THIRD

Annual Report of the Bonneville Power Administration

Portland, Oregon

1940

THIRD

ANNUAL REPORT OF THE ADMINISTRATOR OF THE BONNEVILLE POWER ADMINISTRATION

◊

LETTER

FROM

THE SECRETARY OF THE INTERIOR

TRANSMITTING

A LETTER FROM THE ADMINISTRATOR OF THE BONNEVILLE POWER ADMINISTRATION SUBMITTING, PURSUANT TO THE "ACT TO AUTHORIZE THE COMPLETION, MAINTENANCE, AND OPERATION OF THE BONNEVILLE PROJECT FOR NAVIGATION, AND FOR OTHER PURPOSES" (50 STAT. 731), APPROVED AUGUST 20, 1937, THE THIRD ANNUAL REPORT OF THE ADMINISTRATOR OF THE BONNEVILLE POWER ADMINISTRATION

PORTLAND, OREGON

1940

LETTER OF SUBMITTAL

Department of the Interior,
Washington, December 30, 1940.

The Speaker of the House of Representatives:

My Dear Mr. Speaker:

I have the honor to submit herewith, for the consideration of the Congress, the Third Annual Report of the Bonneville Administrator, made under the provisions of section 9 (c) of the Bonneville Act (Public, No. 329, 75th Cong., approved Aug. 20, 1937).

Sincerely yours,

HAROLD L. ICKES,
Secretary of the Interior.

LETTER OF TRANSMITTAL

Department of the Interior,
Office of the Administrator,
Bonneville Power Administration,
Portland, Oreg., December 30, 1940

Hon. Harold L. Ickes,
Secretary of the Interior,
Washington, D. C.

My Dear Mr. Secretary:

The Third Annual Report of the Bonneville Power Administration of the Department of the Interior is herewith submitted. This report covers operations and transactions during the fiscal year 1940. It covers in detail the Administration's activities from the standpoint of power contracts and negotiations, the marketing of Bonneville power, construction and expansion of the Bonneville system, a report of the Administration's finances, and management of the enterprise.

As a result of emphasis on National Defense toward the close of the year, supplementary statements relating to adaptation of the agency's program to defense needs during the first six months of fiscal 1941 have been included. Special attention also has been given to a report of improvements in management--a field in which recent substantial progress has been made.

Tables, maps and photographs necessary for a satisfactory explanation or amplification of the text have been included with the narrative report or as appendices.

Sincerely yours,

PAUL J. RAVER, Administrator

CONTENTS

CONTENTS

THIRD ANNUAL REPORT OF THE BONNEVILLE POWER ADMINISTRATION

Fiscal Year 1940

(With supplemental data on first six months of fiscal year 1941)

I. SUMMARY OF ACCOMPLISHMENTS

The force of the federal government's long-range program for the development of the multiple uses of the Columbia river is already being felt in the Pacific Northwest.

Events of the fiscal year July 1, 1939 to June 30, 1940 indicate that the construction of such multi-purpose projects as Bonneville dam, 40 miles east of Portland, Ore., and Grand Coulee dam, farther up the Columbia river in North Central Washington, is providing the foundation for a new and more abundant economy in the region.

Not only do these projects provide for irrigation and flood control and for new avenues of inland transportation, but they also create a great and wholly new source of electric power which is already contributing materially to the full development of the territory.

Because power is not the sole product of the large dams, but merely one of many products of large scale projects such as Bonneville, it is possible to market the electric energy at the lowest wholesale rate in America--$17.50 a kilowatt year at any point on the government's transmission system. These low rates already have been reflected in a general lowering of retail rates charged consumers on systems using federally-generated Columbia river power, in a general rise in domestic and commercial electric usage and in the establishment of wholly new industries in the area. In addition, construction of Bonneville dam apparently has served as an impact upon the retail rates of private utilities in the territory. Since development of the Bonneville project in 1935, annual rate reductions put into effect by private utilities in Washington and Oregon have totalled $6,825,000. Of this total about $4,760,000 of

reductions were made effective since completion of the initial generating units at Bonneville in the latter part of 1938. On a cumulative basis, these reductions have meant savings of more than $13,000,000 to rate payers of the two states from 1935 to 1940.1/

Development Begun in 1933

Federal development of the Columbia river began on September 30, 1933, with the start of construction of Bonneville dam, 40 miles east of Portland, Ore., by the War Department under the immediate direction of the U. S. Army Corps of Engineers.

On December 18, 1933, construction of Grand Coulee dam on the upper river, 90 miles west of Spokane, was undertaken by the Department of the Interior under immediate direction of the Bureau of Reclamation.

Both dams were of the multiple-purpose type: Bonneville for the dual purpose of improving navigation and the generation of hydroelectric power; Grand Coulee, for irrigation and the generation of hydroelectric power.

By 1937, construction at Bonneville was largely complete. The spillway dam had been erected, a mammoth single-lift shipping lock was in operation, and two generating units had been installed in the powerhouse.

In August of that year the Bonneville Power Administration was created by Act of Congress2/ as a provisional agency set up for the transmission and sale of Columbia river hydroelectric power.

The period between November, 1937 and June 30, 19383/ was devoted largely to formation of initial policies and staff organization by the first Administrator, the late J. D. Ross (1872-1939).

During the Power Administration's second fiscal year (July 1, 1938-June 30, 1939)4/, the major development was the launching of a

---

1/ For detailed summary of annual rate reductions by private utilities in Oregon and Washington, see Tables 9,10,11-pp.55,56,57.
2/ Public No. 329 - 75th Congress (see Appendix A)
3/ See First Annual Report of the Bonneville Power Administrator
4/ See Second Annual Report of the Bonneville Power Administrator

streamlined construction program which involved the design and building of an initial network of high voltage transmission lines. First funds for construction facilities were appropriated by the Congress in May, 1938, and were made immediately available. Actual erection of the first steel tower line began in March, 1939.

During the Power Administration's third fiscal year (July 1, 1939-June 30, 1940)--the period covered by this report--the potentialities of power marketing and distribution began to be realized. It was during this period that first units of the Power Administration's transmission system were completed and energized. It was during this period also that the present administrator, Dr. Paul J. Raver, assumed direction of the agency.

Marketing Proceeds Rapidly

All through fiscal 1939-1940 the marketing of Columbia river power proceeded at a rapid rate. By April 16, 1940, the Bonneville Power Administration already had begun to contract ahead of its installed generating capacity of 86,400 kilowatts. On June 30, 1940, at the end of the fiscal year--only seven months after completion of the initial transmission line into the Portland area--the Bonneville Power Administration had executed firm power contracts totalling 101,350 kilowatts. These commitments included not only contracts with public agencies, which were immediately reflected in lower resale rates to consumers, but substantial sales to new industrial enterprises as well.

In accordance with terms of the Bonneville Act, which provides that Columbia river power shall be "for the benefit of the general public...particularly of domestic and rural consumers" and that "the Administrator shall at all times...give preference and priority to public bodies and cooperatives", emphasis was placed at all times during the year on sales to public agencies, and assistance was given to such agencies in every way possible, within the limits of the Act, to enable them to purchase power from the Bonneville system.

Five public utility districts in Skamania, Pacific, Wahkiakum, and Klickitat counties, Wash., and in Tillamook county, Ore., had contracted for purchase of a total of 5,600 kilowatts of prime power by June 30, 1940.

Other publicly-owned agencies under contract included the municipal power systems of Cascade Locks, Forest Grove, Canby,

Monmouth and McMinnville, all in Oregon, and Centralia, Wash., which had agreed to purchase a total of 2,950 kilowatts of prime power, and the large municipal systems of Tacoma and Seattle, Wash., which had executed interchange contracts with the Power Administration. One rural electric cooperative, that in Benton and Lincoln counties, Oregon, also had contracted for purchase of power.

Growth in industrial load was reflected at the close of the year by three large contracts. Two of them covered purchases by the Aluminum Company of America. Power commitments for the three totalled 71,000 kilowatts of prime power.

New Power Plays Defense Role

In addition to these increasing benefits to the region, where in the past the economy had been based largely upon the lumber industry and upon agriculture, it became recognized during the latter part of the year that Bonneville and Grand Coulee dams would immediately fill a vital need in providing power for the defense industries of the nation. Nowhere in the United States was there so great an immediate or potential source of the dependable electric power that is so essential to many of the industries engaged in the manufacture of defense materials.

As the fiscal year drew to a close, it became increasingly apparent that, as expansion of these industries took place to meet the growing demands of the federal government, such defense industries would be forced to turn to the Pacific Northwest.

Additional Generating Capacity Scheduled

As a result of this emergency demand, as well as a result of the rapidly expanding normal market, which studies indicated would require the total output of both dams by 1950, it became apparent during the latter half of the fiscal year that generating equipment should be installed as rapidly as possible at both Bonneville and Grand Coulee.

The Power Administration's generating position at the close of the year (June 30, 1940) was as follows:

The United States Army Corps of Engineers had installed and were operating two 43,200-kilowatt generators at Bonneville dam.

Two additional 54,000-kilowatt generators were being installed, scheduled for service in January 1941. Two others of the same size were scheduled for installation by January 1942, and recommendations had been made for advanced installation of the four remaining 54,000-kilowatt generators which would bring the Bonneville plant to its full capacity of 518,400 kilowatts.

Installation of the first of eighteen 108,000-kilowatt generators in the Grand Coulee powerhouse was scheduled for July 1941, with No. 2 scheduled for September 1941, and No. 3 for January 1942.

Construction Program Pushed

In order to meet the expanding market for Columbia river power, and in order to carry out the mandate of Congress that Columbia river power be carried to the markets of the Pacific Northwest over government lines at the low uniform wholesale rate and to provide power to public distribution agencies, it was necessary, during the year, to push with even greater force the speedy construction of a high-voltage grid system linking Grand Coulee and Bonneville dams with the principal hydroelectric plants of the territory. The need to keep construction abreast of sales resulted in simultaneous construction of lines on many fronts and involved a program of considerable magnitude.

Planning, design and construction units of the administration's Engineering division made rapid progress on numerous substations and transmission lines. Design work was performed on 16 substations. Designs for four of these were completed. Surveys were made for 32 transmission lines totalling nearly 1,750 miles in length. Surveys for 27 of these lines, comprising 1,441 miles, were completed. Design work, necessary for construction specifications, was completed for 12 lines and was well under way for 10 additional lines. Right-of-way requests and acquisition data were prepared for 1,115 miles of line.

Seven steel tower lines designed for potentials up to 230,000 volts were under construction during the fiscal year. At the close of the year, two of these lines were completed, a third was 99% complete, another was 93% complete, and two were about 66% complete. The Bonneville ship canal crossing, designed for 115,000 volt operation and of steel tower construction, was 95% complete.

At the close of the year, there were six wood pole lines under construction which were designed for potentials up to 115,000 volts. One of these was completed, and two were scheduled for completion within 30 days following the year's end.

Eleven substations were under construction or completed. Four of these were energized and in service, including two temporary substations. Two others were rapidly nearing completion.

In addition to the lines and substations, a number of buildings, such as control houses, warehouses and service buildings, were in various stages of completion. Design work had been completed on 22 of these, and 11 were actually under construction.

Operations Activities Expanded

System operation activities of the Engineering division increased markedly during the fiscal year, as additional power sales contracts became operative.

Temporary contracts with privately-owned utility companies and long-time contracts with public agencies and industries increased the system's load to a point where a total of 208,571,158 kilowatt-hours were delivered between July 1, 1939 and June 30, 1940. The power demand of these loads at times used all available capacity of system equipment in service.

Planning and Management Procedures Streamlined

Coincident with substantial gains in construction and power sales, definite progress was made during the year in the planning and management procedures of the enterprise.

Pattern of this progress was twofold: (1) basic, long-time plans for orderly development of the Columbia river were embarked on with initiation of basic power load and other surveys to determine the year-to-year needs of the region for the next decade, and (2) the Power Administration itself was organized in accordance with the principles of scientific business management.

To implement the first of these, a "system planning and marketing" staff was put to work to investigate all present and potential power supplies in the region, to determine rates of growth in power usage in the future, and to investigate all possible undeveloped uses of low-cost power. These surveys included such research projects as investigation of the feasibility of developing various Northwest mineral resources, agricultural

application of power, and correlation of all data on Northwest industrial sites.

To streamline the day-to-day processes of the production and marketing program, a management staff was set up to study and simplify office procedures with a view to speeding up the conversion of millions of dollars of appropriations into transmission lines, substations and power deliveries to ultimate consumers. This work was attended by marked success. The period required for converting appropriations into disbursements for plant was reduced during the year by 35 per cent, with an attendant increase in revenue by making possible more rapid power sales.

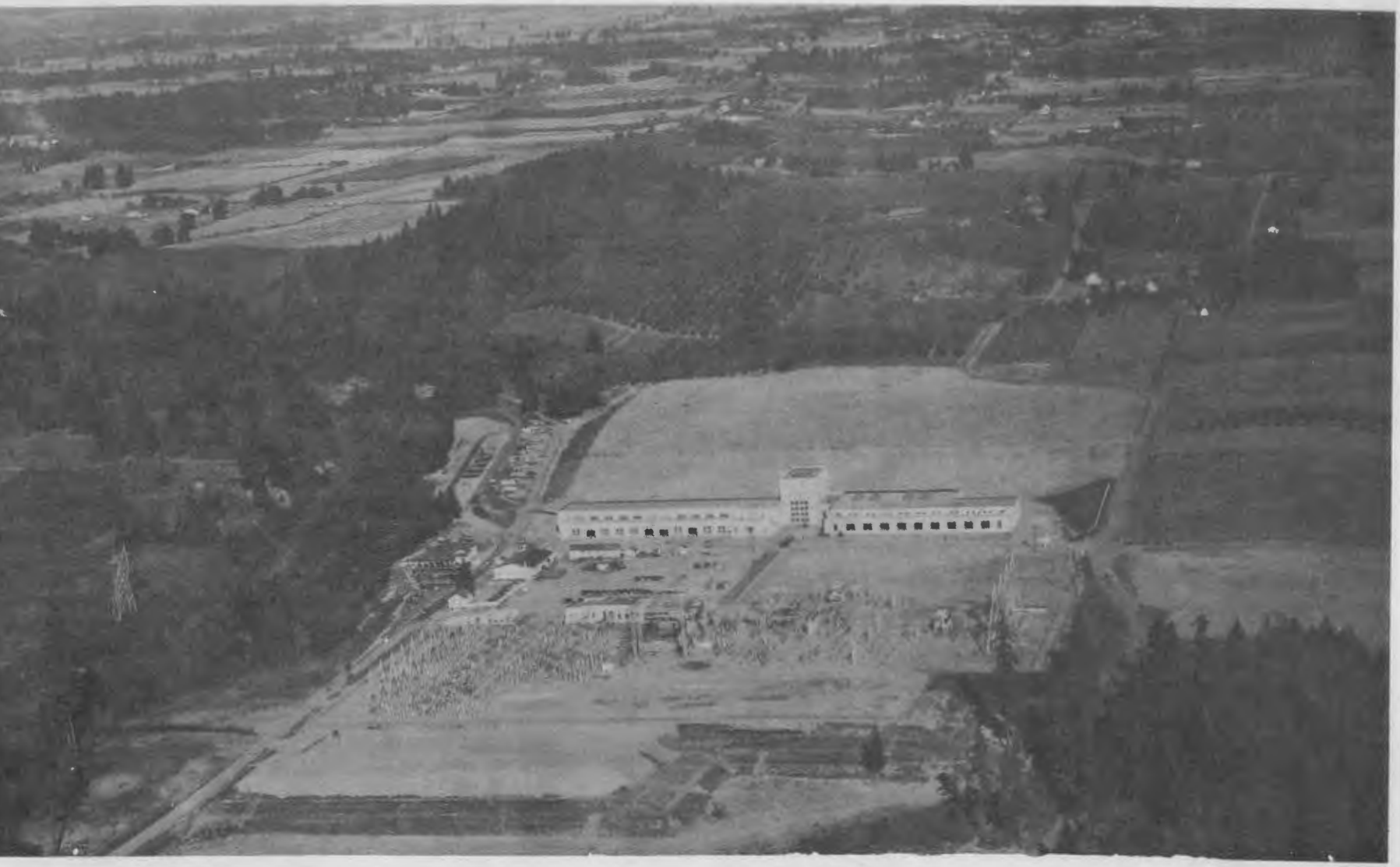
Gains of this sort were reflected in all divisions of the Power Administration. Thus land acquisition for transmission rights-of-way was speeded and the cost per mile reduced. Similarly, the time required in handling construction and materials contracts was reduced by 20 per cent.

Because of the rapid development of the construction program, it was necessary to increase the Bonneville Power Administration personnel during the year. On June 30, 1940, 2,421 persons were employed. Of these, 947 were engaged as hourly laborers in work such as the clearing of rights-of-way and 256 as skilled craftsmen in work such as the location and construction of power lines, substations, and related equipment.

All employees were secured in accordance with federal Civil Service rules and regulations and in accordance with Section 10 of the Bonneville Act, with special emphasis being placed on selection of employees from the Pacific Northwest. An analysis of the staff showed that 92.6 per cent were residents of Oregon and Washington.

Labor Policies Supported

The Power Administration fulfilled its purpose not only as a creator of permanent economic benefits in the Northwest region during 1940, but as a creator of employment in the Northwest as well. During the year, Bonnevill's construction, administrative and clerical activities provided 3,965,806 man hours of direct labor, with a total payroll of $3,656,207.30. The cumulative total at the close of the fiscal year 1940 was 5,478,244 man hours of work and $5,035,108.10 expended for labor for the three fiscal years of the Power Administration's existence. The Power Administration insisted on maintaining a program of close cooperation with those labor organizations in the Northwest which are



Buildings and yard at North Vancouver substation, major distribution point for Columbia River power in western Oregon and Washington.

230 KV bus structures at North Vancouver substation.

affected by its activities. In sales of power to distribution agencies, both publicly and privately owned, the Power Administration directly and affirmatively recommended that wages, hours and working conditions maintained by those agencies be "equal to or better than those" prevailing throughout the territory in which the power is delivered. In relation to its own employee staff and to labor employed by private concerns holding contracts for the construction of transmission lines and substations, the Power Administration consistently supported the program of organized labor.

THE FIRST HALF OF FISCAL YEAR 1941

Because of the rapid expansion of the program, especially in the field of power sales and new power uses, it seems desirable to call attention in this report to progress made by this administration in the six-month period immediately following the close of the fiscal year on June 30, 1940.

By December 31, 1940, contracts for firm power sales had been increased from 101,350 kilowatts to 218,352 kilowatts. This new total represented 42.11 per cent of the total ultimate installed capacity of Bonneville dam. These gains represented growth in both industrial and domestic load--growth in sales to both privately-owned and publicly-owned agencies. Deliveries of this power were scheduled in accordance with customers' needs as rapidly as generator installation and transmission line completion would permit.

Particularly satisfying to the Power Administration were the gains in sales to publicly-owned power distribution agencies, such as public utility districts, municipal systems and rural cooperatives.

At the close of fiscal year 1939-1940, many of these applicants were not in a position to take power immediately. In the six-month period immediately following the close of the fiscal year, however, a number of these districts made rapid strides in this direction. Among them were the districts in Kittitas, Lewis and Grays Harbor counties, Washington, and Northern Wasco county, Oregon, which executed contracts for the purchase of Columbia river power. Several rural cooperatives in Oregon and Washington financed by the Rural Electrification Administration also executed power purchase contracts.

In addition to the foregoing, substantial progress was made by power users in Oregon and Washington in the formation of new utility districts.

Commitments to Public Agencies Increase

By December 30, 1940, prime power commitments to public agencies had been increased to 20,300 kilowatts. The importance of this gain in the public power market lay in the fact that the Congress provided in the Bonneville Act that 50% of installed generating capacity at Bonneville dam be reserved until 1942 for public bodies and cooperatives, and that preference be given those groups thereafter.

These gains in the public power market were supplemented by even greater gains in the industrial power market, as the result of tremendous stimulation from the nation's preparedness program.

Largest single power sales contract to industry in the first half of fiscal 1940-41 was that covered by the Power Administration's third contract with the Aluminum Company of America. This contract, involving the sale of 97,500 kilowatts of prime power, resulted from the Aluminum Company's decision to add three more production units to its large reduction plant near Vancouver, Washington. This move was in response to the national defense need for aluminum metal in the aircraft industry, and brought the Power Administration's total prime power commitments to this company to 162,500 kilowatts. On December 6, 1940, a second industrial consumer, the Pacific Carbide and Alloys Company, which had contracted for 2,000 kilowatts of prime power on July 13, 1940, placed its new plant in operation in the Portland area, and on December 17 a contract for the sale of power was signed with still another new industry, the Pennsylvania Salt Manufacturing Company.

Advances such as these in the first half of fiscal 1940-1941 were in addition to steadily increasing deliveries of power over the Bonneville system. Deliveries at times ranged as high as 91,000 kilowatts, or more than the rated capacity of the two generating units in operation at the Bonneville powerhouse.

With power deliveries and commitments expanding far beyond the installed generating capacity and with sharply increased prospects for future sales to defense industry, it became increasingly important that the Power Administration's position be clarified with respect to the sale of power generated at the Grand Coulee dam project.

This problem was complicated by the fact that the Bonneville Power Administration had status under the law as a provisional agency only, pending establishment of a permanent administration for Bonneville and other Columbia river projects. Yet because

installation of first generating units at Grand Coulee was imminent, an immediate solution was needed.

Accordingly, on August 26, 1940, President Franklin D. Roosevelt, after consultation with the National Power Policy Committee, signed an executive order designating the Bonneville Power Administration as transmission and marketing agency for the power to be available for sale at Grand Coulee.

This order made it possible to integrate a power sales program for the two dams in such a way as to permit delivery of large blocks of power to almost every section of the region as need might arise.

Steady expansion of the power market after the close of the fiscal year 1939-1940 also had its effect on expectable income from power sales. On the basis of contracts negotiated and other prospective sales, revenues of the Bonneville Power Administration were expected to total about $1,895,793 for the fiscal year ending June 30, 1941. Expectable revenues for fiscal year 1942, on the basis of contracts signed or substantially agreed on, were estimated at $4,101,000. Contracts in prospect but not fully negotiated on December 31, 1941, represented an additional $1,570,000 of revenue in fiscal 1942.

In addition to all this, contract negotiations were being carried on with applicants of all types--public and private agencies, cooperatives and industries which, by December 31, 1940, had applications on file representing a total potential sale of power approximating 750,000 kilowatts.

Aluminum Company of America, Vancouver, Wash.

Bonneville service line to Aluminum Company of America near Vancouver, Wash.

II. POWER MARKETING IN FISCAL YEAR 1940

On June 30, 1939, five months before completion of the first unit of the federal transmission network, the Bonneville Power Administration was delivering energy to but two customers. One was the municipal system of Cascade Locks, Oregon, five miles above Bonneville dam; the other was a privately-owned utility company in Portland, Oregon, which was buying dump energy on a month-to-month basis, and taking delivery at the powerhouse. Total income for the preceding year had been only $50,007.

On June 30, 1940--just 12 months later--the Power Administration had a total of 19 contracts covering delivery periods from one to 20 years and representing an overall "face" value of $16,500,000 in expectable revenue.1/

This growth in power sales during a single year was beyond question the year's most significant development in the entire federal power program in the Pacific Northwest because it marked the metamorphosis of the Power Administration from purely a construction agency into a power sales agency, and the beginning of the fulfillment of the program laid down by Congress in the Bonneville Act.

The marketing problem resulting from this evolution made it necessary for the Power Administration to establish a smoothly working procedure to handle immediate sales of existing generating capacity to retail distributor applicants of all types and to prepare for the sale of future capacity.

In order to be prepared with necessary generation and transmission facilities as the markets developed, it became essential to inaugurate a long-range planning and marketing program to develop new markets for Columbia river power, pave

---

1/ As of December 31, 1940, revenue value of all contracts was approximately $51,000,000. See supplementary data on contracts executed since June 30, 1940, Table 7, p. 46.

the way for the orderly integration of the Bonneville sales program with those of other systems, and maintain reliable forecasts of the region's yearly power needs for the next decade.

Need for an organization to handle immediate sales was obvious. Need for the planning program arose from evidence that the region already faced the possibility of a serious power shortage and from the mandate contained in the Bonneville Act requiring the Power Administrator to see that federally-developed Columbia river power be made equally available to all sections of the region upon demand. It was not enough to wait for power contracts before building lines. No marketing program could be considered practicable which did not anticipate regional power demands and have transmission facilities immediately available as the need arose.

Sales Staff Organized

To meet this situation, the administrator early in fiscal 1940 established a System Planning and Marketing division to handle all power sales, plan system construction, and assist power purchasers in meeting their own administrative and fiscal problems.

Sales of power to publicly-owned distribution agencies were made the responsibility of a Distribution Projects section within the new division. The work of this unit included the review of all power applications of public bodies, investigation into the feasibility of operations by and contract negotiations with such groups.

Sales of Columbia river power direct to industrial consumers were placed in charge of a Market Development section, a unit designed to accelerate sales to industry through direct contact with interested organizations. This section also launched upon investigations of northwest resources which might prove attractive to new power using industries.

To facilitate the work of these two major units, a Rates and Statistical staff was established, and given the task of working out additional wholesale rate schedules suitable to special types of power users which found existing schedules out of line with their particular types of power requirements. The services of this staff also were made available to Bonneville customers seeking to establish equitable resale rate schedules reflecting not only the mandates of the Bonneville Act but also providing economically sound bases for meeting the customers' own fiscal problems.

As another means of keeping in close touch with the problems of the administration's customers, a Distribution Operations section was established within the System Planning and Marketing division as a liaison unit to act in a consulting and advisory capacity in assisting the administration's wholesale customers in the solution of their day-to-day operating problems. This consulting and advisory service to the distributors of Columbia river power has been of material assistance in making this power available at the lowest possible cost, and has contributed materially to an over-all reduction in retail rates resulting from the improved operating efficiency of the distribution agencies.

These four units within the System Planning and Marketing division were established to constitute the Power Administration's front line of all sales operations, and their activities, coordinated with the Power Administration's management staff, brought about effective procedures for the prompt handling of marketing problems.

In order to meet properly the problems of a long-time sales program it was desirable to create a special planning staff which would closely coordinate the activities of the marketing force with those of the Engineering division, builder and operator of the Power Administration's transmission network. Accordingly, a System Planning section was established in the System Planning and Marketing division and a staff of consulting engineers was created. A joint research program was begun immediately by the two staffs, utilizing the personnel of the consulting staff.

Marketing Policies Defined

Coincident with the establishment of a permanent sales and planning organization, fundamental sales policies were defined to serve as a practical guide to Power Administration staff members. The principal objectives of the sales and planning policies were summarized as follows:

(1) To make available low cost federally-generated power to the largest possible number of consumers in the Northwest, especially domestic and rural consumers, at the lowest possible retail rates, as provided in the Bonneville Act, with preference given to publicly owned agencies.

(2) Development of the sale of industrial power with special emphasis on the procurement of industries new to the

Northwest and of a type which would make maximum use of Northwest power and resources and foster the general development of the region.

(3) Power sales coverage of the entire Northwest area to the maximum distance permitted by the economics of transmission line construction and operation.

(4) Development of the program with due regard to the potentialities of other future federal developments in the area, both as to quantity of power and location.

In line with the establishment of a permanent sales staff and procedure, and with the formulation of more definite marketing policies, the Power Administration developed and placed in effect revised wholesale rate schedules.1/ The existing basic wholesale rate of $17.50 per kilowatt-year was retained in the rate schedules, as was the power rate of $14.50 per kilowatt-year for customers obtaining delivery within 15 miles of the Bonneville power house. Two new rate schedules were added: (1) A new optional prime power rate was provided (Rate Schedule F-1). This rate particularly benefited small public distribution agencies with relatively low load factors. The monthly demand charge under this rate is 75¢ per kilowatt, to which is added an energy charge of a quarter-cent per kilowatt-hour. (2) A new dump energy rate (Rate Schedule H-1) was also added. This rate provides for sale of power at a quarter-cent per kilowatt-hour primarily to replace fuel generation by customers which have their own generating plants.

Bonneville's wholesale rates are among the lowest in the United States and are particularly advantageous for public agencies and rural cooperatives purchasing relatively small amounts of power for distribution at retail, and for industries and other customers able to use their maximum power requirements a large part of the time.2/

The Year's Power Sales

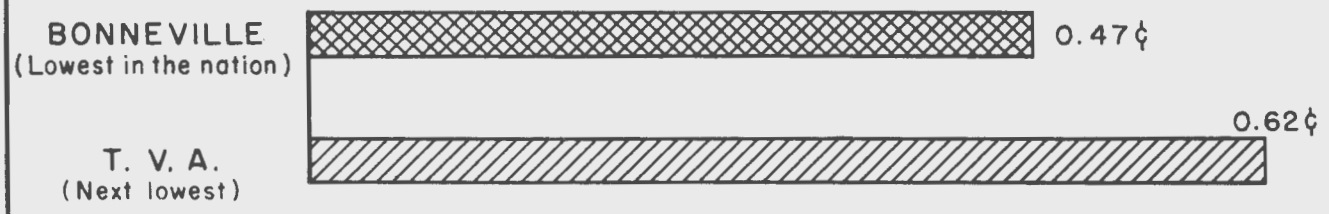
The Power Administration's marketing program during the fiscal year 1940 fell into two general categories: Power actually sold and power contracts executed for future delivery of power.

1/ For complete details of the revised wholesale rates and the order of the Federal Power Commission approving the revised rates, see Appendix C.

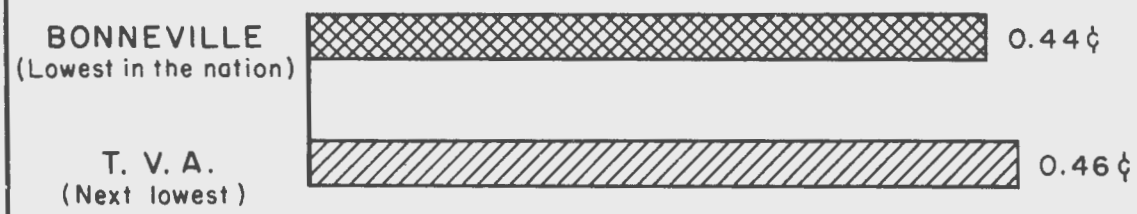
2/ For comparison of revised Bonneville wholesale rates with wholesale rates of the Tennessee Valley Authority refer to Plate I.

WHOLESALE RATES
AVERAGE COST PER KWH

SMALL DISTRIBUTING AGENCY (1)



MEDIUM SIZE DISTRIBUTING AGENCY (2)



LARGE INDUSTRIES (3)
USING PRIME POWER 80% OF TIME

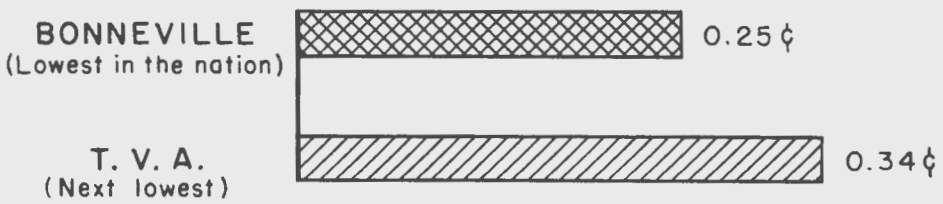


PLATE I

(1) ASSUMPTIONS: 500 KW; 1,750,000 KWH ANNUALLY (40% ANNUAL LOAD FACTOR)

(2) ASSUMPTIONS: 5000 KW; 19,700,000 KWH ANNUALLY (45% ANNUAL LOAD FACTOR)

(3) ASSUMPTIONS: 50,000 KW; 350,000,000 KWH ANNUALLY (80% ANNUAL LOAD FACTOR)

U. S. DEPT OF THE INTERIOR — BONNEVILLE POWER ADMINISTRATION

C136-876.3-A9

The average power sales during the fiscal year represented 28% of the existing generating capacity of the Bonneville plant. (The maximum plant demand for the year was 71.5% of rated capacity.) These sales represented the Power Administration's first full fiscal year as a power distribution agency.1/

The number of power contracts executed during the fiscal year involved an output substantially in excess of the installed generating capacity of 86,400 kilowatts at Bonneville dam. A total of 18 contracts was signed involving a total demand of 101,150 kilowatts, or 14,750 kilowatts more than the installed generating capacity at the Bonneville powerhouse. Execution of contracts in advance of generator installation was made practicable by the fact that a number of purchasers were in the process of acquiring their distribution systems or were building their industrial plants and therefore were not in a position to take delivery of their requirements immediately. A further compensating factor lay in the execution of a number of power interchange contracts with other systems having excess generating and storage capacities during certain seasons of the year.2/

Because the Power Administration's wholesale customers were of two types--public and private--the sales work was divided between the Distribution Projects section and the Market Development section of the System Planning and Marketing division. With the assistance of the Legal division, the former took over all negotiations involving publicly-owned agencies, and the latter handled the industrial customer group.

Summary of Sales to Publicly-Owned Systems

A total of 13 contracts was executed during the year for the sale of 8,650 kilowatts of prime power plus varying amounts of dump power to seven municipal systems, five public utility districts and one electrical cooperative as follows: 3/

The City of Canby, Oregon: This contract was executed for a period of 20 years and involved the purchase of 300 kilowatts

---

1/ For record of power sales during the fiscal year 1940 see Table 1, page 16.
2/ For complete details of interchange agreements see Appendix D.
3/ Listed in Table 2, p. 17.

TABLE 1

POWER SALES AND REVENUES

FISCAL YEAR 1940

Purchaser	Rate Schedule	Max. Annual Demand Kw	Energy Kwh	Billing
Canby, Oregon	F-1	195	313,600	$ 1,442.59
Cascade Locks, Ore.	A-1, A-2, B-1, H-1 Transmission Charges	252	1,003,040	2,833.32
Forest Grove, Ore.	F-1	696	1,404,800	6,527.00
Skamania County P.U.D.	A-1*	198	391,510	1,517.36
Northwestern Electric Co.	E-1, H-1	30,000	99,499,435	166,786.64
Portland General Electric Company	C-2, H-1	56,130	85,783,108	188,556.28
Columbia Construction Co.	F-1	44	20,500	306.73
Total Sales			188,415,993	$367,969.92

* Transmission charge of $1.25 per year per kw of billing demand added.

TABLE 2

PUBLIC AGENCIES - PRIME POWER CONTRACTS EXECUTED

FISCAL YEAR 1940

Name	Kilowatts	Date Executed	Contract Period (Years)
Public Utility Districts 3/			
Skamania	200	8-2-39	20
Pacific	1,500	10-5-39	20
Wahkiakum	400	10-10-39	20
Klickitat	1,500	12-5-39	5
Tillamook 1/	2,000	5-15-40	20
Total	5,600		
Municipalities			
Forest Grove	750	11-7-39	20
Canby	300	12-22-39	20
Monmouth	400	1-4-40	20
McMinnville 1/	1,000	1-13-40	20
Centralia 2/	300	2-13-40	5
Tacoma 2/	Interch.	2-23-40	10
Seattle 2/	Interch.	5-6-40	10
Total	2,750		
Co-operatives			
Oregon 4 Lincoln	300	6-27-40	20
Total	300		
TOTAL PUBLIC AGENCIES	8,650		

1/ Contract calls for additional sales of dump power and provides for interchange of power.

2/ Contract provides for interchange of power.

3/ For the sake of simplicity the term "Public Utility Districts" will be used throughout this report to refer to both the public utility districts of Washington and the peoples' utility districts of Oregon

of prime power. Payment for power was to be at the standard F-1 wholesale rate of 2½ mills per kilowatt hour, plus a monthly demand charge of 75¢ per kilowatt. Provision was made for increases in the prime power commitment under the contract, by subsequent agreement, in accordance with the customers' system requirements. Lower resale rates were placed in effect by the city.

The City of Centralia, Washington: The contract for this city was executed for a period of five years and involved the purchase of an initial 300 kilowatts of prime power and provided for subsequent increases in contract demand by mutual agreement. It also provided for the mutual interchange of surplus energy. Breakdown relief was pledged to either contracting party by the other to the limit of available facilities. The prime power was contracted for under the standard F-1 wholesale rate. The city adopted, as its objective, Bonneville standard resale rates.

The City of Forest Grove, Oregon: This contract was executed for a period of 20 years and involved the purchase initially of 750 kilowatts of prime power. The city owned 666 kw of Diesel-electric generation which would be operated for the Bonneville Power Administration upon request, the latter paying incremental costs. Payment for power was provided at the Power Administration's standard F-1 wholesale rate of 1/4¢ per kilowatt hour, plus a monthly demand charge of 75¢. The city adopted new low retail rates recommended by the Bonneville Power Administration.

The City of McMinnville, Oregon: This contract was executed for a period of 20 years and involved the sale of 1,000 kilowatts of prime power at the standard C-2 wholesale rate. The usual contract provision for increases in prime power commitments by mutual agreement, in accordance with the contractor's system load requirements, was included. An additional feature was the provision for the sale of dump energy under the H-1 rate, interchange of excess energy by pre-arrangement, and mutual breakdown relief to the limit of available facilities. New resale rates were placed in effect by this municipality at the time Bonneville power was made available. These rates carried a small surcharge above Bonneville standard resale rates.

The City of Monmouth, Oregon: This contract called for delivery of an initial 400 kilowatts of prime power at the standard F-1 wholesale rate over a period of 20 years. The city agreed to purchase all its power requirements from the Bonneville Power Administration. Resale rates were left as a matter of mutual agreement at the time operations commenced.

The City of Seattle, Washington: This contract provided for interchange of excess energy only, and extended for a period of 10 years.1/

The City of Tacoma, Washington: This contract provided for interchange of excess energy and for breakdown relief, and extended for a period of 10 years.2/

Klickitat County P.U.D., Washington: This contract was effected for a period of five years and provided for delivery of 1,500 kilowatts of prime power at the standard F-1 wholesale rate. Under the terms of the contract, 100 kilowatts of prime power were contracted for initially. The resale rates were left to subsequent negotiations at the time of commencement of operations.

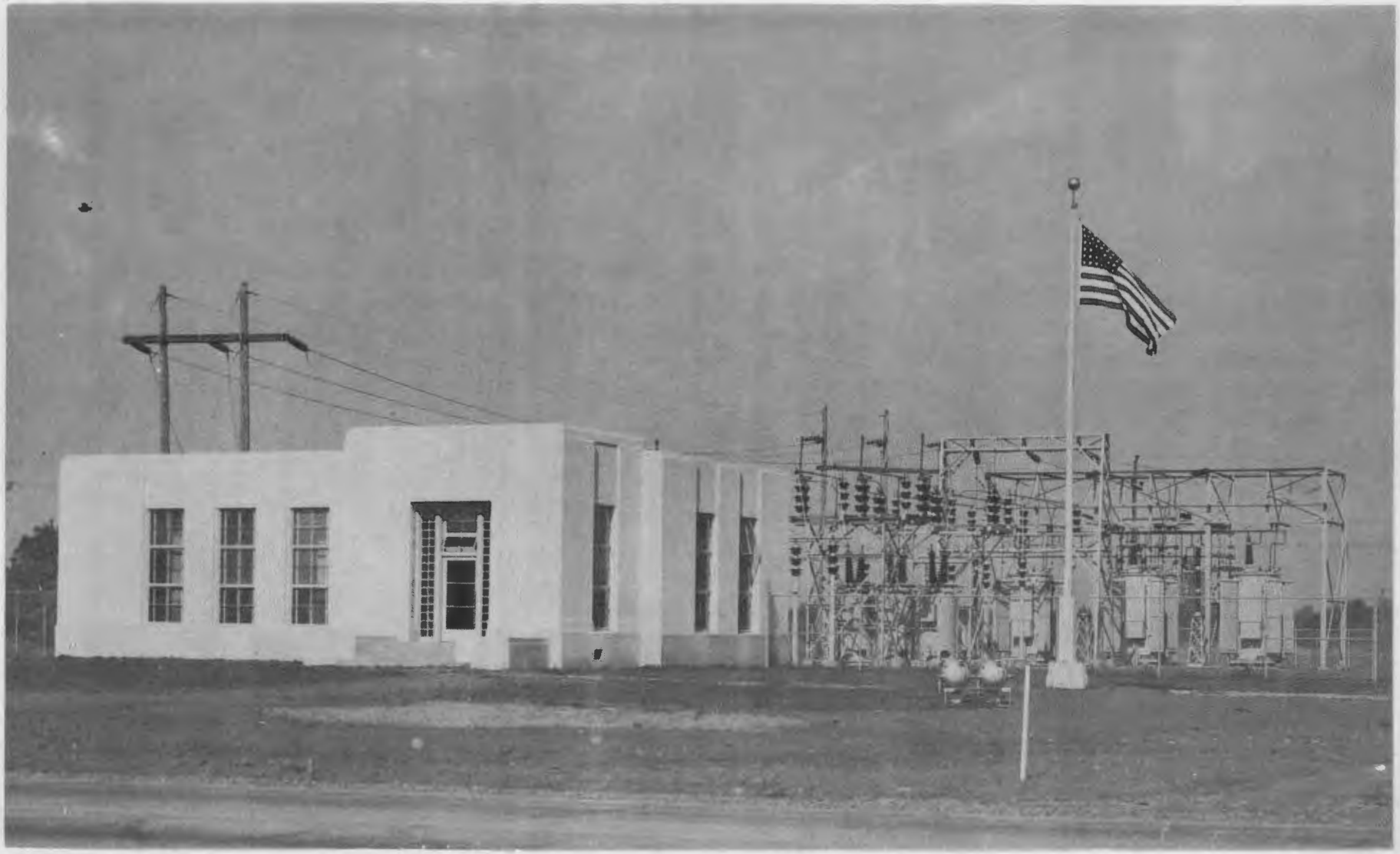
Pacific County P.U.D., Washington: Under the terms of this contract the Bonneville Power Administration obligated itself to deliver initially 1,500 kilowatts of prime power at the standard F-1 wholesale rate. New low rates were made effective under the contract.

Skamania County P.U.D., Washington: This contract provided for delivery initially of 200 kilowatts of prime power at the standard A-2 wholesale rate for a period of 20 years. New low rates were effected in the area served by this P.U.D. under the terms of the contract.

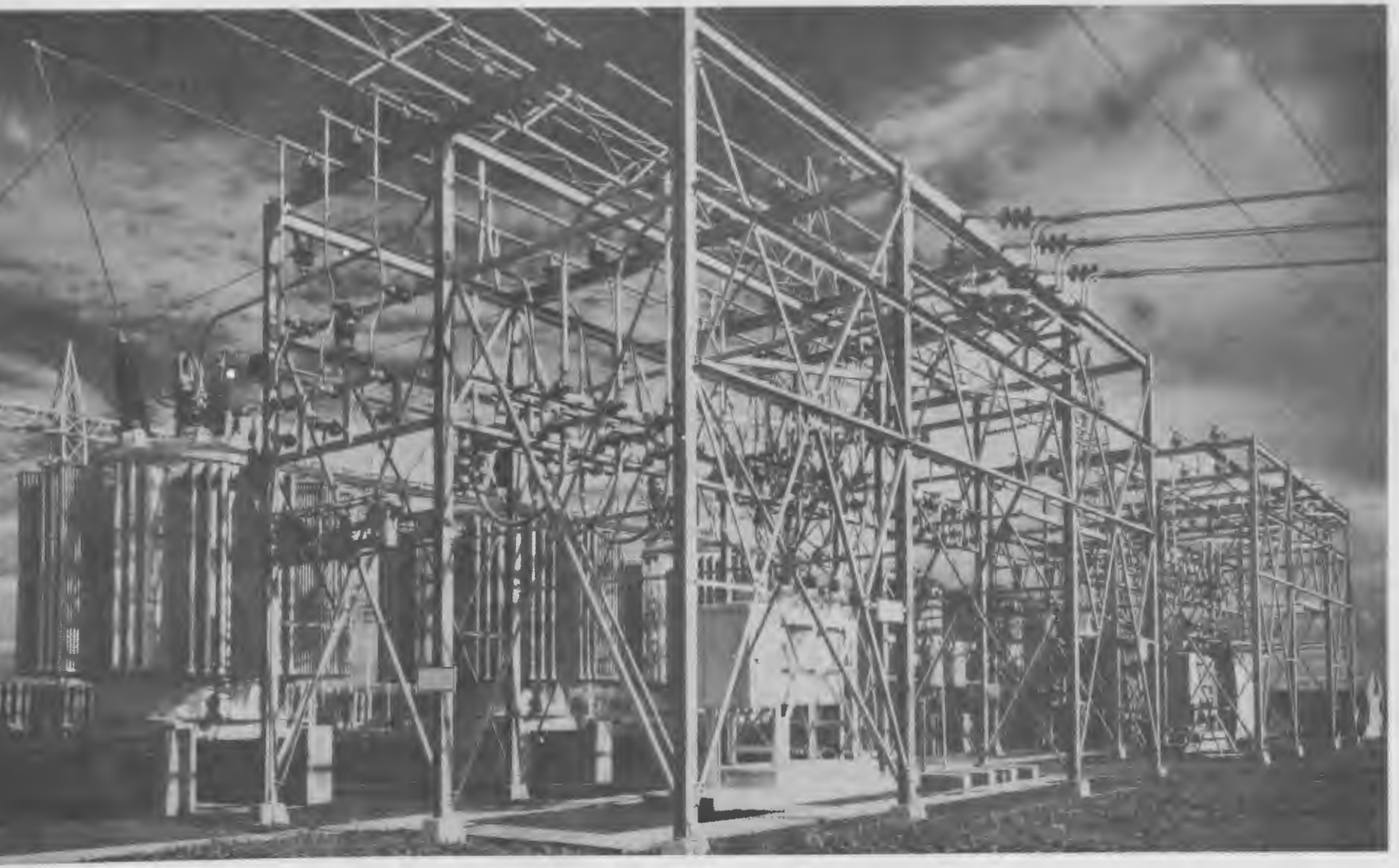
Tillamook County P.U.D., Oregon: Terms of this contract provided for delivery of 2,000 kilowatts of prime power at the standard C-2 wholesale rate over a 20 year period. The usual provisions for subsequent increases in the contract demand were included in the contract. Additional features included provisions for interchange of dump energy and mutual breakdown service. Resale rates were left to subsequent negotiation at the time of commencement of operations.

Wahkiakum County P.U.D., Washington: Under the terms of this contract the Bonneville Power Administration obligated itself to deliver 400 kilowatts over a period of 20 years at the standard F-1 wholesale rate. The usual provisions for subsequent increases in the contract demand were included in the contract. Rate deductions were effected by this public utility district shortly after commencement of operations. Bonneville standard retail rates were the objective under the contract.

1/2/ For disoussion of interchange features see p. 31



Completed substation at Eugene, Oregon, terminus of Bonneville Power Administration's southern transmission system in western Oregon.



Bonneville substation at Vancouver, Wash.
Serving Aluminum Company of America.

Benton-Lincoln Electric Cooperative, Inc. (Oregon-4-Lincoln): This contract was effected for a period of twenty years and involved the purchase initially of 300 kilowatts of prime power at the standard F-1 wholesale rate. Resale rates were made a matter of mutual agreement between the Cooperative, Rural Electrification Administration, and Bonneville Power Administration.

Negotiations with Public Agencies

The above contracts were included in applications and negotiations for power sales contracts comprising a total of 94,194 kilowatts of public agency load. On June 30, 1939, at the beginning of the year, there were on hand 72 applications for 312,701 kilowatts needed by publicly-owned systems. In detail, these applications were as follows:

MUNICIPALITIES	KW APPLIED FOR
Centralia, Wash.	300
Ellensburg, Wash.	2,000
N. Bonneville, Wash.	200
Canby, Oregon	250
Eugene, Oregon	1,000
Forest Grove, Oregon	750
Hood River, Oregon	100
McMinnville, Oregon	1,000
Milton, Oregon	750
Monmouth, Oregon	400
West Salem, Oregon	300
Total Municipalities	7,050

PUBLIC UTILITY DISTRICTS[1/]	
Adams County, Wash.	4,000
Asotin County, Wash.	1,400
Benton County #1, Wash.	2,300
Chelan County, Wash.	16,000
Clark County #1, Wash.	34,110
Columbia County, Wash.	925
Cowlitz County #1, Wash.	5,000
Douglas County #1, Wash.	2,000
Ferry County #1, Wash.	925

1/ Formed or being sponsored

PUBLIC UTILITY DISTRICTS (Continued)	KW APPLIED FOR
Franklin County #1, Wash.	1,130
Garfield County, Wash.	500
Grant County #2, Wash.	3,000
Grays Harbor County #1, Wash.	2,000
King County, Wash.	56,000
Kittitas County #1, Wash.	6,400
Klickitat County #1, Wash.	1,500
Lewis County #1, Wash.	400
Lincoln County #1, Wash.	1,800
Mason County #3, Wash.	5,000
Okanogan County #1, Wash.	5,300
Pacific County #2, Wash.	1,500
Pend Oreille County #1, Wash.	1,200
Skagit County #1, Wash.	12,000
Skamania County #1, Wash.	200
Snohomish County #1, Wash.	33,000
Stevens County #1, Wash.	1,400
Thurston County #1, Wash.	8,500
Wahkiakum County #1, Wash.	400
Walla Walla County, Wash.	7,000
Whatcom County #1, Wash.	16,000
Whitman County, Wash.	9,638
Yakima County, Wash.	31,000
Benton County, Ore.	1,500
Clackamas County, Ore.	10,000
Clatsop County, Ore.	76
Hood River County, Ore.	1,350
Linn County, Ore.	5,500
Polk County, Ore.	2,500
Tillamook County, Ore.	2,000
Wasco County (Northern), Ore.	2,700
Washington County, Ore.	2,250
Yamhill County, Ore.	2,500
Total Public Utility Districts	301,904
REA COOPERATIVES	
Oregon-14-Umatilla	130
Total REA Cooperatives	130
DRAINAGE DISTRICTS	
Beaver	455
Clatskanie	55
Columbia #1	75

DRAINAGE DISTRICTS (Continued)	KW APPLIED FOR
Deer Island	565
John	15
Kerry Island	205
Marshland	65
Magruder	150
Midland	55
Palm	22
Prescott	75
Rainier	170
Sauvies Island	500
Scappoose	580
Warren	260
Webb	75
Westland	95
Multnomah County #1	200
Total Drainage Districts	3,617
TOTAL PUBLIC AGENCIES	312,701

During the fiscal year, a number of new applications were received from public groups. By June 30, 1940, at the close of the year, the following additional applications had been received:

MUNICIPALITIES	KW APPLIED FOR
Cashmere, Wash.	1,100
Cheney, Wash.	616
Seattle, Wash.	Interchange
Soap Lake, Wash.	195
Tacoma, Wash.	Interchange
Bandon, Oregon	300
Drain, Oregon	85
Oakridge, Oregon	160
Total Municipalities	2,456

PUBLIC UTILITY DISTRICTS 1/	
Grant County No. 1, Wash.	1,200
San Juan County No. 1, Wash.	550
Columbia County, Oregon (Columbia District)	14,000
Coos County, Oregon	2,500

1/ Formed or being sponsored.

PUBLIC UTILITY DISTRICTS (Continued)	KW APPLIED FOR
Marion County, Oregon	8,750
Multnomah (City of Portland, Oregon)	25,000
Umatilla County, Oregon	6,000
Total Public Utility Districts	58,000
REA COOPERATIVES	
Wash.-36-Adams	160
Wash.-8-Benton	150
Wash.-31-Chelan	30
Wash.-20-Columbia	60
Wash.-38-Douglas	60
Wash.-37-Lincoln	160
Wash.-32-Okanogan	105
Wash.-35-Pend Oreille	90
Wash.-9-San Juan	150
Wash.-18-Spokane	760
Wash.-30-Stevens	350
Wash.-34-Whatcom	90
Oregon-22-Clackamas	70
Oregon-5-Clatsop	100
Oregon-21-Coos	300
Oregon-20-Curry	100
Oregon-17-Douglas	180
Oregon-18-Eugene	140
Oregon-2-Lane	90
Oregon-4-Lincoln	300
Oregon-16-Malheur	120
Oregon-26-Wasco	150
Idaho-4-Bonner	300
Idaho-10-Nezperce	800
Idaho-11-Kootenai	175
Idaho-15-Idaho	250
Calif-6-Modoc	500
Total REA Cooperatives	5,240
DRAINAGE DISTRICTS	
Riverland	187
Total Drainage Districts	187
TOTAL ADDITIONAL PUBLIC AGENCIES	65,883

Inasmuch as the power demands proposed by many of the applicants were purely tentative and inasmuch as many of the applicants had not yet acquired distribution systems and had no immediate need for power, all applications were reviewed in consultation with each applicant organization and the proposed demand figures adjusted to determine probable initial demands.

Applicants found to be progressing satisfactorily in the acquisition of distribution systems were segregated and contract negotiations begun. This work required the establishment of a force of field engineers thoroughly familiar with power system operations and valuation appraisals. As a basis for definite contract negotiations this engineering staff completed 27 reports on the feasibility of operating such systems through the purchase of federally-generated Columbia river power.

At the close of fiscal 1940 the following contracts had reached the active negotiation stage:

MUNICIPALITIES	KW
Ellensburg, Washington	2,000
Oakridge, Oregon	160
West Salem, Oregon	300
Drain, Oregon	85
Eugene, Oregon	1,500
Total Municipalities	4,045

PUBLIC UTILITY DISTRICTS	
Grays Harbor No. 1, Washington	2,000
Lewis County No. 1, Washington	400
Wickiup, Clatsop County, Oregon	76
Columbia County (Clatskanie District), Oregon	500
Hood River County, Oregon	1,350
Wasco (Northern) County, Oregon	2,700
Total Public Utility Districts	7,026

REA COOPERATIVES	
Wash.-8-Benton	150
Wash.-37-Lincoln	250
Oregon-5-Clatsop	100

REA COOPERATIVES (Continued)	KW
Oregon-17-Douglas	180
Oregon-18-Eugene	140
Oregon-2-Lane	90
Oregon-14-Umatilla	130
Oregon-26-Wasco	150
Total REA Cooperatives	1,190
Total Public Agencies	12,261

Final or near-final drafts had been submitted for signature on three contracts. Every evidence pointed to the fact that at least 19 contracts involving a total demand of 12,261 kilowatts would be executed in the near future.

Advisory Service to Potential Buyers

Because the Bonneville Act expressed a broad mandate to the Power Administration for the stimulation of the public power market, the Distribution Projects section established an advisory service for the purpose of giving all groups interested in the formation of public distribution agencies factual information as to the feasibility of using Columbia river power. This service comprised a staff of men familiar with Northwest power problems, particularly those affecting rural distribution in the Northwest area. Services of those men were made available to groups sponsoring the formation of utility districts, municipal systems, and rural cooperatives upon properly authorized requests from the officials of the sponsoring groups.

