)	Estimated date of full power sale	Average kilowatts discounted to 1943		Ratio of each total to their sum (percent)
			Amount	Percent of total	
Bonneville	150, 100	1945	141, 484	15. 98	
Rock Island	82, 600	1949	69, 176	7. 81	
Umatilla	180, 100	1953	134, 011	15. 14	
Foster Creek	272, 400	1956	185, 491	20. 95	
Priest Rapids	215, 600	1959	134, 355	15. 18	
The Dalles	172, 500	1962	98, 375	11. 11	
John Day	122, 700	1963	67, 937	7. 67	
Arlington	101, 500	1964	54, 561	6. 16	
Total	1, 297, 500		885, 390	100. 00	48. 43

GRAND COULEE

Prime power from natural flow	515, 800	
Prime power from storage	484, 500	
Total	1, 000, 300	
Discounted for 2 years	942, 883	51. 57

The first analysis (table 3) shows the relative present worth of benefits. It should be noted that the benefits are determined on a purely incremental basis, on the assumption of selling all of the power 100 percent of the time. This is quite adequate for obtaining a ratio since the same rule is applied to both elements. However, these benefit figures cannot be used as measures of value, since a part of the benefit would apply as well to additional generating facilities installed for the purpose of generating the additional firm power. The present worth of the common facilities, i. e., the dam and reservoir, to power at Grand Coulee Dam, is $83,251,281 as compared to the present worth of Grand Coulee storage to power production at existing and future downstream hydro plants in the amount of $83,153,357. The rounded ratio of each of these amounts to their sum is, respectively, 50 percent for power production at Grand Coulee Dam and 50 percent for power production at downstream hydro plants. Four principal assumptions are involved in this study. (1) In calculating these capitalized benefits, a value of $8.50 per kilowatt-year is assumed for the firm power output at the plant. However, it makes little difference whether this price is increased or decreased, since both capitalized amounts change in almost the same proportion and only the ratio between these two capitalized amounts is significant for this report. For example, a value of $9 or of $8 for the power at the plant would change the ratio only a small fraction of 1 percent. (2) The capitalized benefits for the downstream hydro plants are obtained by taking the difference between the annual value of the increased prime power at $8.50 per kilowatt-year and the incremental annual cost of power-machinery investment and operating charges estimated as necessary to be

incurred by the downstream hydro plants in order to produce the increased firm power, this difference being treated as net income to the downstream hydro plants, being capitalized on a 50-year 3-percent basis and then being discounted to a present value basis to allow for the time lag before the downstream plants come into production. (3) The time lag for bringing the downstream hydro plants into production is based upon a production schedule necessary to meet a growth in regional power load of approximately 6 percent per annum after the anticipated postwar recession in power load. This is considered to be conservative in view of the normal growth in the area's general service load and the probability that large, new industrial loads will be attracted to the region by the availability of large blocks of low-cost hydro power. To the extent that load growth results in more rapid development of downstream hydro plants the present value of the benefits to those plants would be increased and would tend to justify allocating to the downstream hydro plants more of the common facilities investment chargeable to power. (4) The capitalized value of the benefits of the common facilities investment chargeable to power production at Grand Coulee Dam is determined by evaluating the entire firm power output at $8.50 per kilowatt-year at the bus bar, adding $500,000 for the estimated annual value of secondary power, deducting therefrom the estimated annual operating expenses (including replacements) of the power plant, dam, and reservoir, capitalizing this net income on a 50-year, 3-percent basis, and deducting the direct power investment. The resulting capitalized value of the common facilities for the production of power at Grand Coulee reflects the benefits for both head and storage water at the Grand Coulee site.

In the second analysis (table 4) the firm power output attributable to the common facilities investment at Grand Coulee Dam is calculated for both the downstream hydro plants and Grand Coulee. The additional firm power output in downstream hydro plants resulting from Grand Coulee storage totals 1,297,500 kilowatts, but because of the time lag necessary to bring these plants into production (on the assumptions mentioned above), this amount should be discounted at 3 percent to a present-value basis. This results in a total of 885,390 kilowatts for the downstream hydro plants. The Grand Coulee output resulting from natural stream flow (515,800 kilowatts) and from storage water (484,500 kilowatts) totals 1,000,300 kilowatts, based on 5,200,000 acre-feet of usable storage. This amount, discounted for 2 years, gives a present value in kilowatts of 942,883. The ratio is then 51.57 percent for firm power production at Grand Coulee Dam and 48.43 percent for firm power production at downstream plants. Any change in the usable storage would be reflected in both the Coulee production and the downstream production, so that the ratios would be changed only slightly. To the extent that the schedule on the downstream plants is accelerated, a larger percentage would be allocable to them.

