OFFICE OF DIVISION ENGINEER,
PACIFIC DIVISION,
October 23, 1931.

Memorandum to the Chief of Engineers, United States Army.

Diagrams [2] relating to rates of power growth made by Principal Engineer C. I. Grimm of this office, which are self-explanatory, are enclosed. These data indicate that estimated rates of power growth as used in the Columbia River report are over optimistic. Using the more conservative prediction proposed on the diagram, it is estimated that beginning in 1940 about 25 years would be required to absorb the primary power output of the Grand Coulee high-dam project, assuming that this power would be taken to the extent of excluding all other power development in the market area, which is not probable. If the period of power absorption is extended to 25 years instead of 15 years as used in the set-ups made in the Columbia River report, the surplus available for subsidizing irrigation will be small for many years to come. In this connection it would seem that provision should be made for the use of some of this surplus income from power for building locks, when needed, as well as for promoting irrigation.

THOMAS M. ROBINS,
Lieutenant Colonel, Corps of Engineers,
Division Engineer.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Seattle, Wash., December 1, 1931.

Subject: Financial study of Grand Coulee power project and Columbia Basin irrigation project.

To: The division engineer, Pacific Division, San Francisco, Calif.

1. There are forwarded herewith two diagrams [2] illustrating financial conditions at the proposed Grand Coulee power development on Columbia River using the high dam; also two diagrams [2] illustrating financial conditions of the Columbia Basin irrigation project as developed in connection with the high Grand Coulee Dam. These studies are based upon assumptions suggested by the division engineer. They differ in some respects from those appearing in the 308 Columbia report. The assumptions are listed in paragraph 5 below.

2. The submission of the diagrams has been much delayed, as it has been necessary to completely recast the repayment studies given in the report, to meet the new conditions imposed by considering the Grand Coulee plant alone without reference to other plants on the river, and to meet the future conditions due to the new assumptions as to the increase in the future power market.

3. The data relative to irrigation requirements given in the 308 Columbia River report (par. 212, appendix no. 2) were based on the assumption that the river above the Snake would be fully developed and that power from downstream plants would be used to aid in pumping irrigation water during critical months. The justification

[2] Not printed.

for this assumption was that the power from downstream plants used for irrigation would be a proper return to Grand Coulee for the benefits received by the down-river plants from regulation of the reservoir formed by the high Coulee Dam. In the water-supply studies for the report the reservoir above the high dam was regulated so as to produce the maximum power in the system comprising all the plants from and including Grand Coulee to mouth of Snake River. The drawdown used in these studies was 80 feet. The irrigation reservoir in the Grand Coulee was not considered in the water-supply studies.

4. As the diagrams [2] now submitted are to show conditions obtaining at Grand Coulee power plant without reference to other plants on the river, it was necessary that the reservoir in the river and the reservoir in the Grand Coulee be regulated so as to provide for the irrigation requirements, both water and power to pump it, and to deliver the maximum possible commercial power. When part of the power for pumping irrigation water was obtained from down-river plants, the demand for power for pumping during the critical period varied from 50,542 kilowatts, when irrigation was started, to 419,520 kilowatts, when the irrigation area had been fully settled. With the modified regulation assumed for the diagrams submitted herewith, the demand for irrigation power during the critical period varies from 48,676 kilowatts to 375,000 kilowatts; the reduction in critical values being effected by regulation of storage in the two reservoirs.

5. The two power diagrams showing financial conditions for the Grand Coulee power plant are based on the assumptions:

That the power market supplied from this plant will increase at a uniform rate from zero to the prime power of the site (907,000 kilowatts) in a period of 25 years, or at a rate of 36,280 (average) kilowatts per year.

That the energy sold will be paid for at a rate of 2¼ mills per kilowatt-hour.

That the cost of operation, maintenance, and depreciation will be one fourth mill per kilowatt-hour for both the energy sold and the energy used in pumping irrigation water.

That the load factor for commercial power will be 55 percent.

That the rated capacity of the machines will obtain throughout the range in head; that is, that with reduced head the water wheels will still be able to turn the generators when they are delivering the full load of 105,000 kilowatts.

6. For those diagrams which involve the Columbia Basin irrigation project the rate of settlement has been taken at 50,000 acres per year. Zero year for all of the diagrams is taken as the year when work is started on the power plant at Grand Coulee. During the second year the irrigation works are started. Colonization of the irrigation project is completed in the twenty-ninth year.