Branch Offices Established

Operations of the power sales staff in the public field were decentralized insofar as was practicable in an effort to permit as expeditious service as possible to all potential customers and interested groups. Branch offices were established in Eugene and Portland, Oregon, and Yakima, Washington, to handle inquiries originating in the areas contiguous to those communities and to assist in contract negotiations. Other branch offices were scheduled for establishment in Seattle and Spokane, Washington, early in fiscal 1941.

Special Services and Studies

In addition to establishment of the field engineering staff and the branch office personnel, provision was made during fiscal 1940 for special studies and services in connection with power load building.

An irrigation and drainage unit was established to advise customers and potential customers as to the feasibility of applying power to land drainage and irrigation. This service was operative largely in load areas west of the Cascade mountains where the trend toward supplementary irrigation and land drainage was growing.

A utilization unit, aimed at increasing wholesale power requirements of Power Administration customers by promoting larger retail use of electricity, also was established. Assistance was rendered distributors in determining programs for the development of electrical appliance sales and the application of low-cost power to farm operations. Plans were made for the development of a home economics advisory service to assist municipal systems, public utility districts and rural cooperatives purchasing Columbia river power in promoting retail power sales for the domestic market.

Power Sales to Industry

It became apparent from a review of power applications on hand at the beginning of the year that direct sales of high-load factor power to industry formed a large portion of the immediate market and would play an increasingly important part in Columbia river development during the next decade. Tremendous impetus was given to this phase of the administration's program near the close of the year by the quickened emphasis on national preparedness and the imminence of large Government purchases of electrochemical and electrometallurgical products.

On July 1, 1939, the beginning of the fiscal year 1940, the Power Administration had on file inquiries from 33 industries for power. By the close of fiscal year 1940, contracts totaling 71,000 kilowatts of prime power had been executed with electrometallurgical and electrochemical industries. These included the first 65,000 of 162,500 kilowatts contracted for by the Aluminum Company of America for its new western reduction plant

near Vancouver, Washington. Negotiations were nearing completion with the Pacific Carbide & Alloys Company for the sale of 2,000 kilowatts of prime power to be used at an electrochemical plant in Portland.

By the close of fiscal year 1940, inquiries for industrial power had been received from 97 firms of which 27 had reached a stage in which actual kilowatt demands ranging up to 350,000 kw were being discussed. In addition to these negotiations, the Power Administration, through its Market Development staff, undertook to serve American power-using industry by a series of research projects into major industrial possibilities offered in the Northwest region. It was apparent that the broad purposes of the Bonneville Act could best be served by developing a long-range program of industrialization in the Pacific Northwest, which in the past had been more or less handicapped by its dependence on agricultural and forest products.

The first of the research projects undertaken included a thorough investigation into the possibility of developing a power-using iron and steel industry in the region. A report holding that such an operation was feasible was submitted to the Secretary of the Interior on January 10, 1940.

Another study[1] involved institution of the first of a series of industrial site surveys with the object of determining how best to lay out the transmission system to meet industrial expansion and to assist industries in finding suitable locations in the Pacific Northwest. The initial survey was confined to the lower Columbia river valley because the Power Administration was in a position to serve consumers immediately in that area. Eventually every region of the Pacific Northwest within transmission range of the Bonneville and Grand Coulee generating plants was to be surveyed.

Still another survey[2] undertaken was a preliminary investigation of all mineral resources in the Northwest which might prove susceptible of development through the application of low-cost hydroelectric power. This survey, undertaken in collaboration with the Bureau of Mines and state colleges of the northwest states, was completed and submitted to the Secretary of the Interior on April 8, 1940. With the advent of the national defense program, it was decided to supplement the original study and an investigation was undertaken to determine availability of resources in the Pacific Northwest which might

---

1/ For details of this survey see p. 52
2/ For details of this survey see p. 51

implement the national preparedness. Special attention was given to the incidence of strategic minerals and to their development through the application of low-cost hydro power. These additional data were submitted to the Secretary of the Interior and to the National Defense Advisory Committee in preliminary form during the latter part of May 1940.

Sales to Privately Owned Utilities

Pending a general agreement on the resale rate policies, a few short-term contracts were made with the privately-owned utility systems. These contracts were of an emergency nature in order to alleviate an immediate power shortage, or through interchange contracts to hold in storage as much power as was possible to meet the increasing demands of power for national defense purposes.

By the close of fiscal 1939 the Power Administration had sold 30,035,711 kilowatt-hours to the Northwestern Electric Company, a privately owned operating agency which serves portions of southwest Washington and the metropolitan area immediately contiguous to Portland, Oregon. This sale was handled under a temporary agreement for the purpose of relieving the company's overload condition. At the time the Power Administration had no transmission lines of its own and in order to utilize a small portion of the already installed capacity at Bonneville it was necessary to deliver the power to the consuming area over a relatively low-voltage line owned by the purchasing utility.

This contract remained operative until Bonneville's first transmission line, the 40-mile twin-circuit between Bonneville and Vancouver, Washington, was completed on December 1, 1939. At that time power deliveries were begun into the Portland area over Bonneville transmission lines under terms of a one-year contract for 20,000 kilowatts of prime power executed with the Portland General Electric Company. Direct deliveries to the Northwestern Electric company ceased at that time.

Portland General Electric Company: The contract as executed originally extended for one year and called for delivery of 10,000 kilowatts of prime power until June 1, 1940, at which time the total prime would be increased to 20,000 kilowatts. Provision was also made for delivery of dump power at the H-1

rate. The short period for which this contract was executed was for the purpose of making available a period of time during which negotiations might be entered into between the two contracting parties in regard to resale rates, while at the same time relieving the danger of immediate power shortage in the Portland area. These negotiations were contemplated in conformity with the Bonneville policy as laid down in the Bonneville Act, to pass on all savings due to the utilization of federal power to the ultimate consumer. Negotiations were not completed in time to permit of the signing of a long-term contract. As a result, later in 1940, the Portland General Electric Company exercised its option to renew the contract for one more year. Although a satisfactory agreement has not been reached as to resale rates, substantial reductions in rates have been made available to consumers in the Portland area, since Columbia River power was made available to the Portland General Electric Company. Since this area is served by Northwestern Electric Company as well as Portland General Electric Company, rate reductions effected by one company were made available, as well, by the other company. Estimates of reductions made possible for the consumers of the two companies follow:

	Portland General Electric Co.	Northwestern Electric Co.	Total
Residential customers	$ 687,672	$ 212,516	$ 900,188
Commercial customers	464,612	242,969	707,581
Industrial customers	181,000	31,200	212,200
Total	$1,333,284	$ 486,685	$1,819,969

Pacific Power and Light Company: This contract provided for delivery initially of 1500 kw of prime power at the Bonneville C-2 wholesale rate for a period of one year. Delivery will begin in the spring of 1941 upon completion of the construction of the St. Johns-Astoria transmission line. A provision for increasing the contract demand to 2000 kw was included. Additional terms of the contract provided for the sale of dump power at the H-1 rate, mutual emergency breakdown relief, and transfer privileges over the company's lines in order to make Columbia river power available to the Nehalem Valley Cooperative Electric Association and the Wickiup People's Utility district.

Total power sales to private utility interests during fiscal 1940 were 185,282,543 kilowatt-hours and brought an income to the administration of $355,342.92

At the beginning of the fiscal year 1940, the Power Administration had on file applications for power purchase by private utilities as follows:

UTILITY	KW APPLIED FOR
Mountain States Power Co.	3,000
Portland General Electric Co.	20,000
Total	23,000

At the close of fiscal 1940 these applications had been augmented by the following:

UTILITY	KW APPLIED FOR
Cascade Utilities Inc.	400
Pacific Power & Light Co.	1,500
West Coast Power Co.	500
Total	2,400

Power Interchange Contracts[1/]

Numerous contracts executed during the year contained provisions for interchange of surplus power with the Bonneville system. Details of these interchange features follow:

1/ In furtherance of coordination of power facilities of the Northwest is the following interchange contract negotiated shortly after the termination of fiscal year 1940:

Northwestern Electric Company and the Washington Water Power Company: On July 27, 1940, the Bonneville Administration executed a contract for interchange of power with these two companies. The two companies, combined, owned and operated 258,100 kw of hydro generating capacity and 42,500 kw of steam generating capacity. The two systems had a combined system maximum demand of 235,565 kw. Provision was made for monthly settlement of exchanges of fuel generated energy at actual incremental cost. The contract contemplated termination on September 1, 1942, but provided that disposal of net balances of exchanged energy remaining at that date would be a matter of subsequent agreement. Breakdown and emergency relief was mutually pledged.

The City of Centralia, Washington: At the time the contract was executed the city owned and operated 4,400 kilowatts of hydro generating capacity with a prime capacity of 2,200 kilowatts. Since the system peak exceeded the prime capacity by only a few hundred kilowatts, an interchange breakdown agreement was of substantial mutual value. Accordingly, the contract provided that either party might by pre-arrangement take on an exchange basis up to five million kilowatt-hours from the other's system. In the event that the city utilized more than a net of five million kilowatt-hours under the interchange provision of the contract, settlement would be made under the H-1 rate.

The City of McMinnville, Oregon: At the time this contract was executed the city owned 2,710 kilowatts of Diesel electric generation and 200 kilowatts of hydroelectric generation. Under the terms of the contract, either party may utilize excess energy available from the other's system for breakdown relief. Hydroelectric energy thus obtained would be paid for at the standard H-1 wholesale rate.

The City of Seattle, Washington: At the time this contract was executed the city owned and operated 201,556 kilowatts of hydro capacity and 30,000 kilowatts of steam capacity with a system maximum demand of 120,000 kw. Under the terms of the contract, either party may accumulate up to 100 million kilowatt hours net balance in an exchange account. Deliveries in excess of this figure would be paid for at the rate of 2½ mills, except that fuel energy would be paid for at actual incremental cost. Breakdown relief was mutually pledged.

The City of Tacoma, Washington: At the time this contract was negotiated the city owned and operated 114,000 kilowatts of hydro capacity and 34,000 kilowatts of steam capacity with a system maximum demand of approximately 90,000 kw. It was apparent that an interchange arrangement between the Bonneville Power Administration and the city of Tacoma would be mutually advantageous. Either party may obtain from the other a net total of up to 50 million kilowatt hours, with the excess being paid for at the rate of 2½ mills, or, in the event of steam energy, at actual incremental cost. Breakdown relief was mutually pledged.

Tillamook County P.U.D., Oregon: At the time of execution of this contract the P.U.D. contempleted acquisition of the local privately owned utility properties. These latter operated 4,000 kilowatts of steam capacity and 300 kilowatts of Diesel-driven capacity. The interchange provision of the contract would permit interchange and standby service to the mutual advantage of both parties.

Portland General Electric Company: When this contract was executed the company owned and operated 183,000 kw of hydro and steam generating capacity. The 1939 maximum system demand was 171,000 kw. Under the interchange agreement, low cost Columbia river power would be utilized by the company at the standard H-1 rate and the Power Administration would obtain a source of steam power that could be called upon as and if the necessity arose. Breakdown relief was mutually pledged and provision was made for settlement at actual incremental cost for steam generated energy required by either party of the other.

Pacific Power & Light Company: When this contract was executed the company served its entire Astoria-Seaside division by means of an 8,000 kw steam plant at Astoria, Oregon. The maximum demand of this division was 6,300 kw. Since the company was also contracting for the purchase of 1,500 kw of Bonneville prime power this interchange agreement made approximately 3,000 kw of steam capacity available to the Power Administration when required. Additional provision included terms of payment for steam generated power on an actual incremental cost basis and mutual emergency breakdown relief.

Transfer Agreements

Portland General Electric Company - Canby, Oregon: A contract was executed providing for transfer of Bonneville power to Canby, Oregon, over lines of the Portland General Electric Company. This contract provided that the company would furnish the municipality with its firm power requirements, the Company receiving two kilowatt-hours of Bonneville dump energy for each kilowatt-hour of firm energy furnished the city. The contract provided for termination upon completion of Bonneville lines to Canby.

Portland General Electric Company - Forest Grove, Oregon: A contract providing for transfer of Bonneville power over this company's lines to Forest Grove was executed during the fiscal year 1940. Details of the contract were substantially the same as those of the Canby contract.

Policies Governing Retail Rates for Columbia River Power

Although the Bonneville Power Administration is primarily an agency for the sale of hydroelectric energy at wholesale only,

the federal legislation governing its policies clearly states that any contract it enters into with any utility engaged in the sale of electric energy to the general public "shall contain such terms and conditions, including among other things stipulations concerning resale and resale rates by any such utility, as the Power Administrator may deem necessary, desirable, or appropriate to effectuate the purposes of (the) Act and to insure that resale by such utility to the ultimate consumer shall be at rates which are reasonable and nondiscriminatory."

The Power Administration in its negotiations for the sale of energy to both publicly-owned and privately-owned systems determined its resale policies in accordance with the following factors: (1) the Congressional mandate that power costs to the ultimate consumer be brought to a minimum, (2) the fiscal problems of each wholesale power purchaser, (3) the existing record and policy of each distribution agency in regard to rate reduction. In the case of newly organized agencies, resale rates were worked out by the agencies' officials in cooperation with the Power Administration's rate staff and initial resale reductions were determined by agreement. When contracts were signed with established public agencies, rate reductions were recommended when it was clearly apparent that they would be made possible by the lower cost of the new power supply. In cases where a well established public agency already had low resale rates in effect and where its records showed reductions had been made as rapidly as costs and growth in power consumption warranted, no effort was made to obtain further reductions immediately upon delivery of Columbia river power.

For the most part, however, substantial reductions were made possible immediately upon delivery of power to those publicly-owned agencies which executed contracts and took delivery during fiscal 1940. In some cases reductions averaged as much as 46%.

The Power Administration's Rate section devoted a substantial portion of its time during the fiscal year to working out, on a cooperative basis, feasible resale rate schedules in cooperation with Bonneville customers and potential customers. Each customer requesting such service was given individual study. Every schedule was set up with due regard for the customer's capital indebtedness and amortization program, cost of power, distribution cost, previous rate, and in accordance with certain fundamental principles of operation devised by the Power.

Administration. These principles of operation were made a part of nearly every contract entered into between the Power Administration and its public customers.1/

Following the delivery of Columbia river power to the Forest Grove, Oregon, municipal electric system on November 27, 1939, new low rates were put into effect by this system on bills sent out in December, 1939. These rates had been designed and recommended to the municipal plant by the Bonneville Power Administration. When Canby, Oregon, began distributing Bonneville power on February 1, 1940, this municipal system also adopted new low rates. The same schedule of rates was used as in Forest Grove, except that the residential minimum bill was $1.00 per month instead of 75¢.

Operations of these plants under the new low rates disclosed immediate large increases in use of electricity by consumers. Financial results under the new rates were successful from the beginning.2/ Revenues were sufficient to meet all costs of operation, including cost of power at wholesale, payroll, materials, depreciation, local and state taxes equivalent to those a similar private plant would pay, and interest on the net book value of plant at 6% annually, and still leave a substantial surplus.

After observing the results of the first few months of operation under the new rate schedules in Forest Grove and Canby, the Bonneville Administrator on May 4, 1940, announced that the Power Administration was prepared to recommend the Forest Grove-Canby rate schedules as standard resale rates3/ for public systems purchasing all or the major portion of their power requirements from Bonneville.

These rates, for residential and commercial customers, are summarized as follows:

Residential:

First	50	kw-hrs.	used	per	month	at	3¢	per kw-hr.
Next	50	"	"	"	"	at	2¢	" "

1/ For complete details of principles of operation, see Appendix D, Contract with the City of McMinnville, Oregon, Exhibit D.
2/ For discussion in greater detail see pp. 38 to 44.
3/ For complete standard resale rate schedules see Appendix D, Contract with the City of Forest Grove, Oregon, Exhibit C.

Residential (Cont.):

Next	200	kw-hrs.	used	per	month	at 1¢	per	kw-hr.
Next	900	"	"	"	"	at ½¢	"	"
Over	1200	"	"	"	"	at 3/4¢	"	"

Minimum monthly bill - 75¢

Commercial Lighting and Power:

First	150	kw-hrs.	used	per	month	at 3¢	per	kw-hr.
Next	350	"	"	"	"	at 2¢	"	"
Next	1,000	"	"	"	"	at 1¢	"	"
Next	13,500	"	"	"	"	at 0.8¢	"	"
Next	25,000	"	"	"	"	at 0.6¢	"	"
Next	60,000	"	"	"	"	at 0.4¢	"	"
Over	100,000	"	"	"	"	at 0.3¢	"	"

For customers with over 10 kw demand, an additional charge of 95¢ for each kilowatt of demand in excess of 10 kw also applies

Minimum monthly bill (Customers less than 10 kw demand) - $1.00

Retail Power Sales by Public Agencies[1/] Distributing Bonneville Power

Four publicly owned electric systems were distributing Bonneville power during the first part of 1940, all of them operating under lower rates than were in effect previously. An examination of the operating results achieved by these electric systems during the first eight months of calendar 1940 provides preliminary information as to the effects of the rate reductions, and the extent to which the new rates provide for all the costs of operation. The distributors instituting these rates broke away from the traditional requirement that customers must "earn their reductions" before receiving them, and the new rates were based on estimates of what the sales, revenues and expenses would be under lower rates. This approach was considered essential if the "vicious circle" that had hampered the development of full utilization of electricity in the past was

---

1/ It will be noted that for purposes of comparison of operations, before and after delivery of Bonneville power, the first eight months of the calendar years 1939 and 1940 have been used.

to be broken. Utilities have generally insisted that consumption must first be increased before the rates can be cut, and the customers have been equally insistent on lower rates being available before materially increasing their consumption. In any competitive business this "vicious circle" would have been broken long ago, but utilities have generally relied on their position as monopolies, and with some important exceptions have refused to reduce rates in anticipation of larger use under the lowered rates. The facts as to the manner in which customers respond to lowered rates have become so generally known in recent years that the effects of the rate reduction on customers' usage can be readily considered when determining the amount of reduction that can be made.

Cascade Locks, Oregon, was the first system to distribute Bonneville power. This municipal plant acquired its properties and began serving the entire community in August, 1939, and in the following November made substantial rate reductions. The average residential cut was 32% and the average commercial and power reduction was 13%.

Forest Grove, Oregon, was the next distributor, beginning the purchase of Bonneville power on November 27, 1939. December bills were at new low rates, which have since been adopted as the Bonneville Standard Resale Rates. The average residential reduction in Forest Grove was 36%, and the average commercial and power reduction was 46%.

The Canby, Oregon, municipal plant commenced distribution of Bonneville power on February 1, 1940, with a rate cut effective this same month. The rates adopted by Canby were the same as those used in Forest Grove, except for a higher residential minimum bill. The average residential reduction was 30%, and the average commercial and power reduction was 42%.

Skamania County Public Utility District purchased Bonneville power first in January 1940, and later reduced its rates, effective with bills for June 1940. The average reductions here were 10% for residential users and 5% for commercial lighting customers. This district had received a rate reduction a few months prior to acquisition of the properties by the Public Utility District; and, compared with rates in effect during the first eight months of 1939, the new rates represented a reduction of about 20% for residential customers and about 11% for commercial lighting users.

When these public electric systems reduced their rates[1] it was expected that the consumers of electricity would immediately respond to the lower prices by making large increases in their use of electricity. This expectation has been realized.[2] Total residential kilowatt-hours sold increased 51% on the average. Cascade Locks' sales to this class of users rose 77%, Forest Grove 47%, Canby 49%, and Skamania County Public Utility District 39%. Some of this increase resulted from the connection of new customers, which itself resulted partly from lowered rates, but increased sales per customer were the prime factor. On the average, monthly sales per residential user during the first eight months of the year went up from 66 to 90 kwh or 36%. In Cascade Locks the unit consumption rose 61%, in Forest Grove 28%, in Canby 43%, and in the Skamania District 28%.[3]

Increases in commercial and industrial sales were not so large as for the residential class, but here also large added usage has occurred. Total commercial and industrial sales rose 21% on the average, and each system showed increases as follows: Cascade Locks 2%, Forest Grove 26%, Canby 32%, and Skamania District 48%. The showing in Cascade Locks is affected by the fact that a large construction camp which was served in 1939 was closed down during 1940.

Total sales of energy by these four public agencies were 35% greater during the first eight months of 1940 than in the comparable period of 1939.

Despite the rate reductions placed in effect, the Skamania County Public Utility District's revenues from electric sales were greater in the first eight months of 1940 than in the similar period of 1939. In this district two rate reductions were made in the short space of one year. In the other communities revenues were lower in the first eight months of 1940 than in 1939 - in Cascade Locks 5% lower, in Canby 12% lower, and in Forest Grove 17% lower. In Cascade Locks the lower revenues may be attributed to the loss of certain commercial business, since residential revenues, where a 32% rate reduction was made, were slightly greater in the 1940 period. The rate cut for this class of customer was recovered in about six months' time.[4]

1/ For rates of the four systems see Table 3, p. 39. For cost to consumers, see Table 4, p. 40.

2/ For details on increases in sales see Table 5, p. 41.

3/ For comparison of the use of electricity per residential customer and the revenue per residential kilowatt-hour for these four distributors see Plate II.

4/ See table 5, p. 41.

In Forest Grove and Canby it will take longer than eight months to recover the 30 to 40% rate reductions. Revenues per customer after the rate reductions did not increase to the level existing before the rate reductions in any case except commercial revenues in the Skamania district. However, in every instance substantial progress was made toward recovery of revenue per customer to the same level as prevailed prior to the rate reduction.

Another evidence of the effect of rate reductions on the systems of these public agencies was found in the "load factors" before and after the rate cuts. "Load factor" may be defined in various ways, but reduced to the simplest terms it means the ratio of the average load to the greatest load during a given period. The following table compares monthly load factors in the first month of delivery of Bonneville power with those in August 1940:

	First Full Month of Bonneville Power Delivery		August 1940
	Month	Load Factor	Load Factor
Cascade Locks	Aug. 1939	48.3%	55.2%
Forest Grove	Jan. 1940 1/	41.3	52.5
Canby	Feb. 1940	43.6	49.2
Skamania P.U.D.	Feb. 1940	48.8	55.0

It is apparent that without exception the system load factors improve when rates are cut. Hours of use of appliances and lights are increased, and the effect of such longer hour use of equipment is to improve load factors, thereby reducing the kilowatt-hour cost of supplying electricity.

Rates Financially Feasible

From a financial standpoint the new low retail rates proved decidedly feasible.2/

The surplus earnings of the four systems during the period studied equaled 16½% of their combined revenues. These earnings

1/ December 1939, actual first month of delivery to Forest Grove, was a long month, about 35 days, for billing purposes. Note: Interval used in measuring demands is 30 minutes.

2/ See Table 6, p. 42.

TABLE 3

COMPARISON OF RATE SCHEDULES OF
FOUR PUBLIC AGENCIES DISTRIBUTING BONNEVILLE POWER

Residential	Forest Grove	Canby	Skamania Co. P.U.D.	Cascade Locks
First 50 kw-hrs. per month at	3¢	3¢	4½¢	4½¢
Next 50 " " " at	2¢	2¢	2¢	2¢
Next 200 " " " at	1¢	1¢	1¢	1¢
Next 900 " " " at	½¢	½¢	½¢	½¢
Over 1200 " " " at	3/4¢	3/4¢	3/4¢	3/4¢
Minimum Bill	$.75	$1.00	$1.00	$1.00
Commercial				
Energy Charge:				
First 150 kw-hrs. per month at	3¢	3¢	4½¢	4½¢*
Next 350 " " " at	2¢	2¢	3¢	2½¢*
Next 1,000 " " " at	1¢	1¢	2¢	2¢*
Next 3,500 " " " at	0.8¢	0.8¢	1.8¢	1.8¢
Next 10,000 " " " at	0.8¢	0.8¢	0.8¢	0.8¢
Next 25,000 " " " at	0.6¢	0.6¢	0.6¢	0.6¢
Next 60,000 " " " at	0.4¢	0.4¢	0.4¢	0.4¢
Over 100,000 " " " at	0.3¢	0.3¢	0.3¢	0.3¢
Demand Charge:				
First 10 KW of demand	None	None	None	None
Excess above 10 KW at	95¢	95¢	95¢	95¢
Minimum Bill (10 KW demand or less)	$1.00	$1.00	$1.00	$1.00

* In Skamania County P U.D. the first blocks of the commercial rate are 125,250, and 1,125 kw-hrs., respectively.

TABLE 4

COMPARISON OF TYPICAL ELECTRIC BILLS
BEFORE AND AFTER DISTRIBUTION OF BONNEVILLE POWER

	Residential 100 Kwh			Commercial Lighting 750 Kwh (6.0 Kw)		
	New Rate	Old Rate	Percent Reduction	New Rate	Old Rate	Percent Reduction
Forest Grove	$2.50	$3.64	31%	$14.00	$35.50	60%
Canby	2.50	3.37	26	14.00	30.75	54
Skamania County P.U.D. 1/	3.25	3.62	10	19.38	19.40	--
Cascade Locks	3.25	4.60	29	22.25	25.50	13

1/ Under the rates effective in the area served by Skamania County P.U.D. during the first 8 months of 1940, the residential bill for 100 kwh was $4.00 (reduction under new rates - 19%), and the commercial lighting bill for 750 kwh was $20.08 (reduction under new rates - 3%).

TABLE 5

SALES OF ELECTRIC ENERGY
BY PUBLICLY OWNED UTILITIES DISTRIBUTING COLUMBIA RIVER POWER
First Eight Months, 1940 and 1939

	Cascade Locks, Ore.			Forest Grove, Ore.			Canby, Ore.[1]			Skamania P.U.D.[2]			Total		
	1940	1939	% Change	1940	1939	% Change	1940	1939	% Change	1940	1939	% Change	1940	1939	% Change
Kilowatt-hours Sold															
Residential	262,053	147,603	77.5	781,371	530,964	47.2	214,200	143,363	49.4	178,101	128,139	39.0	1,435,725	950,069	51.1
Commercial and Industrial	396,865	387,508	2.4	490,701	389,185	26.1	211,879[4]	134,809	57.2[4]	236,460	160,324	47.5	1,335,905	1,071,826	24.6[4]
Street Lighting	21,261	5,079	--	93,805	97,800[3]	-4.1	16,157	16,150[3]	--	17,080	18,068	-5.5	148,303	137,097	8.2
Total to Ultimate Consumers	680,179	540,190	25.9	1,365,877	1,017,949	34.2	442,236	294,322	50.3	431,641	306,531	40.8	2,919,933	2,158,992	35.2
Revenues															
Residential	$7,565	$7,466	1.3	$15,264	$17,616	-13.4	$4,084	$4,874	-16.2	$6,052	$5,899	2.6	32,965	35,855	-8.1
Commercial and Industrial	11,083	12,272	-9.7	10,085	14,065	-28.3	4,149	4,722	-12.1	6,229	5,540	12.4	31,546	36,599	-13.8
Street Lighting	231	223	3.6	990	--	--	207	--	--	235	260	-9.6	1,663	483	--
Total from Ultimate Consumers	18,879	19,961	-5.4	26,339	31,681	-16.9	8,440	9,596	-12.0	12,516	11,699	7.0	66,174	72,937	-9.3
Customers (Average Per Month)															
Residential	415	375	10.7	972	851	14.2	296	285	3.9	396	366	8.2	2,079[5]	1,877[5]	10.8
Commercial and Industrial	108	106	1.9	203	182	11.5	95	87	9.2	109	105	3.8	515[5]	480[5]	7.3
Street Lighting	1	1	--	1	1	--	1	1	--	1	3	-66.7	4[5]	6[5]	-33.3
Total Customers	524	482	8.7	1,176	1,034	13.7	392	373	5.1	506	474	6.8	2,598	2,363	9.9
Kw-hrs. Per Customer Per Month[6]															
Residential	79	49	61.2	100	78	28.2	103	72	43.1	64	50	28.0	90	66	36.4
Commercial and Industrial	461	459	0.4	302	267	13.1	319	222	43.7	311	218	42.7	341	294	16.0
Revenue Per Customer Per Month[6]															
Residential	$2.28	$2.49	-8.4	$1.96	$2.59	-24.3	$1.97	$2.44	-19.3	$2.18	$2.30	-5.2	$2.07	$2.50	-17.2
Commercial and Industrial	12.87	14.54	-11.5	6.20	9.64	-35.7	6.24	7.79	-19.9	8.18	7.53	8.6	8.06	10.04	-19.7
Revenue Per Kw-hr.															
Residential	2.89¢	5.06¢	-42.9	1.95¢	3.32¢	-41.3	1.91¢	3.40¢	-43.8	3.40¢	4.60¢	-26.1	2.30¢	3.77¢	-39.0
Commercial and Industrial	2.79	3.17	-12.0	2.06	3.61	-42.9	1.96	3.50	-44.0	2.63	3.46	-24.0	2.36	3.41	-30.8
Street Lighting	1.09	4.38	-75.1	1.06	--	--	1.28	--	--	1.37	1.44	-4.9	1.12	--	--

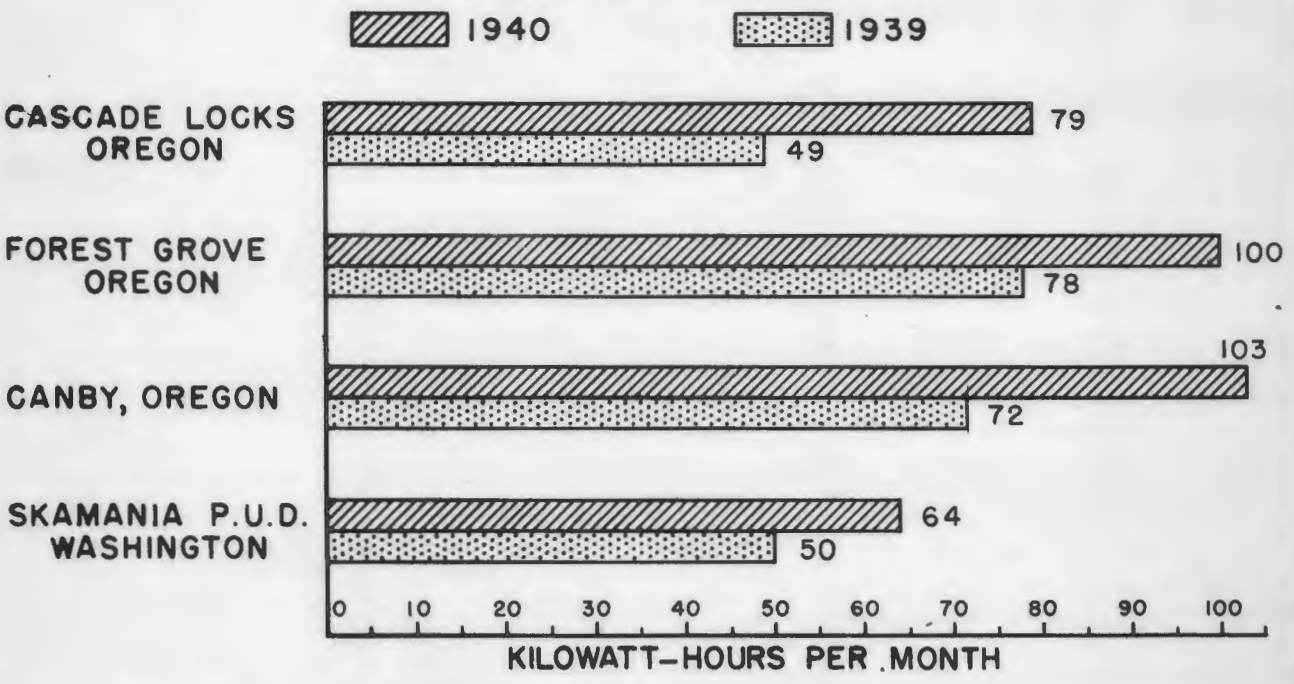
1/ Data for Canby are included for seven months only since no Bonneville service was taken in January, 1940.
2/ Data for Skamania P.U.D. are included for seven months only since comparative figures are not available for January, 1940.
3/ Estimate.
4/ 1940 Commercial sales in Canby include sales to City Hall and water pump, which were served free in 1939, and therefore excluded from sales. The percentage increase in the first 8 months, 1940, excluding such sales was 31.6% for Canby and 21.4% in total for all distributors.
5/ The total of average customers per month for each distributor; these figures were not used for computation of kw-hr. and revenue ratios, which are based on total monthly billings.
6/ These ratios are based on total customer billings, not average per month.

PUBLIC AGENCIES DISTRIBUTING BONNEVILLE POWER

FIRST EIGHT MONTHS OF 1940

RESIDENTIAL KILOWATT-HOURS PER CUSTOMER

FIRST EIGHT MONTHS OF YEAR



RESIDENTIAL REVENUE PER KILOWATT-HOUR

FIRST EIGHT MONTHS OF YEAR

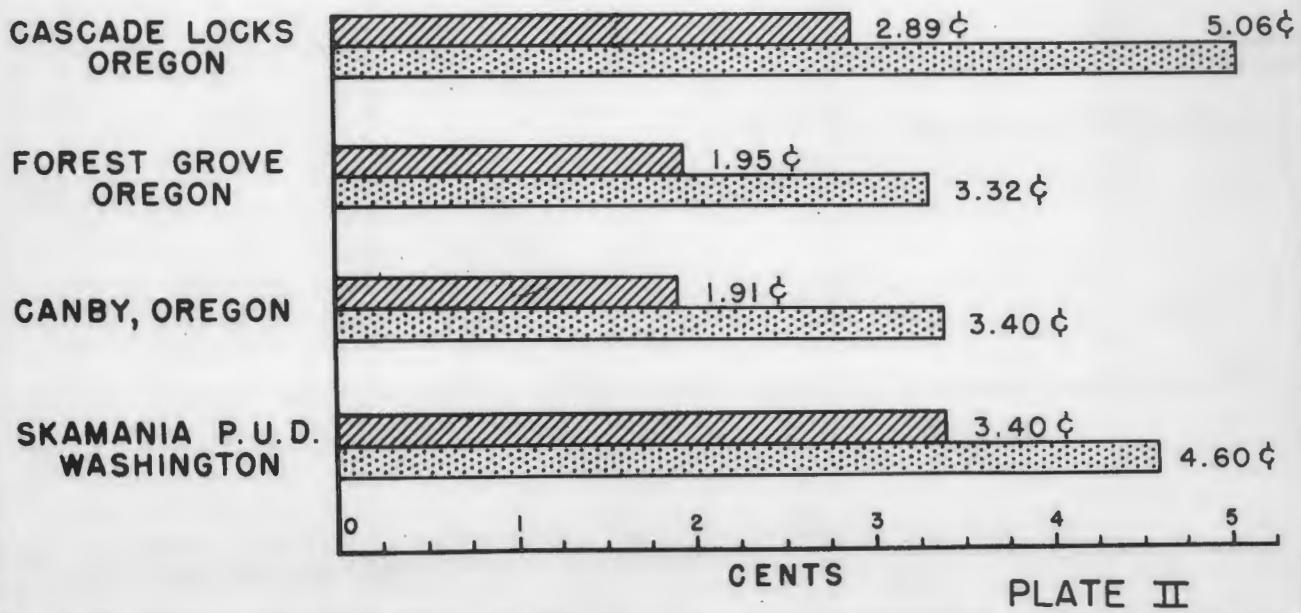


PLATE II

U.S. DEPT OF THE INTERIOR BONNEVILLE POWER ADMINISTRATION

TABLE 6

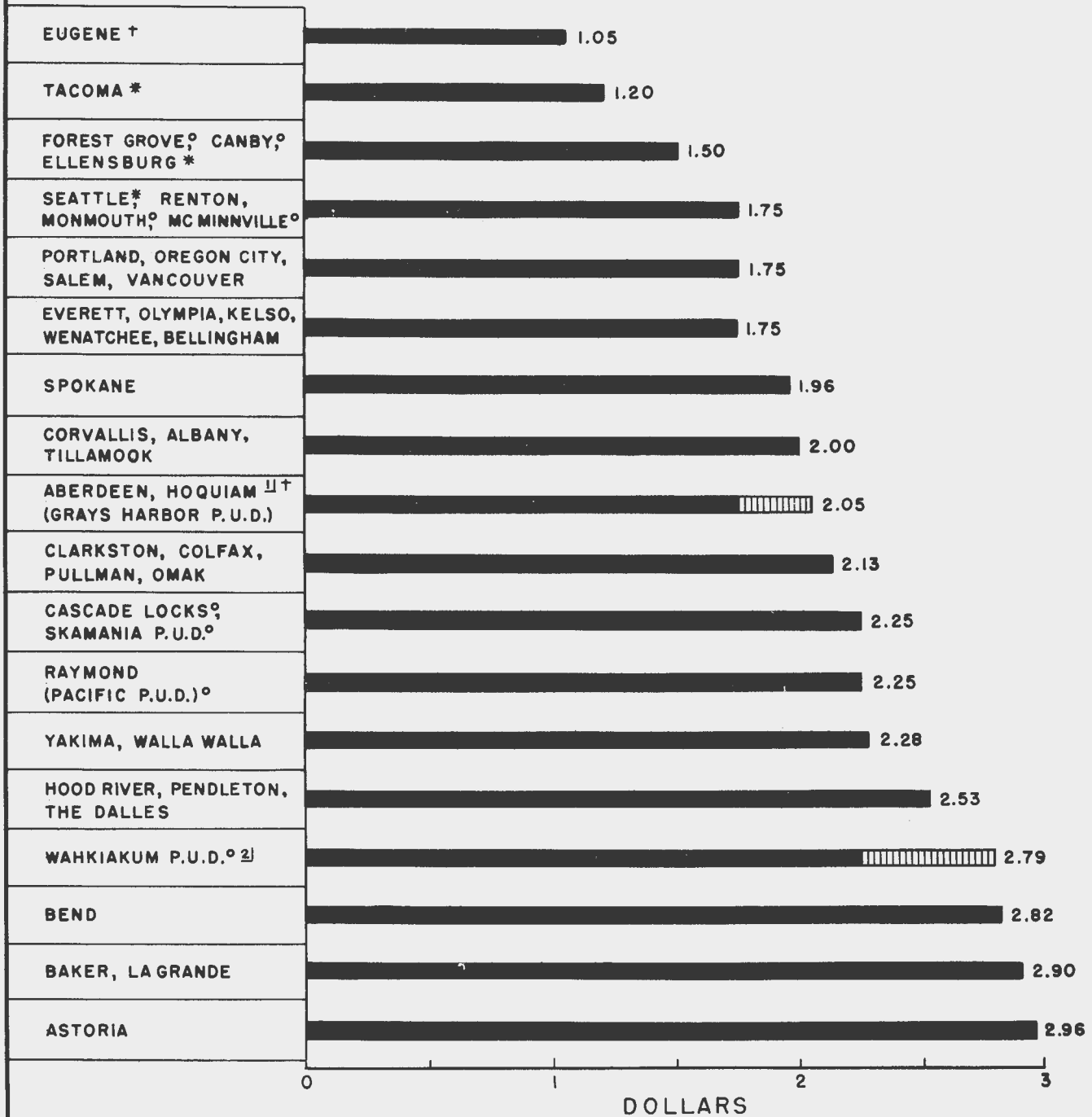
COMPARISON OF EARNINGS FOR PUBLICLY OWNED DISTRIBUTORS
OF COLUMBIA RIVER POWER
FIRST EIGHT MONTHS, 1940

	Forest Grove, Oregon	Cascade Locks, Oregon	Canby, Oregon 3/	Skamania P.U.D. Wash.
Revenues				
Amounts received from customers for electric energy used 1/	$26,534	$19,547	$8,439	$14,390
Expenses				
Operating Expenses Amounts spent for purchased power, labor and materials for operating and maintaining the electric system.	12,542	9,332	4,937	8,103
Provision for Taxes or Equivalent Funds set aside for payment to the city or other governmental bodies.	3,200	2,090	527	461
Depreciation and Amortization Amounts set aside to take care of wear and tear of property used in supplying electric service. 2/	2,480	2,320	438	1,020
Total Expenses	$18,222	$13,742	$5,902	$9,584
Net Operating Revenues Balance of revenue remaining after deducting items listed above.	$ 8,312	$ 5,805	$2,537	$4,806
Disposition of Net Revenues				
Interest on Bonds	-	2,125	-	1,675
Interest on City's Investment in Electric System	5,000	-	875	-
Other Miscellaneous Items	-	321	-	135
Total Deductions	$5,000	$2,446	$875	$1,810
Net Profit Cash represented by these net earnings may be used for principal payments on bonds, reserve funds, property additions, or working capital.	$3,312	$3,359	$1,662	$2,996

1/ These amounts also include some minor miscellaneous revenues.
2/ These funds may be used for property additions or replacements, applied to amortization of the utility's debt, or otherwise invested.
3/ Includes data for 7 months only since no Bonneville Service was taken in January 1940.

COMPARATIVE ELECTRIC BILLS
WASHINGTON AND OREGON COMMUNITIES

RESIDENTIAL SERVICE
LIGHTING AND SMALL APPLIANCE USE - 50 KWH PER MONTH
DECEMBER 1940



* MUNICIPAL SYSTEM
† PUBLIC SYSTEM PURCHASING MINOR PART (LESS THAN 20%) OF ITS POWER FROM BONNEVILLE
° PUBLIC SYSTEM DISTRIBUTING BONNEVILLE POWER
[1] NEW RATES EFFECTIVE 1-1-41 WILL REDUCE BILL TO $1.75
[2] NEW RATES EFFECTIVE 2-15-41 WILL REDUCE BILL TO $2.25

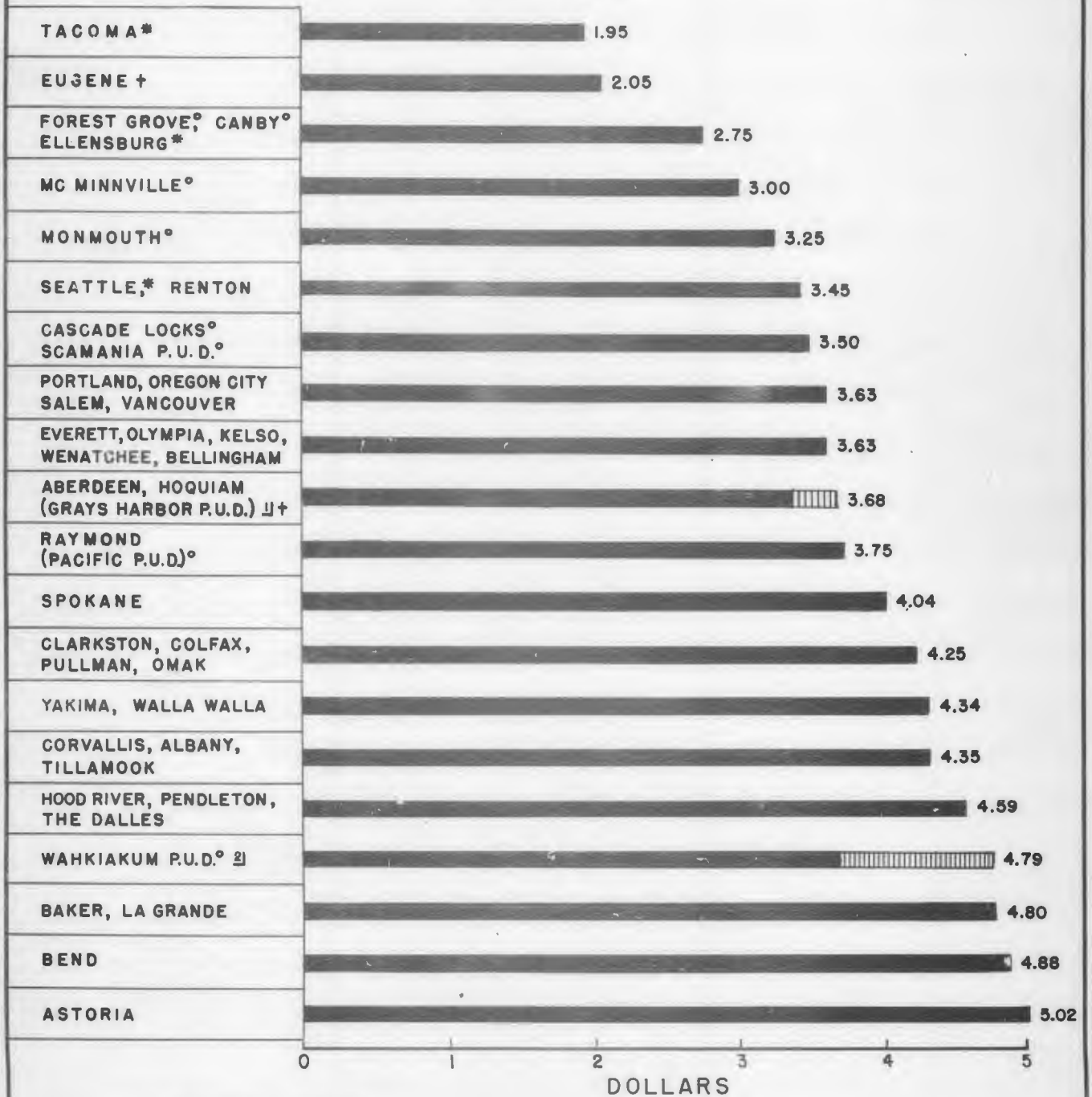
PLATE III

U. S. DEPT. OF THE INTERIOR — BONNEVILLE POWER ADMINISTRATION

C136-876.3-A5

COMPARATIVE ELECTRIC BILLS
WASHINGTON AND OREGON COMMUNITIES

RESIDENTIAL SERVICE
AVERAGE MONTHLY USE IN AREA - 125 KWH
DECEMBER 1940



* MUNICIPAL SYSTEM
† PUBLIC SYSTEM PURCHASING MINOR PART (LESS THAN 20%) OF ITS POWER FROM BONNEVILLE
° PUBLIC SYSTEM DISTRIBUTING BONNEVILLE POWER
1/ NEW RATES EFFECTIVE 1-1-41 WILL REDUCE BILL TO $3.38
2/ NEW RATES EFFECTIVE 2-15-41 WILL REDUCE BILL TO $3.75

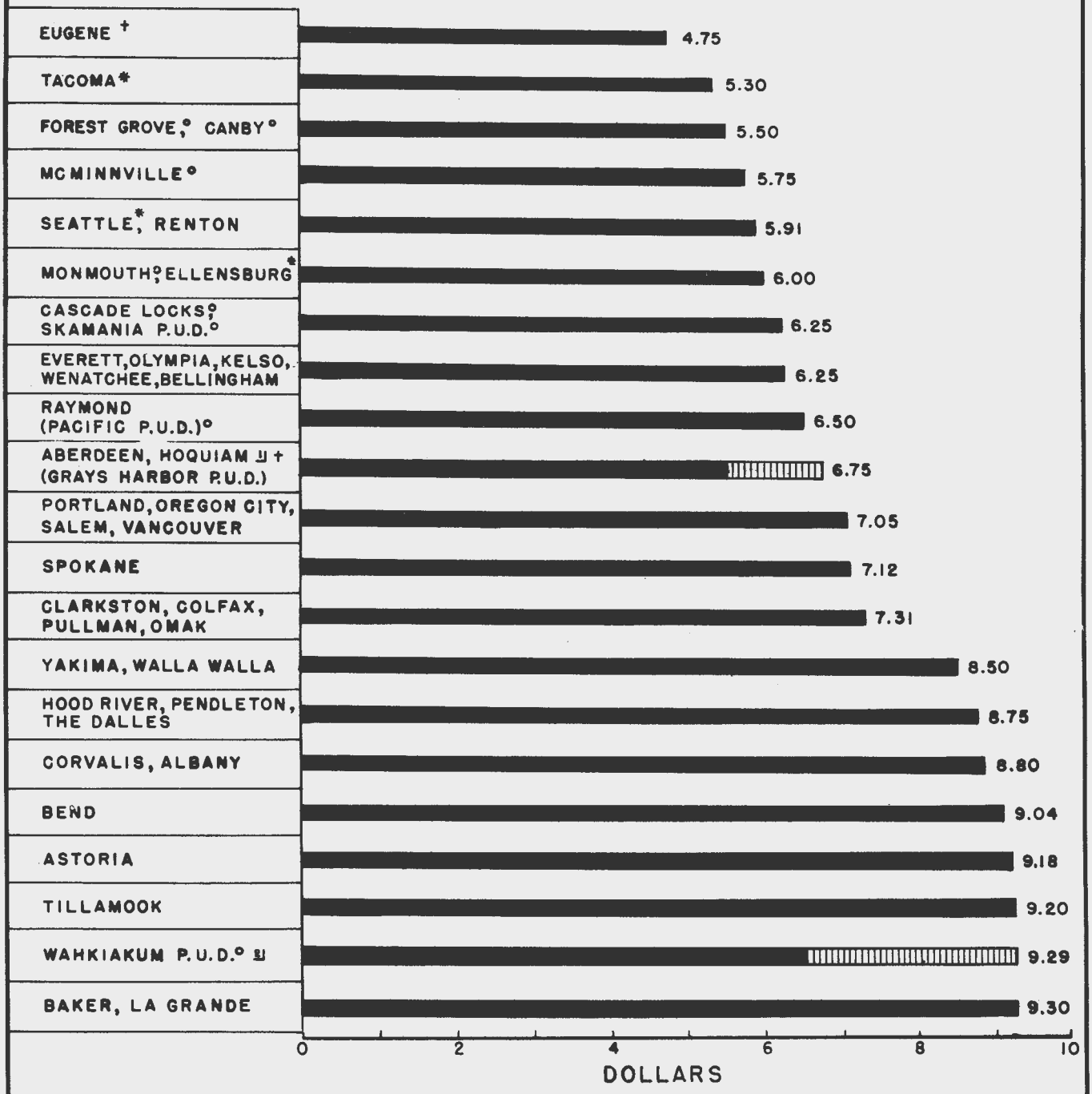
PLATE IV

U.S. DEPT. OF THE INTERIOR — BONNEVILLE POWER ADMINISTRATION

C136-876.3-A6

COMPARATIVE ELECTRIC BILLS
WASHINGTON AND OREGON COMMUNITIES

RESIDENTIAL SERVICE
ALL ELECTRIC HOME USE — 500 KWH PER MONTH [3]
DECEMBER 1940



* MUNICIPAL SYSTEM
† PUBLIC SYSTEM PURCHASING MINOR PART (LESS THAN 20%) OF ITS POWER FROM BONNEVILLE
° PUBLIC SYSTEM DISTRIBUTING BONNEVILLE POWER
[1] NEW RATES EFFECTIVE 1-1-41 WILL REDUCE BILL TO $5.50
[2] NEW RATES EFFECTIVE 2-15-41 WILL REDUCE BILL TO $6.50
[3] INCLUDES 300 KWH WATER HEATING, COMPUTED AT SPECIAL METER RATES WHERE THESE WOULD BE ADVANTAGEOUS TO THE CUSTOMER

PLATE V

U.S. DEPT. OF THE INTERIOR — BONNEVILLE POWER ADMINISTRATION

C136-876.3-A7

were shown after providing for all costs of operation including cost of power, labor, materials, taxes or payments in lieu of taxes, depreciation, and interest on debt and capital investment.

Provisions for amortization of debt were not deducted in the statement of income, as such amortization is a question of cash resources rather than earnings. Such cash may be derived from sources other than net profits. Depreciation provisions can also be used for this purpose if not required for replacements of plant or new construction. However, in both Cascade Locks and Skamania net profits were more than sufficient to meet amortization needs. In both cases the first debt principal payment coming due is $3,000, and the proportion of this amount applicable to an eight-month period would be $2,000. In Cascade Locks the profits were $1,359 in excess of this amortization requirement, or a margin of 7% of revenues. In Skamania County, the margin of profits above the amortization requirement was $996, also 7% of revenues.

The Forest Grove and Canby municipal plants have no bond repayment problems, as they are free of debt. The amount of interest[1] on the city's investment in the electric system for these plants was computed at 6% of the taxpayers' equity in the electric property, assumed to be the net book value of the property. This "interest" item was transferred to general city funds, and is an additional contribution to relieve taxpayers.

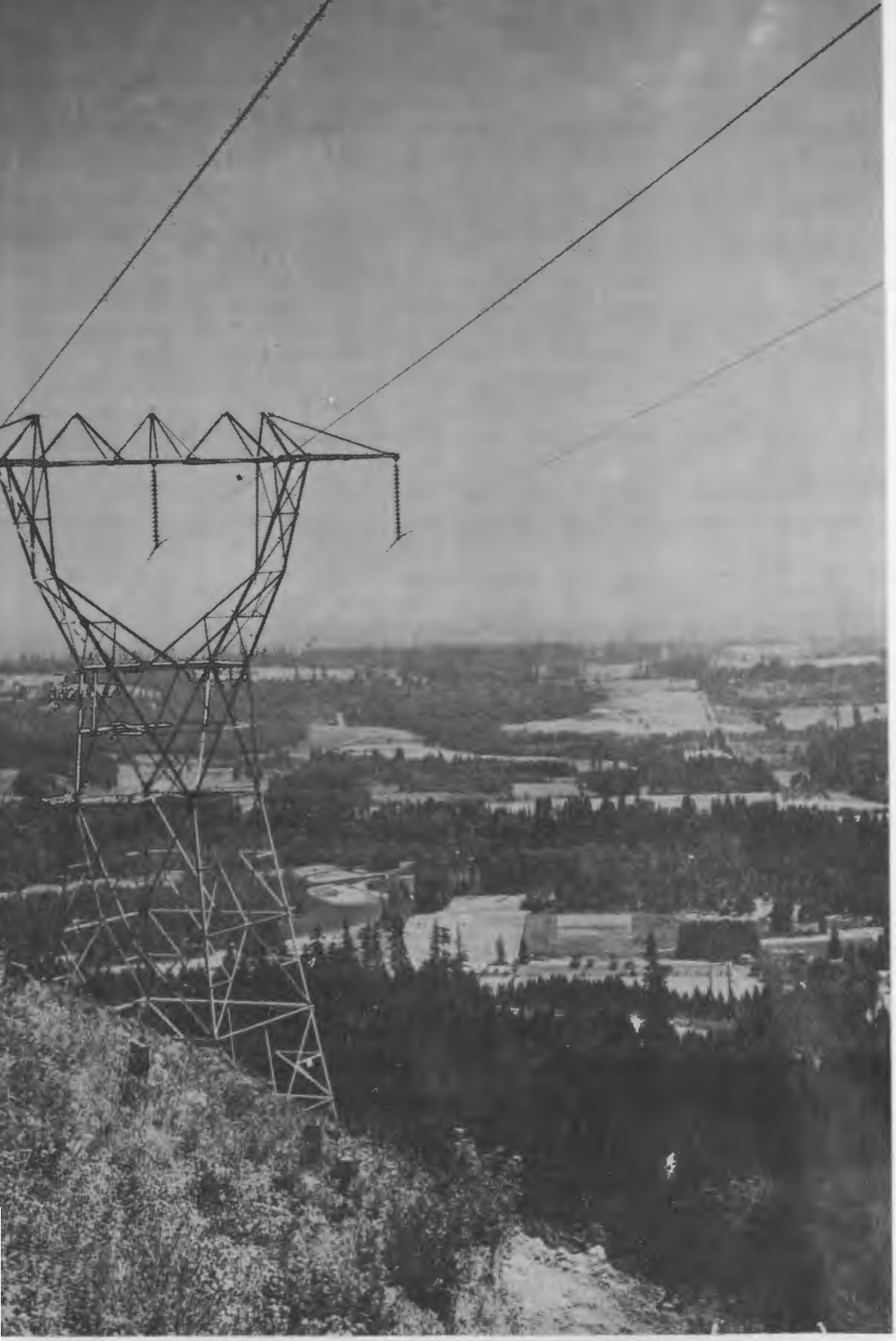
Allowances for taxes and tax equivalents in the three municipal plants ranged from 6% to 12% of revenues - 6% in Canby, 11% in Cascade Locks, and 12% in Forest Grove. In these systems the deductions for taxes and tax equivalents were computed on the same basis as the state and local property taxes which would be paid by similar private utilities. The Skamania County District set aside funds for the Washington state gross revenue tax, which is the only tax the law permits such districts to pay at present. However, the District's earnings were sufficient to enable it to pay property taxes equal to those paid by the former private company. In 1939 this company reported property taxes for the Skamania county portion of its system equal to 1½% of revenues. The Public Utility District's margin of net profit above all financial requirements, including debt amortization, was 7% of its revenues in the first eight months of 1940.