If the fact is taken into consideration that the full amount of Coulee power will not be available for several years, the above calculations, both on a dollar and a kilowatt basis, would be altered slightly, with a somewhat lower percentage to Grand Coulee and a correspondingly higher percentage to the downstream plants.

In view of all these factors, a suballocation of the common facilities investment chargeable to commercial power in the amount of 50 percent of such investment to Grand Coulee Dam and 50 percent to the downstream hydro plants, existing and future, is considered reasonable. In other cases, where little or no additional capacity is installed to take advantage of the benefits, little or no risk is involved, and the storage is of greater value to the downstream plants than to the plant at the upper dam, it is believed that almost all of the full incremental benefit of storage may be properly attributable to the upstream storage creating the benefit. The present allocation of investment is solely for the purpose of this report. It should not be interpreted as a precedent, or as controlling for purposes of assessing for the account of upstream storage and river regulation, reasonable and equitable annual charges against the benefited downstream hydro plants, a function which, in the case of plants under private ownership, is assigned by law to the Federal Power Commission.

Section 9 of the Reclamation Project Act of 1939 provides for the allocation of a part of the estimated costs of a project, among other purposes, to power and to "miscellaneous purposes." It requires, with respect to such allocations, a finding of their probable return to the United States, but in the case of the latter does not indicate the source of return. River regulation, in addition to that represented by flood control and navigation, was one of the express purposes for which Grand Coulee Dam was originally authorized, as stated in the act of August 30, 1935, supra. Section 9 of the 1939 act does not provide expressly for allocations to river regulation, but the category of "miscellaneous purposes" set up in paragraph (5) of subsection 9 (a) is broad enough to embrace this purpose, if a return from some source can be indicated as probable, as is done in this report. One measure of the value of river regulation is in the increased production of firm power at downstream plants, existing and future. But in the case of future downstream plants, the actual translation of the benefit into increased power production depends on the construction of the downstream plants with the capabilities for such translation. That is to say that such an allocation, while measured in terms of increased power production, is but potentially an allocation to power. Until capable of translation, it remains appropriately an allocation to downstream river regulation.

At the present time the only downstream plant realizing substantial benefits from Grand Coulee storage is the Bonneville project. It is chargeable with 13.75 percent of the total downstream allocation.[2] This amounts to $4,826,129,[3] and should be considered a part of the commercial power allocation instead of a part of the allocation to miscellaneous purposes resulting from downstream regulation. The balance, $30,272,991, for the present is to be treated as an allocation to downstream river regulation.

While remaining in this category, it is properly treated as not being governed by the provisions of subsection 9 (c) of the 1939 act, which requires that power rates must produce revenues at least sufficient to cover, among other things, "interest on an appropriate share of the

[2] See table 3, p. 14.

[3] See table 5, p. 18. The annual payment, representing interest at 3 percent from 1943 and amortiztion of this amount over a 50-year period. commencing 1945, is $198,993. Over a period of 50 years this amounts to a total of $9,949,650. Application of revenues available from the Bonneville project from fiscal year 1943 reduces the annual rate of payment to $187,570, for a total of $9,378,500.

construction investment." This "share" is interpreted to be that which, under the provisions of paragraph (4) of subsection 9 (a) is "properly allocated to power." This amount is exclusive of that allocated under "miscellaneous purposes" to river regulation based on potential future increases in "firm" power at downstream plants.

As indicated in part III, revenues from the sale of commercial power produced at the Grand Coulee Dam power plant will be sufficient to return the remaining sum allocated to river regulation should the downstream plants not be constructed. As the potential value of river regulation becomes realizable, however, through downstream power installations capable of translating such regulation into increased firm power production, the allocations will be revised and amounts allocated to river regulation will be reallocated to commercial power.