7. Diagram no. 1 [2] illustrates conditions when the plant is developed as a power plant without reference to the irrigation requirements, except that 1,000 second-feet have been deducted from the flow to provide for leakage in the Coulee Reservoir. The plant as designed for the 308 Columbia report contains 15 units of 105,000 kilowatts

[2] Not printed.

each, or a total installation of 1,575,000 kilowatts. If this is operated on a 55-percent load factor the total amount of energy for sale is (1,575,000) (0.55) = 866,250 kilowatts. This is less than the prime power of the river (907,000 kilowatts). Therefore, the plant is loaded in about 24 years, or 29 years after start of work. This diagram shows that the plant will be fully paid for, with interest at 4 percent, in a period of 50 years and that there will be a surplus of $4,020,000 per year for the last 21 years of the 50-year period.

8. Diagram no. 2[2] shows conditions at the Grand Coulee power plant when available commercial power is limited by the diversion of water for irrigation and by the use of power for pumping. The power for pumping is delivered on a 100-percent load factor and the commercial power on a 55-percent load factor. This diagram is based on making full use of storage in the reservoir above the dam and in the reservoir in the coulee so as to produce the greatest possible amount of commercial power. The water for irrigation and the energy for pumping it are donated to the irrigation project. The diagram shows that, beginning with the twenty-sixth year, the annual charges for interest, and operation, maintenance, and depreciation, begin to decrease due to partial liquidation of capital expenditures. It also shows that there will be no surplus until after the fifty-eighth year. There will be an unliquidated balance at the end of the 50-year period of $72,000,000, at which time annual interest and operation, maintenance, and depreciation charges, as shown by the diagram, amount to about $5,100,000.

9. Diagram no. 3[2] shows the financial status of the Columbia Basin irrigation project with receipts from the land at $3 per acre in addition to the cost of operation, maintenance, and depreciation of the irrigation works, which it is estimated will also cost $3 per acre per year. The total cost to the farmer is therefore $6 per acre per year.

Irrigation water and power for pumping it are received from the power project without cost to the irrigation works.

Interest is taken at 4 percent.

It has been assumed that the land would be settled at the rate of 50,000 acres per year; that the farmer would not be required to make payments for water until the third year after settlement.

At the end of the 50-year period the project is in debt in the amount of $585,000,000.

10. Diagram no. 4[2] shows the condition of the irrigation project when no interest charge is made and the water and power for pumping it are given the district.

11. It is proposed to have made and submitted within the next few days an additional diagram showing conditions at the Grand Coulee plant with 20 units installed in place of the 15 as illustrated in diagram no. 2.

C. L. STURDEVANT,
Lieutenant Colonel, Corps of Engineers,
District Engineer.

[2] Not printed.

[First indorsement]

OFFICE DIVISION ENGINEER, PACIFIC DIVISION,
San Francisco, December 4, 1931.

To the CHIEF OF ENGINEERS, UNITED STATES ARMY:

1. Forwarded. It is believed that these studies may be of interest.

THOMAS M. ROBINS,
Lieutenant Colonel, Corps of Engineers,
Division Engineer.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Seattle, Wash., December 7, 1931.

Subject: Financial study of Grand Coulee power project and Columbia Basin irrigation project.

To: The division engineer, Pacific Division, San Francisco, Calif.

1. There is inclosed herewith diagram no. 5[2] referred to in my letter of December 1, 1931.

2. This diagram shows conditions at Grand Coulee power plant with 20 units installed in place of 15 as given on diagram no. 2 and as used in the 308 report. The additional 5 units have been assumed to cost $4,000,000 each. This high cost was assumed because these 5 units could not be placed with the 15 units in the power house, which is integral with the dam, but must go in a separate power house located downstream from the dam and parallel to the river.

3. As a matter of interest, diagram no. 6[2] has been prepared showing conditions when the power market is one half the estimated increase in the future power market as given in the 308 report. In this case zero on the diagram is January 1, 1935.

4. In my letter of December 1, 1931, the descriptions of diagrams nos. 3 and 4 should be interchanged. Diagram no. 3[2] is without interest on money used to construct the irrigation project, and no. 4[2] is with interest.

C. L. STURDEVANT,
Lieutenant Colonel, Corps of Engineers,
District Engineer.

[First indorsement]

OFFICE DIVISION ENGINEER, PACIFIC DIVISION,
San Francisco, Calif., Dec. 14, 1931.

To: The CHIEF OF ENGINEERS, UNITED STATES ARMY.

1. The above letter supplements a previous one forwarded by the division engineer by first indorsement dated December 4. The error referred to in paragraph 4 was corrected in this office by interchanging the numbers of diagrams 3 and 4.

THOMAS M. ROBINS,
Lieutenant Colonel, Corps of Engineers,
Division Engineer.

---

[2] Not printed.