On the basis of experience in the first few months of operation it appeared that the rates being charges for the retail

---

1/ See Table 6, p.42.

Construction starts on substation near Salem, Oregon.



230 KV line construction near Kelso, Washington.

distribution of Columbia river power would "pay out", in the sense that all of these four systems were meeting their operating and financial charges and were accumulating substantial surpluses.

The standard retail rates at Forest Grove and Canby placed them well down among those northwest communities having low power costs. A comparison of electric bills for lighting and small appliance use,1/ for average monthly domestic power use2/ and for all-electric home use3/ shows the standard resale rates ranking close to the bottom in cost to the consumer.

Power Sales Progress in the Fiscal Year 1941

Both actual sales and marketing operations developed at a rapid rate during the six months immediately following the close of fiscal year 1940. Direct effect of the national defense program was first felt on October 21, 1940, when the Aluminum Company of America executed a new contract for the purchase of 97,500 kilowatts of prime power. This purchase was in addition to the Company's previous contracts with the Power Administration and was for the primary purpose of extending its Vancouver reduction facilities to meet increased demand for aluminum metal in the airplane industry.

During the first six months of the new fiscal year 1941, thirteen contracts were executed by the Power Administration covering a total power commitment of 112,950 kilowatts.4/ In addition to these contracts, applications for power during this same period reached a total of 105,105 kilowatts.

Power sales and income from such sales also showed a material increase.5/ Not only did deliveries under some of the contracts negotiated and executed in fiscal 1940 become effective, but new contracts signed after the close of the fiscal year brought with them demands for immediate transmission and distribution. The Power Administration was able to meet these demands through the completion of additional segments of its

---

1/ See Plate III following p. 42.
2/ See Plate IV following p. 42.
3/ See Plate V following p. 42.
4/ For contracts executed in fiscal 1941 see Table 7, p. 46.
5/ For power sales revenues between July 1, 1940, and November 30, 1940, see Table 8, p. 47.

transmission network. Agencies which began receiving power between June 30, 1940, and December 31, 1941, included:

Agency	Date of Initial Delivery
Centralia, Washington	12-30-40
Eugene, Oregon	11-28-40
McMinnville, Oregon	10-18-40
Monmouth, Oregon	12-5-40
Grays Harbor County PUD, Washington	11-7-40
Pacific County PUD, Washington	10-17-40
Wahkiakum County PUD, Washington	10-30-40
Benton-Lincoln Cooperative	10-12-40
Aluminum Company of America (1st Contract)	8-31-40
Aluminum Company of America (2nd contract)	11-28-40

Revenue Gains Assured

During the complete fiscal year of 1941 it is estimated that the revenues will increase 415% over the preceding year, while the kilowatt-hours sold will increase approximately 329% for the same period. These spectacular gains are the result both of an ever increasing demand for power for national defense industries and the stimulated increase in the consumption of electricity resulting from substantial rate reductions throughout the region. The estimated kilowatt-hour sales and revenue for the fiscal year 1941 are shown in the following table.

Type of Agency	Average Monthly Peak Kw 1/	Kwh Sales	Revenue
Municipalities	7,515	15,177,510	$ 64,876
Public (Peoples') Utility Districts	8,805	28,527,056	95,993
REA Cooperatives	1,200	1,359,216	6,901
Private Utilities	31,500	322,885,206	745,984
Industrial Purchasers	69,160	440,961,120	982,036
Total	118,180	808,930,108	$1,895,790

1/ Summation of individual non-coincidental monthly peaks. Dump loads excluded.

TABLE 7
POWER CONTRACTS EXECUTED (Prime Power)
July 1 - December 31, 1940

Name	Kilowatts	Date Executed	Contract Period	Energization Schedule	Energization Actual
Public Utility Districts					
Kittitas	100	10- 3-40	20	4- 1-41	
Lewis	400	10- 4-40	20	3-15-41	
Northern Wasco	4,000	10-28-40	20	---	
Grays Harbor 1/	2,000	11- 7-40	20	---	11- 7-40
Total	6,500				
Municipalities					
Ellensburg	2,000	8- 1-40	5	4- 1-41	
Eugene 2/	1,500	8-20-40	1 & 10		11-28-40
Total	3,500				
Cooperatives					
Wash. 20 Columbia	300	10- 1-40	20	5- 1-41	
Oregon 26 Wasco	200	10- 2-40	20	5- 1-41	
Wash. 18 Spokane	800	10- 3-40	20	---	
Oregon 5 Clatsop	150	10- 7-40	20	4- 1-41	
Total	1,450				
Industries					
Pac. Car. & Alloys Co.	2,000	7-13-40	20	12-31-40	---
Aluminum Co. of America	97,500	10-21-40	20	-(4- 1-41 (5- 1-41 (6- 1-41	
Penn. Salt Co.	2,000	12-14-40	20	---	
Total	101,500				
TOTAL CONTRACTS EXECUTED	112,950				

1/ Contract calls for additional sales of dump power and provides for interchange of power.

2/ Contract provides for interchange of power.

TABLE 8

SALES AND REVENUES
FIRST FIVE MONTHS OF FISCAL YEAR 1941
JULY 1, 1940 to NOVEMBER 30, 1940

Purchaser	Rate Schedule	Maximum Demand Kw	Energy Kilowatt-hours	Billing
Cascade Locks, Oregon	A-2,B-1,H-1*	326.4	544,080	$ 1,363
Canby, Oregon	F-1	286.5	417,290	1,956
Forest Grove, Oregon	F-1	792	1,120,640	5,127
**McMinnville, Oregon	C-2, H-1	2,112	1,000,000	2,466
**Grays Harbor, Wash., P.U.D.	C-2, H-1	3,240	1,034,433	2,323
**Klickitat, Wash., P.U.D.	F-1	34.4	880	4
**Pacific, Wash., P.U.D.	F-1	1,987.5	720,571	4,252
Skamania, Wash., P.U.D.	A-2*	280	442,550	1,560
**Wahkiakum, Wash., P.U.D.	F-1	572	127,391	581
**Benton-Lincoln Elec. Coop.	F-1	130.8	46,645	233
Total Public Agencies			5,454,480	$ 19,865
Portland General Elec. Co.	C-2, H-1	66,135	143,921,980	$332,007
Total Private Utilities			143,921,980	$332,007
**Aluminum Company of America	C-2	40,208	60,711,600	105,778
Total Industrial Purchasers			60,711,600	105,778
TOTAL			210,088,060	$457,650

* Billings also include transmission charges.
** Service commenced after June 30, 1940.

NOTE: In Second Annual Report, page 3, it was stated that the revenue for the calendar year 1940 would total nearly $1,000,000. Actual total earnings were $748,986.62.

Participation in Acquisition Proceedings

The trend toward public ownership is continuing through the first half of the 1941 fiscal year. In the general election of November 1940 four public utility districts in Washington and five people's utility districts in Oregon were created by vote of the people. These new districts are:1/

Clallam County Public Utility District - Washington
Jefferson County Public Utility District - Washington
Kitsap County Public Utility District - Washington
Yakima County Public Utility District - Washington
Central Lincoln People's Utility District - Oregon
Central Oregon People's Utility District - Oregon
Clatskanie People's Utility District - Oregon
Columbia River People's Utility District - Oregon
Union County People's Utility District - Oregon

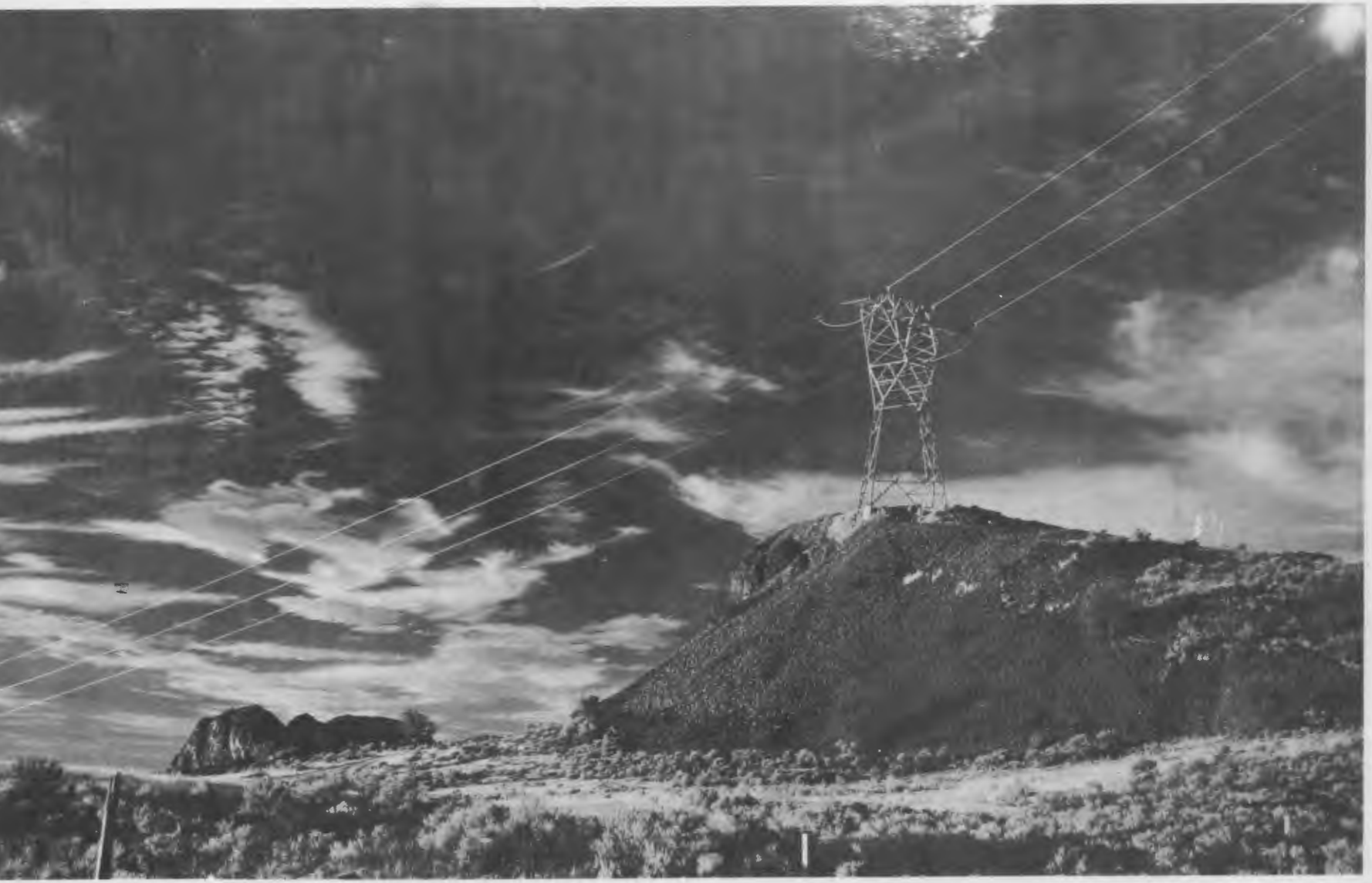
In addition to the creation of these nine new utility districts, four existing Oregon districts voted bond issues totaling $1,515,000 for the acquisition of existing power distribution facilities and the construction of new facilities. These districts are:

Tillamook County People's Utility District	$ 750,000
Wickiup People's Utility District	80,000
Northern Wasco People's Utility District	475,000
Nehalem Basin People's Utility District	210,000
Total	$1,515,000

Because of the large number of utility districts and municipalities which were opening or preparing to open negotiations looking to the acquisition of existing privately owned distribution facilities, the Bonneville Power Administration early in the fiscal year 1941 set up an Acquisition Staff as part of the System Planning & Marketing division. This staff renders technical assistance to the various districts in their acquisition problems. Several of the largest private utilities in the Northwest have opened their books to the members of this staff for purposes of making preliminary valuations of the companies' properties. The data obtained in these studies of the companies' records are made available to the various districts to be used as a guide in their acquisition proceedings.

1/ For an illustration of the growth of utility districts see Plate VII following p. 54.

Construction starts on Midway substation at Vernita, Washington. When complete, this station will serve the Yakima valley and eastern Oregon and Washington communities.



230 KV transmission line construction near Grand Coulee dam.

System Planning

One of the most significant accomplishments of the Power Administration during the year was the initiation of a series of comprehensive fact-finding surveys dealing with the economic development, power resources, and load and load growth of the Pacific Northwest power marketing area. These surveys, based upon a detailed analysis of the fundamental factors of the various sub-areas of the region, established a rational basis for the determination and location of the present and future power markets, thus permitting an orderly planning of an adequate long-range construction program. These surveys also provided the basis for forecasting expected revenues and determining the economic feasibility of the necessary federal transmission and generating facilities.

In making these basic studies and investigations, close cooperation was maintained with private and state agencies, the National Resources Planning Board, Bureau of Reclamation, Department of Agriculture, and other interested federal agencies.

Industrial and Agricultural Resources Survey

This survey was, in fact, a series of studies covering all major phases of Northwest economic development and their relation to the development of the region's hydroelectric power resources. In purpose the studies were pointed at the discovery of the region's economic needs and to what extent development of the Columbia river could fill those needs. In scope the studies covered such subjects as general business activities, population trends, local and developmental potentialities of the region's mineral deposits, the trend of new industrial development and the growth of power distribution by public agencies.

Most of these studies were launched during the fiscal year and some of them were brought well along the road to completion. In addition to their function of enabling the Power Administration to obtain a clearer picture of the way in which it might best serve the Northwest region and of the form its transmission lines should ultimately take, these studies provided, in numerous instances, sales promotional material needed for securing potential power customers.

Industrial aspects of these surveys were handled by the Market Development staff. Agricultural aspects[1] were handled

---

1/ See p. 53.

by research engineers attached to the Distribution Projects section and the Rates and Statistics section.

The normal contributions of the region to the industrial requirements of the nation were rapidly expanding to meet the increased activity leading to the manufacture of defense materials. In this respect the Northwest with its forest and agricultural resources, its mineral deposits, and vast quantities of electric power was moving to a position of major importance in the national program as a whole. This, of course, demanded a stepping-up of the Power Administration's construction program to meet the accelerated industrial growth.

The outputs of the forest products industries were reaching new peaks due to the demands for material for cantonments and other military and naval uses, and to replace materials hitherto imported from other parts of the world. For example, due to the shutting off of imports of high grade Scandinavian wood pulp, large quantities of this Northwestern material were being produced and shipped to the East for final processing. Similarly, due to the efforts of the defense agencies in procuring materials important to the defense program, particularly of a strategic and critical nature, renewed activity was noticed in the mineral fields of the region. Old mines were being reopened and new ones were being developed for the production of manganese, antimony, mercury, chromite, and other minerals.

In the field of industrial power utilization, national defense industries which rely heavily on basic electrochemical and electrometallurgical industries were showing an ever increasing active interest in Northwest plant location. Concrete examples of this interest were evidenced in the industrial contracts signed during the year by the Bonneville Power Administration.

Studies of the many inquiries received from other industries by the Bonneville Power Administration, and the known plans of certain corporations to locate shortly in the Northwest clearly indicated that industrial demands for Bonneville-Coulee power would become increasingly important in the near future. Among the industries making inquiry were those concerned with production of the following: aluminum (utilizing the western mineral, alunite), electrolytic zinc, ferrochrome, magnesium, phosphate, explosives, glass, and carbon electrodes. An unusual amount of interest was evidenced by various industrialists in western markets for steel and steel alloy products.

The industrial expansion taking place was found to be particularly significant in its relationship to the regional

economy. The Northwest had depended largely on its forest products industries and its agriculture. The approaching depletion of the timber resources of the region and the critical situation in the national agriculture made diversification of the economic bases of the Northwest an imperative step. In addition, new opportunities should be created for the continuing influx of peoples from other parts of the nation. By creating a more favorable trade balance for the region through the development of new industries, many of these crucial and imminent problems could be ameliorated.

Early findings such as these coincident with the rapid industrial expansion, convinced the Power Administration's research staff of the necessity for surveying all industrial potentialities of the region as rapidly and thoroughly as possible. First such investigations relating to industrial power demands were concentrated on large power consuming industries. A number of brief technical memoranda were prepared in response to specific inquiries from various industrial prospects. These dealt with the feasibility of specific processes, supplies of materials, costs, and markets. Among the commodities or industries reported on were electrolytic chromium, sponge iron, tin smelting, plastics, calcium carbide, wood pulp, and paper.

One extensive report was published dealing with the feasibility of iron and steel production in the Northwest, using Columbia river power. Also prepared was a review discussing the processes and location factors of major electro-industries related to national defense and feasible for the Northwest.

In view of the current expansion of defense industries on the Pacific Coast, a survey was initiated covering the markets for certain semi-raw materials, some of which could be produced in the Northwest. The commodities under survey included steel for shipbuilding, metals and alloys used in aircraft, and chemicals for explosives. This study was scheduled to be completed early in 1941.

The conduct of industrial investigations required frequent reference to data on the location, size, and quality of Northwest mineral deposits. A method was set up for continuous assembly of all such data by the Power Administration from governmental and other publications, and from owners and lessors of mineral deposits who voluntarily provided information. Using all available information, the Bonneville Power Administration published a folio of mineral deposit maps showing the approximate locations in the Northwest of both developed and undeveloped deposits of 41 minerals.

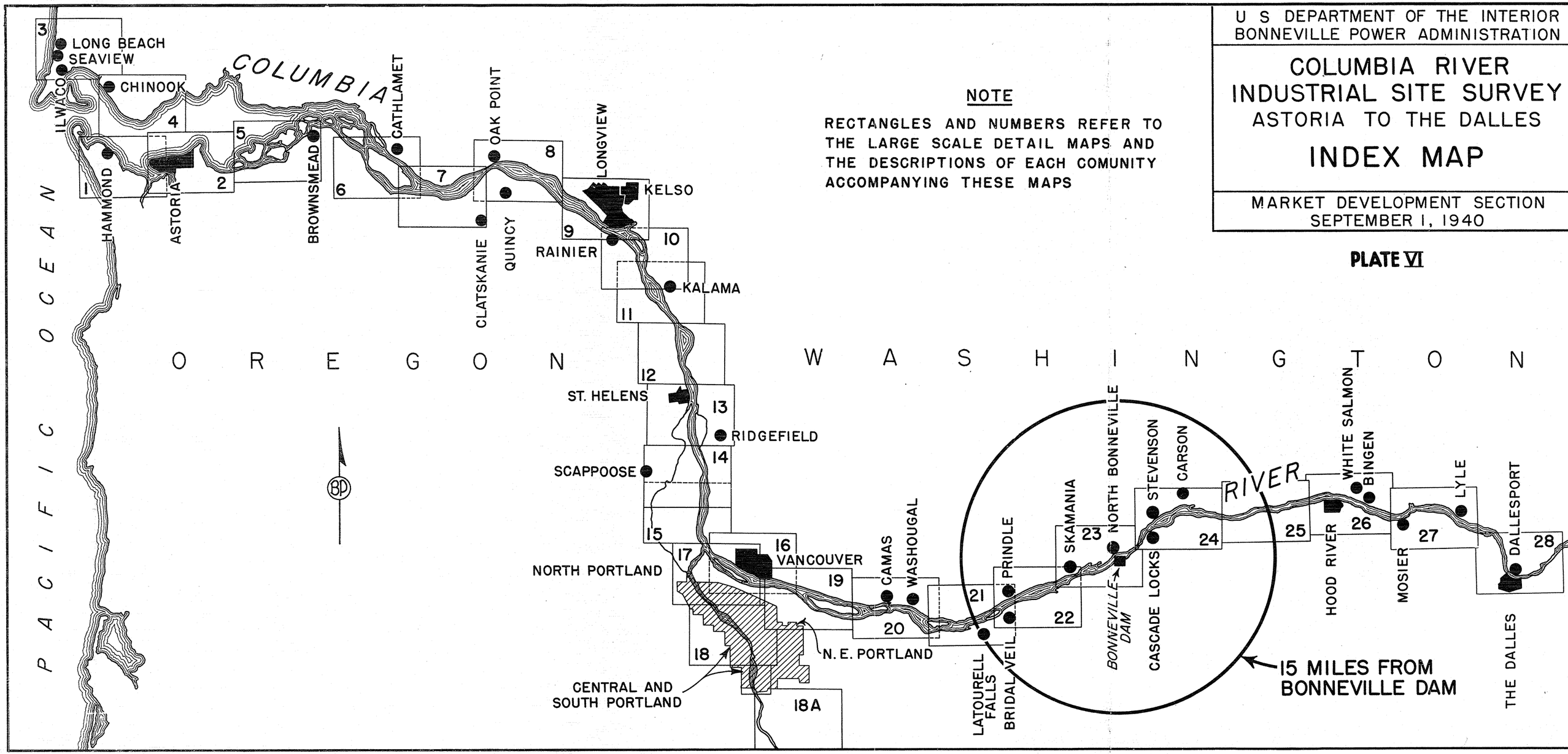
The likelihood of the inauguration in the Northwest of other electrometallurgical and chemical industries buying Columbia river power made it necessary to appraise the most suitable centers for their location. These site surveys were begun in collaboration with chambers of commerce and leading citizens of the various communities. As the first step in effecting the survey a group of sub-regional investigations was launched dealing with local industrial resources, facilities, and plant sites. The sub-regions in the order of survey were:

Lower Columbia river - Astoria to The Dalles, Oregon and Washington[1/]
Lower Puget Sound, Washington
Coulee-Spokane, Washington
Willamette Valley, Oregon
Grays Harbor, Washington
Central and southeastern Washington

The results were summarized as completed in brief maps and reports to be made available to these communities. They would provide the collected information to some industrial prospects. Other prospects may receive such information directly from the Bonneville Power Administration and then be referred to persons in the communities.

Experiences upon completion of the first site survey amply demonstrated its value. This survey of the lower Columbia river helped the Power Administration to appraise the likelihood of industrial developments in various localities and to plan future locations of power facilities. At the same time, industrial prospects were enabled, with little cost to themselves, to view objectively and comprehensively the various possible locations, their advantages and disadvantages. Finally, the surveyed communities accessible to Columbia river power were placed in a position to receive fair and equal consideration by new industries. Thus a sound base of fact was being developed for promotional use by Northwest communities and substituted for the chance decisions of businessmen affecting the locations of industries. Consequently, these surveys should contribute to the most economical planning of industrial locations in the Northwest.

1/ See plate VI following.


U S DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
COLUMBIA RIVER
INDUSTRIAL SITE SURVEY
ASTORIA TO THE DALLES
INDEX MAP
MARKET DEVELOPMENT SECTION
SEPTEMBER 1, 1940
PLATE VI
NOTE
RECTANGLES AND NUMBERS REFER TO THE LARGE SCALE DETAIL MAPS AND THE DESCRIPTIONS OF EACH COMUNITY ACCOMPANYING THESE MAPS
PACIFIC OCEAN
OREGON
WASHINGTON
COLUMBIA RIVER
LONG BEACH
SEAVIEW
CHINOOK
ILWACO
HAMMOND
ASTORIA
BROWNSMEAD
CATHLAMET
OAK POINT
CLATSKANIE
QUINCY
LONGVIEW
KELSO
RAINIER
KALAMA
ST. HELENS
RIDGEFIELD
SCAPPOOSE
NORTH PORTLAND
VANCOUVER
CAMAS
WASHOUGAL
N. E. PORTLAND
CENTRAL AND SOUTH PORTLAND
18A
LATOURELL FALLS
BRIDAL VEIL
PRINDLE
SKAMANIA
NORTH BONNEVILLE
BONNEVILLE DAM
CASCADE LOCKS
STEVENSON
CARSON
WHITE SALMON
BINGEN
HOOD RIVER
MOSIER
LYLE
DALLESPORT
THE DALLES
15 MILES FROM BONNEVILLE DAM
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28

Agricultural Studies

In a program of regional development in which power has such a prominent place, it is essential that the agricultural interests of the Pacific Northwest receive their just share of attention. The Power Administration, therefore, inaugurated a five-fold program of surveys and research for the purpose of determining how Columbia river power could best serve Pacific Northwest agriculture. These, like the industrial studies, served the dual function of implementing the long-time development program and providing data necessary in the promotion of immediate power sale.

The work was divided into five major categories:

1. Statistical material relative to the agriculture of the Pacific Northwest was collected and tabulated. This was for the purpose of collecting information on agricultural trends, farm income, land uses, and the application of electricity to various farm operations.

2. Farm organizations and individual farmers were asked to cooperate in studies in the rural districts served by Bonneville to determine present and future uses of power on farms, and to obtain and analyze farmers' ideas on improvement of rural service.

3. A comprehensive study of irrigation development and its possibilities with relation to the use of power was started. Special emphasis was being given to the assembly and distribution of information on pumping methods for irrigation and drainage.

4. Consultive assistance was instituted for REA cooperatives, public utility districts, and municipal systems serving rural customers in the solution of their rural power load problems.

5. Close contact and an exchange of information was maintained between the Power Administration's new survey unit and other federal and local governmental agencies as well as with universities concerned with agricultural problems. These agencies include the Farm Security Administration, the Soil Conservation Service, the Farm Credit Administration, the Forest Service, the Reclamation Service, Rural Electrification Administration and others.

Studies in Public Ownership Trends

Because the Bonneville Act specifies that the Power Administration shall give preference at all times to public bodies and cooperatives in the sale of power, it was necessary to make a thorough investigation of the trends in public ownership in the Columbia river region. Primary purpose of this survey was to determine as nearly as possible what proportion of total future customer load would be absorbed by such agencies. To this end historical studies of the rate of growth and of the quantity and type of power consumption, and of the fiscal problems of such agencies were instituted.1/ In this connection studies also were instituted into the effect of public ownership on retail power rates within the region and into the effect of those reductions on present and future power consumption.2/

Water Power Resources Survey

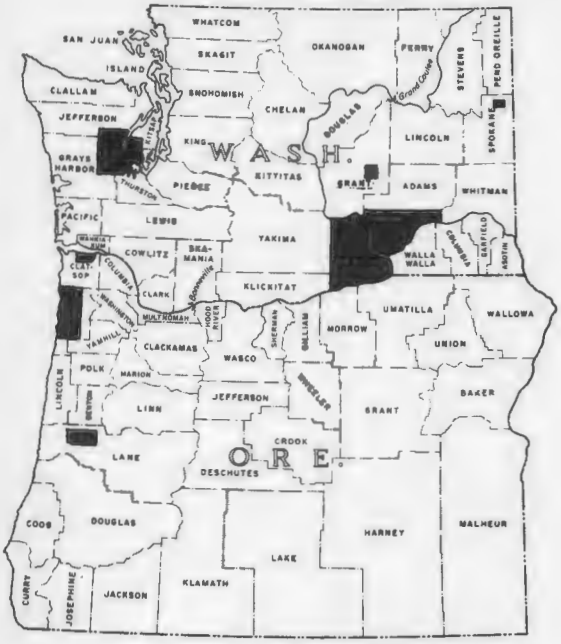
A second basic survey essential to the development of a comprehensive long-range plan for the marketing of the Columbia river power was instituted during the year. This survey, made jointly by the Consulting Engineering office and System Planning section, and in close cooperation with the National Resources Planning Board and other federal agencies, covered the existing and potential water power resources of the Pacific Northwest drainage basins. Three types of power resources were examined: (1) Existing hydroelectric developments exclusive of those on the Columbia river, (2) hydroelectric developments of the Columbia river, and (3) existing steam generating plants. For the sake of analysis, the Pacific Northwest region was divided into five principal power supply districts in addition to those districts contiguous to the Bonneville and Grand Coulee plants. The power capabilities of each of these districts were determined on the basis of the critical water year of 1936, and on this basis the rated generating capacities of the plant capabilities of those various power supply districts are given in the following table:

District	Rated Capacity kw	Estimated Power Available November & December, 1936 kw	kw	Reservoir Storage kwh
Puget Sound (Wash.)	463,700	145,400	183,800	253,591,000
Eastern Washington	245,000	173,400	169,800	300,580,000
Central Washington and Eastern Oregon	17,100	10,070	12,690	
Portland Area	160,800	54,900	97,300	32,534,000
Southwest Oregon	58,600	39,500	43,800	102,000,000

1/ See Plates VII, VIII and IX following.

2/ For details on rate reductions see Tables 9, 10, and 11, pp. 55, 56, & 57.

GROWTH OF UTILITY DISTRICTS IN WASHINGTON AND OREGON



1935

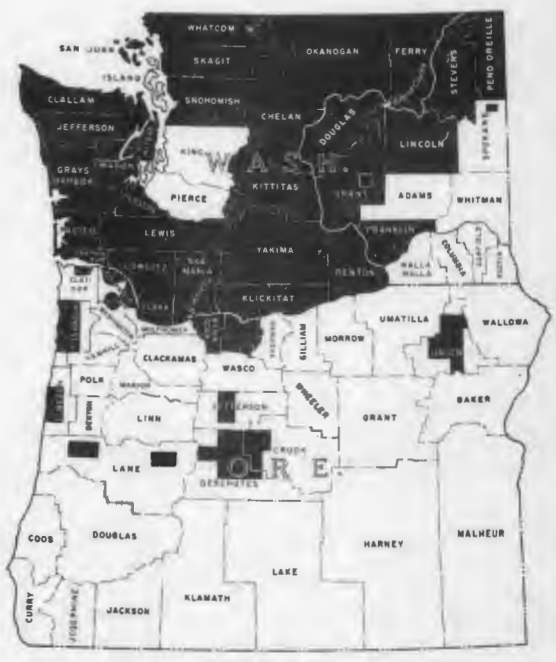
9 DISTRICTS

1937

24 DISTRICTS

1939

34 DISTRICTS



1940

44 DISTRICTS

PLATE VII

U. S. DEPT OF THE INTERIOR — BONNEVILLE POWER ADMINISTRATION

C136-877-A3

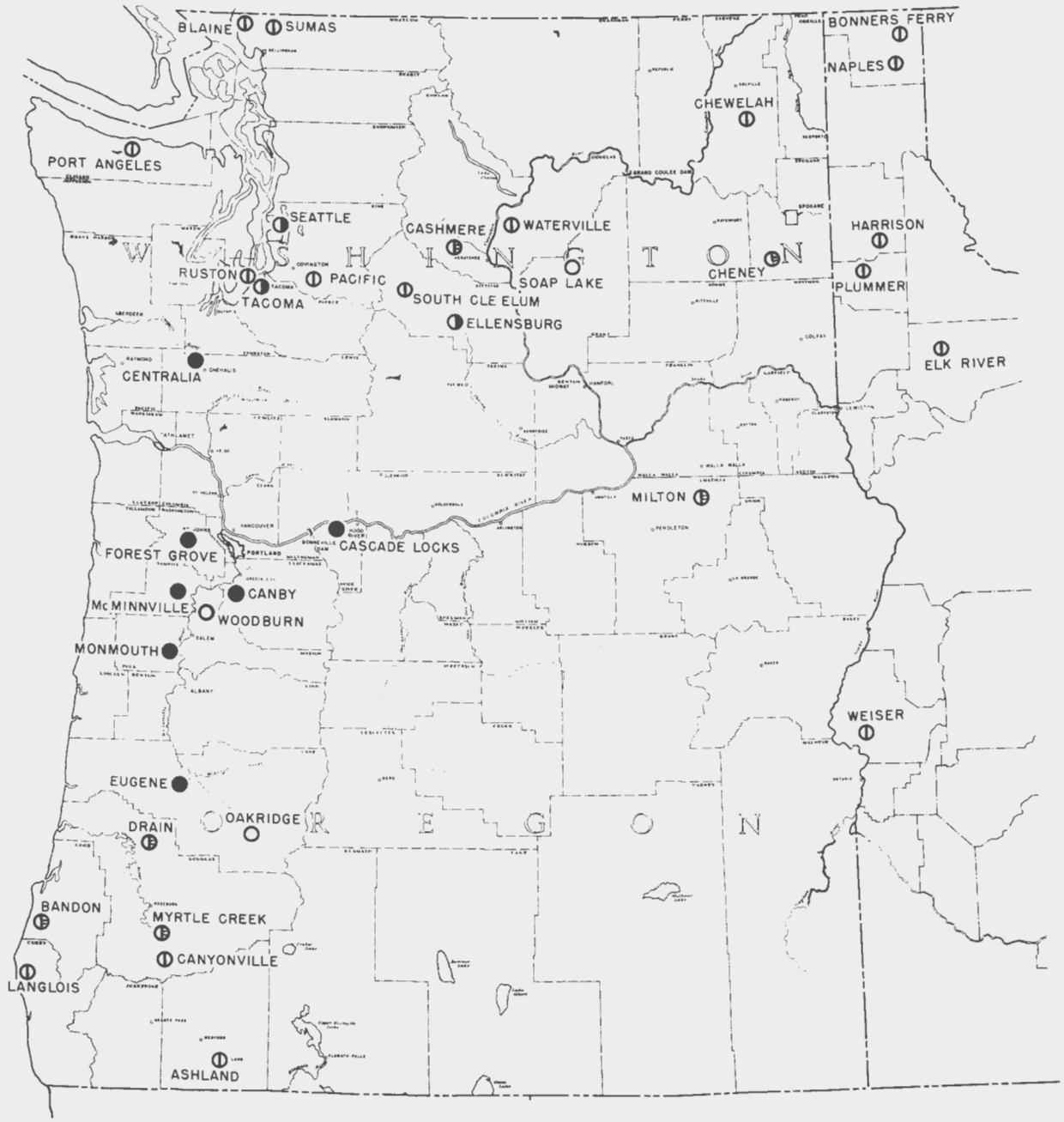
GROWTH OF R.E.A. COOPERATIVES
IN WASHINGTON, OREGON AND IDAHO PANHANDLE

1938

1940

PLATE VIII

STATUS OF MUNICIPALLY-OWNED ELECTRIC UTILITIES



MUNICIPAL ELECTRIC UTILITIES

- ● USING BONNEVILLE POWER
- ◑ CONTRACT FOR BONNEVILLE POWER SIGNED — CUSTOMER NOT YET CONNECTED
- ○ FORMING, APPLICATION FOR BONNEVILLE POWER RECEIVED
- Ⓔ IN OPERATION, APPLICATION FOR BONNEVILLE POWER RECEIVED — NO CONTRACT YET EXECUTED
- Ⓘ IN OPERATION, NO APPLICATION RECEIVED

PLATE IX

U. S. DEPT. OF THE INTERIOR BONNEVILLE POWER ADMINISTRATION

DEC. 30, 1940 C136-879.2-B9

TABLE 9

ANNUAL ELECTRIC RATE REDUCTIONS

Washington and Oregon

Private Utilities[1]

Year	Washington	Oregon	Total
1935	$ 402,700	$ 58,902	$ 461,602
1936	329,600	266,870	596,470
1937	311,000	529,899	840,899
1938	25,300	137,306	162,606
1939	1,094,772	1,050,306	2,145,078
1940	1,100,147	1,517,808	2,617,955
Total	$3,263,519	$3,561,091	$6,824,610

Public Electric Systems[2]

1939	$ 213,000	$ 93,910	$ 306,910
1940	865,465	107,646	973,111
Total	$1,078,465	$ 201,556	$1,280,021

1/ These data were supplied by the Washington Department of Public Service and the Oregon Public Utilities Commissioner.

2/ These data were obtained from the public systems concerned, from newspaper reports, or were estimated on the basis of available data. Only the major systems have been included.

TABLE 10

ANNUAL ELECTRIC RATE REDUCTIONS

Major Private Utilities in Washington and Oregon 1/

Oregon	1938	1939	1940
California Oregon Power Co.	$ 1,116	$ 54,900	$ 127,166
Eastern Oregon Light & Pwr. Co.	2,813	29,594	70,208
Idaho Power Co.	10,000	22,400	32,345
Mt. States Power Co.	104,990	80,332	214,242
Northwestern Electric Co.	-	144,000	275,766
Pacific Power & Light Co.	-	117,893	3,200
Portland General Electric Co.	-	565,672	740,800
West Coast Power Co.	7,700	24,380	36,277
Total for Other Utilities	10,687	11,135	17,804
Total Private Utilities (Oregon)	$137,306	$1,050,306	$1,517,808
Washington			
Northwestern Electric Co.	2/	40,000	26,919
Pacific Power & Light Co.		95,380	-
Portland General Electric Co.		-	26,812
Puget Sound Power & Light Co.		731,500	797,450
Wash. Gas & Electric Co.	600	300	2,450
Wash. Water Power Co.		201,000	231,323
West Coast Power Co.	3,900	16,322	13,717
Total for Other Utilities		10,270	1,476
Total Private Utilities (Washington)	$ 25,300	$1,094,772	$1,100,147

1/ These data were supplied by the Washington Department of Public Service and the Oregon Public Utilities Commissioner.
2/ Complete detail not available for 1938.

TABLE 11

ANNUAL ELECTRIC RATE REDUCTIONS

Principal Public Electric Systems in Washington and Oregon [1]

System	1939	1940
Canby	$ --	$ 4,869
Cascade Locks	5,430	--
Forest Grove	18,480	--
Ellensburg	--	44,270
Eugene	70,000	65,000
Grays Harbor P.U.D.	--	150,367
McMinnville	--	33,177
Monmouth	--	4,600
Pacific County P.U.D.	--	51,121
Seattle	50,000	613,000
Skamania P.U.D.	--	2,707
Tacoma	145,000	--
Wahkiakum P.U.D.	--	4,000
Centralia	18,000	--
Total	$306,910	$973,111

[1] These data were obtained from the public systems concerned, from newspaper reports, or were estimated on the basis of available data. Only the major systems have been included.

The power capabilities were determined for the months of November and December 1936 because of the critical stream flow conditions, and also because the months of November and December represent the period of maximum power demands of the year.

During the year preliminary studies were prepared to determine the actual generating capabilities in each of the foregoing power supply areas, and from these studies[1] the following data were determined for each of the above mentioned areas:

1. The 60-minute integrated maximum demand in kilowatts for each month.

2. The average monthly kilowatt demand during 1939.

3. The average monthly hydroelectric capability available to supply the load during critical stream flow conditions.

4. The kilowatt capacity required to supplement the hydroelectric generating stations at the time of maximum system load.

5. Hydroelectric capacity in excess of the load demands within the various areas which might be interchanged with other areas to meet critical load conditions.

These studies indicated that the period of maximum hydroelectric capability was during the months of April and May; that, at the period of minimum capacity, the actual shortages occurred during the months from August to January; and, that, during the remaining portion of the year the plant capabilities were fairly constant. With the exception of certain stream flow plants in central Washington and north-central Oregon, all of the hydroelectric plants in Oregon and Washington were found to have power in excess of their load demands during the periods of maximum annual run-off, and particularly during the months of April and May. It was also determined that the generating capabilities of the stream flow hydroelectric plants on the Columbia river were reduced during the period of high run-off as the result of a reduction in the net hydraulic head during flood stage. Studies were also made to determine the effect of interconnecting the existing hydroelectric plants with Bonneville and Grand Coulee and the benefits resulting from complete coordination of the storage and stream flow plants through the Federal transmission system. Because of the diverse characteristics of the various streams, such interconnection and coordination will prove advantageous and provide a more effective utilization of the water resources of the area. A typical example of this is the existing interconnecting facilities between the municipal plants, Tacoma and Seattle. Through this interconnection maximum utilization of the water resources and

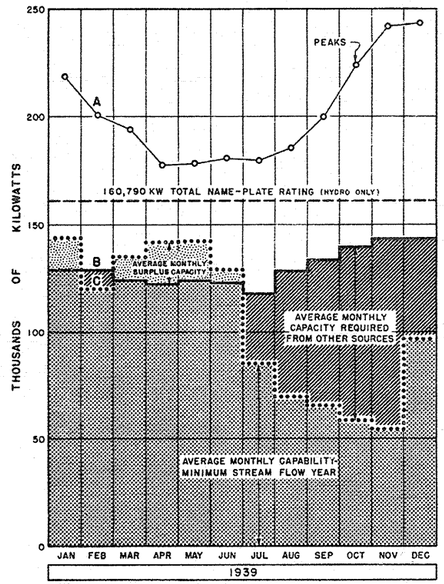
---

1/ See Plate X.

PORTLAND AREA

60 MINUTE INTEGRATED PEAKS, AVERAGE MONTHLY DEMANDS, AND AVAILABLE POWER IN KILOWATTS

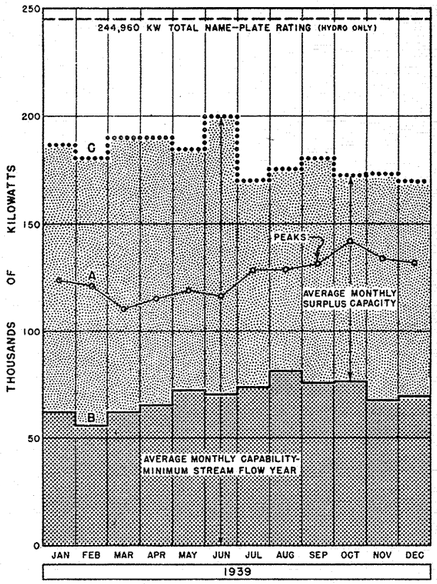
MONTH	PEAK	AVE. LOAD	HYDRO	OTHER	SUR. CAP.
JANUARY	218,760	128,760	143,300		14,540
FEBRUARY	201,230	128,720	120,100	8,620	
MARCH	194,140	124,060	134,800		10,740
APRIL	178,360	121,670	141,900		20,230
MAY	178,690	123,790	142,300		18,510
JUNE	181,020	123,190	129,100		5,910
JULY	179,930	118,410	85,100	33,310	
AUGUST	186,040	128,900	70,300	58,600	
SEPTEMBER	199,660	134,440	65,700	68,740	
OCTOBER	223,640	139,920	58,800	81,120	
NOVEMBER	241,670	143,610	54,900	88,710	
DECEMBER	244,390	143,550	97,300	46,250	



EASTERN WASHINGTON AREA

60 MINUTE INTEGRATED PEAKS, AVERAGE MONTHLY DEMANDS, AND AVAILABLE POWER IN KILOWATTS

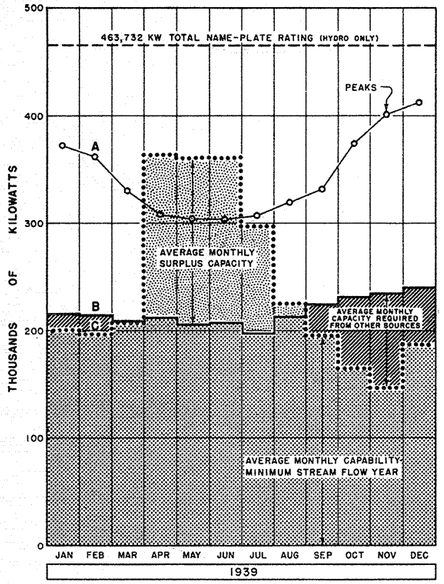
MONTH	PEAK	AVE. LOAD	HYDRO	OTHER	SUR. CAP.
JANUARY	123,800	62,900	186,400		123,500
FEBRUARY	121,000	56,600	180,400		123,800
MARCH	110,500	62,100	189,500		127,400
APRIL	115,400	65,700	189,900		124,200
MAY	119,300	72,500	184,100		111,600
JUNE	116,800	70,300	199,200		128,900
JULY	127,700	74,400	169,500		95,100
AUGUST	127,900	81,900	175,400		93,500
SEPTEMBER	131,200	76,700	180,100		103,400
OCTOBER	141,900	76,700	172,700		96,000
NOVEMBER	134,100	67,800	173,400		105,600
DECEMBER	132,100	69,600	169,800		100,200



PUGET SOUND AREA

60 MINUTE INTEGRATED PEAKS, AVERAGE MONTHLY DEMANDS, AND AVAILABLE POWER IN KILOWATTS

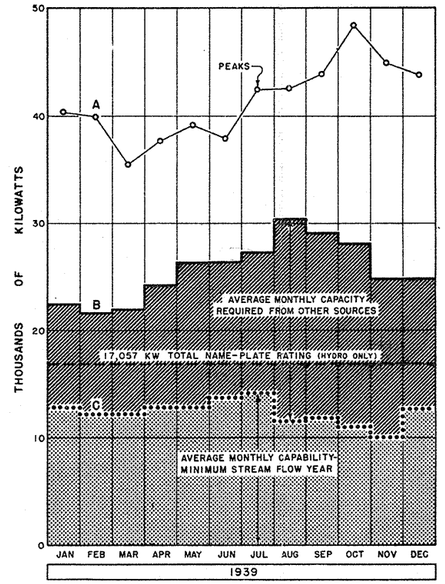
MONTH	PEAK	AVE. LOAD	HYDRO	OTHER	SUR. CAP.
JANUARY	372,470	215,100	201,800	13,300	
FEBRUARY	360,880	214,790	198,400	16,390	
MARCH	330,080	209,340	207,700	1,640	
APRIL	308,210	211,140	364,100		152,960
MAY	303,760	204,940	361,400		156,460
JUNE	303,810	206,940	362,400		155,460
JULY	306,750	197,170	297,600		100,430
AUGUST	319,960	212,820	225,800		12,980
SEPTEMBER	331,180	223,890	195,600	28,290	
OCTOBER	373,780	230,840	164,400	66,440	
NOVEMBER	400,950	235,420	145,400	90,020	
DECEMBER	411,430	240,480	183,800	56,680	



CENTRAL WASHINGTON & N. CENTRAL OREGON AREA

60 MINUTE INTEGRATED PEAKS, AVERAGE MONTHLY DEMANDS, AND AVAILABLE POWER IN KILOWATTS

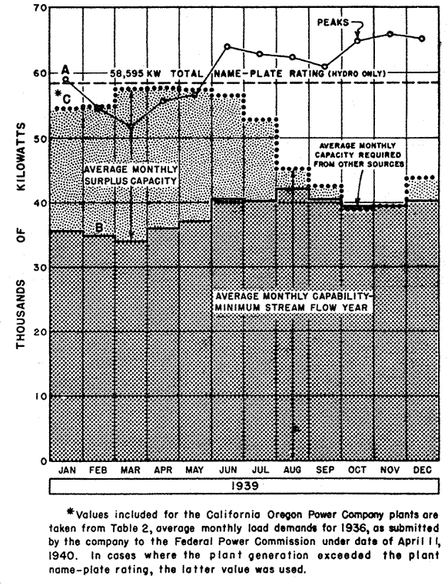
MONTH	PEAK	AVE. LOAD	HYDRO	OTHER	SUR. CAP.
JANUARY	40,350	22,470	12,800	9,670	
FEBRUARY	39,900	21,750	12,200	9,550	
MARCH	35,500	22,010	12,200	9,810	
APRIL	37,650	24,390	12,900	11,490	
MAY	39,160	26,430	12,900	13,530	
JUNE	37,900	26,420	13,800	12,620	
JULY	42,460	27,390	14,200	13,190	
AUGUST	42,520	30,490	11,600	18,890	
SEPTEMBER	43,830	29,110	11,900	17,210	
OCTOBER	48,330	28,110	11,000	17,110	
NOVEMBER	44,850	24,890	10,100	14,790	
DECEMBER	43,750	24,870	12,700	12,170	



SOUTHWESTERN OREGON AREA

60 MINUTE INTEGRATED PEAKS, AVERAGE MONTHLY DEMANDS, AND AVAILABLE POWER IN KILOWATTS*

MONTH	PEAK	AVE. LOAD	HYDRO	OTHER	SUR. CAP.
JANUARY	59,150	35,610	54,600		16,990
FEBRUARY	54,670	34,960	54,900		19,940
MARCH	51,800	34,090	57,600		23,510
APRIL	55,630	36,080	57,800		21,720
MAY	56,620	37,140	57,500		20,360
JUNE	64,050	40,630	56,500		15,870
JULY	62,920	40,230	52,800		12,570
AUGUST	62,370	42,130	45,200		3,070
SEPTEMBER	60,850	40,400	42,500		2,100
OCTOBER	64,860	39,410	39,100	310	
NOVEMBER	63,900	39,430	39,500		70
DECEMBER	65,120	40,110	43,800		3,690



*Values included for the California Oregon Power Company plants are taken from Table 2, average monthly load demands for 1936, as submitted by the company to the Federal Power Commission under date of April 1, 1940. In cases where the plant generation exceeded the plant name-plate rating, the latter value was used.

NOTES

Points on Curve "A" represent the total sixty-minute non-coincidental integrated peaks for each month and include all of the utilities represented in each supply area.

Curve "B" represents the total of the average monthly load demand of the systems and is equal to the total integrated kilowatt-hours divided by the hours in the month.

Curve "C" represents the total average monthly hydroelectric power available to supply the load demand, and is limited by plant characteristics and stream conditions for the critical period of January 1, 1936 to December 31, 1936.

When Curve "C" occurs below Curve "B", the ordinate represents the average monthly capacity required from other sources.

When Curve "C" occurs above Curve "B" the ordinate represents the average monthly hydroelectric capacity in excess of the average monthly load.

The total name-plate rating is a summation of the ratings of all hydro plants included in the study of available hydroelectric power in each area, and includes all but a few small plants for which stream flow and plant data is not available. The individual name-plate ratings agree with those appearing in the Federal Power Commission Report for 1939.

The available hydroelectric power shown on these charts does not include present or future generation of the Bonneville or Grand Coulee power developments.

HYDROELECTRIC SYSTEMS INCLUDED IN SUPPLY AREAS

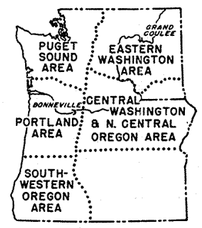
PUGET SOUND AREA
- City of Seattle Municipal System
- City of Tacoma Municipal System
- Puget Sound Power & Light Company plants west of the Cascade Mountains

EASTERN WASHINGTON AREA
- Washington Water Power Company
- Puget Sound Power & Light Company plants east of the Cascade Mountains

CENTRAL WASHINGTON and EASTERN OREGON AREA
- Pacific Power & Light Company

PORTLAND AREA
- Portland General Electric Company
- Northwestern Electric Company including the Ariel plant of the Inland Power & Light Company

SOUTHWESTERN OREGON AREA
- California Oregon Power Company
- City of Eugene Municipal System



NOTE: These charts do not include present or future generation of the Bonneville or Grand Coulee power developments.

PLATE X

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR
SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
POWER, LOAD AND HYDROELECTRIC SUPPLY
WASHINGTON & OREGON

Submitted: Jack W. Stevens — Approved: Edward E. Carmon
Recommended: Henry R. Stevens — Approved: Chief

Designed by J D S — Traced by J P M — Checked by P L E — Drawn by J P M

Date: 12-17-40

G136-810.1-D3
1-N01

storage facilities have been made with a resulting increase in the combined capabilities of the two systems. Under the present arrangement Tacoma uses the surplus power from the Seattle system during the high run-off months while storing water in its own reservoir, thereby adding to the combined storage facilities of the two systems and increasing the capabilities of the combined system during the periods of low stream flow months. When the Seattle, Tacoma, and Columbia River power systems are interconnected through the Federal transmission system, a greater utilization of the water resources of the area will be made effective.

Transmission lines now under construction between Bonneville's substation and the cities of Seattle and Tacoma will provide an interconnection having an approximate capacity of 100,000 kilowatts. Changes are also being made to increase the capacity of the present tie line between the systems of these two cities to 60,000 kilowatts.