On the basis of the foregoing analysis, a summary of the commercial power allocation is presented in table 5. To the commercial power-plant investment of $73,901,994 is added $35,099,120, which is 50 percent of the cost of the dam and reservoir allocated to power, and $4,826,129, which is the Bonneville project share of downstream river regulation benefits that is properly allocable to commercial power, to make a total allocation to commercial power of $113,827,243. Temporarily allocated to river regulation at future downstream plants is the sum of $30,272,991.

TABLE 5.—*Alternative justifiable expenditure allocation (detail of commercial-power allocation)*

	Present commercial power	Temporarily, river regulation	Total
Total commercial power allocation:			
Power plant	$73,901,994		$73,901,994
Dam and reservoir:			
Comercial power at Grand Coulee	35,099,120		35,099,120
Downstream power and river regulation	[1] 4,826,129	30,272,991	35,099,120
Total	113,827,243	30,272,991	144,100,234

[1] Bonneville Dam, 13.75 percent of $35,099,120. (See table 3.)

TABLE 6.—*Alternative justifiable expenditure allocation (total allocation)*

	Direct costs		Joint costs, dam and reservoir	Percent of joint costs	Total
	Power plant	Irrigation works			
Irrigation (including power for pumping)	$5,992,054	$280,782,180	$55,155,760	[1] 43.65	$341,929,994
Commercial power (including downstream river regulation)	73,901,994		70,198,240	[1] 55.56	144,100,234
Navigation and flood control			1,000,000	.79	1,000,000
Total	79,894,048	280,782,180	126,354,000	100.00	487,030,228

[1] These are the equivalent of 44 and 56 percent, respectively, of the remaining joint costs after first deducting the allocation to flood control and navigation.

Table 6 presents a recapitulation of the allocation to all purposes on the basis of the alternative-justifiable-expenditure approach. Of the total project cost of $487,030,228, a total of $341,929,994 is allocated to irrigation, $144,100,234 is allocated to commercial power, including downstream river regulation, and $1,000,000 is allocated to flood control and navigation.

The "use benefit" allocation approach

In addition to the alternative-justifiable-expenditure approach, the use-benefit approach to the problem was also studied. This approach is that of determining, as far as possible, the exact uses which each purpose makes of each feature of the project, and the exact benefits it receives from each feature. It is applied frequently by the Bureau of Reclamation. A separate benefit approach is often applied as a basis for taxing or assessing the cost of special improvements upon those who receive a special benefit from them. However, such special assessments are usually applied where the expenditures are for a single use, such as flood control, and where expenditures are made jointly only for those drawing the same kind (even though not the same amount) of benefit from an improvement. Unless checked by the "use" approach it is not always a sufficiently rigorous criterion for the measurement of multiple purposes and multiple effects.

As applied in this report the use-benefit approach follows the normal procedure of first assigning to each feature the direct costs of facilities used by that feature, but in connection with joint costs the benefit test is applied to irrigation only. This is believed justified because it would be inconsistent to apply this criterion to the allocation of joint costs to power in view of the large contribution to be made by power to the repayment of irrigation costs.

Irrigation assignment.—This use-benefit approach leads directly to the conclusion that all of the irrigation works are used by and are for the benefit of irrigation and should be so allocated. The total cost of the irrigation works is $280,782,180.

The power plant has already been allocated 92.5 percent to commercial power and 7.5 percent to irrigation on a weighted use basis. (See note, p. 9). This allocation is equally valid under the use-benefit approach.

This approach also leads to the conclusion that the existence of the dam and reservoir creates a specific benefit to the reclamation interests in that the water does not have to be pumped from the normal river level but can be pumped from the higher level established by the reservoir. Over the 75-year period during which the irrigable lands are expected to be developed, and during which the water users are expected to pay off the portion of the irrigation investment assumed by them, a total of 98,000,000,000 additional kilowatt-hours of energy would have been used if there had been no dam and reservoir.[4] Assuming that power could be obtained at another Government plant, it is unlikely, considering transmission costs and losses, that it could be delivered to the pumping plant at less than 0.75 mill per kilowatt-hour. Therefore, $0.00075 multiplied by 98,000,000,000 kilowatt-hours equals $73,500,000, represents the minimum that could be expected from any other source.

The sum total of the power and joint facilities which would be allocated to irrigation by this approach (table 7) would then be $5,992,054 plus $73,500,000, or $79,492,054.

[4] See the following:

	Kilowatt-hours
Power required to pump from normal river level (approximately)	191,000,000,000
Power required to pump from reservoir, not including 8,000,000,000 kilowatt-hours for supplemental pumping (approximately)	93,000,000,000
Savings (approximately)	98,000,000,000

Power assignment.—The use-benefit analysis finds no power use and benefit in the irrigation works.

It indicates that all of the power plant, except that used for the benefit of irrigation as indicated above (7.5 percent of $79,894,048, or $5,992,054), is useful to power and should be so assigned.

It leads to the conclusion that all of the dam and reservoir not allocated to flood control and navigation, and not allocated to irrigation as a result of benefit or use, is useful and beneficial to power. No amount in excess of the difference between total cost and the flood control, navigation, and irrigation benefits should be assigned to power, because power revenues must contribute in large measure to the irrigation allocation, and to charge power on a benefit basis would be to charge it with a benefit it would not realize. The irrigation assignment to the dam and reservoir was $73,500,000. The remainder is $51,854,000. This would be assigned to power under the use-benefit approach.

As a result of the earlier analysis of allocation to downstream plants (see p. 18), 50 percent of the benefits of the storage capacity assigned to power, or $25,927,000, may be allocated to downstream plants. The benefits to the Bonneville project of this storage represent 13.75 percent of the allocation to all the downstream plants. Under the use-benefit approach this would be $3,564,963.

TABLE 7.—*Use-benefit approach*

		Commercial power and river regulation	Irrigation
Power plant:			
Total investment	$79,894,048		
Irrigation pumping	[1] 5,992,054		$5,992,054
Commercial power	73,901,994	$73,901,994	
Dam and reservoir:			
Total investment	126,354,000		
Flood control and navigation	1,000,000		
	125,354,000		
Use-benefit irrigation	73,500,000		73,500,000
Power	51,854,000	51,854,000	
Total		125,755,994	79,492,054
Downstream regulation (including Bonneville)		25,927,000	
Total commercial power at Grand Coulee		99,828,994	
Total commercial power at Bonneville		[2] 3,564,963	
Future downstream power benefits	$22,362,037		
Total commercial power		103,393,957	

SUMMARY

	Single purpose	Joint purpose	Total
Irrigation	$286,774,234	$73,500,000	$360,274,234
Power	73,901,994	51,854,000	125,755,994
Flood control and navigation	0	1,000,000	1,000,000
Total	360,676,228	126,354,000	487,030,228

[1] 7.5 percent of total power facilities. (See note p. 9.)
[2] 13.75 percent of total downstream. (See table 3.)

The total allocation to commercial power and river regulation on the basis of the use-benefit approach would then be separated, as indicated in table 7, between commercial power (including the allocation to the Bonneville project) in the amount of $103,393,957 and future downstream power benefits in the amount of $22,362,037.

Other benefits.—No municipal water values of importance are expected to result from the project, and no benefits have been assigned to that purpose.

While the construction of the dam, reservoir, and power plant gave a great amount of employment and was, in fact, started by the Public Works Administration partly for that purpose, and provided 150,000,000 man-hours of work, no benefits are here assigned for that purpose.

Similarly the existence and operation of the project has, during the war, given great and almost incalculable aid to the Nation's struggle to secure adequate production of munitions. However, no benefits are here assigned for that purpose.

The project is expected to have great recreational values and benefits. Similarly, the benefits in increasing the industrial and agricultural growth and independence of the region are expected to be very large. However, no benefits are here assigned for these purposes.

Conclusion—Use-benefit approach.—This approach indicates that on a use-and-benefit basis the irrigation allocation would be $360,274,234 and the power allocation would be $125,755,994, of which $103,393,957 would be present commercial power costs.

The use-benefit approach produces results, as will be seen below, which vary somewhat from the results obtained through the application of the alternative-justifiable-expenditure approach.