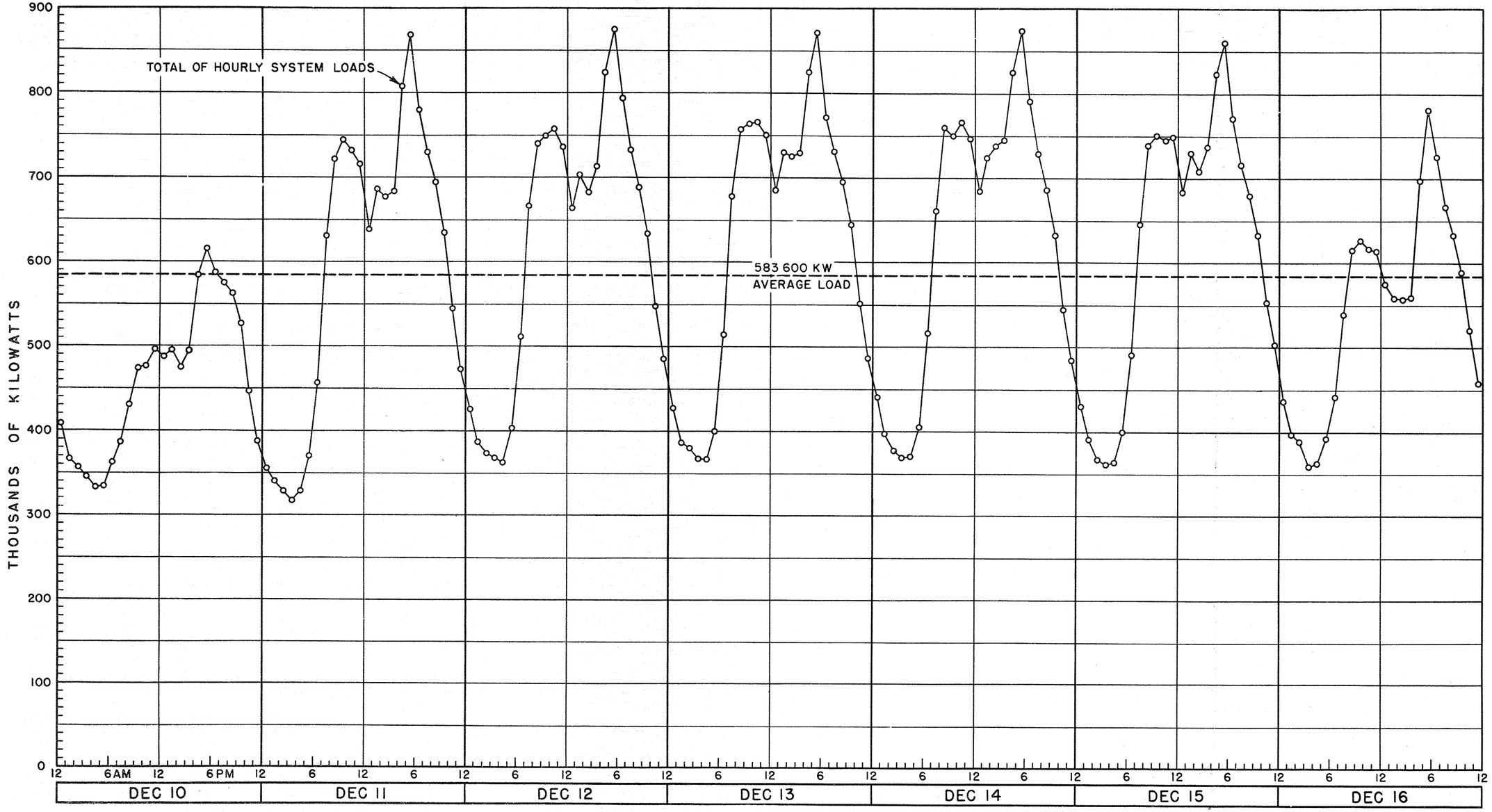
The total storage in the Puget Sound area was found to be equivalent to 253,591,000 kilowatt-hours. The available power from stream flow in the same area was estimated to be 215,801,000 kilowatt-hours, based on stream flow conditions which existed for November and December 1936, a low run-off year. Adding the amount of storage power and stream flow there was found available under critical conditions, for the months of November and December, 469,392,000 kilowatt-hours. The generating capacity available to produce this power was found to be 463,732 kilowatts.

The survey showed definitely that by complete coordination of generating facilities through the construction of adequate transmission lines, there would be sufficient water to operate the generating facilities in the area at 73% load factor during the months of November and December when system peak loads are greatest.

Adequate interconnections between the major generating plants in this area should, therefore, permit a higher economic use of the water power resources of the area and increase substantially the plant utilization factor of hydro plants for the months of November and December over 100%. Adequate interconnections would also permit using stream flow power when available and holding water in storage in reservoirs for use when stream flows are low.

A check of the combined hourly load curve for major power systems in Oregon and Washington for the week of December 10-16, 1939, showed variations in the load from 318,000 to 875,000 kw, a swing of 557,000 kw. The total hydro generating capacity in the same area connected to storage facilities is 584,642 kw.1/

1/ See Plate XI



NOTE

This curve shows a typical variation in the total load of approximately 90% of the generating systems in Oregon, Washington, and that part of Idaho served by the Washington Water Power Company for the 7-day period of December 10-16, 1939. The load on the Bonneville hydroelectric plant is not included.

PLATE XI

UNITED STATES DEPARTMENT OF THE INTERI
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISIO

BASIC POWER INVESTIGATION
TYPICAL LOAD CURVE
PACIFIC NORTHWEST AREA

Sub. Joshua W. Stearns		App'd. [illegible]	
Rec. H.P. Stearns SECTION		App'd. [illegible] Chief	
DR PLE CK DB	TR RGC CK EEW	DATE 12-16-40	C136-810.1-IN 1 - NO I

This indicated that if the generating systems were interconnected with an adequate transmission system, there would be ample generating capacity supplied from storage to take care of the variable portion of the entire load of the two states, leaving a block load of 318,000 kw for stream flow and Columbia river plants.

There are three hydroelectric developments on the Columbia river, namely Bonneville, Grand Coulee and Rock Island. The Rock Island plant near Wenatchee, owned and operated by the Puget Sound Power & Light Company, is one of the plants of the eastern Washinton area. 1/

The ultimate development of the Bonneville plant provides for the installation of ten main generating units with a total installed capacity of 518,400 kilowatts. As of June 30, 1940, two of these units, totaling 86,400 kilowatts, were in service. Construction was under way to provide for the installation of four additional units, two of which were scheduled for operation January 1, 1941, while the remaining two were scheduled for operation December 1, 1941. These six units will provide a total installed capacity of 302,400 kilowatts as of December 1, 1941.2/

The ultimate development of the Grand Coulee project provides for eighteen main generating units totaling 1,944,000 kilowatts. The present construction schedule provides for the installation of the first 108,000 kilowatt generating unit by July 1, 1941; the second, October 1, 1941; and the third, January 1, 1942.3/

The Grand Coulee project, with the useful storage capacity of 5,370,000 acre-feet, will provide a source of 984,000 kilowatts of prime power available 95% of the time, and 1,700,000 kilowatts of power available 50% of the time. This project, in addition to providing a prime power source of approximately 1,000,000 kilowatts in excess of the power required for the pumping associated with the Columbia basin development, also serves as a means of regulating the stream flow of the Columbia river and increasing the capability of the Bonneville plant.

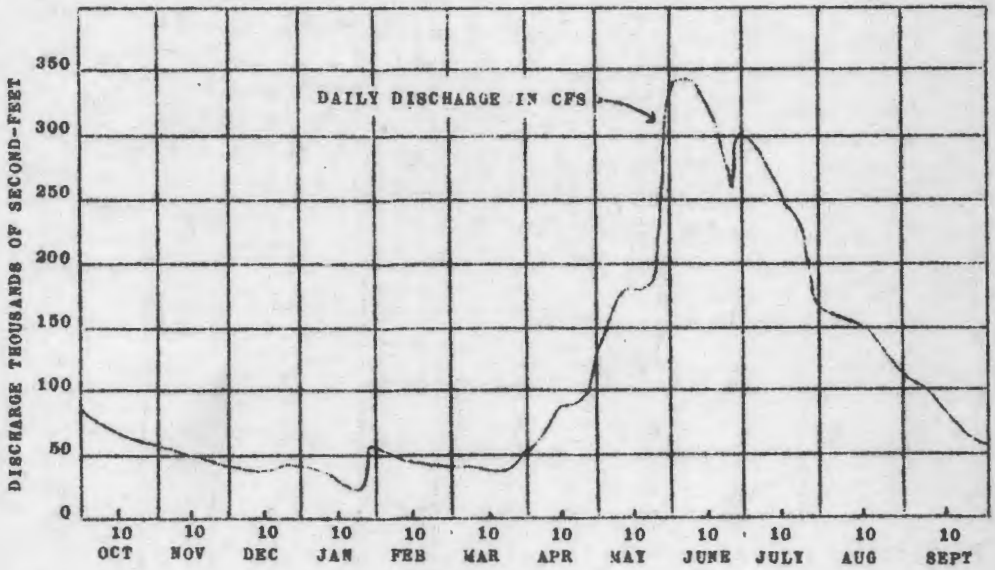
1/ See Plate X, following p.58

2/ A report of the water power resources of this development is contained in interim report Part I Basic Power Investigation, prepared by the Consulting Engineering staff under date of June 1940.

3/ Information received in September indicates a possible delay in the completion of installation of Units 1, 2, and 3 of approximately three months may be expected.

The average annual discharge of the Columbia river at Grand Coulee between 1918 and 1938 was 77,148,000 acre-feet. The natural flow for this 20-year period varies from a minimum of 15,300 second-feet, which occurred January 1, 1937, to a maximum of 469,000 second-feet which occurred June 23, 1933. The average discharge for the period is 106,500 second-feet.

The following hydrograph indicates daily flow at Grand Coulee for an average year and shows that low stream flows occur during the winter months, increasing through April and reaching a maximum about the middle of June. The flow then decreases until September and then remains fairly constant until the following April except for occasional changes resulting from abnormal weather conditions along the head waters of the Columbia river.



COLUMBIA RIVER AT GRAND COULEE
AVERAGE RUN-OFF YEAR 1918-19

In addition to the analysis of the hydroelectric developments which must form the prime power base for low cost energy, a study was made of the steam-electric generating stations in the various load and supply areas.1/ In this study steam-electric stations were considered as emergency stand-by units and as sources of capacity for carrying the incremental load growth during the period of constructing and loading the hydroelectic stations and transmission facilities.

In the Puget Sound area it was found that the municipal and private utilities have an installed steam generating capacity of

---

1/ No consideration was given to the power generated by industrial plants for their own use exclusively. This phase of the problem will be studied later.

173,900 kilowatts. This capacity is available for peaking and stand-by service to supplement the hydro generating capacity when necessary. The steam generating capacity can be used to conserve water storage during years of minimum run-off, and with adequate transmission facilities water storage can be used to the greatest advantage.

In this area a deficiency in hydroelectric power to meet the load demand during the first three and last four months of the year became apparent. The maximum deficiency, based on the low water year and loads of 1939, is 90,020 kilowatts and it occurs during the month of November.1/

This deficiency of available hydro capacity necessitates the use of power from other sources and the available steam capacity in this area is more than ample to supply this need. A steam reserve capacity of 83,990 kilowatts remains after the above hydro deficiency is satisfied.

The Portland area was found to have a generating capacity of 174,240 kilowatts in steam, electric and internal combustion generating plants. These plants are operated for peaking and stand-by service and in some instances as base load plants in connection with hydro generation of the area. The steam generating resources have been and are used to conserve water storage capacity, and in that way serve the same purpose as additional reservoir storage capacity.

The hydroelectric power supply analysis2/for this area shows a deficiency in hydro power during the month of February and also through the months of July to December, inclusive, with the maximum deficiency of 88,710 kilowatts,occurring in November, based on the low water year and 1939 system loads.

The steam capacity of 174,240 kilowatts was found sufficient to satisfy this hydro deficiency and at the same time maintain a steam reserve of 85,530 kilowatts.

The southwestern Oregon area was found to have a total steam generating capacity of 24,000 kilowatts which is operated for peaking and stand-by service in coordination with hydro facilities of the area.

Eastern Washington, central Washington and north-central Oregon areas contain a negligible amount of steam generation and are therefore not considered here.

1/2/See Plate X, following p. 58

Because of the rapidly increasing load and the accelerated demands for power for industries associated with national defense, a special analysis dealing with the years 1939, 1940, 1941, and 1942[1] was prepared to show the relationship of the total average monthly plant generating station capability to the maximum 30-minute integrated peak, and the average monthly load for the States of Oregon and Washington. In this analysis the plant capability was based upon the characteristics of the installed equipment, critical stream flow conditions and the effect of regulation from the Grand Coulee plant.

This analysis established:

1. That by supplementing the natural flow of the Columbia river with 1,725,000 acre-feet of storage from the Grand Coulee reservoir, during stream flow conditions of the critical minimum water year of 1936, the full capacity of the first six units of the Bonneville plant would be available 100% of the time.

2. That there would be no reduction in the capacity of the first six units of the Bonneville plant due to low water but that some slight reduction in the capacity might occur for average wet years when the stream flow might exceed 530,000 second-feet.

3. That this reduction in capacity at times of stream flows in excess of 530,000 second-feet would be made up by the transfer of power from other hydroelectric plants in the northwest area.

4. That the capacity of three units of 108,000 kilowatts each at the Grand Coulee plant could be operated under full head and at full capacity except for a period of approximately 40 days during the extreme flood period of May and June, but at this time a slight reduction of approximately 2,500 kilowatts for each unit might occur.

5. That the total actual and estimated load demands in the two states will exceed the total capabilities of the hydroelectric plants of Oregon and Washington, and at such times steam-generated electric energy would be required to supplement the hydroelectric plants.[1]

1/ See Plate XII.

OREGON AND WASHINGTON

PLANT CAPABILITIES, ESTIMATED PEAK LOADS AND AVERAGE MONTHLY LOAD DEMANDS IN KILOWATTS *

1939

MONTH	BONNEVILLE HYDRO CAPACITY	GRAND COULEE HYDRO CAPACITY	TOTAL OTHER HYDRO CAPACITY ORE & WASH	TOTAL HYDRO CAPACITY	TOTAL AVERAGE MONTHLY LOAD ORE & WASH	ESTIMATED MONTHLY PEAK ORE & WASH
	(A)	(B)		(D)	(E)	(F)
JANUARY	86 400	NONE	598 900	685 300	508 000	867 000
FEBRUARY	86 400	NONE	566 000	652 400	507 400	825 000
MARCH	86 400	NONE	601 800	688 200	496 000	772 000
APRIL	86 400	NONE	766 600	853 000	484 700	718 000
MAY	86 400	NONE	758 200	844 600	514 800	749 000
JUNE	86 400	NONE	761 000	847 400	518 100	754 000
JULY	86 400	NONE	619 200	705 600	506 700	768 000
AUGUST	86 400	NONE	528 300	614 700	551 100	791 000
SEPTEMBER	86 400	NONE	495 800	582 200	561 100	820 000
OCTOBER	86 400	NONE	446 000	532 400	567 200	906 000
NOVEMBER	86 400	NONE	423 300	509 700	565 300	945 000
DECEMBER	86 400	NONE	507 400	593 800	570 000	954 000

1940

MONTH	BONNEVILLE HYDRO CAPACITY	GRAND COULEE HYDRO CAPACITY	TOTAL OTHER HYDRO CAPACITY ORE & WASH	TOTAL HYDRO CAPACITY	TOTAL AVERAGE MONTHLY LOAD ORE & WASH	ESTIMATED MONTHLY PEAK ORE & WASH
	(A)	(B)		(D)	(E)	(F)
JANUARY	86 400	NONE	598 900	685 300	556 400	887 000
FEBRUARY	86 400	NONE	566 000	652 400	538 800	853 000
MARCH	86 400	NONE	601 800	688 200	551 100	803 000
APRIL	86 400	NONE	766 600	853 000	537 500	762 000
MAY	86 400	NONE	758 200	844 600	569 900	790 000
JUNE	86 400	NONE	761 000	847 400	580 600	805 000
JULY	86 400	NONE	619 200	705 600	568 600	829 000
AUGUST	86 400	NONE	528 300	614 700	631 700	871 000
SEPTEMBER	86 400	NONE	495 800	582 200	654 200	916 000
OCTOBER	86 400	NONE	446 000	532 400	676 100	1035 000
NOVEMBER	86 400	NONE	423 300	509 700	679 200	1087 000
DECEMBER	86 400	NONE	507 400	593 800	707 000	1134 000

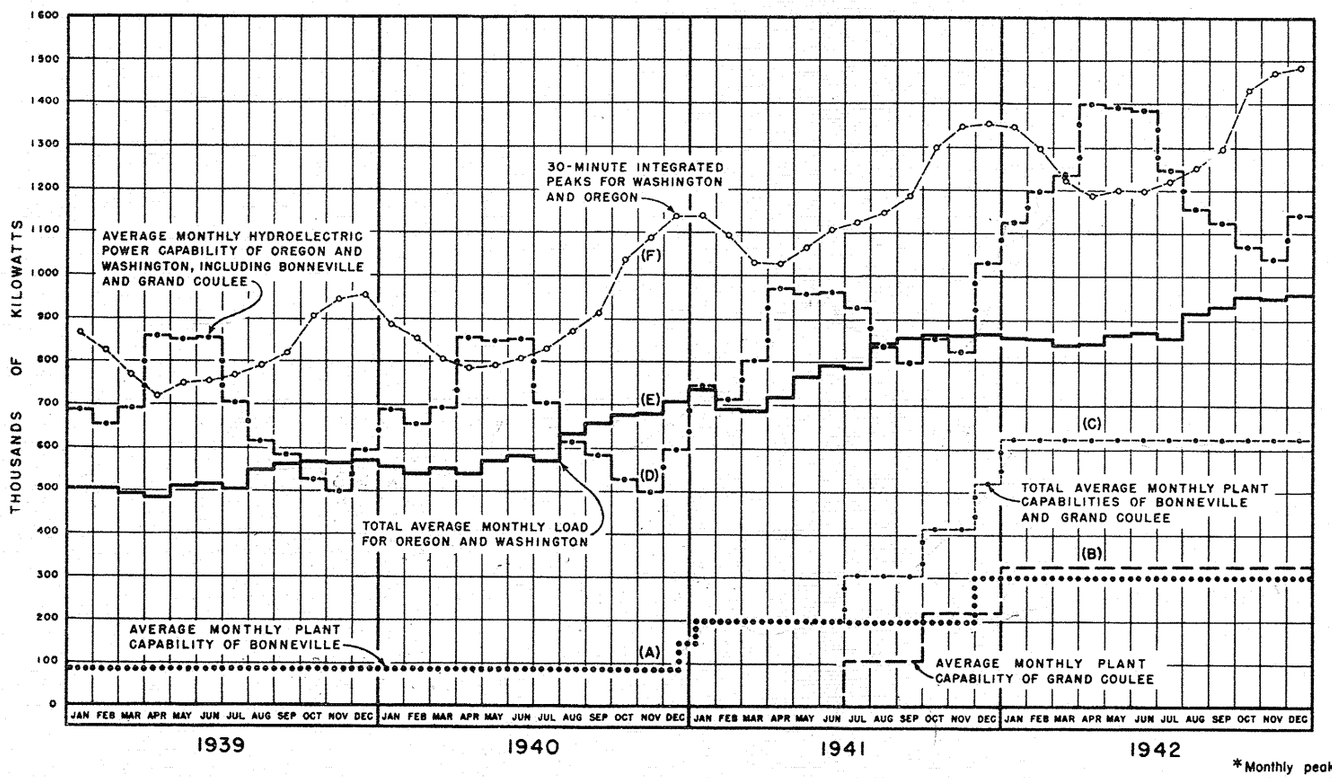
1941

MONTH	BONNEVILLE HYDRO CAPACITY	GRAND COULEE HYDRO CAPACITY	TOTAL OTHER HYDRO CAPACITY ORE & WASH	TOTAL HYDRO CAPACITY	TOTAL AVERAGE MONTHLY LOAD ORE & WASH	ESTIMATED MONTHLY PEAK ORE & WASH
	(A)	(B)		(D)	(E)	(F)
JANUARY	194 400	NONE	598 900	793 300	735 200	1140 000
FEBRUARY	194 400	NONE	566 000	760 400	689 000	1096 000
MARCH	194 400	NONE	601 800	796 200	688 200	1029 000
APRIL	194 400	NONE	766 600	961 000	716 700	1027 000
MAY	194 400	NONE	758 200	952 600	764 800	1063 000
JUNE	194 400	NONE	761 000	955 400	794 400	1101 000
JULY	194 400	108 000	619 200	921 600	784 900	1124 000
AUGUST	194 400	108 000	528 300	830 700	838 700	1146 000
SEPTEMBER	194 400	108 000	495 800	798 200	851 400	1184 000
OCTOBER	194 400	216 000	446 000	856 400	862 900	1298 000
NOVEMBER	194 400	216 000	423 300	833 700	861 100	1346 000
DECEMBER	302 400	216 000	507 400	1025 800	866 900	1356 000

1942

MONTH	BONNEVILLE HYDRO CAPACITY	GRAND COULEE HYDRO CAPACITY	TOTAL OTHER HYDRO CAPACITY ORE & WASH	TOTAL HYDRO CAPACITY	TOTAL AVERAGE MONTHLY LOAD ORE & WASH	ESTIMATED MONTHLY PEAK ORE & WASH
	(A)	(B)		(D)	(E)	(F)
JANUARY	302 400	324 000	598 900	1225 300	854 800	1349 000
FEBRUARY	302 400	324 000	566 000	1192 400	852 600	1294 000
MARCH	302 400	324 000	601 800	1228 200	840 100	1224 000
APRIL	302 400	324 000	766 600	1393 000	840 300	1189 000
MAY	302 400	322 800	758 200	1383 400	862 900	1200 000
JUNE	302 400	316 500	761 000	1379 900	868 100	1199 000
JULY	302 400	324 000	619 200	1245 600	857 500	1222 000
AUGUST	302 400	324 000	528 300	1154 700	915 300	1251 000
SEPTEMBER	302 400	324 000	495 800	1122 200	929 200	1289 000
OCTOBER	302 400	324 000	446 000	1072 400	950 300	1430 000
NOVEMBER	302 400	324 000	423 300	1049 700	947 200	1472 000
DECEMBER	302 400	324 000	507 400	1133 800	955 600	1483 000

* Monthly peak loads and average monthly load demands are actual for 1939 and estimated for 1940, 1941, and 1942.



* Monthly peak loads and average monthly load demands are actual for 1939 and estimated for 1940, 1941, and 1942.

NOTES

Curve (A) represents the average monthly plant capability of Bonneville with installations of from one to six units.

Curve (B) represents the average monthly plant capability of Grand Coulee with installations of from one to three units.

Curve (C) represents the total average monthly plant capabilities of Curves (A) and (B).

Curve (D) represents the total average monthly hydroelectric power capability of Oregon and Washington, including Bonneville and Grand Coulee.

Curve (E) represents the total average monthly load demand of all major systems in Oregon and Washington and is equal to the total integrated kilowatt-hours divided by the hours in the month. Monthly load demands for 1939 are actual, while those for 1940, 1941 and 1942 are estimated.

Points on Curve (F) represent the actual total 30-minute integrated peaks for each month of 1939, and estimated 30-minute monthly peaks for 1940, 1941, and 1942.

All power capability is based on plant characteristics and stream flow conditions for the critical calendar year of 1936.

The average monthly flow at Bonneville did not exceed 530,000 second-feet during the critical low year. When stream flow does exceed this amount there is a reduction in prime power output due to high tail-water.

The average monthly flow at Grand Coulee exceeded 250,000 second-feet during May and June causing a maximum reduction of 2,500 kilowatts for each of 3 units.

When considered in relation to annual load curves, the firm power capability of Bonneville and Grand Coulee is only slightly affected by high stream flows.

Drawing C117-810.3-F25 of Part II, Interim Report, shows deficiencies occurring at Bonneville and Grand Coulee as a result of low and high stream flows. It should be noted, however, that the deficiencies shown on this drawing are based on the total effect of future developments on flow of the Columbia River at The Dalles, Oregon.

PLATE XII

BASIC POWER INVESTIGATION

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

PLANT CAPABILITIES, ESTIMATED* PEAK LOADS AND AVERAGE MONTHLY LOAD DEMANDS
OREGON AND WASHINGTON

Submitted Jack D. Stevens / Recommended Henry R. Stevens SECTION		Approved Chas. E. Conway / Approved Lin Gittins CHIEF	
Drawn FPS / Checked PLE	Traced RGC / Checked EEW	Date: 1-7-41	C136-810.1-C8 IN 1-NO 1

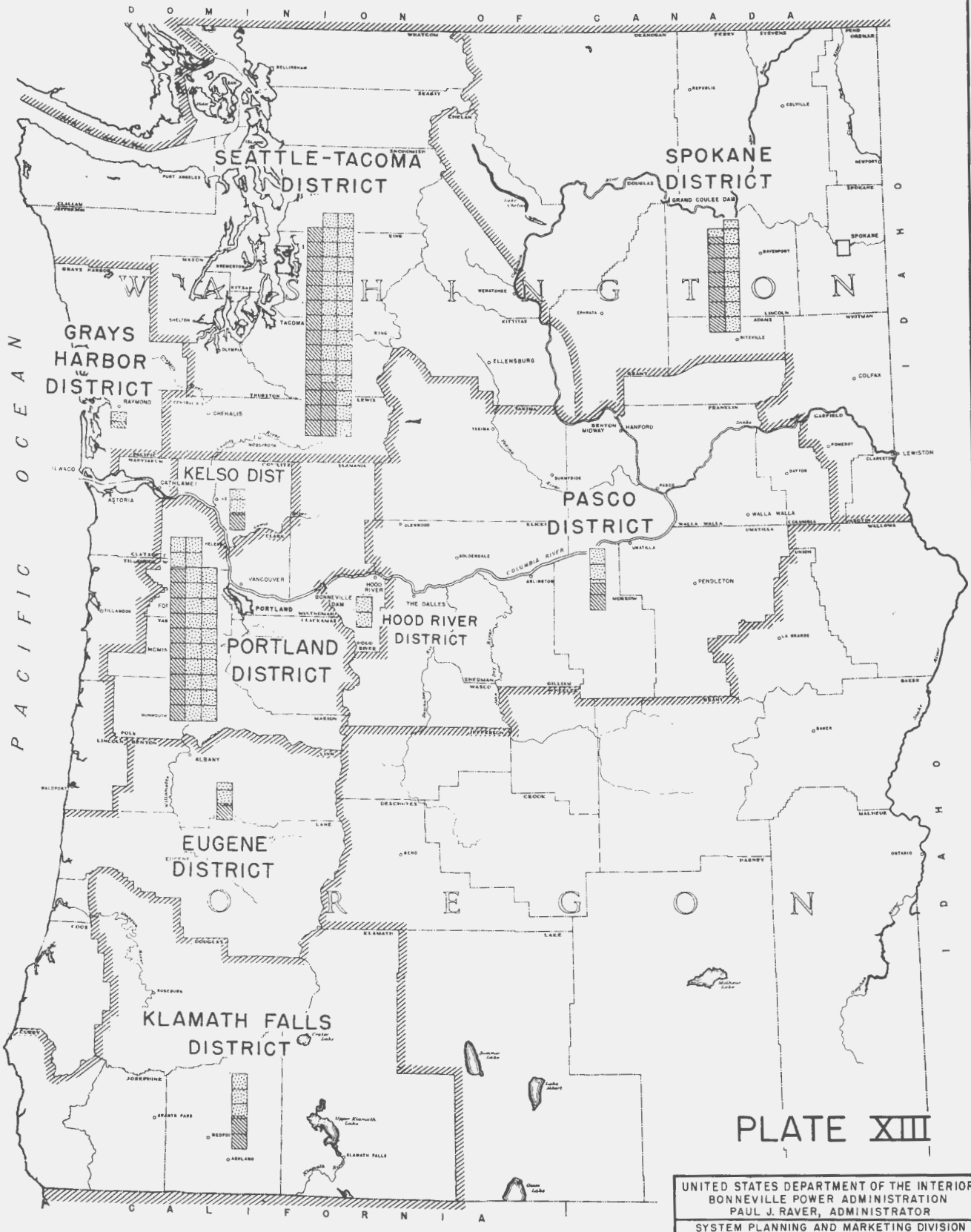
6. That in order to meet the load demands, careful scheduling of the installation of the generators at Bonneville and Grand Coulee must be established and adhered to and that the construction of the transmission lines and substations must proceed coincident with the installation of the generators.

Basic Load Survey

The third basic survey made during the fiscal year 1940 involved an effort to determine the kilowatt and kilowatt-hour requirements for the region for each calendar year from 1940 to 1950, inclusive. This survey, undertaken jointly by the System Planning and Distribution Projects sections, covered the load growth and power requirements of Oregon and Washington and the northwestern portion of Idaho. In order that all factors influencing the load growth might be properly considered, the region was analyzed on the basis of nine load districts.1/

Compilation of the loads prior to 1940 was based upon the latest information obtainable from reports of the operating companies to the Federal Power Commission, reports of the public utility commissions of Oregon and Washington, the Rural Electrification Administration, and an analysis of the contracts signed and under consideration by the Bonneville Power Administration. The load growth studies were based upon detailed analyses of development trends. Consideration was given to such factors as: population trends, construction of new distribution lines to serve areas (particularly REA financed lines in rural territory), the increase in electrical consumption resulting from a general adaptation by 1950 to the standard Bonneville resale rates, the increased consumption resulting from a greater use of electrical appliances made possible by the improvement in the general economic status of the region and a general raising of the per capita income level of the load districts, the present and probable future percent of saturation of various current-consuming devices, increased power requirements resulting from supplemental irrigation and made possible by the advent of low electric rates, the additional power requirements of new industries, particularly those requiring low cost hydroelectric power and operating at high load factor, an increase in population due to new lands being placed under irrigation and new opportunities of employment.

1/ For district boundaries and graphical presentation of 1939 and 1950 district loads see Plane XIII.



UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
COMPARATIVE LOADS BY LOAD DISTRICTS
1939 AND 1950
WASHINGTON, OREGON, AND IDAHO "PANHANDLE"

Sub. Bruce Mercer		Appd Chas. E. Ross	
Rec Henry P. Stearns		Appd Dan A. Hill	
DR JLC CK PLE	TR RGC CK EEW	DATE 1-8-41	C136-B10.1-B12 1-NO. 1

The results of these studies were tabulated for each calendar year from 1939 to 1950, inclusive.1/

The full effect of all these factors on the power and energy requirements of the Pacific Northwest is a rapid increase in the use and consumption of electric energy for industrial, commercial, domestic and agricultural purposes. This study indicates that by 1945 the total demand in Oregon, Washington and Northern Idaho will approximate 1,975,000 kw, and in 1950 will reach a total of 2,748,000 kw.

For the four Pacific Northwest states of Oregon, Washington, Idaho, and Montana the maximum demand for 1945 is estimated to be 2,470,000 kw and for 1950, 3,442,000 kw.2/ 3/

Montana and Idaho are among the foremost states of the nation in mineral output. Power loads reflect directly mining activities. For this reason forecasts of power loads through 1950 were not based upon detailed analyses of the load growth factors listed above.

Investigation into Power Needs

Purpose of the three foregoing described surveys was establishment of a rational basis for the planning and scheduling of the installation of the generators and the construction of the various elements of the transmission system. Because of their location, the Columbia river plants of Bonneville and Grand Coulee may be used to supply all of the additional generating capacity required for the next ten years. These requirements were analyzed by a careful evaluation of the existing generating stations and transmission systems in the Northwest. This evaluation considered such factors as stream flow characteristics, station facilities, obsolescence, plant usefulness for firm power generation, and plant usefulness for emergency operation. The power and power requirements for each of the main load areas were analyzed for the calendar years of 1939 to 1950 and compared with the usefulness of the existing plants.4/ These power and energy requirements, when compared with the capabilities of the existing generating stations, indicated the required increase in the capacity of the generating facilities of the Pacific Northwest. In order to meet these increased

---

1/ See Table 12, page 66.
2/ See Table 13, page 67.
3/ For boundaries of Idaho and Montana load districts see Plate XIV following page 67.
4/ See Plate XV following page 67.

TABLE 12

Existing and Prospective Loads
Washington, Oregon and Northern Idaho
By Districts [1]
Thousands of Kilowatts

Power District	1939 [2]	1940	1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
tle-Tacoma	439	491	550	603	654	708	765	825	888	955	1,027	1,103
land	244	340	479	519	566	609	650	689	730	768	809	852
ane	160	179	197	213	228	244	260	278	298	319	341	365
o	43.8	49.1	54.0	58.3	62.4	66.8	71.5	76.5	81.8	87.5	93.4	99.8
deen	11.0	12.3	13.6	14.7	15.8	16.8	18.0	19.3	20.6	22.1	23.6	25.3
o	28.8	32.4	35.6	38.4	41.1	44.0	47.0	50.3	53.8	57.6	61.6	66.0
River			8.0	17.0	21.0	26.0	30.0	33.0	37.0	42.0	46.0	50.0
ne	27.1	30.4	33.3	36.0	38.5	41.2	44.1	47.2	50.5	54.0	57.8	61.8
ath Falls	55.1	61.7	67.8	73.2	78.3	83.8	89.7	95.9	103	110	118	125
l - Wash.,Ore.& Northern Idaho	1,009	1,196	1,438	1,573	1,705	1,840	1,975	2,114	2,263	2,415	2,577	2,748
crease over eding Year		18.5%	20.2%	9.4%	8.4%	7.9%	7.3%	7.0%	7.0%	6.7%	6.7%	6.6%

Non-coincidental peaks, month of December.

Actual

TABLE 13

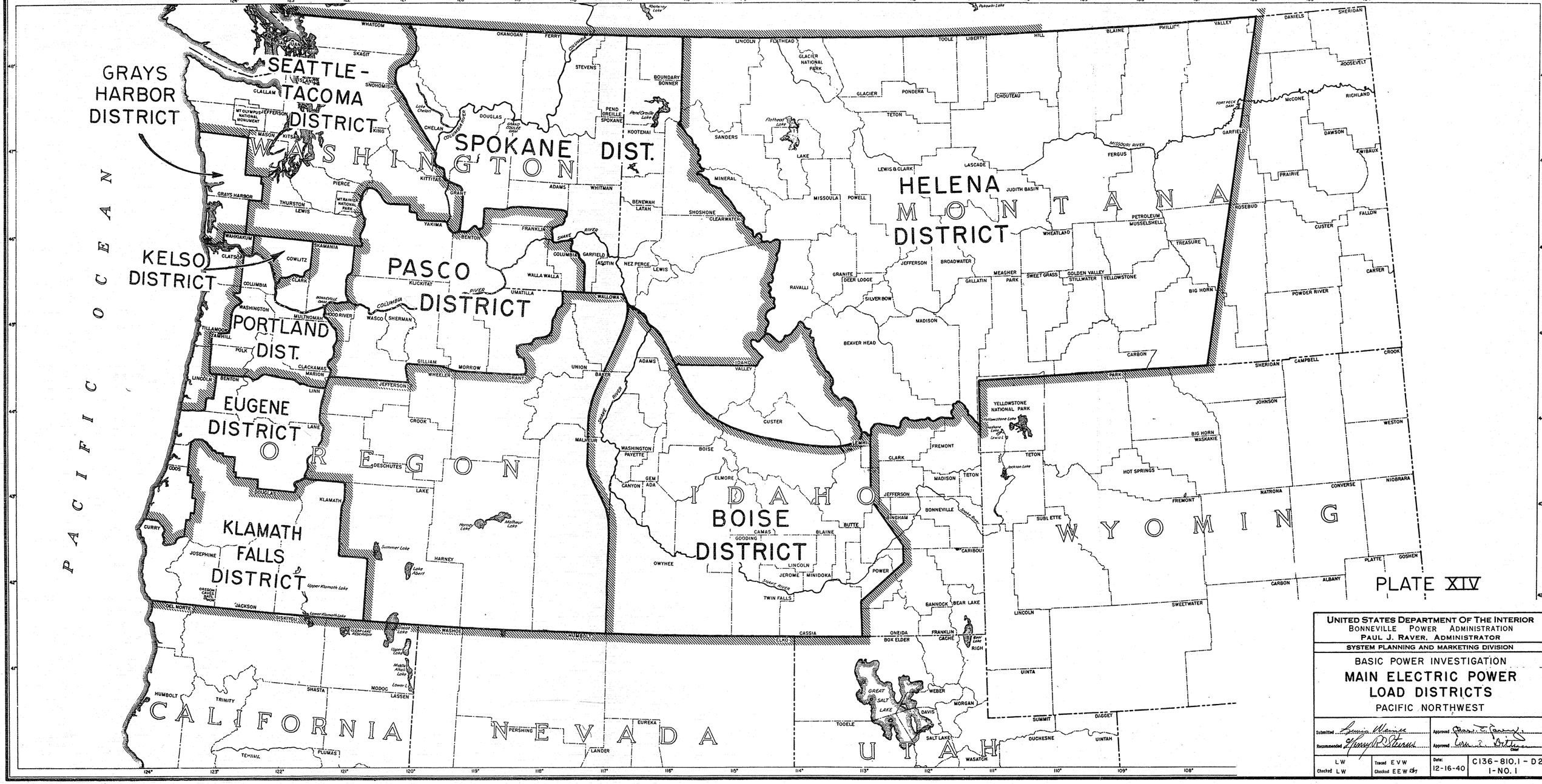
ESTIMATED MAXIMUM ANNUAL DEMAND
AND CAPABILITY
Thousands of kilowatts

ver Districts	Maximum Annual 30-Minute Demand* 1945	1950	Capability of Existing Plants** Hydro	Steam	Total	Additional Capacity Requirements 1/ 1945 With use of steam	1945 Without use of steam	1950 With use of steam	1950 Without use of steam
tle-Tacoma	765	1,103	503	125	628	137	262	475	600
land	650	852	147	121	268	382	503	584	705
ane	260	365	190	0	190	70.0	70.0	175	175
o	71.5	99.8	9.1	0	9.1	62.4	62.4	90.7	90.7
deen	18.0	25.3	0	12.8	12.8	5.2	18.0	12.5	25.3
o	47.0	66.0	0	24.0	24.0	23.0	47.0	42.0	66.0
ne	44.1	61.8	9.2	23.8	33.0	11.1	34.9	28.8	52.6
ith Falls	89.7	125	43.3	0	43.3	46.4	46.4	81.7	81.7
River (at site)	30.0	50.0				30.0	30.0	50.0	50.0
tal Wash., Ore. & orthern Idaho	1,975	2,748	902	307	1,208	767	1,074	1,540	1,846
, Idaho	98.4	140	90.4	0	90.4	8.0	8.0	49.6	49.6
a, Montana	385	539	308	0	308	77.0	77.0	231	231
al Pac. N.W.	2,459	3,427	1,300	307	1,607	852	1,159	1,820	2,127

lues shown are non-coincidental peaks.

nneville and Grand Coulee are not included.
dro capability is based on studies of stream flow for a typical low water year and available storage at ndividual plants.
pability of steam plants is taken as installed capacity of modern steam plants.

ditional generator capacity requirements over and above existing plants to be supplied by Columbia River ojects or additions to other facilities.



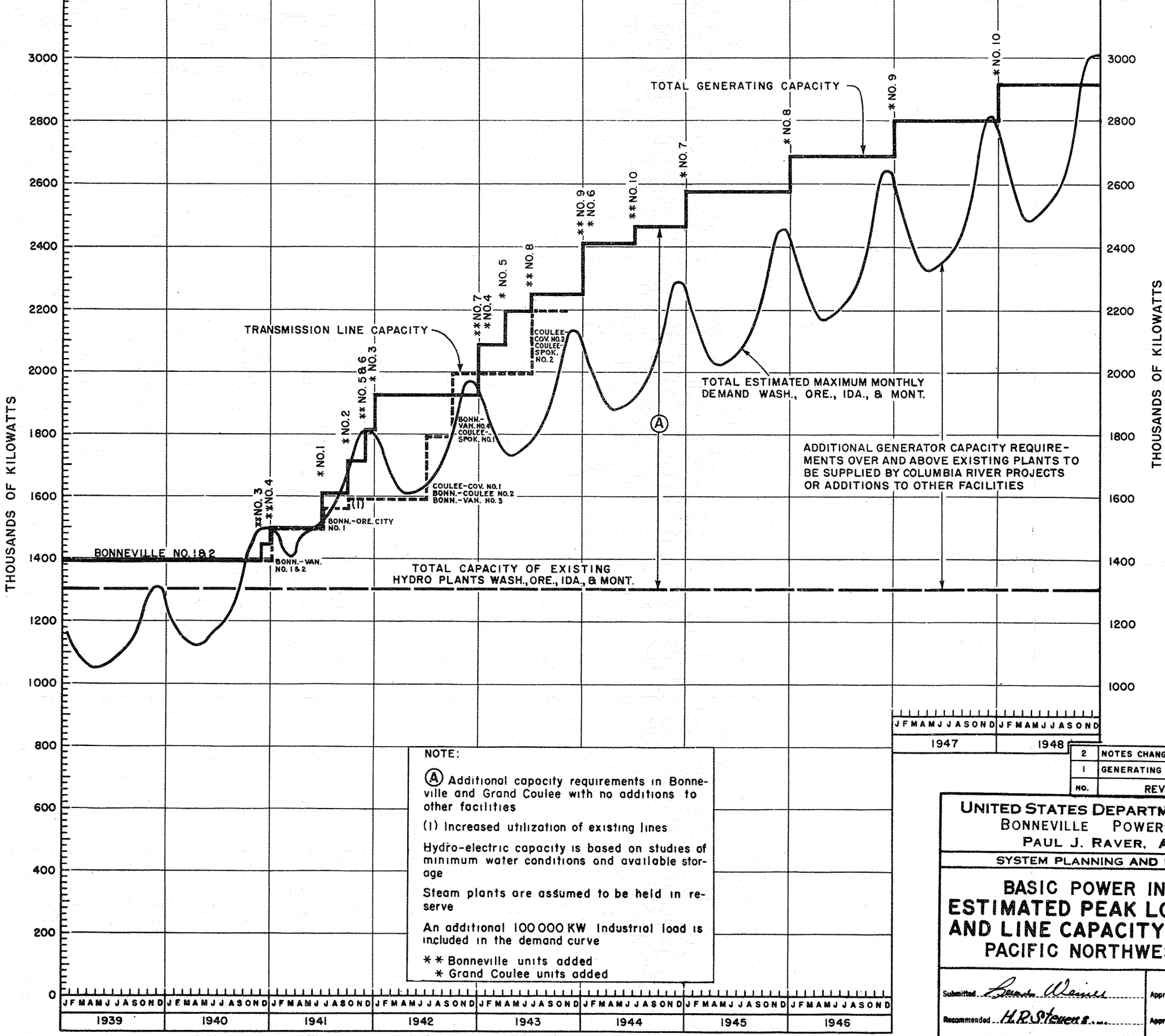
UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR
SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION

MAIN ELECTRIC POWER LOAD DISTRICTS

PACIFIC NORTHWEST

Submitted		Approved	
Recommended		Approved	Chief
LW Checked LW	Traced EVW Checked EEW	Date: 12-16-40	C136-810.1 - D2 1-NO.1



NOTE:

(A) Additional capacity requirements in Bonneville and Grand Coulee with no additions to other facilities

(1) Increased utilization of existing lines

Hydro-electric capacity is based on studies of minimum water conditions and available storage

Steam plants are assumed to be held in reserve

An additional 100 000 KW Industrial load is included in the demand curve

** Bonneville units added
* Grand Coulee units added

PLATE XV

NO.	REVISION	BY	DATE	APPROVED
2	NOTES CHANGED	JLC	1-4-41	WR3 CEC
1	GENERATING CAPACITY '43-'48	JLC	12-13-40	WR3 CEC

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
ESTIMATED PEAK LOAD & GENERATOR AND LINE CAPACITY REQUIREMENTS
PACIFIC NORTHWEST 1939–1948

Submitted: Laura Weiss
Recommended: H.R.S. Stevens
Approved: [illegible]
Approved: [illegible] Chief

Designed by LW
Drawn by LW
Traced by JLC
Checked by [illegible]
Date: 10-18-40

C117-810.3-B 48
1 — NO 1

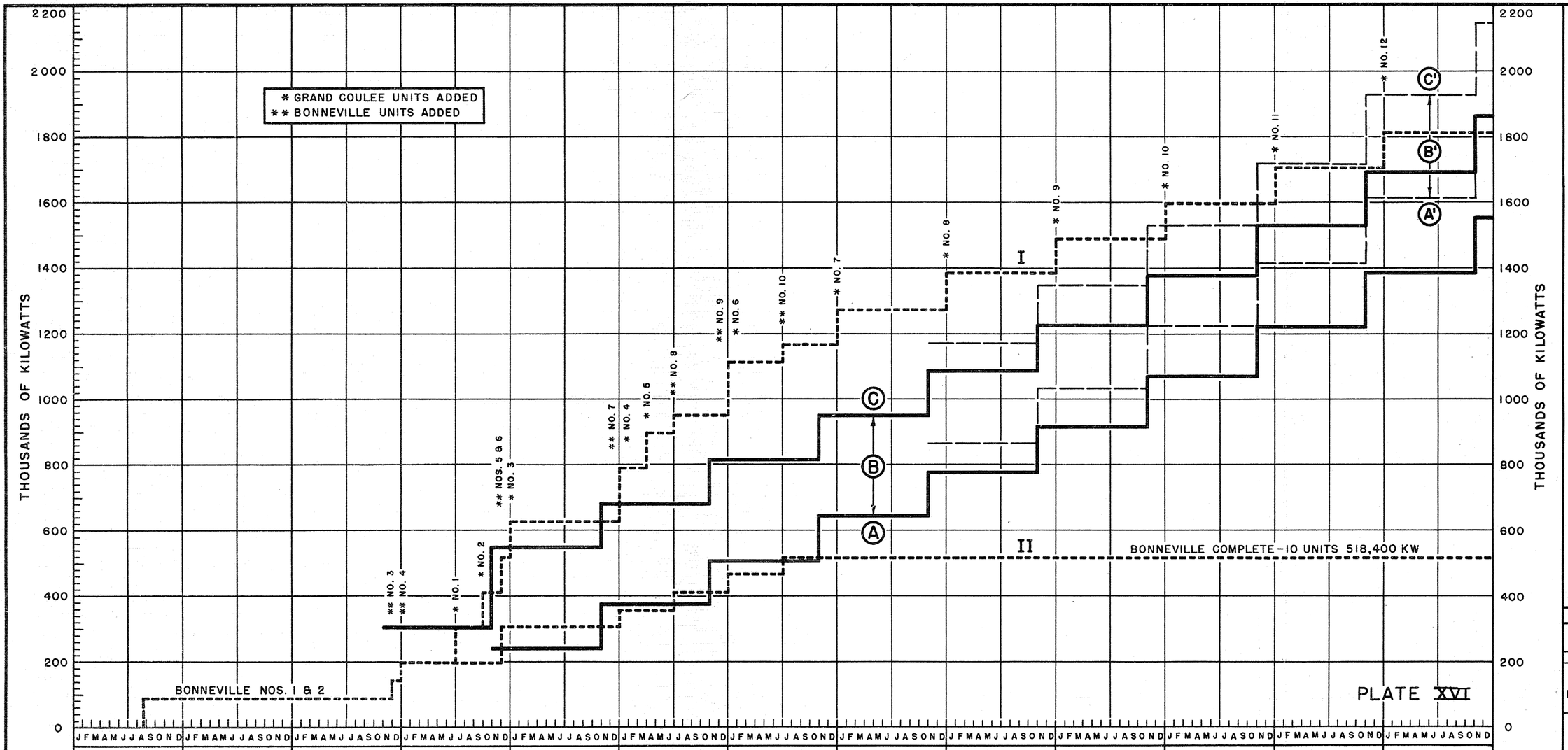
requirements in generation, the following tentative schedule for the installation of generators in the Bonneville and Grand Coulee plants was established:[1]

	Units Added		Total Installed Capacity kw	
Date	Bonneville	Grand Coulee	Bonneville	Grand Coulee
Nov. 1940	Nos. 1 & 2		86,400	
Dec. 1940	No. 3		140,400	
Jan, 1941	No. 4		194,400	
July 1941		No. 1	"	108,000
Oct. 1941		No. 2	"	216,000
Dec. 1941	Nos. 5 & 6		302,400	"
Jan. 1942		No. 3	"	324,000
Jan. 1943	No. 7	No. 4	356,400	432,000
April 1943		No. 5	"	540,000
July 1943	No. 8		410,400	"
Jan. 1944	No. 9	No. 6	464,400	648,000
July 1944	No. 10		518,400	"
Jan. 1945		No. 7	"	756,000
Jan. 1946		No. 8	"	864,000
Jan. 1947		No. 9	"	972,000
Jan. 1948		No. 10	"	1,080,000

By 1950 not only will the capacity of the first ten units at Bonneville and the first ten units at Grand Coulee be required to carry the increase in load, but additional capacity amounting to 250,000 kilowatts will be necessary.[2] This additional capacity may be supplied by additions to some of the existing generating stations or by the construction of additional power plants on the Columbia river such as the Umatilla Project. Studies indicate that by 1945, 767,000 kw of additional generating capacity will be required even with the use of the existing modern steam plants; and 1,074,000 kw of additional generating capacity will be required with complete replacement of steam plants with low cost hydroelectric power.

The additional generating capacity required, with full use of the modern steam-generating stations and other existing generating stations, is 1,540,000 kw, and 1,846,000 kw with replacement of the steam-generating stations by hydroelectric energy. It is estimated that by 1950 the maintenance and obsolescence will have reached a point which will force the retirement of many of the existing steam plants of the area.

1/ See Plates XV and XVI.
2/ See Table 13, p. 67.



NOTES:

CURVE A REPRESENTS THE ESTIMATED ADDITIONAL CAPACITY REQUIREMENTS TO MEET THE PEAK DEMAND IN OREGON AND WASHINGTON WITH EXISTING HYDROELECRIC GENERATING CAPACITY BASED ON A TYPICAL LOW WATER YEAR AND AVAILABLE STORAGE, PLUS THE CAPACITY OF THE MODERN STEAM PLANTS IN THE TWO STATES. BONNEVILLE AND GRAND COULEE ARE NOT INCLUDED.

ORDINATE B REPRESENTS THE CAPACITY OF THE MODERN STEAM GENERATING PLANTS IN OREGON AND WASHINGTON.

CURVE C REPRESENTS THE ESTIMATED ADDITIONAL CAPACITY REQUIREMENTS TO MEET THE PEAK DEMAND IN OREGON AND WASHINGTON WITH EXISTING HYDROELECTRIC CAPACITY ONLY, BASED ON A TYPICAL LOW WATER YEAR AND AVAILABLE STORAGE. BONNEVILLE AND GRAND COULEE ARE NOT INCLUDED.

CURVES A', B' & C' CORRESPOND TO A, B & C EXCEPT THAT THE STATES OF IDAHO AND MONTANA ARE INCLUDED.

CURVE I SHOWS THE INSTALLATION FORECASTS OF BONNEVILLE AND GRAND COULEE FROM AUG., 1938 TO DEC., 1950.

CURVE II SHOWS THE INSTALLATION FORECAST OF BONNEVILLE.

NO LIMITATION IN OUTPUT OF BONNEVILLE DUE TO LOW STREAM FLOW OR LOSS IN HEAD DUE TO HIGH WATER IS INCLUDED.

ESTIMATED MAXIMUM ANNUAL DEMAND IS THE PEAK ARITHMETICAL SUMMATION OF THE INDIVIDUAL MAXIMUM MONTHLY DEMANDS OF FIFTEEN MAJOR OPERATING COMPANIES.

CAPACITY SHOWN AT GRAND COULEE IS OVER AND ABOVE THAT REQUIRED FOR IRRIGATION AND PUMPING.