4. FINAL ALLOCATION

The results of the two approaches to the allocation are summarized as follows:

TABLE 8

	Alternative-justifiable-expenditure approach	Use-benefit approach
Irrigation—including power for pumping	$341,929,994	$360,274,234
Present commercial power	113,827,243	99,828,994
Downstream river regulation	30,272,991	25,927,000
Flood control and navigation	1,000,000	1,000,000
Total	487,030,228	487,030,228

While the two approaches yield somewhat different results, the alternative-justifiable-expenditure analysis is believed to represent the more logical, adequate, and dependable approach, since the alternative irrigation and power projects have been subjected to most careful and detailed analyses and since the use-benefit approach is not properly applicable to commercial power but is necessarily limited to irrigation. The results shown for the alternative-justifiable-expenditure approach in the above tabulation are therefore proposed as the final allocation.

The proposed final allocation of cost is as follows:

TABLE 9

Function served	Joint costs		Direct costs		Total
	Dam and reservoir	Percent	Power plant	Irrigation works	
Irrigation (including pumping power)	$55, 155, 760	43. 65	$5, 992, 054	$280, 782, 180	$341, 929, 994
Present commercial power	[1] 39, 925, 249	31. 60	73, 901, 994		[1] 113, 827, 243
River regulation	30, 272, 991	23. 96			30, 272, 991
Flood control and navigation (nonreimbursable)	1, 000, 000	. 79			1, 000, 000
National defense					
Unemployment relief					
Recreation					
Total	126, 354, 000	100. 00	79, 894, 048	280, 782, 180	487, 030, 228

[1] Includes $4,826,129 allocated to river regulation at the Bonneville project for power production.

PART III. FINDING OF FEASIBILITY

The Reclamation Project Act of 1939 requires a finding of engineering and financial feasibility as to projects that are initiated under that act. It provides also for the making of cost allocations in accordance with the provisions of that act in the case of projects, such as the Columbia Basin project, which were initiated under other acts, and these features of the 1939 act are pertinent to this project by reason of the Columbia Basin Project Act which requires that the repayment of project costs be made in accordance with the 1939 act, among others. The pertinent portion of the 1939 act, subsection 9 (a), is as follows:

> No expenditures for the construction of any new project, new division of a project, or new supplemental works on a project shall be made, nor shall estimates be submitted therefor, by the Secretary until after he has made an investigation thereof and has submitted to the President and to the Congress his report and findings on—
>
> (1) the engineering feasibility of the proposed construction;
>
> (2) the estimated cost of the proposed construction;
>
> (3) the part of the estimated cost which can properly be allocated to irrigation and probably be repaid by the water users;
>
> (4) the part of the estimated cost which can properly be allocated to power and probably be returned to the United States in net power revenues;
>
> (5) the part of the estimated cost which can properly be allocated to municipal water supply or other miscellaneous purposes and probably be returned to the United States.
>
> If the proposed construction is found by the Secretary to have engineering feasibility and if the repayable and returnable allocations to irrigation, power, and municipal water supply or other miscellaneous purposes found by the Secretary to be proper, together with any allocation to flood control or navigation made under subsection (b) of this section, equal the total estimated cost of construction as determined by the Secretary, then the new project, new division of a project, or supplemental works on a project, covered by his findings, shall be deemed authorized and may be undertaken by the Secretary. If all such allocations do not equal said total estimated cost, then said new project, new division, or new supplemental works may be undertaken by the Secretary only after provision therefor has been made by Act of Congress after the Secretary has submitted to the President and the Congress the report and findings involved.

Subsection 9 (b) provides for the allocation to flood control or navigation of such part of the estimated total cost of a project as the Secretary of the Interior may find proper, after consultation with the Chief of Engineers and the Secretary of War.

In accordance with the discussion in parts I and II, above, the project is found to have engineering feasibility; the estimated cost of proposed construction is $487,030,228; and the part of the estimated cost properly allocable to each of the purposes to be served, without regard to the probability of repayment or return is found to be as follows:

Irrigation	$341, 929, 994
Power	113, 827, 243
River regulation	30, 272, 991
Flood control and navigation	1, 000, 000

There remains for determination what amounts are probably repayable or returnable from water users, power revenues, and miscellaneous purposes, and whether such amounts, together with the nonreimbursable allocation to flood control and navigation, equal the total estimated cost of construction, plus, of course, operating expenses and the costs of necessary replacements over the amortization period.

RETURN FROM MISCELLANEOUS PURPOSES

The part of the estimated costs which can properly be allocated to miscellaneous purposes is $30,272,991, allocated to river regulation at downstream power sites. It is probable that further development of the river will provide the return of this allocation. However, such development has not yet been authorized by the Congress and it has been determined to guarantee the return out of revenues from the sale of power produced at the Grand Coulee Dam power plant. When the downstream plants are constructed and assume their respective reimbursement obligations, the money they return will permit the proportionate reduction of the amount for which provision is now made from revenues derived from the sale of power generated at Grand Coulee.

REPAYMENT BY WATER USERS

It has been determined tentatively by the Commissioner of Reclamation, after classification of the lands to be irrigated from the project works and a study of the probable earning capacity of such lands under irrigation, that the water users will be able to pay at the average rate of $85 per acre for the net irrigable acreage of the project on the terms available under the Reclamation Project Act of 1939, subject to a possible reduction later if circumstances warrant. Any such reduction, however, it is proposed now, would not result in an average rate of less than $70 per acre. Such repayment will be effected, as to each irrigation block in the project, over a normal 40-year period, beginning after a development period of not to exceed 10 years from the time water is first available to that block. On the basis of the $85 figure and a net irrigable area of 1,029,000 acres, it is determined that the water users can repay $87,465,000 of the project construction charges.

The water users will be required to pay, in addition, the operation, maintenance, and replacement costs of the irrigation system amounting to several million dollars annually, plus an amount equal to one-half mill per kilowatt-hour for power required for the operation and maintenance of the irrigation system, such power being required principally for the pumping of the project water supply. As indicated in table 10, the sum of the annual payments for pumping over the repayment period is estimated to be $50,500,000.

RETURN FROM POWER

The sale of commercial power is the only source of revenue for the payment of the portion of the replacement costs and operating expenses of the dam, reservoir, and power plant, and the return of project construction costs not to be repaid by the water users or not allocated to flood control and navigation. The total costs so to be returned will amount to $572,551,270, of which $563,173,770 is from power produced at Grand Coulee and $9,378,500 from power produced at Bonneville. The Bonneville Power Administration will pay to Grand Coulee out of revenues derived from the sale of power produced at Bonneville only for the benefits received from Grand Coulee storage. This payment is $187,570 per year for 50 years and represents 3 percent interest and amortization on $4,826,129, which is the portion of the commercial power allocation applicable to the Bonneville Dam project. The amount to be returned from power produced at Grand Coulee may be adjusted by reason of departures of the actual figures from the estimates and changes in the amount to be repaid by the water users. In order to ascertain whether this requirement probably can be met it is necessary to estimate the replacement costs and operating expenses over a reasonable repayment period.

(1) *Amortization period.*—No period for amortization is expressly fixed by law. The implicit legal requirement would appear to be that costs be amortized within a reasonable period and, of course, within the useful life of the project. Water users, however, are required by law to repay costs assessable to any irrigation block within a total of 40 years from the close of a development period not exceeding 10 years from the date that water is first made available to that block. In harmony with this requirement, the period selected for amortization of costs to be returned from power revenues is that which ends with the anticipated date upon which water users would be required by law to pay off the last of their obligations. It is estimated that water will first be made available to the last irrigation block in 1967. Accordingly, the last year of the repayment period will be 2017. Power costs will be returned within 50 years from the time incurred, and irrigation costs to be met from power revenues will be returned within 50 years from the date that water is made available to the irrigation block to which such irrigation costs would, but for inability of the water users to repay, be assessable.

(2) *Replacements.*—In order that revenues may continue to be derived over the entire repayment period, all necessary replacements must be made. In table 10 the estimated cash requirements for replacements during the repayment period are shown as $72,920,000.

(3) *Operating expenses.*—Annual operation and maintenance expense of the entire dam, reservoir and power plant has likewise been estimated. This expense increases to a total of $2,064,878 per year by 1954, and throughout the repayment period amounts to $151,567,042 as shown in table 10.