SUPERSEDES C117-810.3-F63 2-NO1 10-7-40

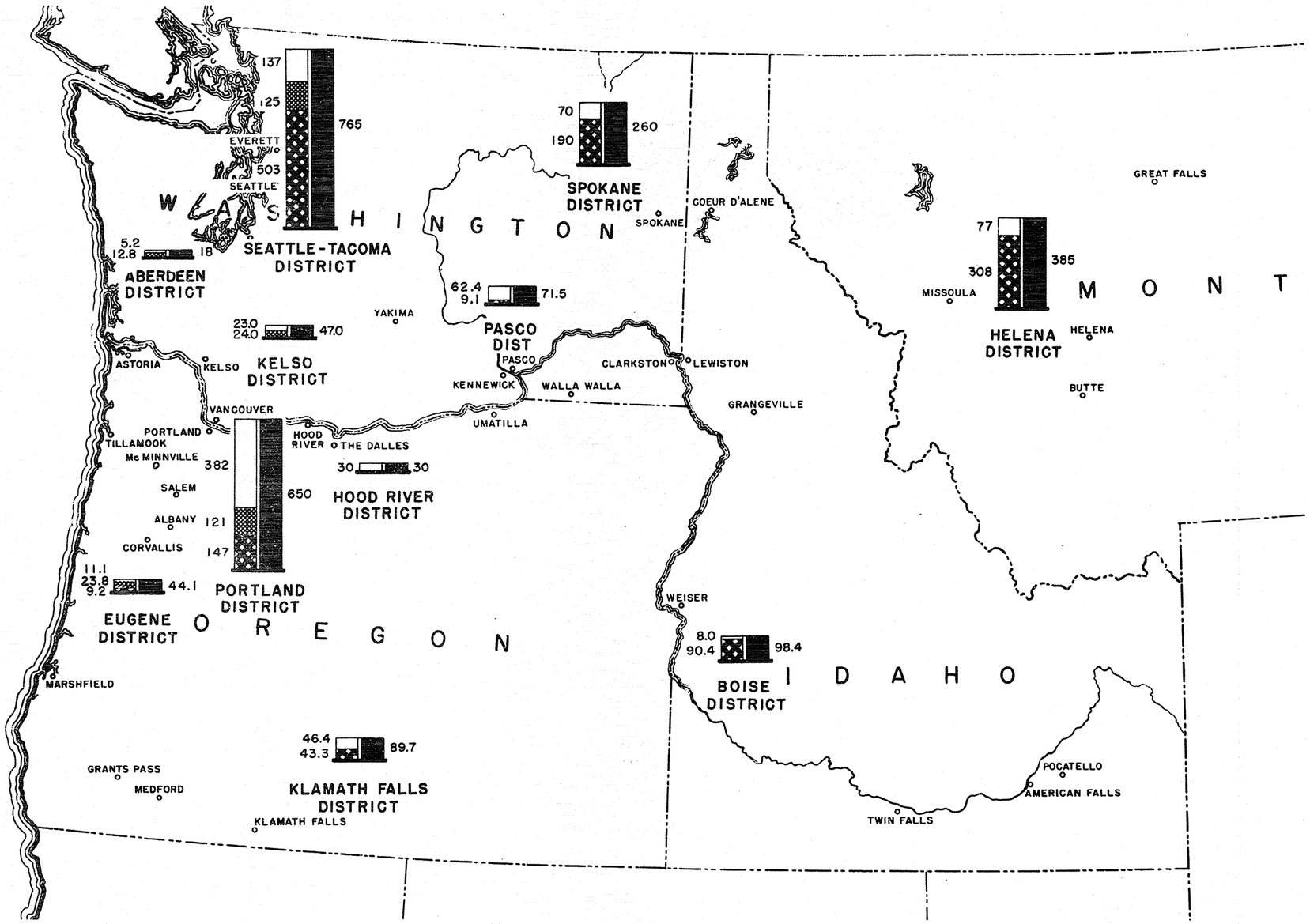
UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION

ESTIMATED ADDITIONAL CAPACITY REQUIREMENTS FOR PACIFIC NORTHWEST 1940-1950

Sub'd Louis Wilmes	App'd Thos. C. Sasser		
Rec'd H.R. Stevens	App'd Lowell Chief		
DR. LW CK. LW	TR LLD CK EEW 2/27	DATE 12-19-40	C136-810.1-F 1-NO. 1



LEGEND

- EXISTING STEAM CAPABILITY
- EXISTING HYDRO CAPABILITY
- ESTIMATED DEMAND
- ESTIMATED SURPLUS
- ESTIMATED DEFICIENCY

NOTES:

PEAK DEMANDS INDICATED ARE NOT NECESSARILY COINCIDENTAL

FIGURES INDICATE THOUSANDS OF KILOWATTS

CAPABILITY OF BONNEVILLE AND GRAND COULEE IS NOT INCLUDED

EXISTING CAPABILITY OF UTILITIES ASSUMED NOT TO CHANGE AFTER 1940

HYDRO CAPABILITY IS PEAKING CAPACITY AT TIME OF MAXIMUM ANNUAL DEMAND AND IS BASED ON STREAM FLOW DURING A TYPICAL LOW WATER YEAR AND AVAILABLE STORAGE AT INDIVIDUAL PLANTS

CAPABILITY OF STEAM PLANT IS TAKEN AS 100% OF THE INSTALLED CAPACITY OF THE MODERN STEAM PLANTS IN THE AREA

PLATE XVII

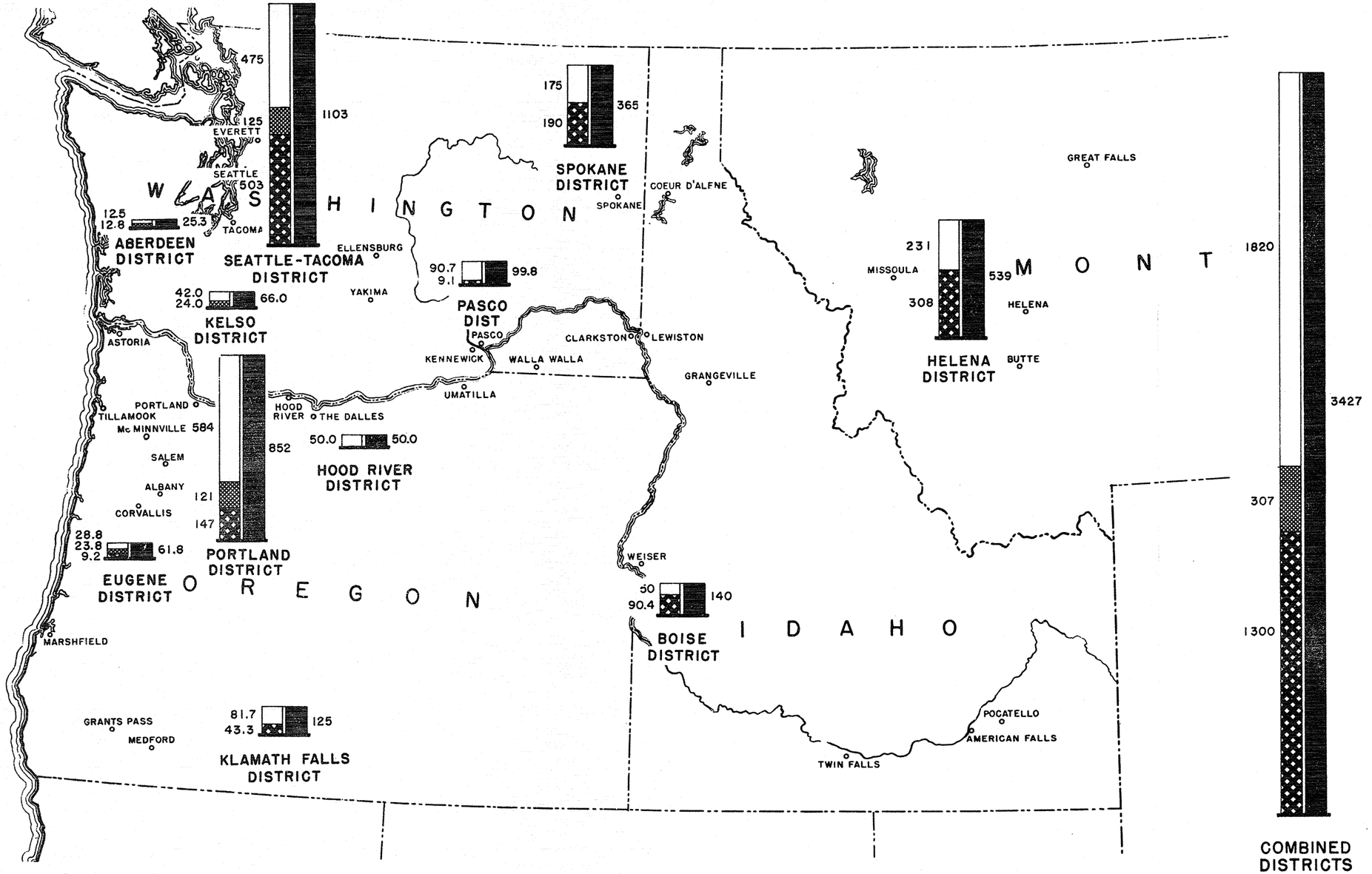
SUPERSEDES C117-810.4-F2 3N02 7-25-40

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
ESTIMATED MAXIMUM 30-MINUTE KILOWATT
DEMAND AND CAPABILITY
PACIFIC NORTHWEST
DECEMBER 1945

Sub. Laura Meyers		App'd. Chas. E. Grunsky	
Rec. Henry P. Stevens		App'd. Wm. A. Dittus Chief	
DR VLN CK LW	TR JLC CK EEW RBy	DATE 12-19-40	C136-810.1-F10 1 – NO 1



LEGEND

- EXISTING STEAM CAPABILITY
- EXISTING HYDRO CAPABILITY
- ESTIMATED DEMAND
- ESTIMATED SURPLUS
- ESTIMATED DEFICIENCY

NOTES:

PEAK DEMANDS INDICATED ARE NOT NECESSARILY COINCIDENTAL

FIGURES INDICATE THOUSANDS OF KILOWATTS

CAPABILITY OF BONNEVILLE AND GRAND COULEE IS NOT INCLUDED

EXISTING CAPABILITY OF UTILITIES ASSUMED NOT TO CHANGE AFTER 1940

HYDRO CAPABILITY IS PEAKING CAPACITY AT TIME OF MAXIMUM ANNUAL DEMAND AND IS BASED ON STREAM FLOW DURING A TYPICAL LOW WATER YEAR AND AVAILABLE STORAGE AT INDIVIDUAL PLANTS

CAPABILITY OF STEAM PLANT IS TAKEN AS 100% OF THE INSTALLED CAPACITY OF THE MODERN STEAM PLANTS IN THE AREA

PLATE XVIII

SUPERSEDES C117-810.4-F2 3N03 7-25-40

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION

ESTIMATED MAXIMUM 30-MINUTE KILOWATT

DEMAND AND CAPABILITY

PACIFIC NORTHWEST

DECEMBER 1950

Sub. Louis Weinzirl		App'd. Thos. E. Carey	
Rec. Henry P. Stevens		App'd. Chief	
DR VLN CK LW	TR JLC CK EEW	DATE 12-19-40	C136-810.1-F11-NO 1

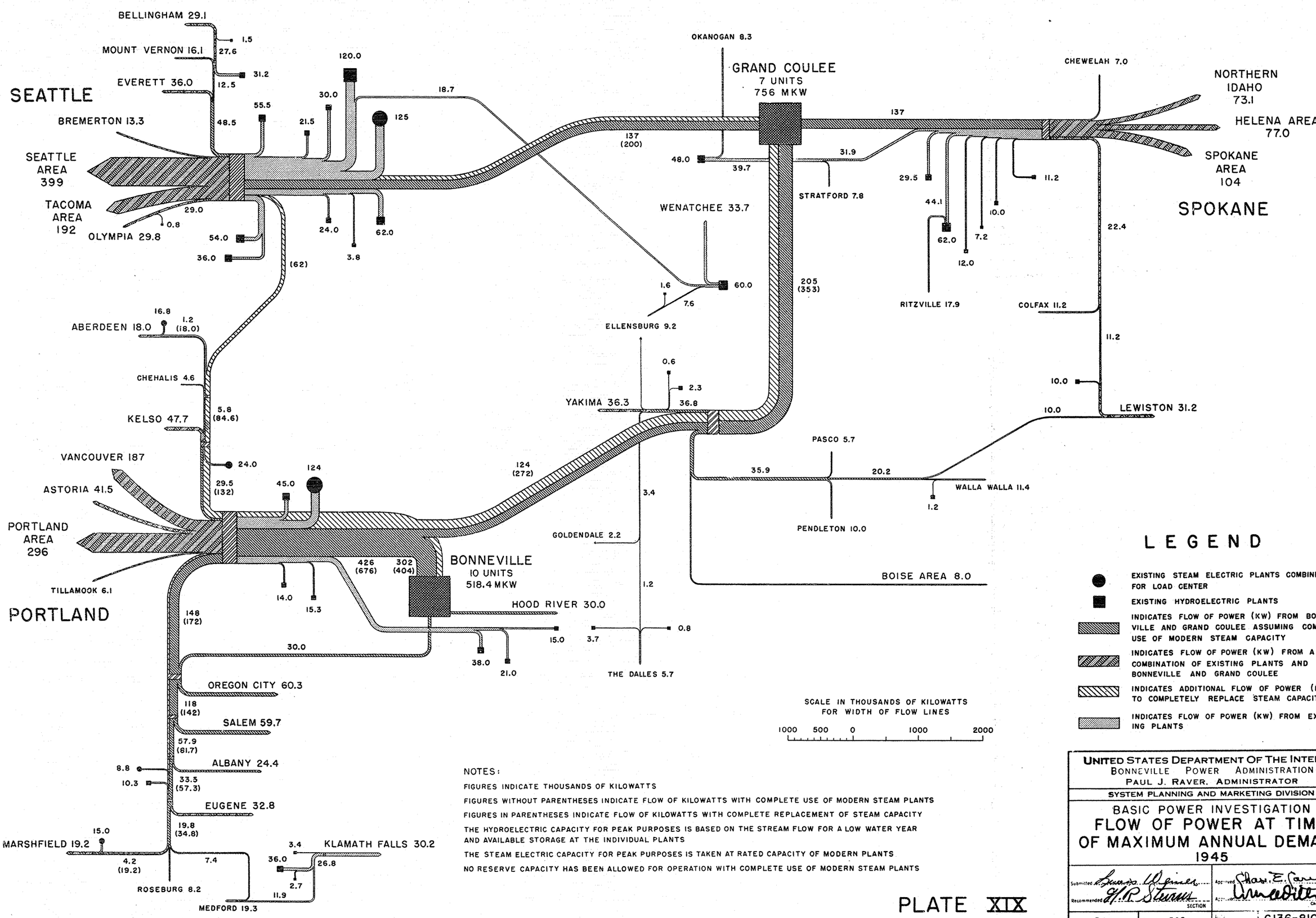
These power requirements are a direct measure of the potential revenue-producing load for the Columbia river plants and form the basis for the planning of the transmission system, the scheduling of the generator installation and the forecasting of the potential revenues from the sale of electric energy.[1]

Planning of the Transmission Network

From the surveys mentioned above it is possible to determine for each year the power requirements of the various load areas, and with this information to establish the power flow diagram indicating the probable and proper use of the various generating stations of the region to supply the present and future load areas.[2] Since the load requirements in the various areas indicate definitely the transmission and substation facilities required to make the Columbia river power available into that area, it was possible to plan the transmission system step by step to meet the growing power requirements of the region and to establish the six-year construction program. During the past year the System Planning section developed the general design of this proposed network and scheduled the required elements of construction for the fiscal years from 1940 to 1947,[3] and a general plan of the development of the system from 1948 to 1950. This transmission system consists of a main interconnecting, high capacity, high voltage transmission network extending from the Grand Coulee plant to the Bonneville plant to Vancouver, Washington, thence north to Covington and east to Grand Coulee, and extending eastward from Grand Coulee through Spokane. This high capacity bus is designed for 230,000-volt operation and will form the main power supply system of the region. From the main substations located at Spokane, Vernita, Vancouver and Covington radiate 115,000-volt and lower voltage transmission lines to supply power to the various load centers and to interconnect the federal transmission system with the existing generating and transmission facilities. This complete system[4] must be conceived and designed not only to be capable of transmitting the large blocks of power from Bonneville and Grand Coulee, but must be so designed that its capacity may be increased as the additional power requirements of the future require the construction of

---

1/ See Plates XVII and XVIII, preceding.
2/ See Plates XIX, XX, and XXI, following.
3/ See Plate XXIV, following p. 71.
4/ Basis for development of the system's design was set up by the Engineering division of the Power Administration in fiscal 1938. For details of this work, see First Annual Report of the Bonneville Power Administrator.



LEGEND

- EXISTING STEAM ELECTRIC PLANTS COMBINED FOR LOAD CENTER
- EXISTING HYDROELECTRIC PLANTS
- INDICATES FLOW OF POWER (KW) FROM BONNEVILLE AND GRAND COULEE ASSUMING COMPLETE USE OF MODERN STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM A COMBINATION OF EXISTING PLANTS AND BONNEVILLE AND GRAND COULEE
- INDICATES ADDITIONAL FLOW OF POWER (KW) TO COMPLETELY REPLACE STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM EXISTING PLANTS

SCALE IN THOUSANDS OF KILOWATTS FOR WIDTH OF FLOW LINES

1000 500 0 1000 2000

NOTES:

FIGURES INDICATE THOUSANDS OF KILOWATTS

FIGURES WITHOUT PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE USE OF MODERN STEAM PLANTS

FIGURES IN PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE REPLACEMENT OF STEAM CAPACITY

THE HYDROELECTRIC CAPACITY FOR PEAK PURPOSES IS BASED ON THE STREAM FLOW FOR A LOW WATER YEAR AND AVAILABLE STORAGE AT THE INDIVIDUAL PLANTS

THE STEAM ELECTRIC CAPACITY FOR PEAK PURPOSES IS TAKEN AT RATED CAPACITY OF MODERN PLANTS

NO RESERVE CAPACITY HAS BEEN ALLOWED FOR OPERATION WITH COMPLETE USE OF MODERN STEAM PLANTS

PLATE XIX

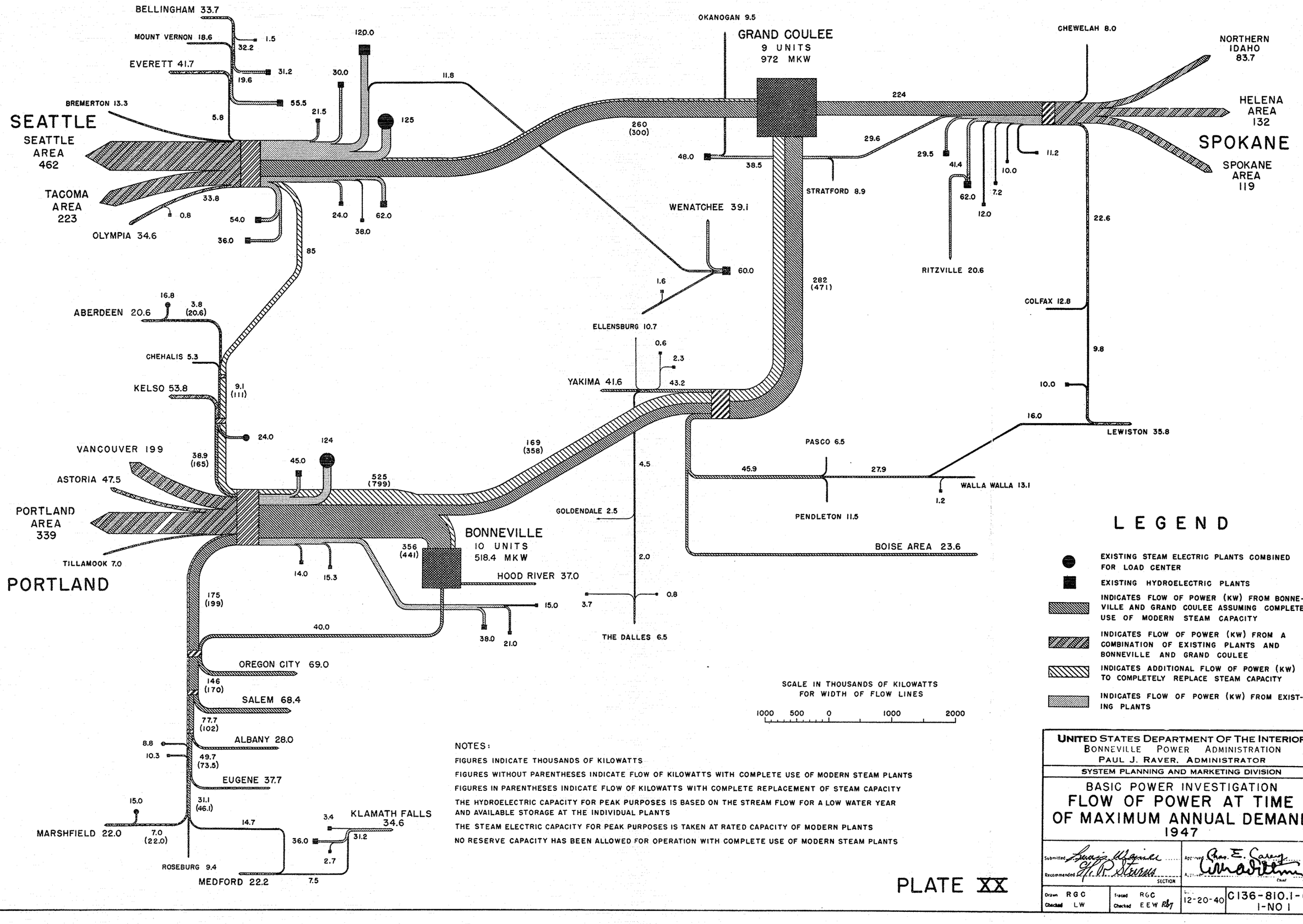
UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION

FLOW OF POWER AT TIME OF MAXIMUM ANNUAL DEMAND 1945

Submitted L. Evans W. Gaines		Approved Shaw E. Sawyer	
Recommended W. R. Stevens SECTION		Approved Irwin Bitterman Chief	
Drawn RGC	Traced RGC	Date 12-20-40	C136-810.1-C
Checked LW	Checked EEW 2/27		1-NO 1



LEGEND

- EXISTING STEAM ELECTRIC PLANTS COMBINED FOR LOAD CENTER
- EXISTING HYDROELECTRIC PLANTS
- INDICATES FLOW OF POWER (KW) FROM BONNEVILLE AND GRAND COULEE ASSUMING COMPLETE USE OF MODERN STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM A COMBINATION OF EXISTING PLANTS AND BONNEVILLE AND GRAND COULEE
- INDICATES ADDITIONAL FLOW OF POWER (KW) TO COMPLETELY REPLACE STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM EXISTING PLANTS

NOTES:

FIGURES INDICATE THOUSANDS OF KILOWATTS

FIGURES WITHOUT PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE USE OF MODERN STEAM PLANTS

FIGURES IN PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE REPLACEMENT OF STEAM CAPACITY

THE HYDROELECTRIC CAPACITY FOR PEAK PURPOSES IS BASED ON THE STREAM FLOW FOR A LOW WATER YEAR AND AVAILABLE STORAGE AT THE INDIVIDUAL PLANTS

THE STEAM ELECTRIC CAPACITY FOR PEAK PURPOSES IS TAKEN AT RATED CAPACITY OF MODERN PLANTS

NO RESERVE CAPACITY HAS BEEN ALLOWED FOR OPERATION WITH COMPLETE USE OF MODERN STEAM PLANTS

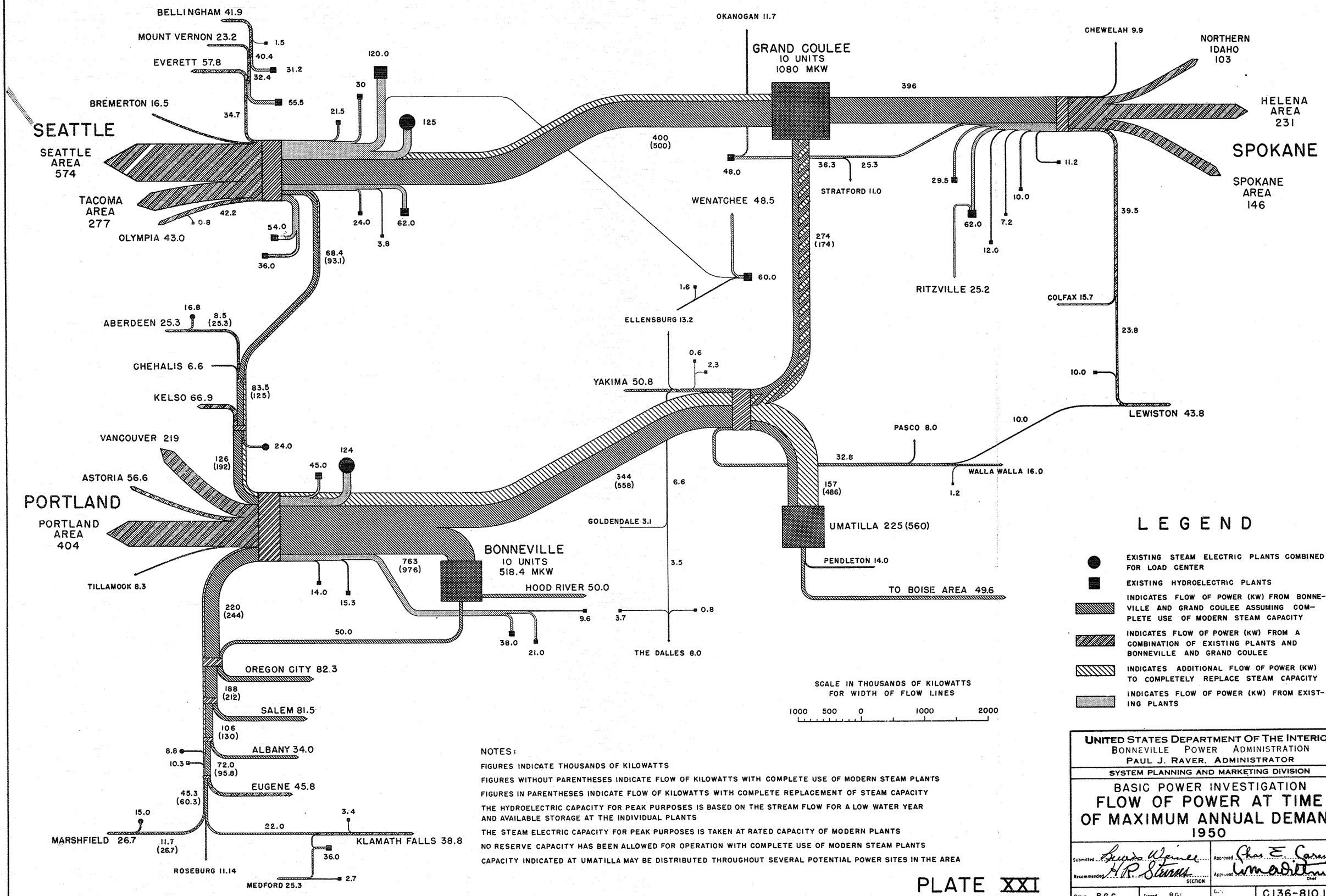
PLATE XX

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
FLOW OF POWER AT TIME OF MAXIMUM ANNUAL DEMAND
1947

Submitted [signature] Recommended [signature] SECTION		Approved [signature] Chief	
Drawn RGC Checked LW	Traced RGC Checked EEW RBJ	Date 12-20-40	C136-810.1-C5 1-NO 1



SCALE IN THOUSANDS OF KILOWATTS FOR WIDTH OF FLOW LINES

1000 500 0 1000 2000

LEGEND

- EXISTING STEAM ELECTRIC PLANTS COMBINED FOR LOAD CENTER
- EXISTING HYDROELECTRIC PLANTS
- INDICATES FLOW OF POWER (KW) FROM BONNEVILLE AND GRAND COULEE ASSUMING COMPLETE USE OF MODERN STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM A COMBINATION OF EXISTING PLANTS AND BONNEVILLE AND GRAND COULEE
- INDICATES ADDITIONAL FLOW OF POWER (KW) TO COMPLETELY REPLACE STEAM CAPACITY
- INDICATES FLOW OF POWER (KW) FROM EXISTING PLANTS

NOTES:

FIGURES INDICATE THOUSANDS OF KILOWATTS

FIGURES WITHOUT PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE USE OF MODERN STEAM PLANTS

FIGURES IN PARENTHESES INDICATE FLOW OF KILOWATTS WITH COMPLETE REPLACEMENT OF STEAM CAPACITY

THE HYDROELECTRIC CAPACITY FOR PEAK PURPOSES IS BASED ON THE STREAM FLOW FOR A LOW WATER YEAR AND AVAILABLE STORAGE AT THE INDIVIDUAL PLANTS

THE STEAM ELECTRIC CAPACITY FOR PEAK PURPOSES IS TAKEN AT RATED CAPACITY OF MODERN PLANTS

NO RESERVE CAPACITY HAS BEEN ALLOWED FOR OPERATION WITH COMPLETE USE OF MODERN STEAM PLANTS

CAPACITY INDICATED AT UMATILLA MAY BE DISTRIBUTED THROUGHOUT SEVERAL POTENTIAL POWER SITES IN THE AREA

PLATE XXI

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION

FLOW OF POWER AT TIME OF MAXIMUM ANNUAL DEMAND 1950

Submitted: Lucas Weimer	Approved: Chas E. Carey		
Recommended: H.R. Stevens (SECTION)	Approved: (Chief)		
Drawn RGC	Traced RGC	Date 12-20-40	C136-810.1-C 1-NO1
Checked LW	Checked EEW		

other multi-purpose project plants along the Columbia river[1]. In addition, the control of the flow of power over this network must be established so that complete integration of all the facilities of the region may be obtained and, by unified operation, obtain maximum utilization of the water resources of the various watersheds.

In determining the requirements of additional generating capacity and the necessary transmission lines and substations, careful consideration has been given to the rapidly increasing demands for power coincident with the national defense. While an attempt has been made to follow these rapidly increasing demands, it was found that the increase during the past month in requests for additional power have been at a greater rate than heretofore experienced in any region. This demand is being brought about by the fact that at the Bonneville and Grand Coulee plants additional capacity can be made available in a very short time, and as a result those industries requiring large blocks of low cost hydroelectric energy necessary for the production of strategic war materials are seeking locations in this area. To meet these requirements it is essential that the construction of the transmission line and substation elements shall progress with the installation of additional generating equipment at Bonneville and Grand Coulee.

1/ Prospective developments on the Columbia river are described in House Document 103, Columbia River and Minor Tributaries, commonly referred to as the "308" report. This report has been supplemented by further investigation by the U. S. War Department and published under House Document No. 704, 75th Congress, 3rd Session. Proposed developments on the Columbia river and principal characteristics are as follows:

Name of Development	Average Static Head in Ft.	Proposed Installation Kw
The Dalles	72.1	658,000
John Day	53.6	480,000
Arlington	46.9	400,000
Umatilla	48.2	420,000
Priest Rapids	127.3	631,000
Rocky Beach	51.2	270,000
Chelan	82.2	408,000
Foster Creek	154.9	706,000

For map of Columbia river drainage area and a graphical profile of Columbia and Snake river prospective developments, see Plate XXII.

LEGEND OF DAMSITES

COLUMBIA RIVER		SNAKE RIVER	
(1)	BONNEVILLE	(12)	FIVE MILE RAPIDS
(2)	THE DALLES	(13)	RESCUE ISLAND
(3)	JOHN DAY	(14)	MONUMENTAL
(4)	ARLINGTON	(15)	STEAMBOAT BEND
(5)	UMATILLA	(16)	LITTLE GOOSE
(6)	PRIEST RAPIDS	(17)	DIAMOND CROSSING
(7)	ROCK ISLAND	(18)	RICE'S BAR
(8)	ROCKY REACH	(19)	LOG CABIN ISLAND
(9)	CHELAN	(20)	KELLEY'S ISLAND
(10)	FOSTER CREEK	(21)	DRY GULCH
(11)	GRAND COULEE		

SYMBOLS

PROFILE	MAP	PROJECT STATUS
		PROJECTS CONSTRUCTED OR UNDER CONSTRUCTION
		RECOMMENDED INITIAL PROJECTS
		SNAKE RIVER PROJECTS
		IRRIGABLE LAND OF THE COLUMBIA BASIN AND PRIEST RAPIDS PROJECTS.

NOTE: NO NAVIGATION FACILITIES TO BE INCORPORATED INITIALLY IN THE DAMS ON THE COLUMBIA RIVER ABOVE THE MOUTH OF THE SNAKE RIVER.

DAMSITE NUMBER	NAME OF PROJECT	AVERAGE STATIC HEAD	† CAPACITY OF PROPOSED INSTALLATION-KW
1	BONNEVILLE	50.0	* 518,400
2	THE DALLES	72.1	658,000
3	JOHN DAY	53.6	480,000
4	ARLINGTON	46.9	400,000
5	UMATILLA	46.2	420,000
6	PRIEST RAPIDS	127.3	631,000
7	ROCK ISLAND	42.1	236,000
8	ROCKY REACH	51.2	270,000
9	CHELAN	82.2	406,000
10	FOSTER CREEK	154.9	706,000
11	GRAND COULEE	330.0	* 1,944,000

† SEE TABLE 3 OF COLUMBIA AND SNAKE RIVERS REVIEW REPORT, H.D. 704, 75TH CONGRESS, 3RD SESSION.
* AS PROPOSED IN CONSTRUCTION PLANS.

SOURCE OF INFORMATION:
MAP AND PROFILE DATA TAKEN FROM MAPS AND CHARTS OF U.S. ENGINEERS OFFICE.
PLANT DATA IN TABLE IS FROM REPORT ON COLUMBIA RIVER AND MINOR TRIBUTARIES, HOUSE DOCUMENT 103, 73RD CONGRESS, 1ST SESSION, AND 704, 75TH CONGRESS, 3RD SESSION.

PLATE XXII

NO	REVISION	BY	DATE	APPROVED
3	TITLE BLOCK REVISED	JPM	12-20-40	
2	TABLE DATA REVISED	RGC	10-21-40	
1	TABLE ADDED	JLC	10-14-40	

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

BASIC POWER INVESTIGATION
COLUMBIA & SNAKE RIVERS
COMPREHENSIVE PLAN OF DEVELOPMENT

Submitted Jack W. Stevens
Recommended Henry R. Stevens
Approved [illegible]
Approved [illegible] Chief

Designed by JDS
Drawn by JLC
Traced by JLC
Checked by JDS/Bth
Date: 9-25-40
C117-810.3-033
1-101

In order to meet the normal and accelerated demand for power in the area, the transmission network was carefully planned and scheduled so that the necessary units and elements of that system would be provided in time to meet the additional load. A six-year construction program was worked out in detail,[1] and careful estimates of the costs of the various sections were determined.[2] The estimated cost of the completed and additional elements of this system is $163,000,000.

Estimated Revenues

In estimating the probable revenues in the sale of power from the multi-purpose federal projects, studies were undertaken to determine variations in the use of power due to fluctuations in general economic conditions. The investigations indicated that power requirements vary between fairly definite limits dependent upon general economic conditions. Accordingly, forecasts of probable revenues to be derived from the sale of power were based on average economic conditions. Estimated maximum, minimum, and average power revenues for the calendar years 1940 to 1947 follows:

Calendar Year	Estimated Annual Revenue[3]		
	Maximum	Minimum	Average
1940	-	-	$ 367,970[4]
1941	-	-	1,895,790[4]
1942	-	-	4,101,016
1943	$10,900,000	$ 6,500,000	8,700,000
1944	13,700,000	8,900,000	11,300,000
1945	16,500,000	11,300,000	13,900,000
1946	19,500,000	13,700,000	16,600,000
1947	22,500,000	16,100,000	19,300,00

1/ Executive Order No. 8455 requires the Power Administration to file with the National Resources Planning Board and the Bureau of the Budget detailed plans for a program six years in advance.

2/ See Plate XXIII.

3/ These revenues are contingent upon providing the generating capacity, transmission lines, and substations required for the delivery of Columbia river power to the various localities of the Northwest as local power deficiencies occur.

4/ Based on existing contracts.

EXECUTIVE OFFICE OF THE PRESIDENT
NATIONAL RESOURCES PLANNING BOARD & BUREAU OF THE BUDGET
WASHINGTON, D.C.

Bureau Bonneville Power Administration

DOCKET NO.	AGENCY PRIORITY NO.	NAME AND LOCATION OF PROJECT	TOTAL ESTIMATED COST	EXPENDITURE TO JUNE 30,1941	ADDITIONAL EXPENDITURE REQUIRED TO COMPLETE	ESTIMATED EXPENDITURE BY FISCAL YEARS						
						FISCAL YEARS OF PROGRAM						ADDITIONAL REQUIRED FOR LATER YEARS TO COMPLETE
						1942	1943	1944	1945	1946	1947	
1	2	3	4	5	6	7	8	9	10	11	12	13
			$	$	$	$	$	$	$	$	$	$
711-45-1	1	Grand Coulee-Covington 230 kv No. 1 Line Washington	4,471,000	1,241,000*	3,230,000	3,230,000						
711-45-2	2	Bonneville-N. Vancouver 230 kv No. 3 Line Washington	1,515,000	296,000**	1,219,000	1,219,000						
711-45-3	3	Covington-Seattle 230 kv Transmission Line Washington	300,000	32,000***	268,000	268,000						
711-45-4	4	Grand Coulee-Spokane 230 kv No. 1 Line Washington	1,520,000		1,520,000	1,520,000						
711-45-5	5	Bonneville-N. Vancouver 230 kv No. 4 Line Washington	800,000		800,000	800,000						
711-45-6	6	Bonneville-Grand Coulee 230 kv No. 2 Line Washington	3,790,220	37,220	3,753,000	3,753,000						
711-45-7	7	230 kv Substation Construction & Additions Washington	6,205,000		6,205,000	6,205,000						
711-45-7a	7a	North Vancouver Warehouse	250,000		250,000	250,000						
711-45-8	8	St. Johns-Oregon City 115 kv No. 2 Line Oregon	255,960	2,960	253,000	253,000						
711-45-9	9	115 kv Substation Construction & Additions Oregon	1,243,000		1,243,000	1,243,000						
711-45-10	10	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	4,000,000		4,000,000	4,000,000						
711-45-11	11	Advance Surveys, Design, and Investigations for future Construction	750,000		750,000	750,000						
711-45-12	12	Tools, Equipment and Stock Inventories	1,000,000		1,000,000	1,000,000						
711-45-13	13	North Vancouver Engineering Office Building Washington	500,000		500,000	500,000						
711-45-14	14	Grand Coulee-Covington 230 kv No. 2 Line Washington	3,500,000		3,500,000		3,500,000					
711-45-15	15	Grand Coulee-Spokane 230 kv No. 2 Line Washington	1,520,000		1,520,000		1,520,000					
711-45-16	16	North Vancouver-Covington 230 kv No. 2 Line Washington	2,538,000		2,538,000		2,538,000					
711-45-17	17	230 kv Substation Construction & Additions Washington	3,435,000		3,435,000		3,435,000					
711-45-18-1	18-1	Bonneville-Vancouver No. 1 & No. 2 115 kv Transmission Lines	1,250,000		1,250,000		1,250,000					
711-45-18-2	18-2	115 kv Transmission Line, Eastern Washington	388,000		388,000		388,000					
711-45-18-3	18-3	115 kv Transmission Lines, Western Washington	1,581,000		1,581,000		1,581,000					
711-45-19	19	115 kv Substations Construction & Additions Oregon, Washington and Idaho	2,906,000		2,906,000		2,906,000					
711-45-20	20	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	3,184,000		3,184,000		3,184,000					
711-45-21	21	Advance Surveys, Design, and Investigations for future Construction	588,100		588,100		588,100					
711-45-22	22	Tools, Equipment and Stock Inventories	333,400		333,400		333,400					
711-45-23	23	North Vancouver Laboratory Building	500,000		500,000		500,000					
711-45-24-1	24-1	Spokane-Missoula 230 kv Transmission Line No. 1	4,950,000		4,950,000			4,950,000				
711-45-24-2	24-2	Midway-Huntington 230 kv Transmission Line	4,400,000		4,400,000			4,400,000				
711-45-24-3	24-3	230 kv Substation Construction & Additions	6,650,000		6,650,000			6,650,000				
711-45-25-1	25-1	115 kv Transmission Lines	3,535,000		3,535,000			3,535,000				
711-45-25-2	25-2	115 kv Substation Construction & Additions	1,465,000		1,465,000			1,465,000				
711-45-26	26	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	3,000,000		3,000,000			3,000,000				
711-45-27	27	Advance Surveys, Design, and Investigations for future Construction	500,000		500,000			500,000				
711-45-28	28	Tools, Equipment and Stock Inventories	300,000		300,000			300,000				
711-45-29	29	Permanent Buildings	100,000		100,000			100,000				
711-45-30-1	30-1	Grand Coulee-Covington 230 kv Transmission Line No. 3	4,471,000		4,471,000				4,471,000			
711-45-30-2	30-2	Grand Coulee-Spokane 230 kv Transmission Line No. 3	1,824,000		1,824,000				1,824,000			
711-45-30-3	30-3	Spokane-Missoula 230 kv Transmission Line No. 2	4,950,000		4,950,000				4,950,000			
711-45-30-4	30-4	230 kv Substation Construction & Additions	3,755,000		3,755,000				3,755,000			
711-45-31-1	31-1	115 kv Transmission Lines	2,380,000		2,380,000				2,380,000			
711-45-31-2	31-2	115 kv Substation Construction & Additions	1,620,000		1,620,000				1,620,000			
711-45-32	32	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	2,800,000		2,800,000				2,800,000			
711-45-33	33	Advance Surveys, Design, and Investigations for future Construction	400,000		400,000				400,000			
711-45-34	34	Tools, Equipment and Stock Inventories	250,000		250,000				250,000			
711-45-35-1	35-1	Bonneville-Grand Coulee 230 kv Transmission Line No. 3	4,800,000		4,800,000					4,800,000		
711-45-35-2	35-2	230 kv Substation Construction & Additions	8,200,000		8,200,000					8,200,000		
711-45-36-1	36-1	115 kv Transmission Lines	2,750,000		2,750,000					2,750,000		
711-45-36-2	36-2	115 kv Substation Construction	750,000		750,000					750,000		
711-45-37	37	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	2,700,000		2,700,000					2,700,000		
711-45-38	38	Advance Surveys, Design, and Investigations for future Construction	200,000		200,000					200,000		
711-45-39	39	Tools, Equipment and Stock Inventories	200,000		200,000					200,000		
711-45-40	40	Permanent Buildings	100,000		100,000					100,000		
711-45-41-1	41-1	Grand Coulee-Monroe 230 kv Transmission Line	4,100,000		4,100,000						4,100,000	
711-45-41-2	41-2	Monroe-Covington 230 kv Transmission Line	950,000		950,000						950,000	
711-45-41-3	41-3	230 kv Substation Construction & Additions	950,000		950,000						950,000	
711-45-42-1	42-1	115 kv Transmission Lines	2,325,000		2,325,000						2,325,000	
711-45-42-2	42-2	115 kv Substation Construction & Additions	675,000		675,000						675,000	
711-45-43	43	Feeder Lines, Service Connections to Load Areas, Industrial Customers, Etc.	3,000,000		3,000,000						3,000,000	
711-45-44	44	Advance Surveys, Design, and Investigations for future Construction	50,000		50,000						50,000	
711-45-45	45	Tools, Equipment and Stock Inventories	100,000		100,000						100,000	
		TOTALS	127,523,680	1,609,180	125,914,500	24,991,000	21,723,500	24,900,000	22,450,000	19,700,000	12,150,000	

* Of this amount $797,000 was contributed by W.P.A. for clearing.
** This amount was contributed by W.P.A. for clearing.
*** Of this amount $15,000 was contributed by W.P.A. for clearing.

SYSTEM PLANNING AND MARKETING DIVISION
December 28, 1940

PLATE XXIII

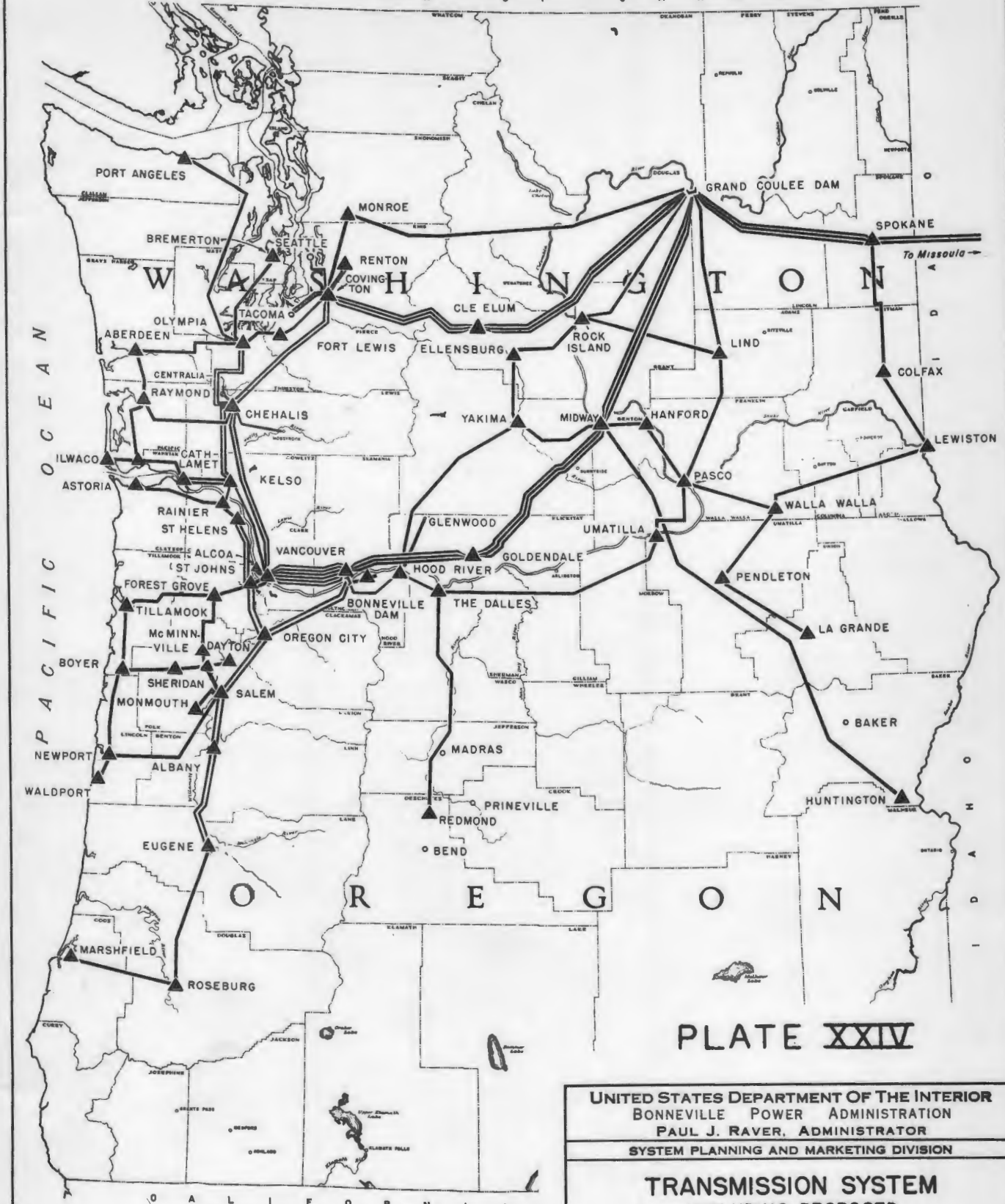


PLATE XXIV

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SYSTEM PLANNING AND MARKETING DIVISION

TRANSMISSION SYSTEM
INCLUDING PROPOSED
1947 FISCAL YEAR PROGRAM

Submitted Hans R. Anderson		Approved Chas. E. Sorey	
Recommended Ommundsen		Approved Wm. E. Gittinger, Chief	
Drawn LLA	Traced AAP	Date: 12-18-40	0136-879.2-B5
Checked HEM	Checked EEW		1 NO 1

III MANAGEMENT OF THE ENTERPRISE

Major organizational changes were made in practically all divisions of the Power Administration during fiscal 1940 and in the first half of fiscal 1941. These were necessary to meet effectively the changing emphasis and rapid expansion of the administration's activities and the widening scope of its jurisdiction.

Reorganizations were effected in both the System Planning and Marketing[1] and the Engineering divisions[2]. The planning staff was strengthened to undertake formulation of the six-year program required by the National Resources Planning Board. Basic power investigations, hydrology studies and related surveys, including those involving the Grand Coulee project, were instituted. Branch office organization was strengthened. With the increase in the number of lines and substations, the Operations section of the Engineering division was steadily expanded. Responsibilities of the Construction, Design and System Engineering sections and of the Materials and Inspection service were adjusted and extended for the purpose of increased system standardization and stabilized development.

Duties previously undertaken by the Administrative division were decentralized on a functional basis. On June 8, 1940, pursuant to an Act of Congress approved March 6, 1940[3], which authorized the Secretary of the Interior to appoint an Assistant Administrator, the Executive Assistant was promoted to this position. Similarly, recognizing the principle of promotion from within, the Technical Assistant was promoted to the position of Executive Assistant.

On April 22, 1940, as a result of the increased volume and scope of the administration's office service functions, these duties were transferred to a new Office Service division. Expanded employment activities also created new problems which were met by giving the

---

1/ See Section II, pp. 11-71
2/ See Section IV, pp. 109-142
3/ Public No. 429-76th Congress. See Appendix

administration's personnel office divisional status and by the appointment of a Chief of Personnel and responsible section heads.

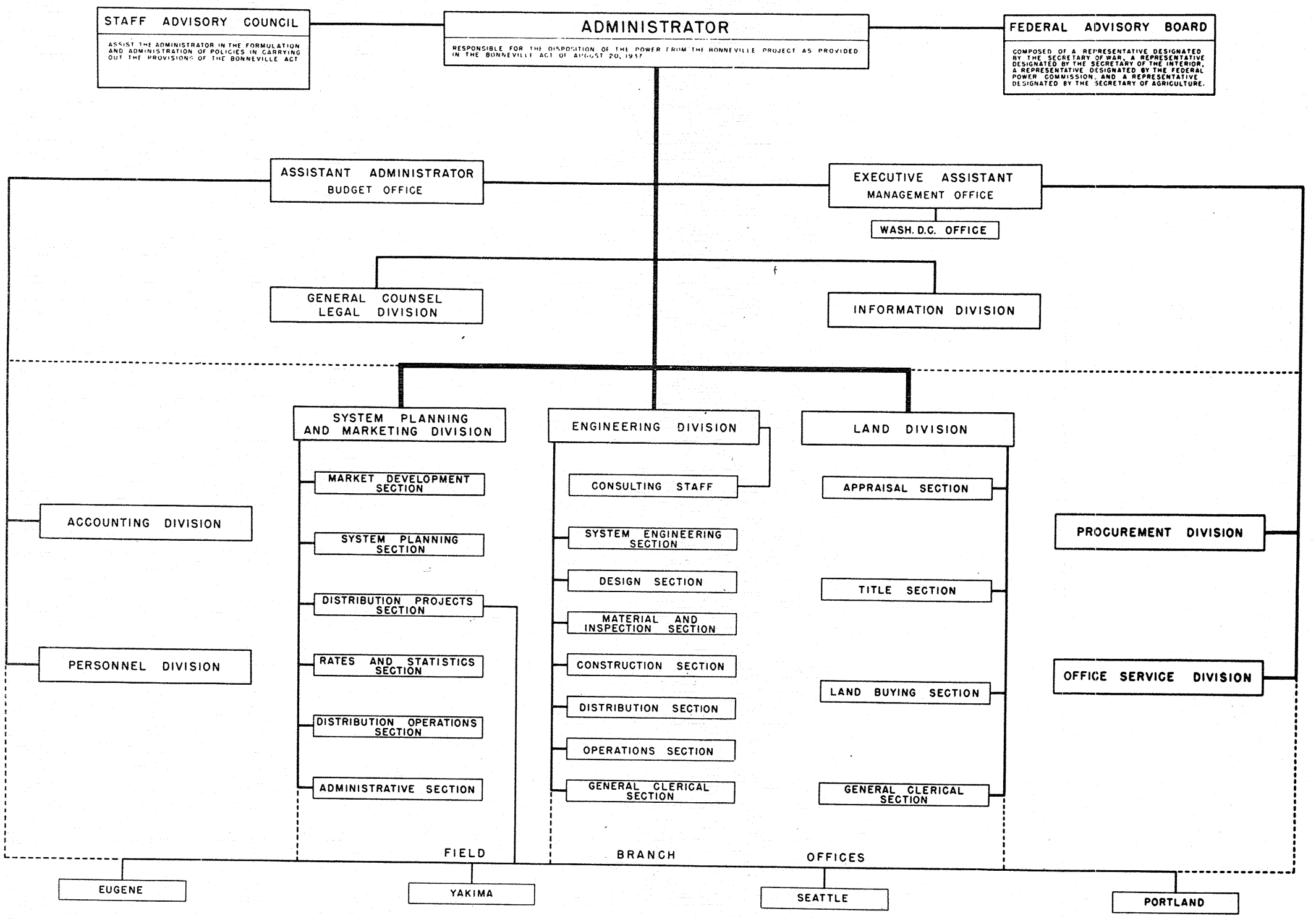
At the close of the fiscal year, an administrative order was issued for the administrative offices, formally establishing the Budget office in the office of the Assistant Administrator, who also was given responsibility for directing the Accounting and Personnel divisions. The order likewise established a Management office in the office of the Executive Assistant, who was given the added responsibility of directing the Procurement and Office Service divisions. Purchasing activities of the Procurement division were segregated for the purpose of permitting that division to operate as a specialized unit while non-procurement responsibilities were transferred to other divisions on a functional basis.

Functions performed by the other divisions also were adjusted in order to meet the rapidly changing requirements of the administration. For example, a shift in policy from condemnation actions to voluntary negotiations in the acquisition of land rights was reflected in the organization of the Land division. In the Legal division, increased emphasis was placed upon power contract work. By the close of the 1940 calendar year, administrative orders were being prepared to crystallize and give recognition to these and other organizational requirements.1/

1/ See Staff Organization Chart, Plate XXV

UNITED STATES DEPARTMENT OF THE INTERIOR

THE BONNEVILLE POWER ADMINISTRATION



CLASSIFICATION SURVEY JUNE 1, 1940

PLATE XXV

MANAGEMENT OFFICE

Increased efficiency and savings were realized during fiscal 1940 by application of the principles of scientific management to all operations of the agency. Production schedules, progress reports, procedural analyses and other techniques of modern management engineering were placed in effect.

The Bonneville Power Administration, during the period of its heavy construction program, is similar to mass production industry in the sense that it must process millions of dollars of congressional appropriations each year into such finished products as transmission lines and substations. These appropriations are converted by the various divisions of the agency into work orders, job orders, requisitions, purchase orders, contracts, materials, labor values and finally into the finished service facilities.

In order to increase the productivity, or earning power, of these appropriations, controls were set up during the year to reduce the "work in process" time to a minimum. The necessity for such action was twofold:

1. The rapidity of power sales required a close, highly efficient coordination of all other activities with the sales program to permit early deliveries on contract commitments, thus bringing revenue from power sales into the federal treasury at the earliest possible dates.

2. Development of the national defense program late in the year required rapid conversion of appropriations into finished facilities to meet the immediate needs of regional defense industry and to offset possible delays in the deliveries of construction materials resulting from war order priorities.

General approach to these management problems was instituted through the medium of time studies. These determined the weaknesses of existing conversion processes and provided a basis for the development of new procedures to eliminate all unnecessary steps.

Time studies showed that 21.5 months had been required to process funds completely, from appropriation to disbursement. The new procedures developed by the management office shortened this processing period to 14 months--a total time saving of 35 per cent. This was accomplished without substantial increase in production personnel and permitted a lower unit cost of operation.

Four Techniques Followed

Responsibility for the development of these procedures was centralized in the Management office, reporting to the Administrator, through the Executive Assistant, which achieved results through the establishment of four general techniques:

1. Organizational changes to determine the most efficient grouping of men. These were inaugurated following conferences and studies for the purpose of highlighting any functional weaknesses in the administration. Changes of this type effected by administrative orders during the year involved each of the two main operating divisions--the Engineering division and the System Planning and Marketing division, and practically all of the facilitating divisions.

These organizational changes were designed not on a permanent basis, but in accordance with a plan to permit staff realignments as often as emphasis might shift from one operating problem to another, such as the transition from initial construction activities to the newer problems of power sales, actual electrical operation, and assistance to established public agencies in system-wide acquisition of existing utility properties.

2. Procedural analyses on all aspects of the administration's production problems were initiated as a permanent management technique. Process charts, or "flow" charts,1/ were used first to present a graphic picture of existing work flow; second, to reveal any duplication, overlapping, or unnecessary processing steps; and third, to serve as a quick operating reference for the revised procedure adopted. After individual and group conferences revealed the weaknesses and requirements of the interested divisions and sections, new procedures were prepared in detail, agreed to by the staff members concerned, and presented to the Administrator for final approval. The installation of new procedures, with accompanying changes in forms, routing, organization, etc., was watched carefully to insure compliance with all provisions and to ascertain the need for further revision and improvement.

Adoption of the Power Applications and Contract Procedure on March 12, 1940, resulted in a more clearly defined processing technique to insure that feasibility reports and staff clearances were obtained in the development of contract negotiations and that all divisions concerned would be given the opportunity to participate in these negotiations.