TABLE 10.—*Revenues required to be provided from sale of commercial power under the provisions of the Federal reclamation law (over repayment period to 2017, inclusive)*

Requirements:		
Reimbursable construction cost		[1] $486, 030, 228
Replacements		72, 920, 000
Other operating expenses		[2] 151, 567, 042
Total		710, 517, 270
Revenues:		
From water users:		
For pumping power	$50, 500, 000	
Construction cost repayment	87, 465, 000	
Total		[2] 137, 965, 000
Balance required from commercial power		572, 552, 270
Revenue for river regulation at the Bonneville project		[3] 9, 378, 500
Balance required from sale of power generated at Grand Coulee		563, 173, 770

[1] Total cost of project, $487,030,228 less $1,000,000 allocated to navigation and flood control.
[2] Not including operation and maintenance expenses of the irrigation system, amounting to several million dollars annually.
[3] See note 3, p. 17.

Table 10 indicates that the total reimbursable costs of the project, including operating expenses and replacement costs of the dam, reservoir and power plant over the amortization period but exclusive of the operating expense of the irrigation system, are estimated to amount to $710,517,270. In order to ascertain what part of this amount must be met from commercial power revenues, there are deducted the anticipated payments of $137,965,000, by water users and $9,378,500, on account of water regulation benefits at the Bonneville project, leaving a balance of $563,173,770. This balance will be budgeted over the amortization period in proportion to the anticipated annual revenues from the sale of commercial power produced at Grand Coulee. The revenues from present rates of the Bonneville Power Administration for prime power, applied to the prime power estimated to be available, plus a reasonable return from secondary power, will be more than sufficient to meet the financial requirements as set forth in table 10, in addition to meeting all estimated obligations in connection with the Bonneville project and the Bonneville-Coulee transmission system. Accordingly, it is found that all the estimated reimbursable construction costs of the project which are allocated to miscellaneous purposes, to irrigation (less the portion to be repaid by the water users) and to power can "probably be returned to the United States in net power revenues"; and that the returnable and repayable allocations, together with the allocation to flood control and navigation, are equal to the total estimated cost of construction.

Therefore, the project is financially feasible, in accordance with the test established by subsections 9 (a) and 9 (b) of the 1939 act.

Consideration needs to be given also in this report to the provisions of subsection 9 (c) of the 1939 act, as it bears on proposals herein made concerning the accounting for the revenues from the sale of commercial power.

TABLE 11.—*Revenues required to repay total reimbursable costs plus interest at 3 percent on investment allocated to power (over repayment period to 2017, inclusive)*

Requirements:		
Reimbursable construction cost		[1] $486, 030, 228
Replacements		72, 920, 000
Other operating expenses		[2] 151, 567, 042
Interest on unamortized balances of investment allocated to power		70, 786, 815
Total		781, 304, 085
Revenues:		
From water users:		
For pumping power	$50, 500, 000	
Construction cost repayment	87, 465, 000	
Total		[2] 137, 965, 000
Balance required from commercial power		643, 339, 085
Revenue for river regulation at the Bonneville project		[3] 9, 378, 500
Balance required from sale of power generated at Grand Coulee		[4] 633, 960, 585

[1] Total cost of project, $487,030,228, less $1,000,000 allocated to navigation and flood control.
[2] Not including operation and maintenance expenses of the irrigation system, amounting to several million dollars annually.
[3] See note 3, p. 17.
[4] This amount is in excess of that required by law to the extent of about $70,786,815, the interest on the investment allocated to power.

Subsection 9 (c) provides, in part, as follows:

* * * Any sale of electric power or lease of power privileges, made by the Secretary in connection with the operation of any project or division of a project shall be for such periods, not to exceed forty years, and at such rates as in his judgment will produce power revenues at least sufficient to cover an appropriate share of the annual operation and maintenance cost, interest on an appropriate share of the construction investment at not less than 3 per centum per annum, and such other fixed charges as the Secretary deems proper * * *

The Bureau of Reclamation has heretofore taken the position that this provision, together with the provisions of subsection 9 (a), required the return from power revenues of operation and maintenance costs and of the project construction costs properly allocated to power, plus the remaining reimbursable construction costs which are properly allocable to other purposes but which are assigned to be returned from power revenues, and in addition interest at 3 percent per annum on the construction costs properly allocated to power. It has been concluded that this position was more stringent than the law requires. It has been concluded that the minimum rates for power must be—

such as to produce revenues sufficient only to meet in addition to the return for operations and maintenance cost, an amount equal to 3 percent of the power construction costs with the proviso that if total revenues thus produced are insufficient to repay all costs allocated to power to be repaid by power revenues, "other fixed charges" must be included in the rate schedule to produce revenues sufficient to repay such costs. (Solicitor's Opinion, September 29, 1944, M–33473.)

The total requirement of subsections 9 (a) and 9 (b) for the repayment period provided for herein, as shown in table 10, greatly exceeds this requirement of subsection 9 (c), due to the large contribution required from power revenues to meet irrigation costs. This contribution from power to irrigation of approximately $224,000,000 amounts to 155 percent of the total power allocation, including the portion allo-

cated to downstream plants, and is far greater than interest during the amortization period on the power investment.

It would be proper, of course, for the Secretary to establish rates which would produce returns in excess of the total requirement of subsections 9 (a) and 9 (b). Rate schedules for projects subject to the 1939 act have in the past been prepared in accordance with the position heretofore taken by the Bureau of Reclamation and representations have been made to Congress concerning this practice. This practice, though permitted by law, is not required.

Table 11 shows the revenues from commercial power produced at Grand Coulee which would be required to produce the additional 3 percent in this case in accordance with that practice. The power investment is amortized with interest at the rate of 3 percent per year on the unamortized balance. This table shows total commercial power revenues of $633,960,585, which exceeds that required as a matter of law for feasibility by $70,786,815.[5] The presently effective rates of the Bonneville Power Administration are anticipated to produce revenues sufficient not only to meet the legal requirements as set forth in table 10, but also to provide revenues, as set forth in table 11, to return the power investment with interest and in addition thereto to repay all irrigation and other reimbursable costs of the project which cannot be repaid otherwise.

It is not planned to make reductions in the immediate future in the existing Bonneville rates below the level required to make returns in accordance with table 11. Instead, it is proposed to earmark in the special account in the Treasury created by Executive Order No. 8526 a portion of the revenues covered into that account equal to the difference between the revenues shown in table 10 and those shown in table 11. If accumulated over the entire repayment period this would amount to $70,786,815. These revenues, it is proposed, would be earmarked notwithstanding any excess of the actual construction costs over the estimates included herein. An extension of the assumed repayment period shown in table 10 would be made, if and to the extent necessary, to cover such additional costs. It is proposed that these revenues would be available as a basis for a reduction, if circumstances warrant, in the total obligation for construction charges which the water users are required to assume, for a reduction in the amounts to be returned from commercial power revenues, and to be taken into account in the determination of the financial feasibility of various other irrigation and power projects that may be undertaken in the Columbia River Basin. The amount available for the above three purposes will not be affected by any excess of actual construction costs over the estimates stated herein. Such excess will be returned by an extension of the repayment period shown in table 10, if and to the extent necessary.

It is recognized that additional legislation may be required to permit the carrying out of the third purpose indicated in the preceding paragraph; but to the extent that any amount available for the third

[5] See the following:

Table 11	$633, 960, 585
Legal requirements (table 10)	563, 173, 770
Difference	70, 786, 815

purpose has not been disposed of or obligated by December 31, 1960, the balance available for that purpose would be released and no further amounts would be earmarked therefor. Earlier disposition of the portion of the amount to be available for the third purpose may be made in accordance with the provisions of law if the Secretary, after consultation with the Bonneville Power Administrator and the Commissioner of Reclamation, finds that such a disposition would better serve to develop the Columbia River Basin.

Detailed arrangements to carry out the purposes of this report will be covered by a memorandum of understanding between the Bonneville Power Administration and the Bureau of Reclamation, to be approved by the Secretary.

H. W. BASHORE,
Commissioner of Reclamation.
PAUL J. RAVER,
Bonneville Power Administrator.

The foregoing report and all the allocations, determinations, and findings set forth therein are hereby approved and adopted.

HAROLD L. ICKES,
Secretary of the Interior.

JANUARY 31, 1945.