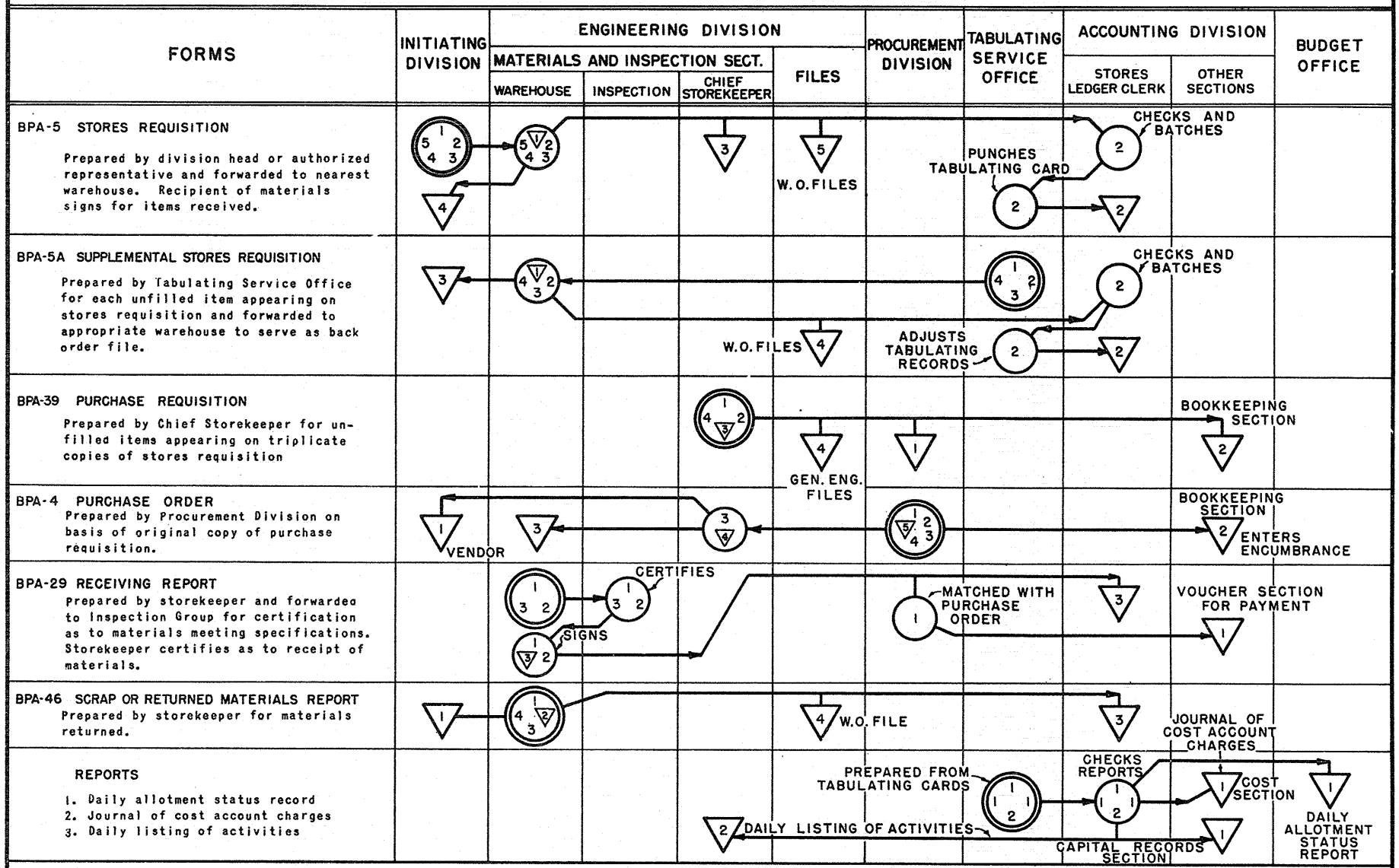
1/ See Plates XXVII and XXVIII

A- ENGINEERING WAREHOUSES

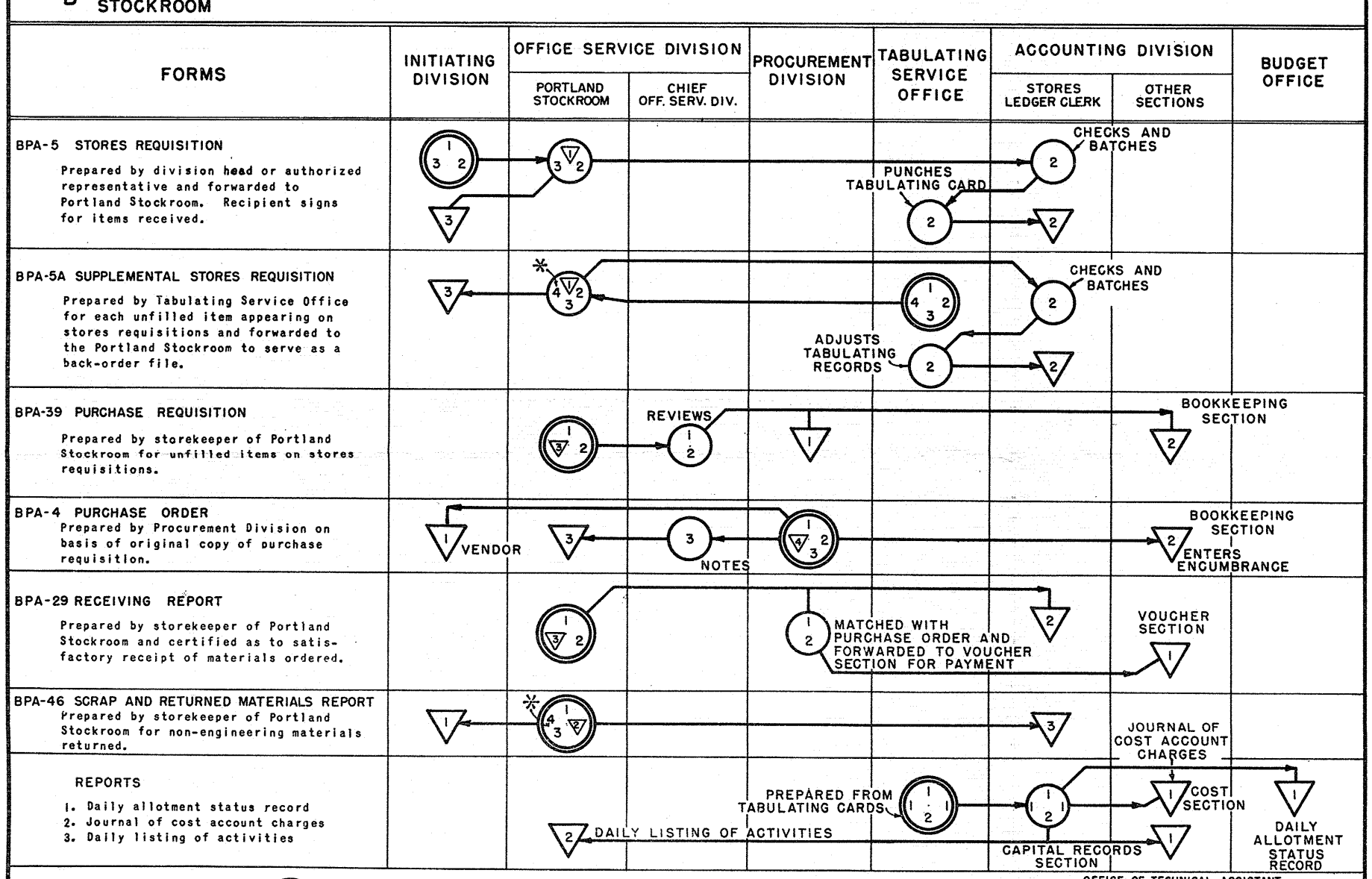
ADMINISTRATIVE ORDER NO 27

CHART SHOWING DISTRIBUTION OF FORMS AND REPORTS

JUNE 10, 1940



B- PORTLAND STOCKROOM



OFFICE OF TECHNICAL ASSISTANT

SYMBOLS ◎ ORIGINATE ○ TRANSMIT ▽ FILE NUMERAL INDICATES NUMBER OF COPY

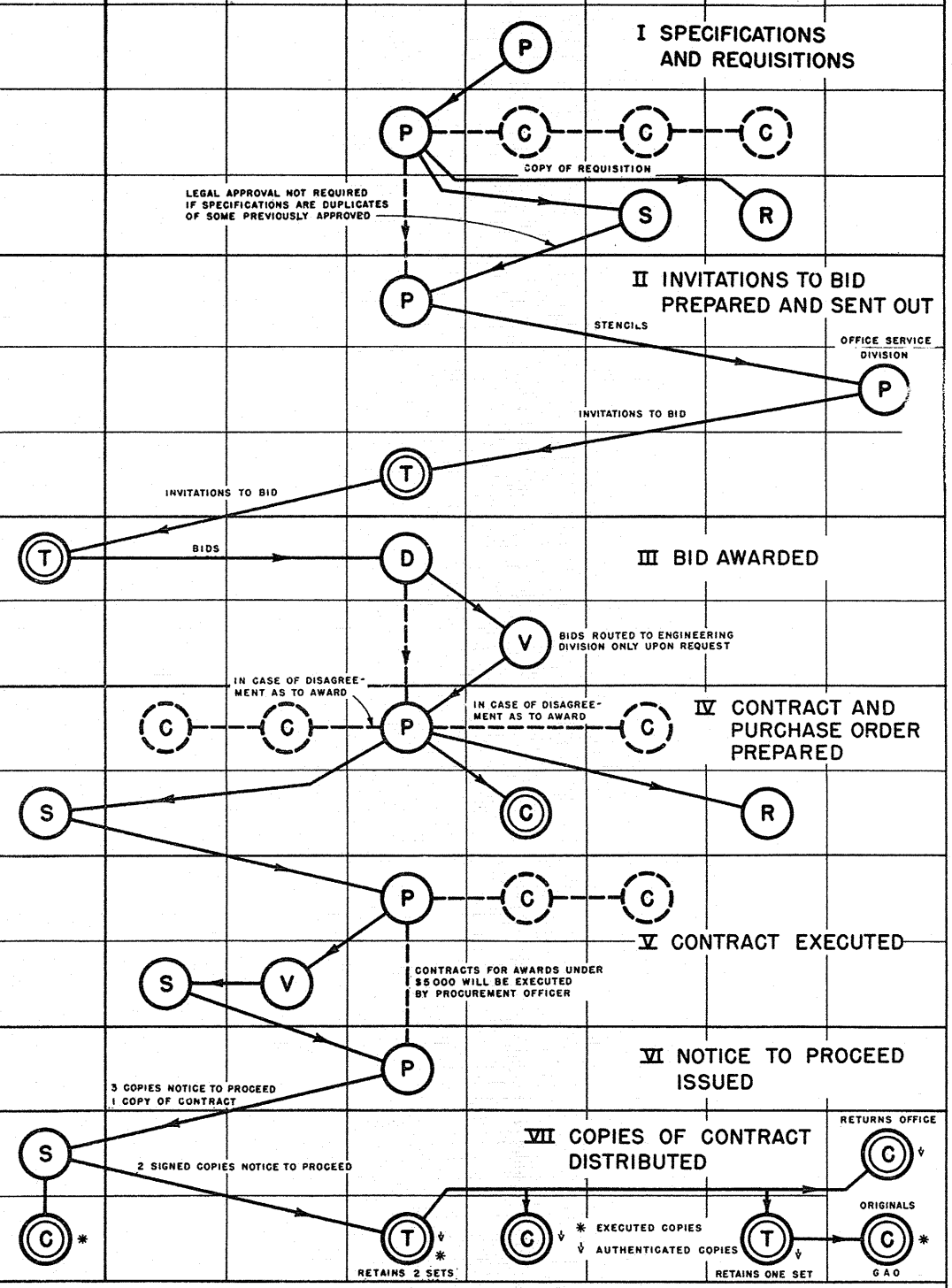
*4 COPIES FILED IN ENGINEERING WORK ORDER FILES IF MATERIALS WERE ORDERED BY ENGINEERING DIVISION

PLATE XXVIII

FLOW CHART OF ADMINISTRATIVE ORDER NO 20

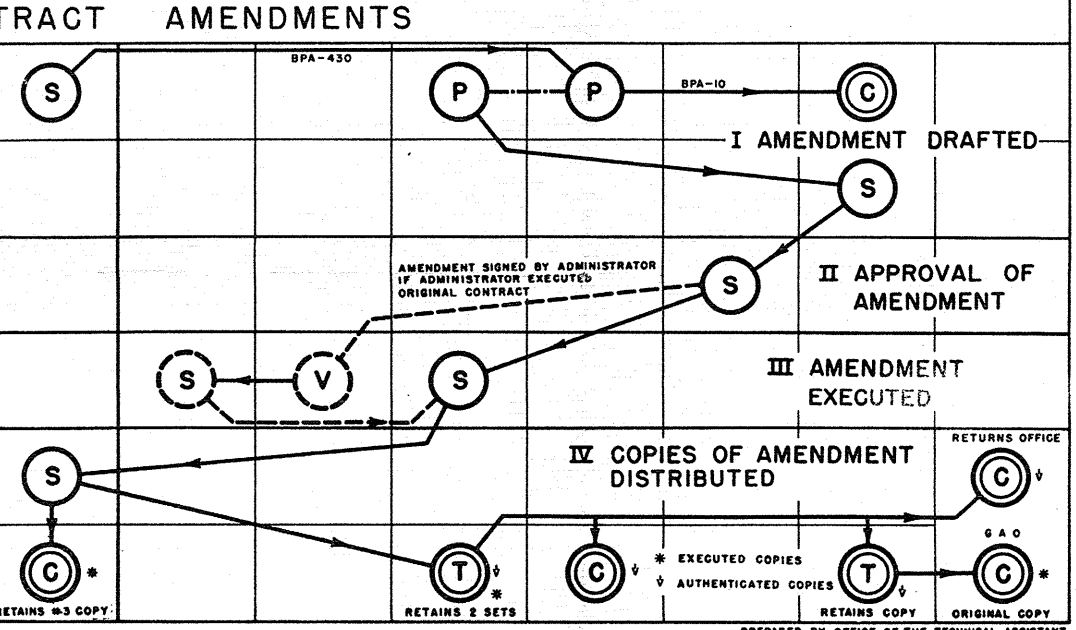
PROCEDURE FOR INITIATION, EXECUTION AND AMENDMENT OF CONTRACTS COVERING CONSTRUCTION AND MATERIALS

STEP NO	DESCRIPTION OF STEPS	BIDDER OR CONTRACTOR	ADMINISTRATOR	EXECUTIVE ASSISTANT	PROCUREMENT	ENGINEERING	LEGAL	FINANCE	OTHER
1	The Engineering Division will submit the original of the specifications together with requisition(s) in triplicate covering items in the specifications.								
2	The Procurement Division will review the specifications, put them in final form for bidding, conferring with the Finance Division, originating officer, or other divisions if necessary. Unless the Engineering Division has certified that the specifications are duplicates of some previously approved by the Legal Division, they will be routed to the Legal Division. Procurement will assign requisition a pro number and send a copy to the Finance Division.								
3	The Legal Division will approve the specifications if acceptable and route them back to the Procurement Division; if not acceptable the Legal Division will return them to Procurement with statement of objections and suggestions as to form. The Finance Division will record commitment of funds, check code and appropriation numbers on the requisition and notify Procurement in case any changes are required.								
4	The Procurement Division will prepare the stencils and forward to Office Service Division with proper requisitions and instructions for duplicating.								
5	The Office Service Division will mimeograph and assemble invitations to bid and forward them to the Procurement Division.								
6	The Procurement Division will mail out the invitations to the prospective bidders, enclosing pertinent drawings and bid bond forms.								
7	On the specified date the Procurement Division will open and abstract the bids and, after necessary consultation with the originating officer or other divisions, will make the award. If the Engineering Division has requested on the requisition to review the bids the Procurement Division will transmit them to the Engineering Division together with abstract and recommendations as to award.								
8	The Engineering Division will review the bids and return them to the Procurement Division with comments or recommendations. In case the award is to be made to other than the lowest bidder meeting specifications, and in case of doubt or disagreement as to award, the Legal Division, Executive Assistant, and if necessary, the Administrator will be consulted.								
9	When agreement as to award is reached the Procurement Division will prepare the contract in quintuplicate, submit the first 4 copies to the contractor and send three copies of the letter of transmittal to the Engineering Division. The Procurement Division will also prepare a purchase order covering items in the contract and send a copy to the Finance Division.								
10	Upon receipt of a copy of the purchase order the Finance Division will adjust its commitment records. The contractor will sign and return the first three copies of the contract, the fourth copy being sent to the bonding company.								
11	The Procurement Division will check the contract and bonds for proper execution and also determine from the Treasury Department's approved list whether the bonding company is acceptable, consulting with Legal Division or originating officer, if necessary and prepare a Statement and Certificate of Award in triplicate and Oath of disinterestedness in duplicate and transmit all copies to the Administrator through the Executive Assistant.								
12	The Administrator will execute 3 copies of the contract and send them, together with Statement and Certificate of Award and Oath of Disinterestedness properly notarized, to the Procurement Division.								
13	The Procurement Division will prepare a notice to proceed in triplicate and send them to the contractor, together with one (or more if required) executed carbon of the contract. Procurement will send two more copies of the purchase order prepared in step #9 to the Finance Division and three copies to the Engineering Division.								
14	The contractor will sign and return the original and duplicate of notice to proceed to the Procurement Division.								
15	Upon receipt of signed copies of notice to proceed the Procurement Division will distribute originals of the contract, bonds, Statement and Certificate of Award, and Oath of Disinterestedness as indicated.								



CONTRACT AMENDMENTS

1	The Engineering Division will secure an estimate of cost and necessary technical data from the contractor on signed copies of BPA-430, Request for Contract Amendment, prepare encumbrance notification BPA-10 and transmit two copies to the Finance Division for recording of commitment or credit of funds. Engineering and Procurement Divisions will jointly draft the formal amendment in quadruplicate and forward all copies to the Finance Division.								
2	The Finance Division will approve the amendment as to provisions covered by General Accounting Office regulations and route all copies to the Legal Division.								
3	The Legal Division will approve the amendment and transmit the four copies to the Procurement Officer or Administrator for signature (depending upon who was the contracting officer in the original contract.) In case the Administrator was the contracting officer all copies will be returned to the Procurement Division.								
4	The Procurement Division will submit the first three copies of the contract amendment to the contractor.								
5	The contractor will sign and return the first two copies to the Procurement Division, retaining the triplicate copy.								
6	The Procurement Division will distribute the contract amendment in the same manner as the original contract, additional copies being prepared as necessary.								



3-30-40

PREPARED BY OFFICE OF THE TECHNICAL ASSISTANT

SYMBOLS: IN COOPERATION — (S) SIGN OR APPROVE — (P) PREPARE — (R) RECORD — (D) DETERMINE — (V) CHECK — (C) CONFER — (C) RECEIVE COPY — (T) TRANSMIT — DOTTED SYMBOLS INDICATE POSSIBLE ACTION

Adoption of the revised Procedure for Handling Construction and Materials Contracts 1/ on March 30, 1940, resulted in a decrease of 20 per cent in the Procurement processing time required.

The average time required under the old procedure was 68 days, including time required for obtaining bids, making bid analysis and award, and signature of contract. The average time required under the new procedure was 55 days, and studies looking toward further reduction of processing time were still in progress as the year closed. The old procedure required 31 separate steps, whereas the new procedure required only 15.

Adoption on June 10, 1940, of the procedure for conducting a central warehouse control system was resulting in greater economies from planned purchasing of materials, and in more expeditious handling of materials. Studies showed that considerably greater economies could be realized--both in procurement and warehousing practice, and in expediting completion and maintenance of service connections to customers--at such a time as the Budget Bureau and Congress permit the maintenance of an adequate revolving stock inventory, in accordance with recognized utility experience, and provide the funds for establishing such necessary working capital.

Closely related to these and other improved procedures was the constant revision and improvement of the various office forms used by the administration. By centralizing in the Management office the responsibility for the design or review of these forms, duplication of effort was detected and eliminated and maximum efficiency obtained in the use of each form. By re-designing old forms, it was found possible not only to provide for more useful information on each form but to increase usable space as much as 75 per cent, and to eliminate unnecessary forms.

3. Scheduling techniques were established during the year to provide a more even work program and for better planning and operating efficiency. Gantt charts and other graphics were introduced to provide the administration with a picture of the task to be accomplished during each fiscal year and with a report of the weekly and monthly accomplishment against that task. Such control made possible prompt measures for the correction of any lag in production.

1/ See Plate XXVIII, preceding.

Necessary bases for work schedules were provided by preliminary time studies of previous experience, conferences with the divisions concerned and estimates of ideal production rates. These schedules, when once agreed to, were placed in effect to be adhered to until additional experience proved the need for their adjustment.1/

Standard schedules were devised and placed in effect for all divisional activities in the agency. A policy of periodic production conferences to review all schedules and to take necessary follow-up action was established.

Encouraging results from the establishment of these schedules included:

(a) Reduction in labor turnover and costs

(b) More accurate determination and meeting of energization dates

(c) Earlier detection and correction of processing flaws

(d) Standardization and simplification of processing techniques with resulting economies

4. Periodic progress reporting provided the operating officials with an over-all picture of the major activities of the administration, in order that their direction might be determined and policies guided accordingly.

The Power Sales Progress chart 2/ revealed to the operating officials the important trends in new applications received, power contracts executed, and power deliveries. A weekly mimeographed supplement report, provided a quick reference to the exact status of the major steps in power sales.

The Personnel chart3/, showed important payroll trends by various classifications.

Other progress charts and reports indicated the current status of land acquisition progress, procurement progress, and other major activities. These reports, combined with the schedule charts, enabled the administration to concentrate on any weak spots which might appear and to interpret operating results more accurately.

1/ See Plate XXIX, following.
2/ See Plate XXX, following.
3/ See Plates XXXI and XXXII, following.

ENCUMBRANCE PROGRESS CHART

Fiscal Year Ending June 30, 1941

		July		August		September		October		November		December		January		February		March		April		May		June	
Total to Allot $11,696,000.00																									
Total to Commit 9,368,000.00																									
Total to Encumber 15,020,000.00		15	31	15	31	15	30	15	31	15	30	15	31	15	31	15	28	15	30	15	30	15	31	15	30
Total to Expend 18,350,000.00																									
PERIOD ENDING												✓													
. ALLOTMENTS	P	5125		2421		50		3850		--		150		--		--		50		25		15		10	
	A			7546		(2352) 7596		11446		11446		11596		11596		11596		11646		11671		11686		11696	
. COMMITMENTS (Materials and Construction Contracts)	P	540		429	429	429	430	1025	1275	1275	1259	750	483	310	210	180	156	40	40	35	30	13	10	10	10
	A			969	1398	1827	2257	3282	4557	5832	7091	7841	8324	8634	8844	9024	9180	9220	9260	9295	9325	9338	9348	9358	9368
. ENCUMBRANCES (Includes earned payrolls only)	P	687		190	631	300	817	477	966	825	1612	1360	1915	610	935	400	782	200	654	40	520	35	528	25	511
	A			877	1508	1808	2625	3102	4068	4893	6505	7865	9780	10390	11325	11725	12507	12707	13361	13401	13921	13956	14484	14509	15020
(a) Materials, Construction Contracts and Misc.	P	298		190	244	300	405	477	524	825	1165	1360	1492	610	515	400	356	200	220	40	84	35	74	25	62
	A			488	732	1032	1437	1914	2438	3263	4428	5788	7280	7890	8405	8805	9161	9361	9581	9621	9705	9740	9814	9839	9901
(b) Labor (construction)	P	225			250		275		300		300		270		260		260		260		260		270		270
	A				475		750		1050		1350		1620		1880		2140		2400		2660		2930		3200
(c) Land and Title Services	P	6			20		18		18		18		18		18		18		18		18		20		20
	A				26		44		62		80		98		116		134		152		170		190		210
(d) Divisional Obligations	P	158			117		119		124		129		135		142		148		156		158		159		164
	A				275		394		518		647		782		924		1072		1228		1386		1545		1709
EXPENDITURES	P	1050			1500		1600		1650		1600		1500		1300		1300		1300		1300		2000		2250
	A				2550		4150		5800		7400		8900		10200		11500		12800		14100		16100		18350

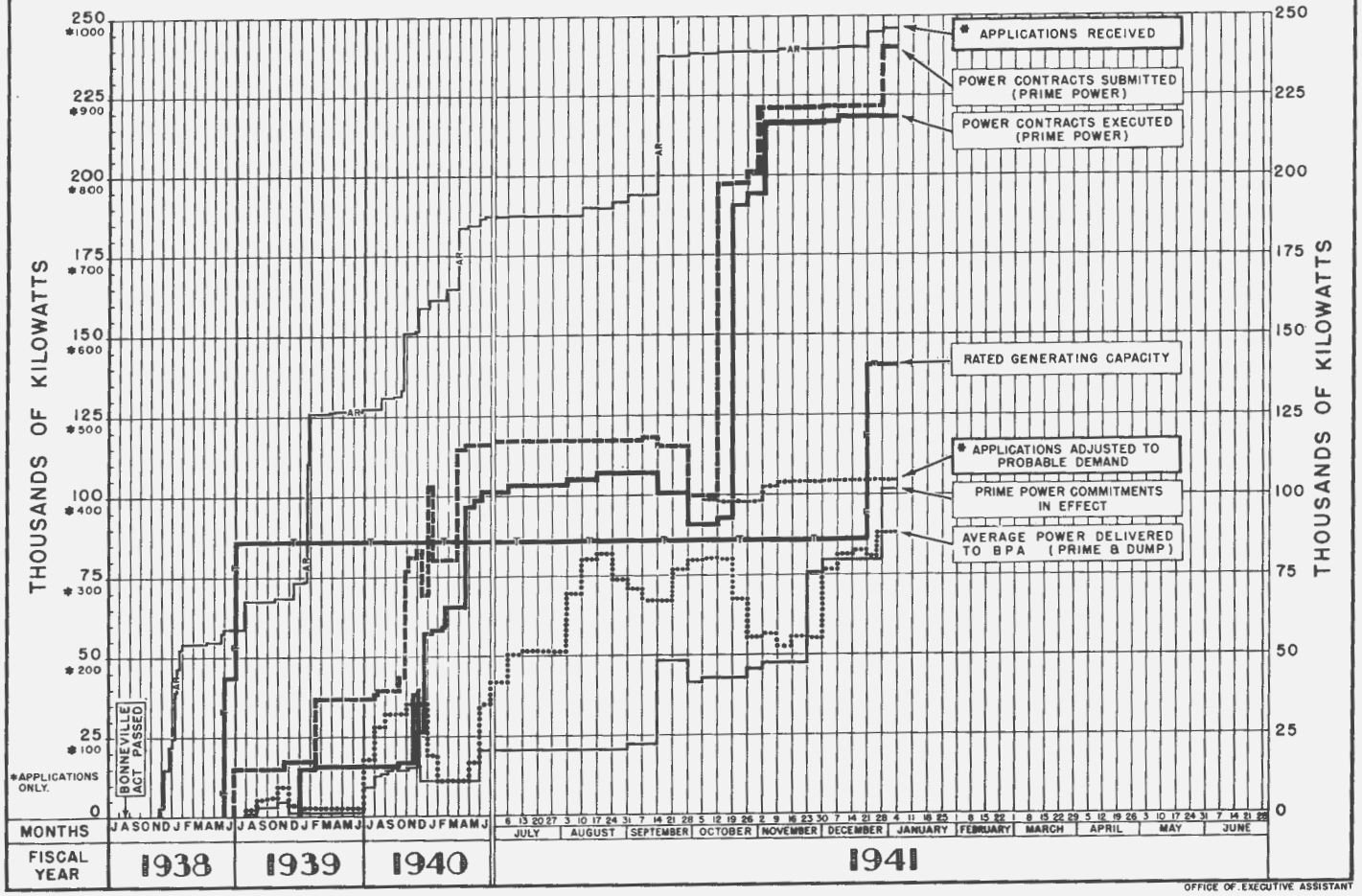
Amounts represent thousands of dollars
P - Period Schedule (semi-monthly or monthly)
A - Accumulative Schedule

—— Period Production
▬▬ Accumulative Production

Office of Executive Assistant
Bonneville Power Administration
12-1-40

POWER SALES PROGRESS

BONNEVILLE POWER ADMINISTRATION



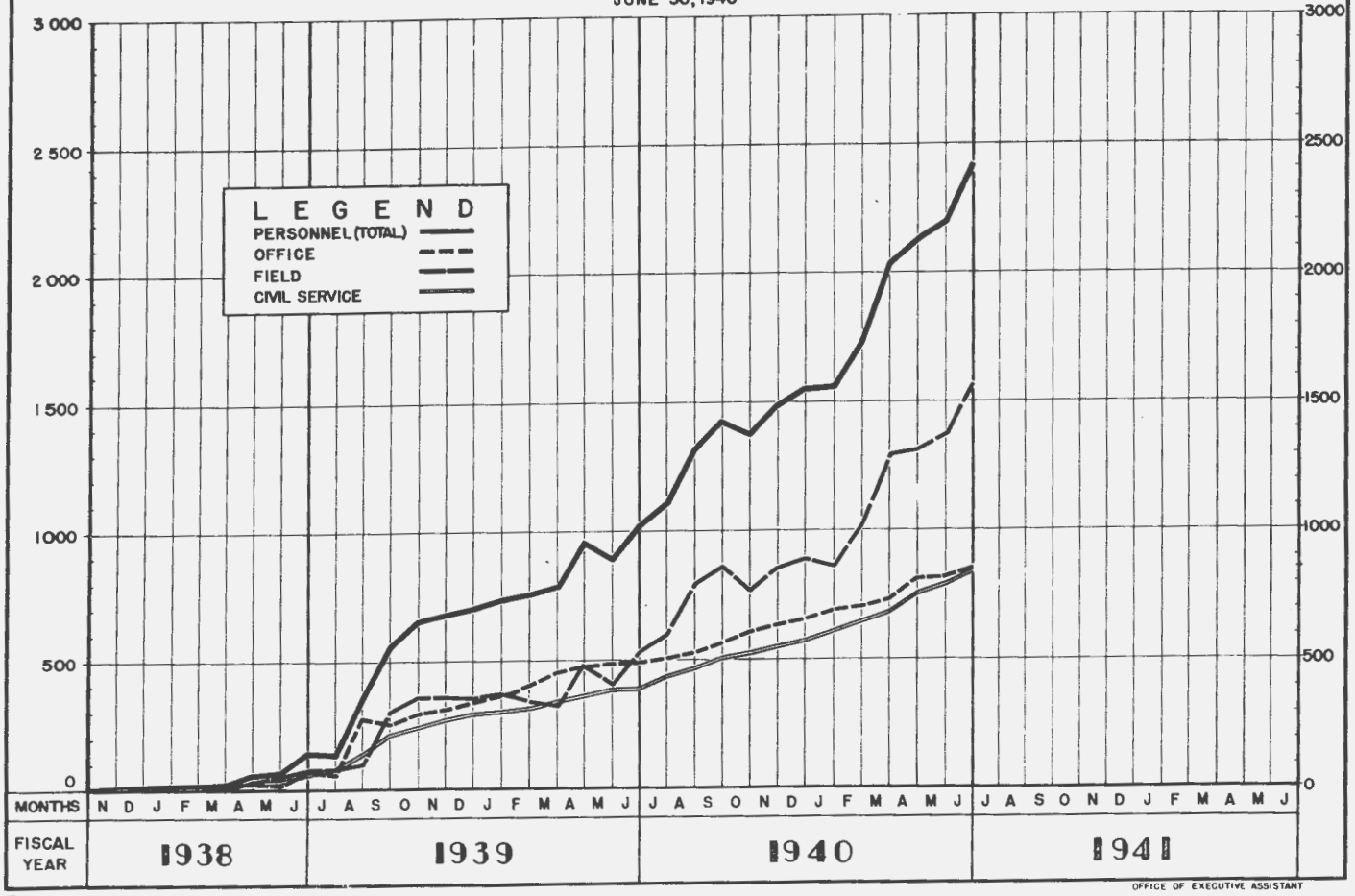
OFFICE OF EXECUTIVE ASSISTANT

PLATE XX

PERSONNEL

BONNEVILLE POWER ADMINISTRATION

JUNE 30, 1940

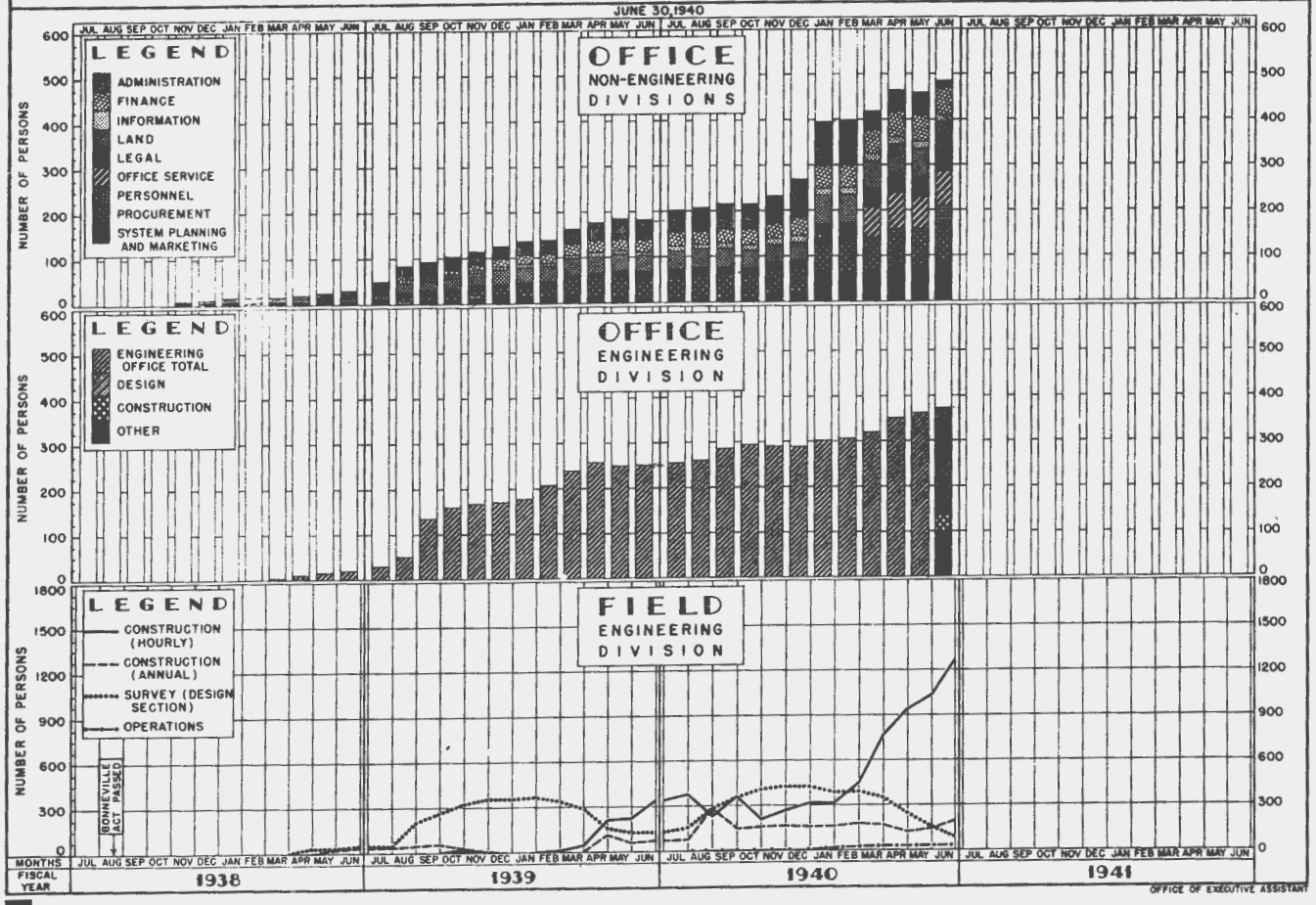


OFFICE OF EXECUTIVE ASSISTANT

PLATE XXXI

PERSONNEL

BONNEVILLE POWER ADMINISTRATION



OFFICE OF EXECUTIVE ASSISTANT

PLATE XXXII

Management Studies in Fiscal 1941

The Management office instituted a number of important studies late in fiscal 1940. As the year closed, many of these had not yet passed their initial development period. Still other major studies were begun in the first few months of fiscal 1941. All these resulted in the steady inauguration of new procedures during the first six months of the new fiscal year.

The new studies covered such subjects as branch office procedure, a revised power application and contract procedure, shop order procedure and the redefinition of functions and procedures in the administration's various facilitating divisions. New scheduling techniques also were being worked out for power contracts, work orders and land acquisition.

Of paramount importance was the establishment of a tabulating service on July 15, 1940.

Installation of eight business machines, operating on the punch-card principle, simplified the vast volume of accounting and statistical procedures and made available comprehensive and immediately current information on such fiscal matters as the status of allotments, summary of payroll, flow of materials and inventory of stock and warehouse items.

Value of the new equipment was immediately reflected in a marked reduction in accounting costs. Basic accounting records were simplified and made susceptible of handling by a smaller staff even in the face of steady growth in volume of accounting activities. Overtime was eliminated in several sections of the administration's accounting offices. As the new year progressed, the Management office gave special study to future applications for these machines.

FINANCIAL REPORT
(June 30, 1940)

The financial activities of the Bonneville Power Administration since the availability of its first appropriation in the fiscal year

1938, the results of its operations, and its financial position as of June 30, 1940, are reflected in the following statements:

Balance Sheet - June 30, 1940	Table 14
Schedule of Balances Showing Status of Appropriations	Table 15
Revenue Statement	Table 16
Income Statement	Table 17
Statement Showing the Construction Program and Construction Costs by Budgetary Groupings	Table 18

The finance or general ledger accounts were kept in accordance with the requirements of the General Accounting office, and the detail records incident to construction, operation, and maintenance activities were kept in accordance with the Federal Power Commission's Uniform System of Accounts. Considerable difficulty was experienced in harmonizing the two very different methods of accounting, making the Power Administration's accounting more costly than would have been the case under other circumstances, but such expense appeared unavoidable under existing laws and regulations.

The accounting policy of the administration was dominated by a desire to maintain records which presented an accurate, unbiased picture and which would be as nearly comparable with those maintained by privately-owned utilities as possible. In keeping with this policy, the records were kept to reflect the value of certain equipment and services beneficial to the project, even though these were furnished by other agencies at no cost to the Bonneville Power Administration.

Balance Sheet Items

The "Balance Sheet"1/was drawn to reflect the financial position of the administration as of June 30, 1940. The form of presentation was varied from that submitted monthly to the General Accounting Office in order to present a report which more nearly conformed to accepted public utility practice.

1/ See Table 14, p. 83

"Cash and Cash Funds", in the amount of $11,868,597.71, were largely offset by "Unliquidated Encumbrances" totaling $7,055,503.09. Of the balance only $1,225,235.00 remained unallotted as of June 30, 1940.

The "Materials and Supplies" item, totaling $352,824.05, consisted principally of construction materials. It was apparent at the close of the year that substantial purchases of maintenance materials would be necessary during fiscal year 1941.

The "Depreciation Reserve", shown as an offset under "Equipment", was established by depreciation accruals on a straight-line basis. Careful estimates were made of the life expectancy of the equipment, with due regard for possible salvage value, and conservative rates were established accordingly. Depreciation studies on lines and substations were not completed during the fiscal year and no figure was reported for this element, but inasmuch as the Power Administration had no major lines in service for any considerable period this was not a material factor.

The amount of $2,514,431.27, shown under "W.P.A. Contributions", represented the amount spent by the Works Progress Administration in clearinglands and rights-of-way for the administration and was assignable to lines as follows:

Bonneville-Vancouver Line	$396,849.64
Bonneville-Grand Coulee	582,207.53
Vancouver-Eugene	63,749.22
Vancouver-Kelso	482,839.73
Kelso-Chehalis-Raymond	655,537.28
Bonneville-The Dalles	264,945.73
Chehalis-Covington	45,055.82
Bonneville-Oregon City	23,246.32

It was recognized that, due to the nature of the activity, the entire amount of such costs could not properly be capitalized. At the close of the year, studies were under way to determine what portion might be so allocated.

"Special Deposits", in the amount of $109,015.09, were held as guaranties of contractual performance. This amount was offset in the contra-account, "Unapplied Special Deposit Collections."

"Retirement and Disability Funds Deposited" was a statistical account maintained to show the amount of retirement fund deductions and collections deposited into the Treasury. It was offset by a similar statistical account, "Retirement Contributions - Civil Service Commission", covering the gross accumulated amount of retirement fund deductions and service credit contributions to the credit of employees, and another statistical account, "Retirement Contributions - Pay Card", which covered the amount of retirement fund deductions during the fiscal year.

"Sales of Electric Energy", were totaled on the balance sheet but were detailed elsewhere.1/

"Other Receipts", in the amount of $7,001.19, consisted of miscellaneous items covered into the Treasury of the United States. These items served to decrease the actual cost of the administration's activities and, under commercial accounting practice, would have increased the cash account.

On the liability side of the "Balance Sheet", "Vouchers Payable - Preaudit" figures were maintained to show the amount of vouchers payable forwarded to the General Accounting office for preaudit. In order to insure the maintenance of disbursements in accordance with the requirements of the General Accounting office, certain vouchers were forwarded to that office for audit prior to payment. This was done, usually, only when the Power Administration's certifying officers were in doubt as to the application of General Accounting office regulations.

Annual leave was accrued at the rate of nine per cent on the salaries of annual employees and charged to the work performed. Leave taken was charged to the "Accrued Annual Leave" account. Therefore, the amount of $106,289.72 appearing under this account represented the earned leave which had not been taken.

The accounts under the heading "Special Fund Accounts" were discussed in connection with the contra-accounts appearing on the asset side of the "Balance Sheet."

1/See Revenue and Income Statements, Tables 16 and 17, pp. 85-86

The "Other Contributions" account represented the value of equipment and services donated by other governmental agencies and the appraised value of a right-of-way donation in the amount of $175.00. Included in this amount was a W.P.A. contribution for photographic work made in addition to the contribution noted above for clearing.

Income Statement Items

The "Income Statement"[1/] was divided into two parts to reflect not only the results of electric operations from the availability of the first appropriation in fiscal 1938 to June 30, 1940, but to show both cumulative and segregated income totals at the close of November 1940--five months after the beginning of fiscal 1941.

"Transmission Expense" included all costs of operating and maintaining transmission lines and substations, including temporary connections made to serve customers prior to completion of the permanent lines and stations.

"Customers' Accounting and Collecting Expense" included all costs of billing and accounting chargeable against electric sales contracts.

"Administrative and General Expense" included office salaries and other office expenses of the administrative and service divisions which were not capitalizable under the Federal Power Commission's Uniform System of Accounts.

The amount shown as "Depreciation" consisted of the amount of depreciation on equipment (excepting transportation equipment) determined to be chargeable to operating expense. The depreciation on transportation equipment was charged to the transportation clearing account and was cleared to the accounts appropriate for the use of the equipment.

"Income Deductions", in the amount of $1,000.27, consisted of preliminary work on proposed transmission lines and substations which were definitely abandoned.

1/ See Table 17, p.86

TABLE 14

BONNEVILLE POWER ADMINISTRATION

BALANCE SHEET - JUNE 30, 1940

Assets

Accounts	Balance Detail	Balance Total
Cash and Cash Funds		
Treasury Cash	$10,819,498.14	
Requisitions in Transit	50,000.00	
Disbursing Funds	1,799,067.57	
Disbursing Officer's Cash-Collections-Repayments	32.00	$11,868,597.71
Current Assets		
Receivables from other Government Agencies	95.30	
Material and Supplies	352,824.05	352,919.35
Fixed Assets		
Equipment - Office and Construction	634,140.54	
Less Equipment Depreciation Reserve	122,528.53	
Net Equipment	511,612.01	
Construction Work in Progress	15,073,889.99	
W.P.A. Contributions - Clearing Right-of-way	2,514,431.27	18,099,933.27
Special Fund Accounts		
Special Deposits	109,015.09	
Retirement and Disability Funds Deposited	77,616.93	186,632.02
Miscellaneous Receipts - Deposited and Accrued		
Sales of Electric Energy	417,735.06	
Other Receipts	7,001.19	424,736.25
		$30,932,818.60

Liabilities

Accounts		Balance Detail	Balance Total
Current Liabilities			
Vouchers Payable - Preaudit		$24,147.49	
Accounts Payable		266,621.37	
Accrued Annual Leave		106,289.72	$397,058.58
Special Fund Accounts			
Retirement Contributions - Civil Service Commission	$38,831.37		
Retirement Contributions - Pay Card	38,785.56	77,616.93	
Unapplied Special Deposit Collections		109,015.09	186,632.02
Miscellaneous Deferred Credits			726.71
Funds and Property Made Available			
W.P.A. Contributions - Clearing Right-of-way		2,514,431.27	
Other Contributions		3,391.12	
Appropriations			
Unallotted Appropriations	1,225,235.00		
Unencumbered Allotments	3,587,859.62		
Unliquidated Encumbrances	7,055,503.09		
Expended Appropriations	16,039,521.93	27,908,119.64	
Net Expense Over Revenue		L- 77,540.74	30,348,401.29
			$30,932,818.60

TABLE 15

SCHEDULE A
SCHEDULE OF BALANCES SHOWING STATUS OF APPROPRIATIONS

Period ended June 30, 1940

A-Available for Allotment
B-Budget Reserve

	91. Appropriations	91.4 Expended Appropriations	01. Treasury Cash	03. Requisitions in transit	03.31 Disbursing Officer's Cash-Disbursing Funds	03.32 Disbursing Officer's Cash-Repayments	TOTAL BALANCES	91.3 Unliquidated Encumbrances	91.2 Unencumbered Allotment	91.1 Unallotted Appropriations
14-808/00513 PWA - 1938-1940	10,750,000.00	8,765,309.22	847,629.89	.00	1,137,028.89	32.00	1,984,690.78	1,303,347.68	681,343.10	.00
149/00614 - Const. Power Dist. System 1939-1940	13,000,000.00	3,301,222.56	9,093,502.39	.00	605,275.05	.00	9,698,777.44	5,621,062.39	2,881,380.05	A-936,335.00 B-260,000.00
1400608 - Operation & Maint. - 1940	400,000.00	293,848.67	27,359.71	50,000.00	28,791.62	.00	106,151.33	92,699.45	5,451.88	A- .00 B- 8,000.00
Total Available Appropriations	24,150,000.00	12,360,380.45	9,968,491.99	50,000.00	1,771,095.56	32.00	11,789,619.55	7,017,109.52	3,568,175.03	1,204,335.00
1490608 - Administrative - 1939	165,000.00	138,546.98	4,154.25	.00	22,298.77	.00	26,453.02	6,889.14	8,663.88	10,900.00
148/90614 - Const. & Maint. 1938-1939	3,500,000.00	3,458,476.48	35,850.28	.00	5,673.24	.00	41,523.52	31,504.43	10,019.09	.00
1480608 - Administrative - 1938	100,000.00	88,998.38	11,001.62	.00	.00	.00	11,001.62	.00	1,001.62	B- 10,000.00
Total Appropriations	27,915,000.00	16,046,402.29	10,019,498.14	50,000.00	1,799,067.57	32.00	11,868,597.71	7,055,503.09	3,587,859.62	1,225,235.00

TABLE 16

BONNEVILLE POWER ADMINISTRATION
REVENUE STATEMENT
Monthly Revenue from the Sale of Electric Energy

	Public Utilities		Municipal Utilities		Industries		Totals		Grand Totals
	F.Y. 1939	F.Y. 1940	F.Y. 1939	F.Y. 1940	F.Y. 1939	F.Y. 1940	F.Y. 1939	F.Y. 1940	
July	---	$ 18,214.37		$ 11.92				$ 18,226.29	$ 18,226.29
August	$ 2,979.45	29,754.77		233.20			$ 2,979.45	29,987.97	32,967.42
September	6,078.08	33,330.11		242.48			6,078.08	33,572.59	39,650.67
October	7,865.75	34,799.98		248.84		$ 19.57	7,865.75	35,068.39	42,934.14
November	10,745.88	35,167.44		356.56		53.75	10,745.88	35,577.75	46,323.63
December	3,833.56	54,361.46		1,291.84		57.00	3,833.56	55,710.30	59,543.86
January	3,078.77	31,032.55		1,532.00		55.50	3,078.77	32,620.05	35,698.82
February	2,780.82	14,486.60		1,797.46		53.00	2,780.82	16,337.06	19,117.88
March	3,078.77	14,583.33	$ 14.79	1,685.18		35.98	3,093.56	16,304.49	19,398.05
April	2,979.45	14,384.16	14.79	1,675.43			2,994.24	16,059.59	19,053.83
May	3,078.77	22,677.88	14.50	1,649.27			3,093.27	24,327.15	27,420.42
June	3,277.40	52,544.20	14.50	1,564.27			3,291.90	54,108.47	57,400.37
	$49,776.70	$355,336.85	$ 58.58	$12,288.45		$274.80	$49,835.28 (a)	$367,900.10	$417,735.38

(a) Does not agree with amounts shown in 1939 Report account here reported on accrual basis.

TABLE 17

Comparative Income Statement

	Cumulative to June 30,1939	Cumulative to June 30,1940	Twelve Months Fiscal Year 1940	Five Months Fiscal Year 1941	Cumulative to November 30,1940	Twelve Months Ending 11/30/40
Electric Operating Revenue						
Commercial and Industrial Sales	-	274.80	274.80	105,777.60	106,052.40	105,979.08
Sales to Public Authorities for Redistribution	-	12,347.03	12,347.03	19,642.71	31,989.74	30,838.16
Sales to Other Electric Utilities	-	405,113.55	405,113.55	332,007.01	737,120.56	536,077.19
Miscellaneous Electric Revenue		L- .32	L- .32	-	L- .32	L- .32
Total Operating Revenue*	-	417,735.06	417,735.06	457,427.32	875,162.38	672,894.11
Operating Revenue Deductions						
Operating Expenses						
Transmission Expense	1,490.69	41,770.23	40,279.54	43,827.17	85,597.40	82,855.31
Customers' Accounting & Collecting Expense	122.02	3,788.10	3,666.08	3,631.58	7,419.68	7,224.66
Administrative and General Expenses	254,207.43	445,610.34	191,402.91	114,194.47	559,804.81	327,842.38
Total Operating Expenses	255,820.14	491,168.67	235,348.53	161,653.22	652,821.89	417,922.35
Depreciation	587.96	3,106.86	2,518.90	1,910.59	5,017.45	3,745.44
Total Operating Revenue Deductions	256,408.10	494,275.53	237,867.43	163,563.81	657,839.34	421,667.79
Net Operating Revenue	L- 256,408.10	L- 76,540.47	179,867.63	293,863.51	217,323.04	251,226.32
Income Deductions						
Miscellaneous Income Deductions	-	1,000.27	1,000.27	L- 657.86	342.41	342.41
Net Income	L- 256,408.10	L- 77,540.74	178,867.36	294,521.37	216,980.63	250,883.91

This Income Statement omits the following items:

1. Cost of producing energy. Energy is produced by the U.S. Army Engineer Corps and costs are not reflected on our records.
2. Interest during construction. The Administration has not yet established memorandum accounts covering this element.
3. Depreciation on lines and stations. This element was omitted due to the relatively short period any of the lines were in service during fiscal year 1940 and to the fact that our depreciation studies are not yet complete.

* Does not agree with amount shown on Revenue Statement by $0.32, which represents loss on an emergency sale of poles to a municipality due to failure to include stores handling on the bill.

TABLE 18

BONNEVILLE POWER ADMINISTRATION
STATEMENT SHOWING THE CONSTRUCTION PROGRAM
AND CONSTRUCTION COSTS BY BUDGETARY GROUPINGS

Description of Necessary Facilities	Work Order Number	Work Completed or in Progress	June 30, 1939 Work Order Totals	Fiscal Year 1940	June 30, 1940 Work Order Totals	June 30, 1940 Group Totals
1. Transmission System (230 kv)		Lines				
The 230 kv system is intended to consist of a loop interconnecting Grand Coulee and Bonneville Dams by way of the western Oregon and Washington and eastern Washington load centers with all necessary substations. Present authorizations include two lines from North Bonneville westward to Vancouver; one line north from Vancouver to Covington via Kelso and Chehalis; one line north from Covington to Seattle; one line eastward from Covington to Grand Coulee; one line south from Grand Coulee to North Bonneville via Midway.	C5	Bonneville-Vancouver Nos. 1 & 2	$827,247.93	$859,285.23	$1,686,533.16	
	C15	Bonneville-Grand Coulee No. 1	140,090.09	3,743,758.23	3,883,848.32	
	C27	Vancouver-Kelso No. 1	197,772.12	813,079.48	1,010,851.60	
	C30	Kelso-Chehalis (230 kv portion) No. 1	61,867.82	477,109.09	538,976.91	
	C47	Chehalis-Covington No. 1	4.91	580,117.42	580,122.33	
	C99	Bradford Island Crossing No. 3		1,437.09	1,437.09	
	C120	Control Cable, etc. - North Bonneville Switching Sta.		507.10	507.10	
			1,526,982.87	6,175,293.64	7,702,276.51	
		Substations and Radio Stations				
	C7	North Bonneville Substation	21,843.62	413,250.52	435,094.14	
	C8	North Vancouver Substation and Radio Station	261,651.53	1,358,372.39	1,620,023.92	
	C16	Midway Substation and Radio Station	3,077.78	48,492.56	51,570.34	
	C32	Chehalis " " " "	4.85	60,575.97	60,580.82	
	C76	Covington Substation Site		6,235.53	6,235.53	
	C83	No. Vancouver Substation - Sec. Trans. Bank & Sw. Eq.		23,959.74	23,959.74	
			286,577.78	1,910,886.71	2,197,464.49	
		Total Group 1	1,813,560.65	8,086,180.35	9,899,741.00	9,899,741.00
2. Transmission System (115 kv)						
(a) Western Oregon		Lines				
The authorized facilities in this group consist of two lines from North Vancouver to St. Johns, Oregon, one line from St. Johns westward to Astoria, Oregon, and one line from St. Johns southward to Eugene via Oregon City, Salem, and Albany. An additional line has been authorized to extend from South Bonneville to Oregon City.	C20	Vancouver-Eugene	629,972.24	958,158.21	1,588,130.45	
	C34	Bonneville-Oregon City		50,054.47	50,054.47	
	C54	St. Johns-Tillamook		47,448.80	47,448.80	
	C64	St. Johns-Astoria		259,673.56	259,673.56	
	C112	Oregon City-Salem		7,452.85	7,452.85	
			629,972.24	1,322,787.89	1,952,760.13	
		Substations and Radio Stations				
	C13	South Bank Substation	7,197.44	56,757.86	63,955.30	
	C21	St. Johns "	17,995.09	280,446.69	298,441.78	
	C22	Oregon City "	608.59	1,490.42	2,099.01	
	C23	Salem Substation and Radio Station	6,774.54	171,779.40	178,553.94	
	C24	Albany Substation	10,149.33	11.26	10,160.59	
	C25	Eugene Substation and Radio Station	21,673.96	156,802.76	178,476.72	
	C53	Astoria Substation		1,888.80	1,888.80	
	C65	Purchase of Forest Grove Substation		9,633.12	9,633.12	
	C103	Forest Grove Substation Additions		112.47	112.47	
	C122	Albany Substation Additions		275.49	275.49	
			64,398.95	679,198.27	743,597.22	
		Total Group 2 (a)	694,371.19	2,001,986.16	2,696,357.35	2,696,357.35

(Sheet 1)

TABLE 18
(Continued)

Description of Necessary Facilities	Work Order Number	Work Completed or in Progress	June 30, 1939 Work Order Totals	Fiscal Year 1940	June 30, 1940 Work Order Totals	June 30, 1940 Group Totals
2. (Continued)						
(b) Western Washington		Lines				
The authorized work in this area consists of a 115 kv line extending from Chehalis, Washington to Raymond, Washington	C30	Kelso-Chehalis-Raymond (115 kv portion)	79,338.24	387,815.65	467,153.89	
		Substations and Radio Stations				
	C28	Kelso Substation and Radio Station	*12,299.05	19,942.87	32,241.92	
	C33	Raymond " " " "	9,090.75	306,003.00	315,093.75	
	C123	Raymond Substation Additions		38.37	38.37	
			21,389.80	325,984.24	347,374.04	
		Total Group 2 (b)	100,728.04	713,799.89	814,527.93	814,527.93
		*Shown as Chehalis in 1939 Report.				
(c) Eastern Washington		Lines				
The work authorized in this area includes a line from the Midway Substation westward to Ellensburg, Washington via Yakima, and a line eastward from Midway via Hanford, Pasco, Walla Walla, and Lewiston, Idaho, to Colfax, Washington.	C42	Midway-Ellensburg		106,387.50	106,387.50	
	C75	Midway-Hanford		13,446.46	13,446.46	
	C97	Pasco-Walla Walla		11,443.77	11,443.77	
	C102	Hanford-Pasco		14,152.79	14,152.79	
				145,430.52	145,430.52	
		Substations and Radio Stations				
	C43	Yakima Substation		155.13	155.13	
	C44	Ellensburg Substation and Radio Station		3,439.04	3,439.04	
				3,594.17	3,594.17	
		Total Group 2 (c)		149,024.69	149,024.69	149,024.69
(d) Eastern Oregon		Lines				
Authorized work includes a 115 kv line eastward from South Bonneville to The Dalles, Oregon, via the city of Hood River, Oregon, and a 115 kv line extending from Walla Walla, Washington, southward to Pendleton, Oregon.	C35	Bonneville-The Dalles	116,409.54	333,844.95	450,254.49	
	C119	Walla Walla-Pendleton		1,719.59	1,719.59	
			116,409.54	335,564.54	451,974.08	
		Substations and Radio Stations				
	C36	Hood River Substation and Radio Station	7,836.52	69,147.27	76,983.79	
	C37	The Dalles Substation	1,300.73	4,158.76	5,459.49	
			9,137.25	73,306.03	82,443.28	
		Total Group 2 (d)	125,546.79	408,870.57	534,417.36	534,417.36

(Sheet 2)

TABLE 18
(Continued)

Description of Necessary Facilities	Work Order Number	Work Completed or in Progress	June 30, 1939 Work Order Totals	Fiscal Year 1940	June 30, 1940 Work Order Totals	June 30, 1940 Group Totals
Feeder Lines, Service Connections to Load Areas						
The construction of feeder lines and service connections is necessarily dependent upon executed contracts for delivery of power. This subdivision covers all transmission construction necessitated by the requirements of existing and proposed contracts.	C3	Line Transformers - Fiscal Year 1939	2,189.73	439.09	2,628.82	
	C4	Customers' Meters	321.80	L- 12.42	309.38	
	C12	Cascade Locks Line	15,464.21	L- 149.20	15,315.01	
	C19	Northwest Electric Co Tie-Line at No. Bonneville	4,543.57	484.81	5,028.38	
	C59	Intermediate Transformers		6,579.35	6,579.35	
	C60	Meters		6,638.58	6,638.58	
	C62	Sectionalizing Fuses, Cascade Locks Line		167.84	167.84	
	C63	Underground 13.8 kv Feeders, So. Bank Substation		10,677.61	10,677.61	
	C67	Klickitat Extension		67,018.98	67,018.98	
	C71	Alcoa Service		62,706.21	62,706.21	
	C72	Salem-McMinnville Line Survey		20,157.17	20,157.17	
	C73	Purchase & Survey of West Coast Power Co. Properties	1,173.00	160,583.07	161,756.07	
	C77	Salem-McMinnville 69 kv Line Construction		10,756.86	10,756.86	
	C78	McMinnville Substation		2,517.38	2,517.38	
	C79	Centralia Metering Equipment		245.43	245.43	
	C80	Rehabilitation - West Coast Power Co. Properties		2,065.41	2,065.41	
	C81	Chehalis-Centralia 69 kv Line		8,281.06	8,281.06	
	C82	Sierra 115 kv Line		1,951.45	1,951.45	
	C105	Covington-Tacoma 115 kv Line		13,919.26	13,919.26	
	C115	Purchase Willapa Electric Properties	306.17	159,422.96	159,729.13	
	C116	Service to Monmouth		2,666.51	2,666.51	
	C118	Ilwaco Substation Additions		47.91	47.91	
		Total Group 3	23,998.48	537,165.32	561,163.80	561,163.80
Advance Surveys, Design, and Investigations for Future Construction						
In order to establish the economic feasibility and necessity for additions to the system and to keep abreast of current developments and area economies, provision is made for funds each year for advance surveys and preliminary design of system additions. When construction results from these advance surveys, the amounts expended for the advance surveys and preliminary design will be transferred to the group appropriate for the facilities constructed. However, if it is determined that facilities will not be constructed, the amounts included herein will be charged against income in the year in which the determination is made.	C10	Preliminary Investigations and Studies	519.42	7,340.60	7,860.02	
	C17	Bonneville-Midway Line No. 2		21,344.56	21,344.56	
	C18	Midway-Grand Coulee Line No. 2		7,973.85	7,973.85	
	C46 (J2)	General System Planning Studies		5,945.79	5,945.79	
	C48	Covington-Grand Coulee Survey	4.95	117,867.71	117,872.66	
	C52	Coulee-Spokane Preliminary Surveys		239.91	239.91	
	C55	Vancouver-Chehalis 230 kv Line No. 2		3,412.93	3,412.93	
	C74	Salem-Corvallis Line Surveys		8,272.04	8,272.04	
	C114	Transmission & Distribution Maps of Existing Power Systems		5,759.23	5,759.23	
	C117	Basic Power Surveys for Pacific Northwest Region		8,781.07	8,781.07	
	C121	Preliminary Survey and Investigation Charges		34,060.18	34,060.18	
		Total Group 4	524.37	220,997.87	221,522.24	221,522.24
Furniture, Tools and Work Equipment						
Provision is made each year for acquisition and replacement funds, depending upon the approved program and the existing inventory covering such equipment. Depreciation on these items will be capitalized in construction costs or charged to operations as indicated by their use.	C1	Tools and Work Equipment Fiscal Year 1939	57,388.70	12,338.90	69,727.60	
	C38	Equipment Purchase		260.23	260.23	
	C45	Furniture and Equipment Fiscal Year 1939	53,296.38	6,380.92	59,677.30	
	C46 (J5)	A.C. Network Analyzer		256.58	256.58	
	C50	Furniture, Tools, and Work Equipment, P.W.A.		16,300.26	16,300.26	
	C51	" " " " " "		110,739.40	110,739.40	
	C57	" " " " " , Fiscal Year 1940		280,605.98	280,605.98	
	C58	" " " " " , " " "		94,161.63	94,161.63	
	C68	" " " " " , Oper. Sec.		1,965.24	1,965.24	
		Total Work Orders	110,685.08	523,009.14	633,694.22	633,694.22

TABLE 18
(Continued)

Description of Necessary Facilities	Work Order Number	Work Completed or in Progress	June 30, 1939 Work Order Totals	Fiscal Year 1940	June 30, 1940 Work Order Totals	June 30, 1940 Group Totals
5. Furniture, Tools and Work Equipment, (Continued)		Equipment Donated by Other Federal Agencies		1,794.92	1,794.92	
		Equipment Retired		L- 1,348.60	L- 1,348.60	446.32
		Total Group 5 - Equipment	110,685.08	523,455.46	634,140.54	634,140.54
6. Permanent Buildings						
Under this heading are included all permanent buildings not considered as appurtenances to substations.	C38	Permanent Warehouse, Shop and Garage Building	5,102.05	192,033.57	197,135.62	
		Total Group 6	5,102.05	192,033.57	197,135.62	197,135.62
		Total Groups 1 to 6, inclusive	*2,874,516.65	12,833,513.38	15,708,030.53	15,708,030.53
		W.P.A. Contributions (See note)				2,514,431.27
						18,222,461.80
		Depreciation Reserve				L- 122,528.53
		Total Fixed Assets (See Table 1)				$18,099,933.27

NOTE: W.P.A. Contributions - Clearing Right-of-way not included in above tabulation

Work Order	C5	$396,849.64
" "	C15	582,207.53
" "	C20	63,749.22
" "	C27	482,839.73
" "	C30	655,537.28
" "	C34	23,246.32
" "	C35	264,945.73
" "	C47	45,055.82
		$2,514,431.27

*See Reconciliation, Table 18a.

TABLE 18a

BONNEVILLE POWER ADMINISTRATION

Reconciliation of Amount Shown as "June 30, 1939" on "Statement Showing the Construction Program and Construction Costs by Budgetary Groupings" with Total Shown on "Work in Progress Statement" in the Fiscal Year 1939 Report

Total Work in Progress June 30, 1939 as shown by 1939 annual report		$2,770,079.95
Deductions:		
Less Work Orders closed to operating and general expense accounts		
C14 Rate Research	$4,820.81	
C40 Alterations, etc.-Adcox Building	1,911.51	
C41 Alterations, etc.-New Lloyd Building	995.23	
Total Deductions		7,727.55
		2,762,352.40
Additions:		
Add items not shown on 1939 statement		
142.1 Acquisition Costs West Coast Properties	1,173.00	
142.2 Acquisition Costs Willapa Properties	306.17	
C1 Tools and Equipment Fiscal Year 1939	57,388.70	
C45 Furniture and Equipment Fiscal Year 1939	53,296.38	
Total Additions		112,164.25
Total Shown as June 30, 1939, in this Annual Report		$2,874,516.65

Construction and Other Capital Items

Costs incurred for construction work in progress, plant acquisitions and equipment purchases were correlated[1] to the administration's program by budgetary groups. This tabulation was devised to permit the items to appear in different groups as the program advanced or as changes in the characteristics of certain items to meet new load requirements appeared.

Income Gains In Fiscal Year 1941

A major characteristic of the Power Administration's financial position in the period immediately following the close of the fiscal year 1940 was the rapid gain made in rate of income from sales of power.

As of November 30--only five months after the close of fiscal 1940--the administration's income statement showed a net income of $216,980.63. This net income appeared in spite of a heavy administrative and general expense incident to the development of a new power sales agency on a "going" basis.

PROCUREMENT DIVISION

The Power Administration's procurement program was maintained on a stable basis during fiscal 1940, with the volume of purchases remaining at practically the same figure as that for the preceding fiscal year.

Purchase orders written during the 12-month period involved the sum of $8,164,734.58. This total did not vary substantially from that of fiscal 1939.

Nearly every section of the country benefitted in some degree from the administration's purchase program. During the year 41 states contributed materials necessary to the operation of the system. In fiscal 1939 Bonneville purchases had been made in only 28 states. These purchases involved the execution of 731 contracts for construction materials and supplies, 49 contracts covering utility services and 56

1/ See Table 18, pp. 87-90

covering leases for office and storage space.

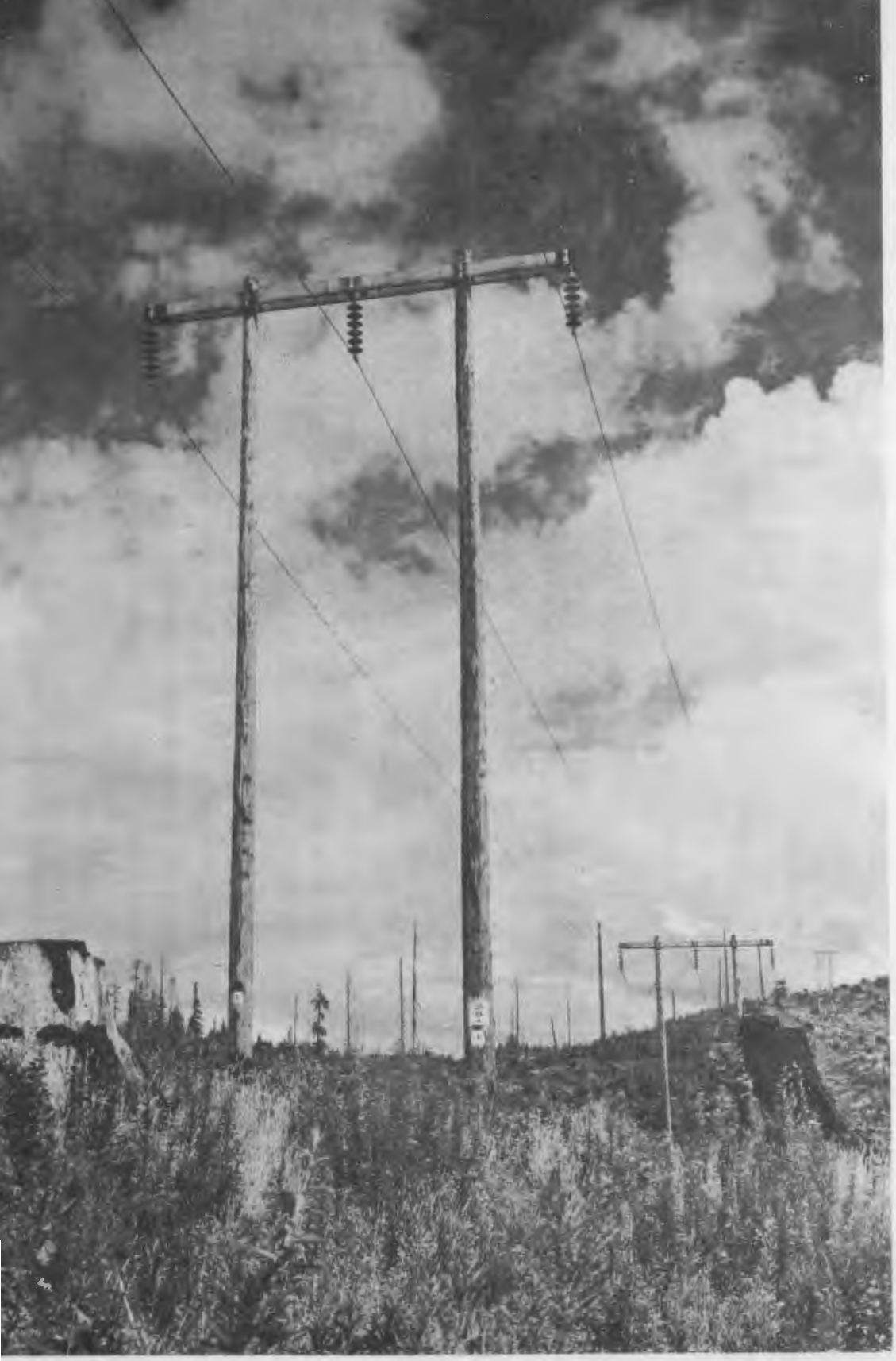
Expenditures by the Power Administration in foreign countries totaled $765.13.

Volume of the agency's purchases during the period necessitated the handling of 595 carloads of material and the issuance of 1,270 bills of lading.

Following is a statement of the geographical distribution of expenditures during the fiscal year:

Alabama	$ 5,123.46
Arizona	7.65
Arkansas	147.00
California	453,510.90
Colorado	91.10
Connecticut	19,353.22
Delaware	247.21
District of Columbia	9,544.36
Florida	9.00
Georgia	1,314.86
Idaho	100,830.80
Illinois	267,315.52
Indiana	11,565.01
Iowa	6,266.25
Kansas	466.31
Kentucky	144.00
Maine	36,999.79
Maryland	46,206.48
Massachusetts	572,848.23
Michigan	114,799.99
Minnesota	12,011.21
Missouri	38,695.46
Montana	16,733.79
Nebraska	16.30
Nevada	2.35
New Jersey	209,976.54
New York	1,062,112.88
North Dakota	1.00
Ohio	186,635.71
Oklahoma	86.85
Oregon	684,157.35
Pennsylvania	2,835,807.25
Rhode Island	19,534.16
South Dakota	101.10
Tennesee	407.80
Texas	3,311.73
Utah	2,488.63
Virginia	936.65
Washington	1,306,969.89
West Virginia	62,572.34
Wisconsin	75,384.45
Total	$8,164,734.58

Harvesting on right-of-way of Bonneville transmission line in Willamette Valley.



The Chehalis-Raymond transmission line which serves public utility districts in Pacific, Wahkiakum and Grays Harbor counties, Wash.

Division Reorganized in Fiscal 1941

During the first three fiscal years the Procurement division had fulfilled a number of duties related indirectly to its principal function as purchasing agent for the administration. These included maintenance of the agency's motor transportation system, operation of its warehouses, maintenance of communications equipment, maintenance of property records and inspection of materials. These operations grew rapidly in volume with the growth of the construction and power sales program until they became sufficiently complex to warrant the establishment of a special division to handle most of them.

Early in 1941 an Office Service division was set up, by administrative order, to handle all such functions with the exception of materials warehousing and inspection and maintenance of construction equipment.

The Procurement division was thereby permitted to concentrate its activities solely on the business of handling purchases. This made possible the integration of a small, highly specialized civil service procurement staff under the direction of the chief purchasing officer, and on the basis of new procedures resulted in more expeditious handling of the purchasing program, with resulting economies to the administration.

LEGAL DIVISION

The Power Administration's Legal division found its work substantially increased during fiscal 1940 in keeping with the rapid pace set by the agency's power sales and transmission line construction programs.

Power sales contracts were a major item on the year's agenda. A huge volume of actions involving acquisition of lands for rights-of-way and substations demanded a large portion of the staff's attention. Numerous claims against the administration required investigation. More than $7,000,000 worth of construction and other procurement contracts required staff services. In addition to these functions, a large number of miscellaneous legal matters were handled.

Early in the year the Legal division presented to the Federal Power Commission and obtained its approval on new wholesale rate schedules governing the sale of Bonneville power. Throughout the year the division participated actively in the negotiation and drafting of power contracts with five public utility districts, eight municipalities, one REA cooperative, two private utility companies, and two industrial corporations. These contracts provided for the sale or interchange of Bonneville power. Outstanding were two contracts with the Aluminum Company of America, providing for the sale to that company of a total of 65,000 kilowatts of prime power.

The Legal division worked with the Land division in the development of procedures with the Department of Justice and in completing a substantial amount of land acquisition work[1]/. Condemnation proceedings involving right-of-way properties needed for completion of the agency's 1939 network construction program resulted in a total of 669 judgments fixing compensation and dispensing funds to landowners. Only 11 of these cases required settlement by contested jury trials, but all of them required considerable legal work for the reason that Bonneville assumed the obligation of assisting the proper persons to secure payment and of aiding the courts in determining to whom payment properly should be made.

In each of the 11 cases in which compensation was fixed by a contested jury trial, the Legal division handled the preparation of the evidence and participated in the trial. The jury verdicts in these cases averaged less than 10 per cent in excess of the original estimated just compensation deposited at the time the actions were instituted.

In addition to the land acquisition and power contract work, the Legal division handled a large variety of miscellaneous legal matters. Bonneville's power customers required rights to build lines connected with the government substations. Railroads, public utility and other companies and individuals required the right to cross under and over Bonneville transmission lines with tracks, roads and power and telephone lines. The Legal division negotiated and drafted many types of instruments creating licenses or easement rights in government rights-of-way and substation sites and numerous franchises and crossing agreements permitting Bonneville's lines to cross municipal streets, state highways, county roads, railroads, telephone lines and other power lines.

1/ See Land Division Report pp. 96-103

The legal staff also examined and passed upon a total of 702 construction and other procurement contracts. Briefs were prepared for presentation to the General Accounting office on many important problems. Approximately 225 claims against the Bonneville Power Administration were examined and disposed of. The staff investigated and made findings with reference to accidents involving the Administration's motor vehicles. A total of 180 formal written opinions of the General Counsel were prepared, covering a wide variety of legal questions upon requests by the Administrator and the various division and section heads of the administration.

LAND DIVISION

During the year ending June 30, 1940, the Power Administration's Land division was engaged in the completion of negotiations with landowners on the 547 miles of transmission line rights-of-way authorized for the 1939 construction program and in the appraisal, negotiation, title clearance and payment to landowners for the 1940 construction program.

A major characteristic of the year's work was the substantial decrease in the cost per mile of right-of-way. Average cost for lines on the 1939-1940 construction program was $437.55 per mile. This was in marked contrast to an average cost of $1,597.72 per mile for right-of-way acquired for lines of the 1938-1939 construction program.

Behind this saving lay extensive revisions in acquisition procedure. Most effective was a major change in policy by which the Power Administration abandoned purchase by title in fee on right-of-way lands in favor of easement purchases only. This reduced per-mile costs by permitting owners to retain title and continued use of their lands, thus eliminating payment of severance damages. It also permitted the lands affected to remain on the tax rolls. A contributing factor in the reduction lay in the fact that right-of-way needed for the 1940 program traversed lands on which timber and other values were lower.

A second important development during the year was revision of acquisition procedure in such a way as to make possible rapid payment of landowners' claims. A system was devised in cooperation with the Department of Justice which permitted elimination of the delays which in previous years had kept right-of-way funds from reaching such landowners promptly.

Scope of Year's Work

In scope, the year's activities involved work for the 1939 construction program on a grand total of 1666 separate right-of-way tracts and 36 substation tracts needed; while for the 1940 program there had been received by June 30, 1940, requests for 908 required right-of-way tracts and 13 substation tracts, representing an estimated 50% of the total expectancy for the 1940 program.

The Land division was also engaged during the year in the appraisal, purchase, determination of title and subsequent payment for the removal of standing timber adjacent to the 1939 program lines where the right-of-way had been acquired partly under mass condemnation and partly by direct purchase. The Engineering division had determined that such timber constituted a hazard to the continuous operation and maintenance of the lines. This work involved purchases of timber on 410 separate ownerships.

Acquisition Policy Studied and Revised

On August 15, 1939, it was administratively determined that the policy for the acquisition of right-of-way, substation sites and other interests in land after that date would be handled by direct purchase and that recourse would be had to judicial proceedings only upon inability to agree with a landowner as to the amount of damages to be paid or when satisfactory title could not be obtained otherwise.

This was a radical departure from the administration's previous policy. During the first two fiscal years the need for unusually rapid construction of transmission lines, arising from the fact that power was awaiting delivery and sale at Bonneville, had made it desirable to acquire rights-of-way by mass condemnation suits and the "declaration of taking" procedure. This method, while permitting the agency to take immediate possession of lands needed for its initial network, had the disadvantage of requiring court action on every ownership, with the result that costs were high and disbursement of right-of-way monies to landowners was slow.

As one of its first management projects of the new fiscal year the Bonneville Administration undertook to find a solution for this problem. Early in September 1939 the administration secured the loan of the services of the Director and Assistant Director of Land

Acquisition at the Tennessee Valley Authority for a study of Bonneville acquisition procedure and policies then in operation. On September 15, 1939, a report reviewing existing procedure and suggesting revisions was submitted to the Administrator.

Major recommendations were (1) acquisition of easements rather than of titles in fee, (2) continuance of the new policy of direct negotiation with each landowner, (3) a method for cooperation with the Department of Justice in obtaining rapid settlement of cases to be handled by the new, direct negotiation method, and (4) reorganization of the land acquisition staff on a functional basis.

To facilitate the new, recommended procedures, arrangement was made with the Tennessee Valley Authority whereby Bonneville secured the loan of the services of its Assistant Director of Land Acquisition, its Chief Land Buyer and a title expert for a period of several months.

Position of the administration's acquisition program on October 1, 1939, when these three men assumed their duties, was as follows:

There were an estimated 1,672 tracts involving 544.21 miles of right-of-way, for which monies had been deposited in Federal court for payment on mass condemnation suits. For these $94,074.91 had been paid on 104 tracts.

This litigation involved only lands needed for the 1939 construction program, and in view of the fact that it had been decided to pursue only a direct purchase policy in the future, it was imperative that a workable title procedure be developed, in cooperation with the Department of Justice, as rapidly as possible so that no delays would develop under the new procedure. Contacts were therefore made in Washington, resulting in conferences with representatives of the Justice Department through the month of November. As a result of these, a policy and procedure governing title approval by the Attorney General in direct purchase acquisition of transmission line easements was worked out. This was put into effect for the Bonneville Power Administration on December 7, 1939. Subsequent practice has proved that this procedure is more practical and economical than that of any Federal agency whose title work is or has been subject to the approval of the Attorney General, and that it has greatly reduced the time required for payments to landowners.

The first payment under this new procedure was made on December 22. Appraisals of lands needed for the 1940 line construction

program began under this new procedure in November. Acquisition operations followed early in January.

With respect to rights-of-way of other interests in land which could not be acquired through direct purchase, or which, for title reasons, required condemnation, the Land division undertook to complete all title work prior to court action, thus making all monies available to owners immediately upon action of the court. In previous mass condemnations, due to the necessity for meeting construction requirements, title work was subsequent to the court action, resulting in unavoidable delay in payment to landowners.

Costs Drop Rapidly Through Year[1]

On July 1, 1939, at the beginning of the fiscal year, there were on hand 127.89 miles of right-of-way commitments totaling 4,191.84 acres at a total cost of $473,915.20. This represented an average cost of $3,705.65 per mile, exclusive of standing timber adjacent to the rights-of-way and designated for removal by the Chief Engineer. These figures represented the sum of right-of-way acquisition completed for the 1939 construction program. The high cost per mile was a reflection of the fact that the right-of-way involved was largely used for the Bonneville-Vancouver and Bonneville-Grand Coulee lines of the agency's major network and that most of the acquisition was in fee simple.

As the fiscal year progressed the new acquisition procedures brought a marked reduction in the per-mile cost of the remaining right-of-way needed for the 1939 construction program. By the close of the year an additional 843 tracts had been acquired for the 1939 construction program. These totaled 371.76 miles of right-of-way. Total cost was $324,387.10, or an average of $872.57 per mile.

At the close of the year, acquisition of rights-of-way for lines on the 1939 program totaled 499.65 miles with an overall average cost of $1,597.72 per mile.

1/ See Table 19, p. 100.

TABLE 19

LAND ACQUISITION PROGRAM

July 1, 1939 - July 1, 1940

1939 Program Lines

Summary of Work to July 1, 1939	No. Tracts	Miles	Acres	Acquisition Cost
Right-of-Way	682	127.89	4,191.84	$473,915.20 1/
Substation Sites	19		184.81	54,357.65 2/

1/ Average cost per mile - $3,705.65
2/ Average cost per acre - $ 294.12

Summary of Work 7/1/39 - 7/1/40				
Right-of-Way	843	371.76	8,078.48	$324,387.10 1/
Substation Sites	13		125.37	23,222.00 2/

1/ Average cost per mile -$872.57
2/ Average cost per acre -$185.23

Grand Total to Date 1939 Lines				
Right-of-Way	1525	499.65	12,270.32	$798,302.30 1/
Substation Sites	32		310.18	77,579.65 2/

1/ Average cost per mile - $1,597.72
2/ Average cost per acre - $250.11

1940 Program Lines

Summary of Work to July 1, 1940				
Right-of-Way	873	176.20	3,355.43	77,097.06 1/
Substation Sites	7		56.40	9,230.00 2/

1/ Average cost per mile - $437.55
2/ Average cost per acre - 163.65

Still further reduction in right-of-way costs was achieved in the acquisition of lands needed for lines scheduled on the 1940 construction program which was begun in the second half of the fiscal year. At the close of the year options on 176.20 miles, or 3,355.43 acres, had been obtained at an average cost per mile of $437.55, inclusive of standing timber adjacent to the right-of-way and designated for removal. During the year there were also acquired 39 permanent access roads involving 27 miles.

Payments Total $568,222.64 1/

Payments to landowners during the year totaled $568,222.64, and were of two types: those for which monies had been deposited with the Federal courts under the mass condemnation actions for the 1939 construction program, and those which were made under the new title procedure which became operative during the fiscal year. The first group comprised a total of $415,856.00 deposited with the Federal courts for release to 528 landowners. The second comprised a total of $152,336.64 to 573 landowners. In detail this latter group included $136,951.23 to 336 landowners for 107.55 miles of right-of-way, $8,602.91 to 14 owners for 58.66 acres of substation land, $350 for one access road, and $6,462.50 to 222 owners of timber adjacent to right-of-way.

Contested Cases Few

During the fiscal year only 11 ownerships, embracing 136.03 acres, reached the point of being contested in the courts. These cases involved a total of $20,016.88 and represented 1.3% of the total number of tracts acquired during the fiscal year. There were no contested cases during the previous fiscal year. Therefore, the foregoing 11 cases represented the grand total of all litigation of this class, and if further compared against all land acquisition from the inception of the project to July 1, 1940, represented slightly less than half of one per cent.

1/ See Table 20, p. 102.

Still further reduction in right-of-way costs was achieved in the acquisition of lands needed for lines scheduled on the 1940 construction program which was begun in the second half of the fiscal year. At the close of the year options on 176.20 miles, or 3,355.43 acres, had been obtained at an average cost per mile of $437.55, inclusive of standing timber adjacent to the right-of-way and designated for removal. During the year there were also acquired 39 permanent access roads involving 27 miles.

Payments Total $568,222.64 1/

Payments to landowners during the year totaled $568,222.64, and were of two types: those for which monies had been deposited with the Federal courts under the mass condemnation actions for the 1939 construction program, and those which were made under the new title procedure which became operative during the fiscal year. The first group comprised a total of $415,856.00 deposited with the Federal courts for release to 528 landowners. The second comprised a total of $152,336.64 to 573 landowners. In detail this latter group included $136,951.23 to 336 landowners for 107.55 miles of right-of-way, $8,602.91 to 14 owners for 58.66 acres of substation land, $350 for one access road, and $6,462.50 to 222 owners of timber adjacent to right-of-way.

Contested Cases Few

During the fiscal year only 11 ownerships, embracing 136.03 acres, reached the point of being contested in the courts. These cases involved a total of $20,016.88 and represented 1.3% of the total number of tracts acquired during the fiscal year. There were no contested cases during the previous fiscal year. Therefore, the foregoing 11 cases represented the grand total of all litigation of this class, and if further compared against all land acquisition from the inception of the project to July 1, 1940, represented slightly less than half of one per cent.

1/ See Table 20, p. 102.

TABLE 20

PAYMENTS TO LANDOWNERS

Payments by Land Division since October 1, 1939	Cases	Miles	Acres	Dollars
Transmission Lines	336	107.55	2,401.25	$136,951.23
Substation Sites	14		58.66	8,602.91
Access Roads	1			350.00
Danger Trees	222			6,462.50
Grand Total of Payments Made by Land Division	573			$152,366.64
Payments to Landowners by Federal Courts of Funds Deposited. (Title work by Legal division, with title certificates furnished by Land division.	528	172.87	4,105.26	$415,856.00
Grand Total of all Monies Paid for Lands from Inception of Bonneville Program to July 1, 1940.	1,101	280.42	6,565.17	$568,222.64

CONDEMNATION ACTIVITIES

Tracts Referred to General Counsel for Condemnation since October 1, 1939. (with title examination completed)				
Right-of-Way	25	7.96	133.89	$ 8,874.00
Substation Sites	7		55.64	4,200.00
Contested Condemnation Cases				
Right-of-Way	10		111.38	$ 15,516.88
Substation Sites	1		24.65	4,500.00

In connection with mass condemnation actions instituted during the previous fiscal year, appearances were made in court in support of the appraisals on 269 tracts, to assist in the release of funds to the owners.

Acquisition Costs Drop in Fiscal 1941

Following the close of fiscal 1940--the period covered by the above report--further substantial reduction in the per-mile cost of right-of-way was achieved.

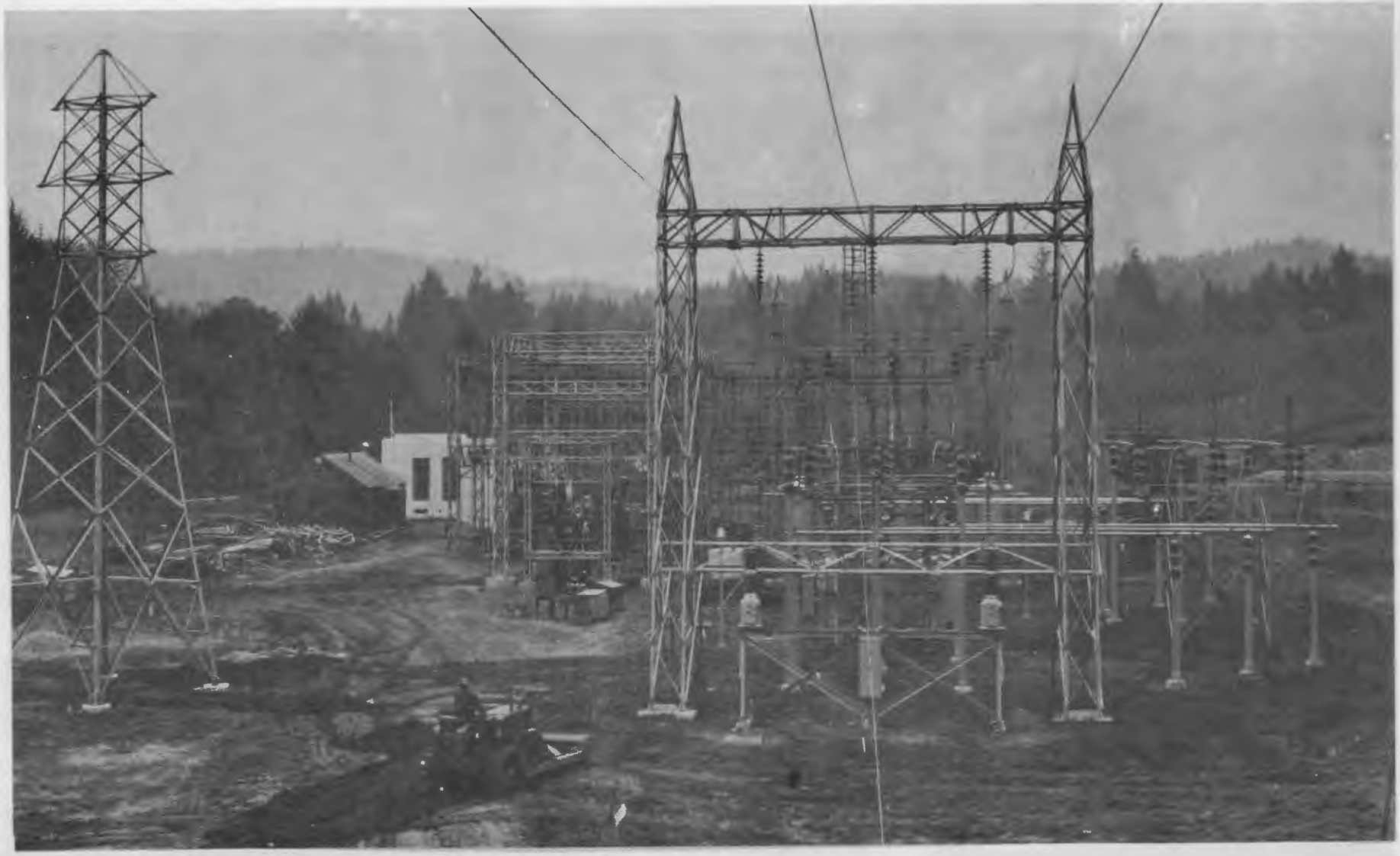
During the six-month period between July 1 and December 31, 1940, the Engineering division requested the purchase of easements on approximately 950 tracts of right-of-way and fee title on nine substation tracts. This land was for use in the completion of the 1940 transmission line program. By December 31 the Land division had contracted for approximately 878 of these tracts. These contracts involved 273.29 miles of right-of-way valued at $75,074.20 and six substation tracts in fee comprising 13.23 acres at a cost of $4,345.

These negotiations reduced the over-all average cost of right-of-way from $437.55 per mile, as of the close of fiscal 1940, to approximately $325 per mile as of December 31, 1940--the midpoint of fiscal 1941.

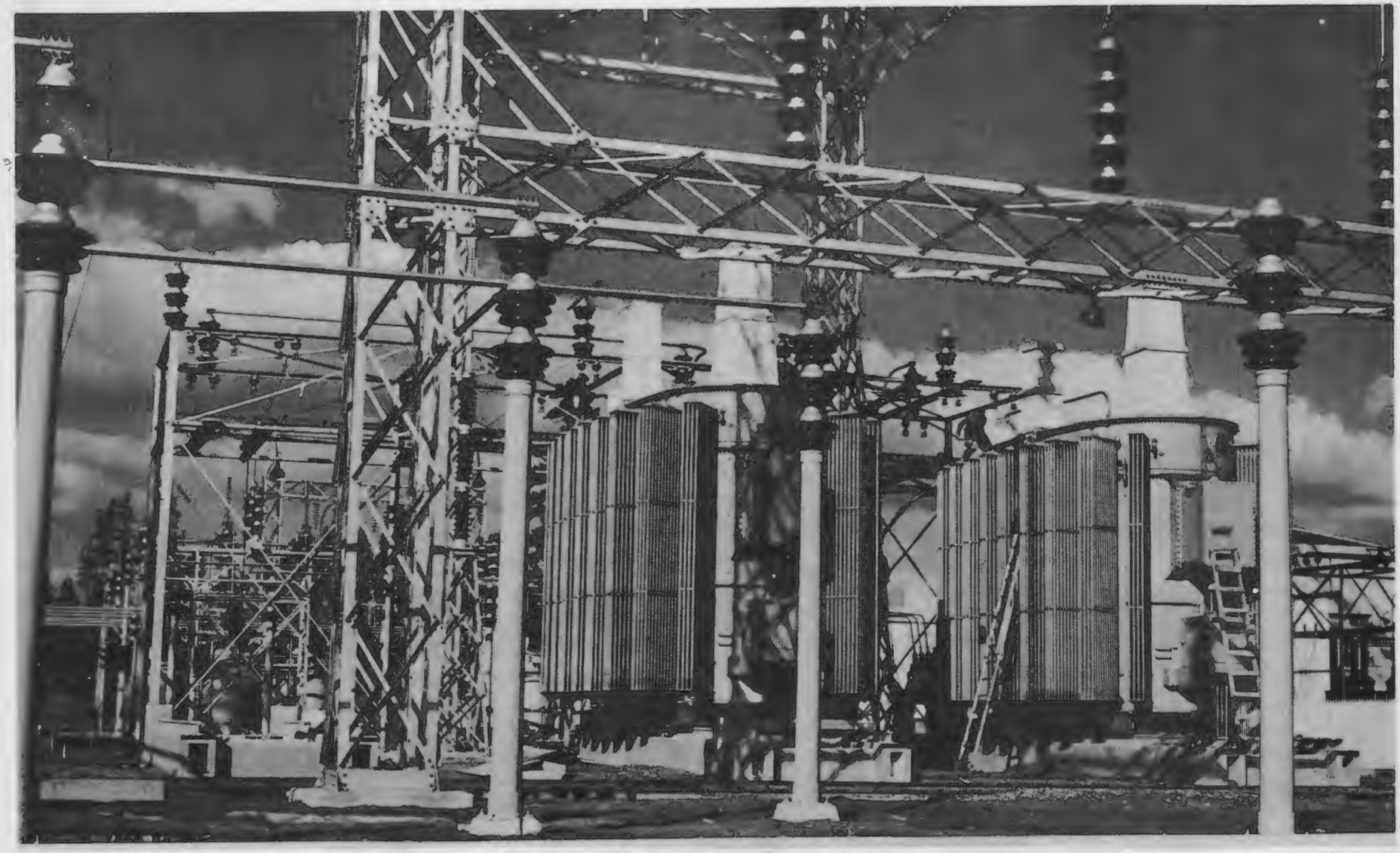
In closing out the acquisition program for lands needed on construction of lines authorized in 1939, the Land division acquired 56 tracts, or 19.23 miles of right-of-way, at a land cost of $38,249.85; and fee title to one 0.45-acre tract at a land cost of $15. Danger tree timber on 342 tracts totaling 20,919 trees was appraised and contracted for at a cost of $20,110.93. Of this, some 340 owners had been paid $16,079.60 by December 31, 1940.

PERSONNEL DIVISION

Because of the desire to bring the Power Administration's employment methods into close coordination with those of the Department of the Interior and the United States Civil Service Commission, and because of the need of conforming the agency's



Raymond Substation during construction.



Mammoth transformer bank during installation at North Vancouver substation.

employment program to the rapidly growing construction program and its needs for a specialized staff, special attention was given to personnel activities during the fiscal year.

A basic personnel program was formulated and put into effect by administrative order on June 7, 1940. This program included the establishment of the Personnel unit as a division under the Assistant Administrator and the development of offices specializing in recruitment, training, classification, employee relations, and related problems. Such an organization permitted expeditious handling of all personnel matters in strict accordance with civil service regulations, Department of Interior policies, and with Section 10 of the Bonneville Act.

At the close of fiscal 1940, the administration's personnel program showed the following characteristics: (1) a high percentage of employment from among Northwest residents, (2) a rapid increase in the percentage of civil service employees, (3) a high percentage of total employees engaged as hourly laborers and skilled craftsmen.

At the close of fiscal 1939, the Power Administration had a total of 969 employees. Of this number 230 were laborers employed on work in connection with the agency's construction program. These could not be considered as permanent employees inasmuch as the positions were not classified under existing civil service regulations. Of the remaining 739, 478 or approximately 64 per cent held civil service appointments. The remaining 261 employees held professional, consultant or expert staff positions or were appointed under authorizations applicable to the use of Public Works Administration funds.

At the close of fiscal 1940, the agency had a total of 2,421 employees. Of this number, 947 were laborers, employed in connection with the construction program, filling jobs which were considered temporary and not classified under civil service regulations. Of the remaining 1,474, 1,316 or approximately 91 per cent held civil service appointments. The remaining 158 positions included all professional, consultant or expert staff appointments. These figures showed a gain of approximately 27 per cent in the proportion of civil service positions during the period of the fiscal year.

In all three fiscal years of the Power Administration's existence the percentage of local employment both civil service and non-civil service was high. At the end of fiscal 1938, 89.8 per cent of all employees were residents of Oregon and Washington. At the end of fiscal 1939, the number had increased to 92 per cent. At the end of fiscal 1940 the number had increased to 92.6 per cent.

Personnel Activities in Fiscal 1941

As fiscal 1940 drew to a close, the problem of employee recruitment became acute as a result of the great demand for skilled workers incident to the national defense program.

Accordingly, in the first months of fiscal 1941, greater emphasis was placed on in-service training for the purpose of developing the efficiency of all employees, and for the instruction of new appointees upon entrance on duty to better qualify them for their specific duties.

In cooperation with the Department of Vocational Education, and with funds supplied by the National Defense Training Program, training classes for carpenters, carpenter helpers and related trades were inaugurated. Plans were prepared for classes in such trades as welding and electrical work. Progress was also made in developing a training program for engineers. By mid-year in fiscal 1941 a training schedule had been prepared for the supervisory staff of the administration, with lectures and discussion groups scheduled for opening the latter part of February, 1941 on administrative policies and functions of the entire organization.

Because of Bonneville's importance as a wholesale power supplier, the administration received status as a defense agency in November, 1940. This action permitted the Personnel division to take advantage of the special regulations applying to staff maintenance and recruitment.

Other developments in the personnel program in 1940 included the establishment of a Safety section, for the purpose of supervising the safety education of all employees and detection and elimination of hazardous and unsafe practices; and the establishment of a Wage Rate unit within the Recruitment and Training section to secure establishment of rates of pay on work done for the administration comparable to rates prevailing in the areas served.

INFORMATION DIVISION

Informational activities of the administration were stabilized during fiscal 1940 by the formulation of permanent procedures to make easily accessible to the public all data relative to the agency's operations.

The division's duties were defined on the basis that the Bonneville Power Administration, as a tax supported institution devoted to the conservation, development and use of an important regional resource, should provide prompt and complete reports to the public and to the purchasers of its power on all details of its operations, transactions

and policies. Effort was made in the fulfillment of this function to utilize established media. These included newspapers, especially those in the Northwest region, periodicals of national and regional circulation; radio stations and educational institutions. Demands for such service maintained a constant high level during the year. In addition to a wide variety of press releases and special articles prepared, three visual exhibits were circulated through the region and five official pamphlets covering various phases of the Power Administration's program were issued.

A second duty developed for the division was that of service to other offices of the agency by the collection and compilation of technical and statistical material covering the entire power field.

For the fulfillment of these functions a small permanent staff was set up, comprising positions approved and specified by the classified federal civil service.

Definite controls in the handling of all informational material were established. These included:

(1) A limited mailing list comprising names of individuals, public and semi-public groups of all sorts, schools, libraries, utilities, governmental officials, newspapers and other publications which had filed with the administration bona fide written requests for information.

(2) Provision for a regular canvass of this mailing list with a view to confining the distribution of information to recipients actively desiring it.

(3) Standard procedure for the filling of miscellaneous requests for information, involving requirements that no informational material be mailed without prior receipt of a request in writing.

(4) Standardization of all charts, rate quotations and similar visual material used by Bonneville representatives in filling speaking engagements.

In fulfilling its service function the division assumed the operation of a technical library for the purpose of providing the administration's large engineering and research staff with necessary data on rate and construction procedures, economic planning techniques, utilities regulation and similar subject matter. Provision also was made to provide technical editorial service to the administration's research units in the preparation for publication and release of technical and statistical reports of all types.

These standardization procedures had the dual value of reducing informational costs and improving service to the public generally.

OFFICE SERVICE DIVISION

The Office Service division was created as a new facilitating unit by administrative order during fiscal 1940.

During previous fiscal years the various routine services necessary to the operation of any large enterprise, such as the messenger detail, the central filing system and the transportation and communications systems, had been developed under the general supervision of the administrative offices and the Procurement division as the need arose.

Division Created April 22, 1940

By mid-year in fiscal 1940, however, the Administration's permanent policies had been sufficiently well established and the volume of its activities had been sufficiently well defined to make it advisable to bring these office service routines under a single supervisor. An administrative order dated April 22, 1940, established the Office Service division and charged to it the responsibility for maintenance and operation of the agency's mail and files section, its duplicating section, its communications section and its protection and guard service section.

In addition to the above functions, the division was charged with the responsibility of providing office equipment and supplies to other divisions and with the assignment of office space required by all units of the agency. An acting chief of office service, reporting to the Administrator through the Executive Assistant, was charged with supervision of these functions.

At the close of the fiscal year the new division comprised 73 employees, most of whom had been transferred from other divisions. Of these, 67 held civil service appointments.

Division Expanded in Fiscal 1941

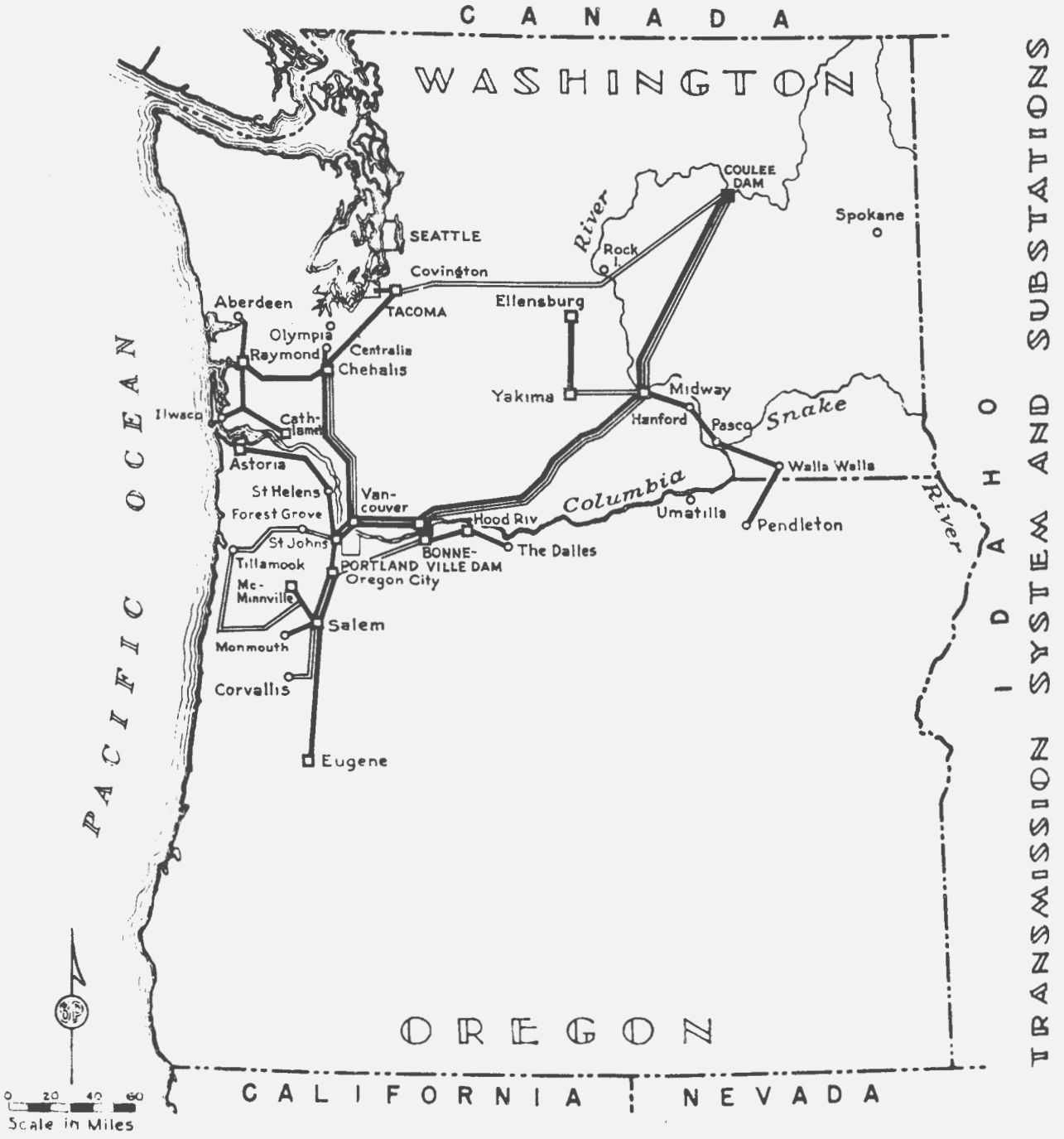
During the first six months of fiscal 1941, operations of the Office Service division were extended. As a result of analyses by

the Management office, the administrative order creating the division was revised under date of September 16, 1940. The division's responsibilities were expanded to include operation of the newly installed tabulating service equipment; supervision of the general service transportation section; supervision of a new, augmented protection section, which included a substantial force of uniformed guards for the protection of the agency's many substations and materials storage depots, and supervision of an office supplies section, comprising a newly established warehouse for the storage of the agency's non-construction supplies.

This enlargement of function resulted from a two-fold necessity: (1) rapid growth of the agency's power marketing program made it imperative to separate its construction from sales and management activities and, in some cases, to service them separately; and (2) speed-up of the entire program to meet national defense needs made it advisable to relieve the Procurement and Administrative divisions of as many routine functions as possible.

By December 31, 1940 the Office Service division comprised a total of 129 employees. Of these, 127 were civil service appointees.

U·S·DEPARTMENT·OF·THE·INTERIOR



TRANSMISSION SYSTEM AND SUBSTATIONS

LEGEND

- SUBSTATIONS.
- LINES COMPLETED OR UNDER CONSTRUCTION.
- SURVEY ONLY.

PLATE XXXIII

CONSTRUCTION PROGRAM

As of May 10, 1940

BONNEVILLE · POWER · ADMINISTRATION

IV CONSTRUCTION AND OPERATION OF THE SYSTEM

(Engineering Division)

Construction of the Bonneville Power Administration transmission system proceeded on many fronts during the fiscal year 1940, as every effort was made to interconnect the government's generating plants at Bonneville and Grand Coulee with other plants and load areas in the Pacific Northwest.1/

During the year the Engineering division, which not only is charged with construction of the transmission system but also with operations, carried on its activities in the fields of research and development, design, and operations.

To meet the increased tempo of activities, the division was reorganized during August and September of 1939. This involved largely a re-grouping of functions which previously had been carried on jointly by certain sections. The reorganization, therefore, resulted in closer supervision of construction and operating activities. Under the plan finally adopted, sections on system engineering, design, materials and inspection, construction, distribution engineering, and operations were established, in addition to the personnel on the Chief Engineer's and Consulting Engineer's staffs.

Where required, these sections were broken down into smaller units, each with specific functions and under the direction of a supervisor responsible for the performance of its duties.

By the end of fiscal 1940, design work had been performed on 16 substations, surveys had been made for 32 transmission lines totaling nearly 1,750 miles, design work had been completed for 12 lines and was in the process for 10 lines, and right-of-way requests and acquisition data had been prepared for 1,115 miles of line.

In addition, complete material deliveries had been made for three substations, and major materials were under order for 11 others. Complete material deliveries were at hand for 11 transmission lines. Contract awards, with partial deliveries, were complete for nearly all materials required for three other lines, and

---

1/ See map, Plate XXXIII.

considerable stock purchases of materials for maintenance and construction purposes had also been made before the close of the year.

Construction work was in full swing at year's end. Eleven substations were under construction. Four, including one temporary unit, were energized and in service; two others were rapidly nearing completion. Of the seven steel tower lines under construction, two were complete and energized. One was 99% complete, one was 93% complete and two, which were about two-thirds finished, were scheduled for completion within the first sixty days of fiscal 1941.

The ship canal crossing at Bonneville, designed to carry power lines over the navigation lock to right-of-way leading to The Dalles, Oregon, and to Oregon City, Oregon, was 95% complete. There were five wood-pole lines under construction and one which had been completed. Two were scheduled for completion within the first thirty days of fiscal 1941. Clearing of right-of-way was being rapidly pushed on several other lines.

In addition to this program of transmission line and substation construction, 22 buildings, such as control houses, warehouses and service buildings, had been designed. Of these, 11 were under construction.

During the year, owing to the rapid expansion of the Bonneville power sales program, it became necessary to make additions to a number of substations which had not been included in the original station proposals. This equipment included a number of major expense items, such as synchronous condensers, transformer banks, and switching equipment. Purchase and installation of these items were handled under separate work orders which were written especially to cover them.1/

Detail of all design activities during the fiscal year are summarized in the following table:

Status of Design Activities2/

Substations--design completed:

North Vancouver, Wash.	Eugene, Ore.
South Bank, Bonneville, Wash.	Salem (Temporary), West Salem, Ore.

1/ For Engineering Expenditures, See Table 18, p. 87, in Financial Report and Plate XXXIV following p. 113.

2/ For brief description of the substations and transmission lines, see Tables 21 and 22, pp. 114 to 116.

Substations under design:

North Bonneville, Wash.
Alcoa, Vancouver, Wash.
Chehalis, Wash.
Astoria, Ore.
Ellensburg, Wash.
Covington, Wash.
McMinnville, Ore.
Midway, Vernita, Wash.
St. Johns, Portland, Ore.
Salem, West Salem, Ore.
Raymond, Wash.
Hood River, Ore.

Transmission Lines--design completed:

Bonneville-Vancouver #1 and #2
Chehalis-Covington
Vancouver-Kelso #1
Kelso-Chehalis #1
Chehalis-Raymond
Vancouver-Eugene
Bonneville-Hood River-The Dalles
Bonneville-Coulee #1
Vancouver-Alcoa
Condit-Glenwood

Transmission Lines under design:

Yakima-Ellensburg
St. Johns-Astoria
Midway-Hanford
Hanford-Pasco
Pasco-Walla Walla
Covington-Tacoma
Covington-Seattle
Chehalis-Centralia
Salem-McMinnville

Transmission Lines--survey work completed:

Bonneville-Coulee #2
Bonneville-Oregon City
Oregon City-Salem
Midway-Yakima
Salem-Corvallis
Vancouver-Kelso #2

Transmission Lines--surveys in process:

Covington-Coulee
Raymond-Naselle Junction
Salem-Monmouth
Walla Walla-Pendleton
Kelso-Chehalis #2

Details of all construction activities during the fiscal year are summarized in the following table:

Status of Construction Activities

Substations completed:

Salem, Ore. (Temporary)

Substations energized and in service but still under construction:

North Vancouver, Wash.
South Bank, Bonneville, Ore.
St. Johns, Portland, Ore.

Substations under construction:

North Vancouver, Wash.
North Bonneville, Wash.
Alcoa, Vancouver, Wash.
Chehalis, Wash.
South Bank, Bonneville, Ore.
Midway, Vernita, Wash.
St. Johns, Portland, Ore.
Salem, Oregon
Eugene, Oregon
Raymond, Wash.

Transmission Lines completed:

Bonneville-Vancouver #1 and #2
Vancouver-Eugene

Transmission Lines under construction:

Vancouver-Alcoa #1 and #2
Bonneville-Coulee
Vancouver-Kelso
Kelso-Chehalis
Chehalis-Raymond
Condit-Glenwood

Transmission Lines--Right-of-way clearing operations:

Chehalis-Covington
St. Johns-Astoria
Bonneville-Hood River-The Dalles
Salem-McMinnville

Details of all material purchases and material deliveries are summarized in the following table:

Status of Materials

Substations for which all materials have been delivered:

North Vancouver, Wash.
South Bank, Bonneville, Ore.
Salem, Ore. (Temporary)

Substations for which principal materials have been ordered:

North Bonneville, Wash.
Midway, Vernita, Wash.
St. Johns, Portland, Ore.
Salem, Ore.
Eugene, Ore.
Raymond, Wash.
Ellensburg, Wash.
Astoria, Ore.
Alcoa, Portland, Ore.
McMinnville, Ore.
Centralia, Wash. (Metering)
Tacoma, Wash. (Metering)

Transmission Lines for which all materials have been delivered:

Bonneville-Vancouver #1 and #2
Bonneville-Coulee
Bonneville-Hood River-The Dalles
Vancouver-Kelso
Kelso-Chehalis
Chehalis-Raymond
Vancouver-Eugene
Yakima-Ellensburg
Vancouver-Alcoa #1 and #2
Condit-Glenwood

Transmission Lines for which principal materials have been ordered:

Chehalis-Covington
Chehalis-Tacoma
St. Johns-Astoria

System Operations[1]

In addition to its functions as a construction unit, the Power Administration's Engineering division found a rapid growth in the demand upon its services as a system operations unit during fiscal 1940. Delivery of power to administration customers had begun as far back as July 9, 1938, when the first purchaser, the city of Cascade Locks, Oregon, was connected at Bonneville. A short time later, on August 18, 1938, the system of the Northwestern Electric Company was also energized on an experimental contract. During fiscal 1939 some 35,476,000 kilowatt-hours of energy had been sold to these two customers.

By mid-year of fiscal 1940, the administrations's own transmission circuit, between Bonneville and Vancouver, Washington, was energized and service was begun immediately to the Portland General Electric Company under a short-term contract. During the year a number of other Bonneville customers began receiving power deliveries and by June 30, 1940, these deliveries totaled 190,288,057 kilowatt-hours for the twelve months.[2]

Construction Program Provides Employment

The Engineering division maintained its position as the largest employer unit within the Bonneville Power Administration during the fiscal year.[3] Completion of design and subsequent entrance into construction operations for the huge transmission network and substation program brought the number of employees in the division to 1,750 by June 30, 1940. Of this number, 1,109 were laborers employed on an hourly basis and 266 were skilled workers in the field holding annual appointments. Office workers in the division totaled 375. These included 125 engineers of all grades, 158 draftsmen and 92 miscellaneious positions, largely involving clerical and fiscal work. In addition to these, 168 men were employed intermittently on an hourly basis for unloading freight.

1/ See Plates XXXV and XXXVI and Tables 23,24 and 25, pp. 117, 118 & 119
2/ For report of income from power sales during fiscal 1940, see financial report, Table 17, p. 86
3/ See Table 26, p.120

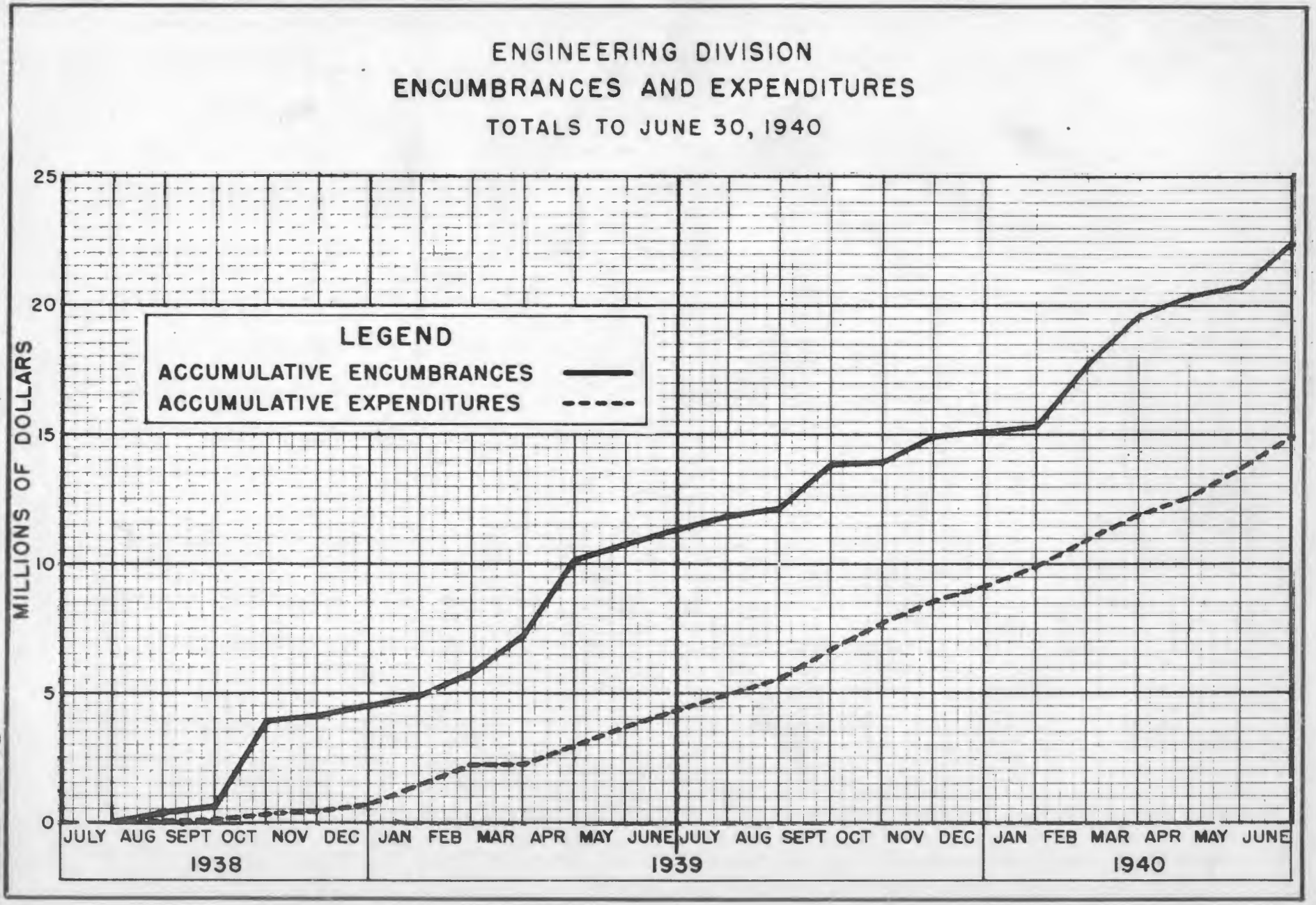

ENGINEERING DIVISION
ENCUMBRANCES AND EXPENDITURES
TOTALS TO JUNE 30, 1940
MILLIONS OF DOLLARS
25
20
15
10
5
0
LEGEND
ACCUMULATIVE ENCUMBRANCES
ACCUMULATIVE EXPENDITURES
JULY AUG SEPT OCT NOV DEC
1938
JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC
1939
JAN FEB MAR APR MAY JUNE
1940

PLATE XXXIV

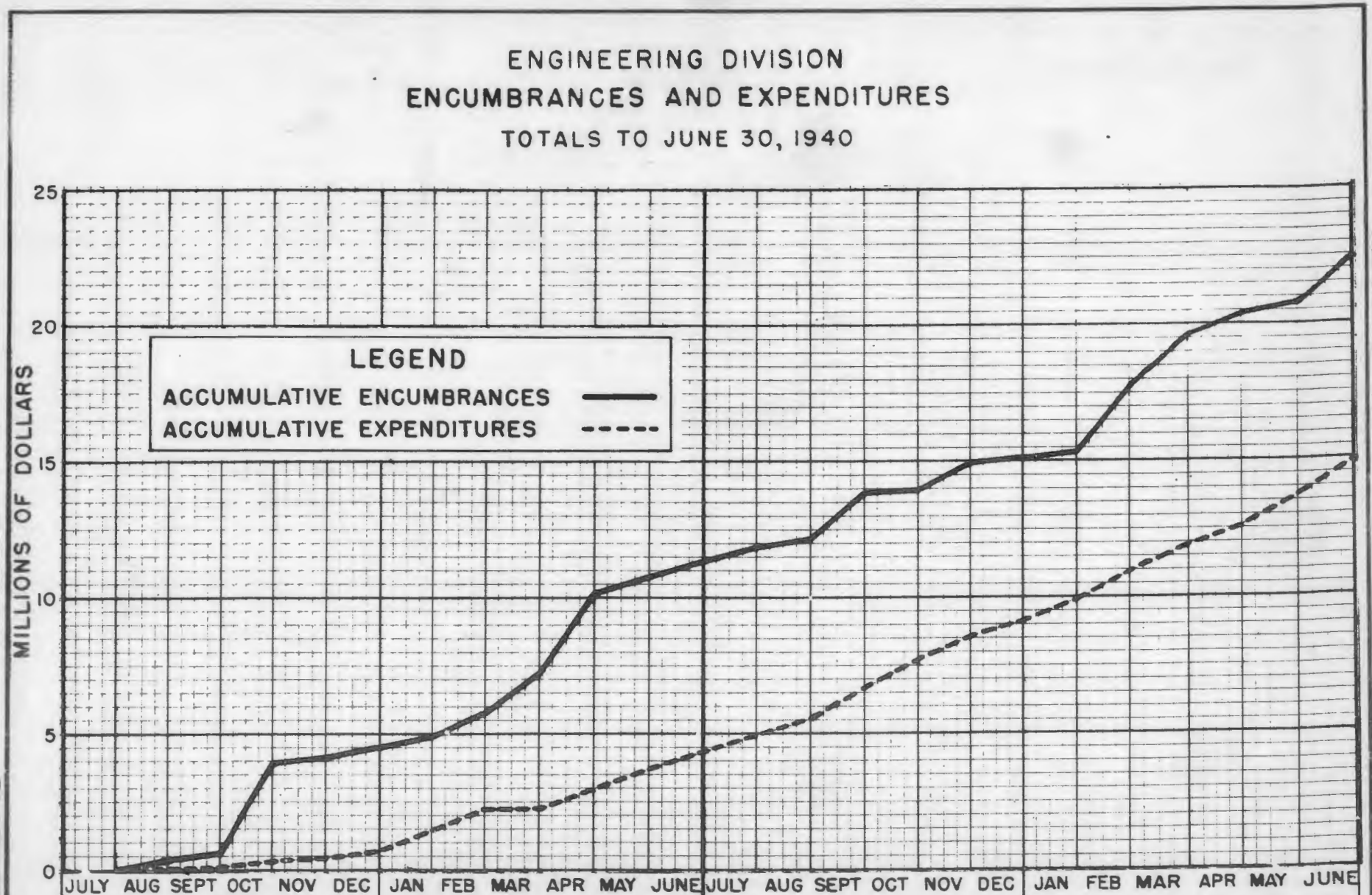

ENGINEERING DIVISION
ENCUMBRANCES AND EXPENDITURES
TOTALS TO JUNE 30, 1940
LEGEND
ACCUMULATIVE ENCUMBRANCES
ACCUMULATIVE EXPENDITURES
MILLIONS OF DOLLARS
25
20
15
10
5
0
JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE

PLATE X

TABLE 21

SUMMARY OF SUBSTATIONS DESIGNED to JUNE 30, 1940

W.O.	Substation	Incoming Lines	Transformer Banks	Outgoing Lines	Synch. Condensers
C7	No. Bonneville	2 - 230 kv 1 - 115 kv 1 - 13.8 kv	---	2 - 230 kv 1 - 115 kv 1 - 13.8 kv	---
C8 & C83	Vancouver	2 - 230 kv	2 - 75,000 kva 220-115.5-13.2 kv	5 - 115 kv	1 - 35,000 kva 13.2 kv
C63 & C13	South Bank	2 - 13.8 kv	---	2 - 13.8 kv	---
PC16	Midway	2 - 230 kv	1 - 50,000 kva 220-115.5-13.2 kv	1 - 115 kv	
PC21	St. Johns	2 - 115 kv	2 - 30,000 kva 110-59.7-13.2 kv	2 - 115 kv 5 - 57.1 kv	
PC23	Salem	2 - 115 kv	1 - 30,000 kva 110-59.7-13.2 kv	1 - 115 kv 4 - 57.1 kv	1 - 20,000 kva 6.9 kv
PC24 & C122	Albany	1 - 115 kv	1 - 1,000 kva 115-7.2/12.45 kv	1 - 115 kv 1 - 12.45 kv	---
PC25	Eugene	1 - 115 kv	1 - 12,000 kva 115-11.5 kv	1 - 11.5 kv	
C32	Chehalis	2 - 230 kv	1 - 75,000 kva 220-115.5-13.2 kv	2 - 115 kv 2 - 69 kv	
PC33	Raymond	1 - 115 kv	1 - 12,000 kva 115-23/69-6.9 kv 1 - 3,000 kva 23/69-34.5 kv	2 - 23 kv 1 - 34.5 kv	1 - 7,500 kva 6.9 kv
PC36	Hood River	1 - 115 kv	1 - 7,500 kva 110-66 kv	2 - 69 kv	
C44	Ellensburg	1 - 69 kv	1 - 3,000 kva 66-2.4 kv	1 - 2.4 kv	
C53	Astoria	1 - 115 kv	1 - 12,000 kva 110-23-12.5 kv	1 - 23 kv 1 - 12.5 kv	
C71	Alcoa	2 - 115 kv	2 - 37,500 kva 110-13.8 kv	2 - 13.8 kv	
C76	Covington	2 - 230 kv	1 - 75,000 kva 220-115.5-13.2 kv	1 - 230 kv 1 - 115 kv	1 - 35,000 kva 13.2 kv
C78	McMinnville	1 - 69 kv	1 - 3,000 kva 66-2.4 kv	1 - 2.4 kv	
C79	Centralia	Metering installations only			
C128	Tacoma	Metering installations only			

TABLE 21

SUMMARY OF SUBSTATIONS DESIGNED to JUNE 30, 1940

W.O.	Substation	Incoming Lines	Transformer Banks	Outgoing Lines	Synch. Condensers
C7	No. Bonneville	2 - 230 kv 1 - 115 kv 1 - 13.8 kv	---	2 - 230 kv 1 - 115 kv 1 - 13.8 kv	---
C8 & C83	Vancouver	2 - 230 kv	2 - 75,000 kva 220-115.5-13.2 kv	5 - 115 kv	1 - 35,000 kva 13.2 kv
C63 & C13	South Bank	2 - 13.8 kv	---	2 - 13.8 kv	---
PC16	Midway	2 - 230 kv	1 - 50,000 kva 220-115.5-13.2 kv	1 - 115 kv	
PC21	St. Johns	2 - 115 kv	2 - 30,000 kva 110-59.7-13.2 kv	2 - 115 kv 5 - 57.1 kv	
PC23	Salem	2 - 115 kv	1 - 30,000 kva 110-59.7-13.2 kv	1 - 115 kv 4 - 57.1 kv	1 - 20,000 kva 6.9 kv
PC24 & C122	Albany	1 - 115 kv	1 - 1,000 kva 115-7.2/12.45 kv	1 - 115 kv 1 - 12.45 kv	---
PC25	Eugene	1 - 115 kv	1 - 12,000 kva 115-11.5 kv	1 - 11.5 kv	
C32	Chehalis	2 - 230 kv	1 - 75,000 kva 220-115.5-13.2 kv	2 - 115 kv 2 - 69 kv	
PC33	Raymond	1 - 115 kv	1 - 12,000 kva 115-23/69-6.9 kv 1 - 3,000 kva 23/69-34.5 kv	2 - 23 kv 1 - 34.5 kv	1 - 7,500 kva 6.9 kv
PC36	Hood River	1 - 115 kv	1 - 7,500 kva 110-66 kv	2 - 69 kv	
C44	Ellensburg	1 - 69 kv	1 - 3,000 kva 66-2.4 kv	1 - 2.4 kv	
C53	Astoria	1 - 115 kv	1 - 12,000 kva 110-23-12.5 kv	1 - 23 kv 1 - 12.5 kv	
C71	Alcoa	2 - 115 kv	2 - 37,500 kva 110-13.8 kv	2 - 13.8 kv	
C76	Covington	2 - 230 kv	1 - 75,000 kva 220-115.5-13.2 kv	1 - 230 kv 1 - 115 kv	1 - 35,000 kva 13.2 kv
C78	McMinnville	1 - 69 kv	1 - 3,000 kva 66-2.4 kv	1 - 2.4 kv	
C79	Centralia	Metering installations only			
C128	Tacoma	Metering installations only			

SUMMARY OF DATA ON TRANSMISSION LINES

TOTAL TO END OF FISCAL YEAR - 1940

W. O. NO.	LINE	DESIGN VOLTAGE OF LINE, K.V.	NUMBER OF CIRCUITS	LENGTH OF LINE, R/W MILES	CIRCUIT MILES OF LINE, TOTAL	WIDTH OF R/W, FEET	STEEL TOWERS, TOTAL	WOOD POLE STRUCTURES, TOTAL	AVERAGE NO. OF STRUCTURES PER CIRCUIT MILE	CONDUCTORS A.C.S.R. M.C.M.	CONDUCTORS COPPER M.C.M.	CONDUCTOR LENGTH, TOTAL FEET	OVERHEAD G.W. LENGTH TOTAL FEET	NO. OF INSULATOR DISCS. TOTAL	TOTAL ESTIMATED COST OF COMPLETED LINE	ESTIMATED COST PER CIRCUIT MILE OF LINE	DATE SURVEYS BEGAN	DATE CONSTRUCTION CONTRACT BEGAN (NOTICE TO PROCEED)	CONSTRUCTION COMPLETED TO DATE	DATE OF ENERGIZATION	
C5-J1	BRADFORD ISLAND X-INGS #1 &#2	230	2	.6	1.2	560	4	--	--	SPECIAL 801.9	--	20,000	7,000	1,900	$ 155,000	--	4/4/38	4/11/39	100%	12/1/39	
C5-J2	BONNEVILLE-VANCOUVER LINES	230	2	35.9	71.8	300	372	--	5.2	MALLARD 795	--	1,148,000	88,000	35,900	1,519,000	$21,100	4/4/38	3/10/39	100%	12/1/39	
PC15	BONNEVILLE-COULEE LINE X	230	1	233.9	233.9	250/300	1,154	--	4.8	MALLARD & DRAKE 795	--	3,780,000	53,000	77,800	3,920,000	16,400	6/1/38	8/11/39	99%	--	
C17	BONNEVILLE-MIDWAY LINE #2 *	230	1	134.9	134.9	B-C #1	--	--	--	--	--	--	--	--	22,000	160	6/15/39	--	--	--	
C18	MIDWAY-COULEE LINE #2 *	230	1	99.0	99.0	B-C #1	--	--	--	--	--	--	--	--	8,000	80	9/20/39	--	--	--	
PC20-J1,J5	VANCOUVER-EUGENE LINES X	115	2	124.8	131.4	50/180	4	1,647	**12.5	IBIS 397.5	250 & 350	2,125,000	107,000	35,400	1,263,000	9,600	8/30/38	3/30/39	100%	2/24/40	
PC20-J2	COLUMBIA-WILLAMETTE X-INGS	230	2	2.9	5.8	150/200	13	--	--	SPECIAL 801.9	--	92,000	31,000	5,700	363,000	--	8/30/38	5/15/39	100%	2/24/40	
PC27	VANCOUVER-KELSO LINE	230	1	41.2	41.2	250/300	188	--	4.6	DRAKE 795	--	667,000	12,000	13,600	1,070,000	26,000	9/1/38	10/12/39	93%	--	
PC30-J2	KELSO-CHEHALIS LINE	230	1	30.5	30.5	300	128	--	4.2	DRAKE 795	--	495,000	12,000	10,100	700,000	23,000	9/26/38	4/15/40	72%	--	
PC30-J4	CHEHALIS-RAYMOND LINE	115	1	45.5	45.5	100	--	432	9.5	--	250	737,000	14,000	9,600	450,000	9,900	9/26/38	11/15/39	94%	--	
C34	BONNEVILLE-OREGON CITY LINE X	115	2	51.2	55.2	100/300	--	--	--	--	350 EQUIV.	--	--	--	850,000	15,400	8/17/39	--	--	--	
PC35-J1	BONNEVILLE-THE DALLES LINE	115	1	38.1	38.1	150	79	281	9.5	IBIS 397.5	250	617,000	18,000	9,800	550,000	14,500	9/1/38	--	--	--	
PC35-J2	BONNEVILLE SHIP CANAL X-ING	115	1	.6	.6	150	4	--	--	MALLARD 795	--	10,000	6,500	500	50,000	--	9/1/38	1/29/40	95%	--	
CL2-J1	MIDWAY-YAKIMA LINE *	115	1	33.8	33.8	100	--	--	--	--	--	--	--	--	23,000	680	8/22/39	--	--	--	
CL2-J2,J5	YAKIMA-ELLENSBURG LINE	115	1	35.6	35.6	100	--	250	7.1	--	250	576,000	15,000	6,300	265,000	7,500	8/24/39	--	--	--	
CL7	CHEHALIS-COVINGTON LINE	230	1	69.4	69.4	250/300	315	--	4.6	DRAKE 795	--	1,120,000	23,000	21,000	1,740,000	25,100	8/23/40	7/-/40	--	--	
CL8	COVINGTON-COULEE LINE *	230	1	182.6	182.6	250/300	--	--	--	--	--	--	--	--	120,000	660	8/20/39	--	--	--	
C54	ST. JOHNS-TILLAMOOK LINE *	115	1	63.0	63.0	60/100	--	--	--	--	--	--	--	--	48,000	760	10/22/39	--	--	--	
C55-J1	VANCOUVER-KELSO LINE #2 *	230	1	41.2	41.2	V-K #1	--	--	--	--	--	--	--	--	3,100	75	6/15/39	--	--	--	
C55-J2	KELSO-CHEHALIS LINE #2 *	230	1	30.5	30.5	K-CH #1	--	--	--	--	--	--	--	--	2,300	75	6/15/39	--	--	--	

XX

* FIELD SURVEYS ONLY
** INCLUDES SINGLE POLE STRUCTURES
X INCLUDES RIVER CROSSING

XX 3/4" EXTRA HIGH STRENGTH OVERHEAD GROUND WIRE USED ON SPECIAL RIVER CROSSINGS
5/8" HIGH STRENGTH OVERHEAD GROUND WIRE USED ON ALL 230 KV. LINES
3/8" HIGH STRENGTH OVERHEAD GROUND WIRE USED ON ALL 115 AND 69 KV. LINES

TABLE 22

SUMMARY OF DATA ON TRANSMISSION LINES

TOTAL TO END OF FISCAL YEAR - 1940

W.O. NO.	LINE	DESIGN VOLTAGE OF LINE, K.V.	NUMBER OF CIRCUITS	LENGTH OF LINE, R/W MILES	CIRCUIT MILES OF LINE, TOTAL	WIDTH OF R/W, FEET	STEEL TOWERS, TOTAL	WOOD POLE STRUCTURES, TOTAL	AVERAGE NO. OF STRUCTURES PER CIRCUIT MILE	CONDUCTORS A.C.S.R. M.C.M.	CONDUCTORS COPPER M.C.M.	CONDUCTOR LENGTH, TOTAL FEET	OVERHEAD G.W. LENGTH TOTAL FEET	NO. OF INSULATOR DISCS, TOTAL	TOTAL ESTIMATED COST OF COMPLETED LINE	ESTIMATED COST PER CIRCUIT MILE OF LINE	DATE SURVEYS BEGAN	DATE CONSTRUCTION CONTRACT BEGAN (NOTICE TO PROCEED)	CONSTRUCTION COMPLETED TO DATE	DATE OF ENERGIZATION	
C5-J1	BRADFORD ISLAND X-INGS #1 &#2	230	2	.6	1.2	560	4	--	--	SPECIAL 801.9	--	20,000	7,000	1,900	$ 155,000	--	4/4/38	1/11/39	100%	12/1/39	
C5-J2	BONNEVILLE-VANCOUVER LINES	230	2	35.9	71.8	300	372	--	5.2	MALLARD 795	--	1,148,000	88,000	35,900	1,519,000	$21,100	4/4/38	3/10/39	100%	12/1/39	
PC15	BONNEVILLE-COULEE LINE X	230	1	233.9	233.9	250/300	1,154	--	4.8	MALLARD & DRAKE 795	--	3,780,000	53,000	77,800	3,920,000	16,400	6/1/38	8/11/39	99%	--	
C17	BONNEVILLE-MIDWAY LINE #2 *	230	1	134.9	134.9	B-C #1	--	--	--	--	--	--	--	--	22,000	160	6/15/39	--	--	--	
C18	MIDWAY-COULEE LINE #2 *	230	1	99.0	99.0	B-C #1	--	--	--	--	--	--	--	--	8,000	80	9/20/39	--	--	--	
PC20-J1,J5	VANCOUVER-EUGENE LINES X	115	2	124.8	131.4	50/180	4	1,647	**12.5	IBIS 397.5	250 & 350	2,125,000	107,000	35,400	1,263,000	9,600	8/30/38	3/30/39	100%	2/24/40	
PC20-J2	COLUMBIA-WILLAMETTE X-INGS	230	2	2.9	5.8	150/200	13	--	--	SPECIAL 801.9	--	92,000	31,000	5,700	363,000	--	8/30/38	5/15/39	100%	2/24/40	
PC27	VANCOUVER-KELSO LINE	230	1	41.2	41.2	250/300	188	--	4.6	DRAKE 795	--	667,000	12,000	13,600	1,070,000	26,000	9/1/38	10/12/39	93%	--	
PC30-J2	KELSO-CHEHALIS LINE	230	1	30.5	30.5	300	128	--	4.2	DRAKE 795	--	495,000	12,000	10,100	700,000	23,000	9/26/38	4/15/40	72%	--	
PC30-J4	CHEHALIS-RAYMOND LINE	115	1	45.5	45.5	100	--	432	9.5	--	250	737,000	14,000	9,600	450,000	9,900	9/26/38	11/15/39	94%	--	
C34	BONNEVILLE-OREGON CITY LINE X	115	2	51.2	55.2	100/300	--	--	--	--	350 EQUIV.	--	--	--	850,000	15,400	8/17/39	--	--	--	
PC35-J1	BONNEVILLE-THE DALLES LINE	115	1	38.1	38.1	150	79	281	9.5	IBIS 397.5	250	617,000	18,000	9,800	550,000	14,500	9/1/38	--	--	--	
PC35-J2	BONNEVILLE SHIP CANAL X-ING	115	1	.6	.6	150	4	--	--	MALLARD 795	--	10,000	6,500	500	50,000	--	9/1/38	1/29/40	95%	--	
C42-J1	MIDWAY-YAKIMA LINE *	115	1	33.8	33.8	100	--	--	--	--	--	--	--	--	23,000	680	8/22/39	--	--	--	
C42-J2,J5	YAKIMA-ELLENSBURG LINE	115	1	35.6	35.6	100	--	250	7.1	--	250	576,000	15,000	6,300	265,000	7,500	8/24/39	--	--	--	
C47	CHEHALIS-COVINGTON LINE	230	1	69.4	69.4	250/300	315	--	4.6	DRAKE 795	--	1,120,000	23,000	21,000	1,740,000	25,100	8/23/40	7/-/40	--	--	
C48	COVINGTON-COULEE LINE *	230	1	182.6	182.6	250/300	--	--	--	--	--	--	--	--	120,000	660	8/20/39	--	--	--	
C54	ST. JOHNS-TILLAMOOK LINE *	115	1	63.0	63.0	60/100	--	--	--	--	--	--	--	--	48,000	760	10/22/39	--	--	--	
C55-J1	VANCOUVER-KELSO LINE #2 *	230	1	41.2	41.2	V-K #1	--	--	--	--	--	--	--	--	3,100	75	6/15/39	--	--	--	

SUMMARY OF DATA ON TRANSMISSION LINES

TOTAL TO END OF FISCAL YEAR - 1939

W. O. NO.	LINE	DESIGN VOLTAGE OF LINE, K.V.	NUMBER OF CIRCUITS	LENGTH OF LINE, R/W MILES	CIRCUIT MILES OF LINE, TOTAL	WIDTH OF R/W, FEET	STEEL TOWERS, TOTAL	WOOD POLE STRUCTURES, TOTAL	AVERAGE NO. OF STRUCTURES PER CIRCUIT MILE	CONDUCTORS - A.C.S.R. - M.C.M.	CONDUCTORS - COPPER - M.C.M.	CONDUCTOR LENGTH, TOTAL FEET	OVERHEAD G.W. LENGTH, TOTAL FEET	NO. OF INSULATOR DISCS, TOTAL	TOTAL ESTIMATED COST OF COMPLETED LINE	ESTIMATED COST PER CIRCUIT MILE OF LINE	DATE SURVEYS BEGAN	DATE CONSTRUCTION CONTRACT BEGAN (NOTICE TO PROCEED)	CONSTRUCTION COMPLETED TO DATE	DATE OF ENERGIZATION	
C64	ST. JOHNS-ASTORIA LINE X	115	1	82.2	82.2	100	2	537	6.6	--	250	1,330,000	6,000	12,400	$1,110,000	$13,500	10/20/39	--	--	--	
C67	CONDIT-GILMER LINE *	13	1	10.4	10.4	--	--	--	--	--	--	--	--	--	6,000	580	1/3/40	1/3/40	--	--	
C71	VANCOUVER-ALCOA	115	2	4.2	8.4	V-E/100	29	--	6.9	DOVE 556.5	--	136,000	23,000	4,000	160,000	19,000	12/28/39	1/17/40	6%	--	
C72-C77	SALEM-McMINNVILLE	69	1	21.7	21.7	60/100	--	176	**8.1	PIGEON 3/0	--	351,000	2,700	3,200	140,000	6,500	2/5/40 *	--	--	--	
C73	RAYMOND-RASELLE JUNCTION *	33	1	27.4	27.4	ROADS	--	--	--	--	--	--	--	--	10,000	365	2/10/40	--	--	--	
C74	SALEM-CORVALLIS LINE *	115	1	34.0	34.0	V-E #1 & OERR	--	--	--	--	--	--	--	--	8,000	240	2/5/40	--	--	--	
C75	MIDWAY-HANFORD LINE	115	1	19.2	19.2	100/300	--	131	6.8	--	250 EQUIV.	311,000	7,000	3,000	129,000	6,700	1/26/40	--	--	--	
C81	CHEHALIS-CENTRALIA LINE	69	1	11.4	11.4	CH-C/50	--	118	10.4	1/0 EQUIV.	--	185,000	--	1,900	60,400	5,300	2/25/40	--	--	--	
C82	SIERRA LINE *	115	1	1.2	1.2	100	--	--	--	--	--	--	--	--	4,000	--	1/16/40	--	--	--	
C97	PASCO-WALLA WALLA LINE X	115	1	32.5	32.5	60	3	211	6.6	--	250 EQUIV.	527,000	10,500	4,800	280,000	8,600	4/28/40	--	--	--	
C99	BRADFORD ISLAND CROSSING #3	230	1	.9	.9	560	3	--	--	MALLARD 795 & SPECIAL 801.9	--	14,000	9,000	1,600	115,000	--	5/23/40	--	--	--	
C102	HANFORD-PASCO LINE X	115	1	34.9	34.9	100	2	231	6.7	--	250 EQUIV.	565,000	7,000	5,200	251,000	7,400	3/10/40	--	--	--	
C105	COVINGTON-TACOMA LINE	115	1	13.1	13.1	60/100	--	81	6.2	IBIS 397.5	--	212,000	7,000	1,900	133,000	10,100	2/25/40	--	--	--	
C112	OREGON CITY-SALEM LINE	115	1	35.7	35.7	V-E #1	--	--	--	--	250	578,000	--	--	299,000	8,100	12/20/39	--	--	--	
C116	SALEM-MONMOUTH LINE *	11	1	10.6	10.6	ROADS/50	--	--	--	--	--	--	--	--	1,500	140	5/27/40	--	--	--	
C119	WALLA WALLA-PENDLETON LINE	69	1	44.0	44.0	50	--	--	--	3/0 EQUIV.	--	--	--	--	204,000	5,100	6/12/40	--	--	--	
142-111	SERVICE TO TILLAMOOK *	69	1	30.0	30.0	60/100	--	--	--	--	--	--	--	--	--	--	4/16/40	--	--	--	
142-113	COVINGTON-SEATTLE LINE *	230	1	11.0	11.0	250/300	--	--	--	--	--	--	--	--	10,000	910	8/23/39	--	--	--	
	TOTALS			1,719.6	1773.8		2,300	4,095				15,596,000	168,700	265,600	$16,042,300						

* FIELD SURVEYS ONLY
** INCLUDES SINGLE POLE STRUCTURES
X INCLUDES RIVER CROSSING

XX 3/4" EXTRA HIGH STRENGTH OVERHEAD GROUND WIRE USED ON SPECIAL RIVER CROSSINGS
5/8" HIGH STRENGTH OVERHEAD GROUND WIRE USED ON ALL 230 KV. LINES
3/8" HIGH STRENGTH OVERHEAD GROUND WIRE USED ON ALL 115 AND 69 KV. LINES

TABLE 22
(Continued)

PLATE XXXV

ENERGY GENERATED FOR
BONNEVILLE POWER ADMINISTRATION

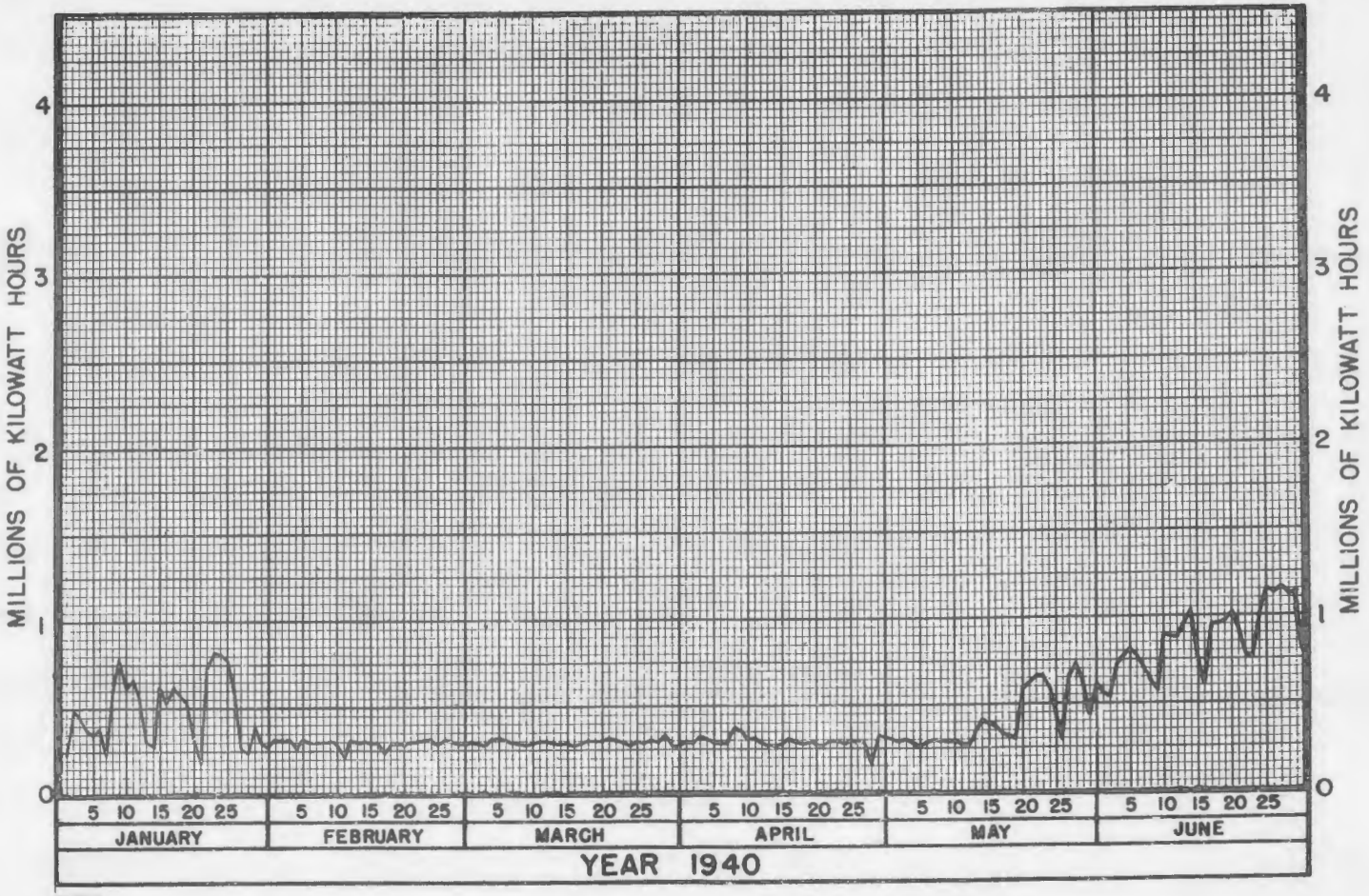


PLATE XXXVI

ENERGY GENERATED FOR
BONNEVILLE POWER ADMINISTRATION

TABLE 23

Maximum Power Demands
- Fiscal Year 1939 - 1940 -

	Maximum Plant Demand 5 min. Gen. KW	NWE Co. Maximum Demand 30 min.	PGE Co. Maximum Demand 30 min.	Forest Grove Maximum Demand	Canby, Oregon Maximum Demand	Cascade Locks Maximum Demand	Skamania County PUD No. 1 Maximum Demand	Columbia Constr. Company Maximum Demand	WPA Camp Maximum Demand
July 1939	26,500	25,000				150.00			Flat Charge
August 1939	29,500	27,000				211.20			
September 1939	31,200	30,000				219.60			
October 1939	32,000	30,000				225.36		44.0	
November 1939	31,500	30,000				240.00		33.0	
December 1939	74,000	30,000	40,600	696		249.60		30.0	
January 1940	48,100		46,800	680		187.20	198	35.5	
February 1940	38,500		34,800	648	195.0	237.60	198	11.5	
March 1940	39,500		33,600	548	170.1	244.80	186	7.5	
April 1940	46,000		41,400	512	165.0	252.00	180		
May 1940	49,000		45,000	484	174.0	252.00	188		
June 1940	61,800		51,540 *9,900	452	174.0	234.00	183		

W.P.A. Camp on Flat Rate per month regardless of KWH delivered, or demand, as per contract.

* Two delivery points for PGE Company

TABLE 24

Disposition of Energy Generated by Months
- Fiscal Year 1939 - 1940 -

	Total Generated KWH	Total KWH to U.S.E.D.	Total KWH to B.P.A.	Calculated System Losses KWH	Total KWH Delivered to B.P.A. Customers
July 1939	12,972,000	410,227	12,561,773	1,539,472	11,022,301
August 1939	21,010,000	447,667	20,562,333	2,509,682	18,052,651
September 1939	23,272,000	454,156	22,817,844	2,771,607	20,046,237
October 1939	24,640,000	606,208	24,033,792	2,961,209	21,072,583
November 1939	24,788,000	826,007	23,961,993	2,864,509	21,097,484
December 1939	29,582,000	900,387	28,601,613	2,287,413	26,314,200
January 1940	16,087,000	1,077,000	15,010,000	615,412	14,394,588
February 1940	8,545,000	983,540	7,561,460	329,116	7,232,344
March 1940	8,990,000	1,002,650	7,987,350	450,236	7,537,114
April 1940	8,608,000	758,000	7,850,000	323,219	7,526,781
May 1940	12,812,000	647,000	12,165,000	507,897	11,657,103
June 1940	26,019,000	561,000	25,458,000	1,123,329	24,334,671
TOTAL	217,325,000	8,753,842	208,571,158	18,283,101	190,288,057

TABLE 25

Disposition of Energy Received by Months
- Fiscal Year 1939 - 1940 -

	N.W.E. Co. KWH Delivered	P.G.E. Co. KWH Delivered	Forest Grove KWH Delivered	Canby, Oregon KWH Delivered	Cascade Locks KWH Delivered	Skam. Co. PUD #1 KWH Delivered	Columbia Const. Co. KWH Delivered	WPA Camp KWH Delivered
July 1939	11,005,452				13,400			3,449
August 1939	17,972,400				75,960			4,291
September 1939	19,959,936				81,360			4,941
October 1939	20,974,848				89,280		2,600	5,855
November 1939	20,995,992				92,160		3,500	5,832
December 1939	8,590,807	17,602,400	*256,000		109,920		4,800	6,273
January 1940		14,243,700	*208,800		75,360	63,530	4,200	7,798
February 1940		7,065,400	*200,800	*59,150	89,040	67,220	3,200	7,484
March 1940		7,368,500	*188,800	*61,925	96,000	63,700	2,200	6,714
April 1940		7,353,800	*192,000	*65,675	97,920	69,520		5,531
May 1940		11,502,000	*188,000	*64,750	93,600	56,960		4,543
June 1940		24,171,000	*170,400	*62,100	89,040	70,570		4,061
TOTAL	99,499,435	89,306,800	*1,404,800	*313,600	1,003,040	391,510	20,500	66,772

* Energy delivered to Forest Grove and Canby included with energy delivered to P.G.E. Company.

N.W.E. Company readings represent 88.1% of energy delivered. 11.9% allowed for losses as per contract.

TABLE 26

PERSONNEL EMPLOYED JUNE 1940

	In the Office	In the Field
Appropriation Number 149/00614C	321	999
Appropriation Number 1400608.001	9	32
Appropriation Number 14-408/00513C		
OP 752-05-168	21	66
OP 752-05-169	3	54
OP 752-05-170	10	138
OP 752-05-171	11	86
TOTAL	375	1,375

Detail of Personnel is as follows:

Office		
Engineers, all grades	125	
Draftsmen	158	
Miscellaneous	92	
TOTAL OFFICE	375	
Field		
Survey parties, construction crews, and force account laborers		1,375
TOTAL FIELD		1,375

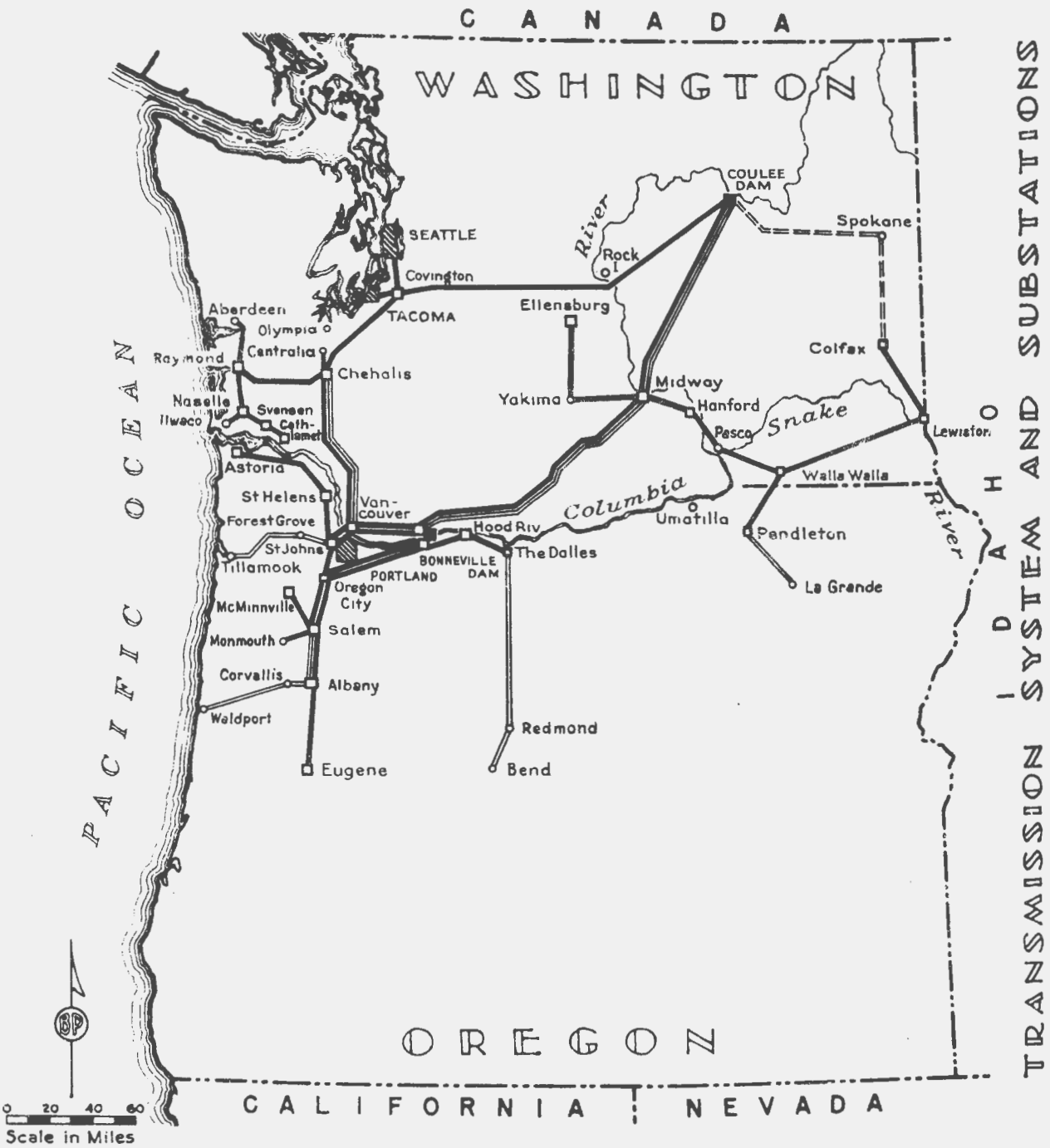
Distribution of Personnel by Sections:

	In the Office	In the Field	
		Hourly	Annual
Chief Engineer's Staff	7	0	0
Consulting Engineering Section	14	0	0
System Engineering Section	25	0	0
Design Section	238	8	53
Material and Inspection Section	18	0	0
Construction Section	35	1,094	190
Distribution Engineering Section	11	0	0
Operations Section	9	7	23
General Office	18	0	0
TOTALS	375	1,109	266

TOTAL PERSONNEL OF THE ENGINEERING DIVISION - 1,750

In addition, 168 men were employed intermittently on an hourly basis for unloading freight.

U·S·DEPARTMENT·OF·THE·INTERIOR



LEGEND

- SUBSTATIONS.
- LINES COMPLETED OR UNDER CONSTRUCTION.
- SURVEY ONLY.
- PROPOSED LINES.

PLATE XXXVII

CONSTRUCTION PROGRAM

As of Dec. 31, 1940

BONNEVILLE · POWER · ADMINISTRATION

Engineering Activities in Fiscal 1941

The period beginning July 1, 1940, and extending to December 31 1940, was marked by the completion of a large number of transmission lines and substations. It is probable that these additions to the Bonneville system represented a greater amount of construction for this type of operation than could be found elsewhere in the country during this period.

Keeping pace with this activity, the increased demand on the system reached new highs and loaded the two generators at the Bonneville powerhouse to full capacity for virtually 100% of the time. During the course of a large portion of this construction work, the Engineering division was confronted with rush schedules in order to meet the energization requirements of new power contracts. Frequently the demand for service was so urgent that the energization of system additions was necessary prior to their completion.1/

Relief came during the last month of the year, with the placing in service of the third generator at the Bonneville powerhouse on December 22, along with a change in operating voltage from 115 kv to 230 kv of one of the Bonneville-Vancouver transmission lines. A further generating unit was being tested and was scheduled for service early in calendar year 1941.

As the result of these system and generating station additions, the Bonneville system will be capable of delivering a total of 194,400 kilowatts to load centers in widespread areas, as contrasted with 86,400 kilowatts to the Portland and Salem areas, as of June 30, 1940. The system capacity will be increased by another 108,000 kilowatts with the installation of the first generator at the Grand Coulee development, which is scheduled for completion during the summer of 1941. Two other generators of similar capacity are scheduled for installation at Grand Coulee later in the year. In this connection, the extension of the Bonneville 230 kv line into the Puget Sound area, scheduled for the spring of 1941, will make it possible to handle this increase of generator capacity by enhancing the load capabilities of the transmission system, and will operate to the advantage of the interconnected systems, making power available in large blocks to major load centers in western Oregon and Washington.

1/ This condition was particularly true for the Salem, Albany, Chehalis, North Bonneville, and St. Johns substations; and the Salem-McMinnville transmission line, for which temporary facilities were erected to meet service requirements.

The Engineering Program

On December 31, 1940, the midpoint in fiscal 1941, a comprehensive system design based on research and engineering work completed to that date comprised the following general specifications:

1. A 230 kv transmission loop from which lower voltage lines radiate to serve specific areas or large loads. This loop is designed to start at Bonneville dam, proceeds 36 miles westward to Vancouver, Washington, as twin lines terminating at the north Vancouver substation. From Vancouver a single 230 kv circuit extends northward for 72 miles to a substation at Chehalis, Washington, whence it continues 69 miles northward to a substation under construction at Covington in the Puget Sound area. At Covington surveys are under way to continue the loop eastward for 183 miles to the Grand Coulee dam for connection with the generators in the Grand Coulee powerhouse. The loop is closed by a 234 mile circuit from the Grand Coulee to the Bonneville power plant. Under construction on this line is the Midway substation, designed to serve as a power distribution point for southeastern and central Washington.

2. Radiating from the various substations located on this central 230 kv loop are a number of lines designed to serve individual loads or load areas. From the 230 kv Vancouver substation 115 kv double circuit lines serve the newly constructed Aluminum Company of America plant. Another pair of circuits cross the Columbia river to supply the St. Johns substation which serves the Portland, Oregon, area. From St. Johns one 120-mile, 115 kv circuit traverses the Willamette valley to serve substations at Salem, Albany and Eugene. Another 115 kv line is under construction from St. Johns to a substation being built at Astoria 82 miles westward at the mouth of the Columbia river. In turn lower voltage lines extend or are planned to extend from some of these substations to serve contiguous areas. From the 230 kv Chehalis substation a 69 kv line serves the nearby city of Centralia, and a 115 kv line extends 45 miles westward to the Raymond substation on the Pacific coast. From Raymond acquired and rehabilitated lines to Aberdeen on the north and to Ilwaco and Cathlamet on the south supply energy to Grays Harbor, Pacific and Wahkiakum counties in western Washington.

Construction has started on radial lines designed to connect the 230 kv Covington substation with the cities of Seattle and Tacoma, providing facilities for supplying large blocks of power to the Puget Sound area. From the 230 kv Midway substation a 64 mile, 115 kv line is under construction west to Yakima and

north to Ellensburg where a substation has been designed to serve that city and an REA cooperative. A 115 kv line is under construction from Midway to a substation at Walla Walla, 82 miles away. From this point it will be continued northeast for 84 miles to Lewiston near the Idaho border where preliminary work is under way on a substation. From Lewiston this circuit will extend in a northwesterly direction 37 miles to a substation at Colfax, Washington. From the Walla Walla substation a 69 kv line, now being designed, will extend 39 miles southward to a station at Pendleton, Oregon, and thence some 55 miles farther to La Grande, Oregon.

From the Bonneville powerhouse a 115 kv line is being constructed eastward along the south bank of the Columbia river for 38 miles to The Dalles, Oregon. From a substation at this point surveys are under way contemplating construction of a 69 kv line southward 110 miles to the city of Bend in Central Oregon. Also under construction from Bonneville is the 51 mile, double circuit, 115 kv line to connect with the completed Willamette valley circuit at Oregon City. This line, together with a contemplated second circuit between Oregon City and Salem, will greatly increase the system capacity to the Willamette valley area.

Not all of the above-mentioned system components had been approved for construction by the Administrator at the close of the 1940 fiscal year. In the first six months of fiscal 1941, however, numerous system extensions were approved. Notable among these were new projects provided under Deficiency Appropriation No. 14X1225. This appropriation of $3,850,000 represented an advancement of some of the funds listed in the 1942 budget, and was granted in order to speed the construction called for in the budget. The deficiency appropriation covered the following five items:

1. Grand Coulee-Covington 230 kv Line No. 1. Design, land and land acquisition, and the purchase of a portion of the materials.

2. Covington Substation (230 kv). Design, and the purchase and installation of a portion of the materials.

3. Covington-Seattle 230 kv Line. Design, surveys and mapping, land and land acquisition, and the purchase of a portion of the materials.

4. Feeder Lines, service connections to load areas and industrial customers. Provides $500,000 for additional construction to serve the Aluminum Company of America.

5. Tools, equipment, and stock inventories. Provides $50,000 for construction tools and equipment for use in connection with the 1941 deficiency appropriation work.

Other notable system additions receiving approval were the further extension of lines into eastern Washington, and the Bonneville-Oregon City-Salem lines. In addition, surveys for new lines, including those from Pendleton to La Grande, Oregon, from The Dalles to Bend, Oregon, and from Albany to Waldport, Oregon, were approved.

Status of System on December 31, 1940

Following are brief descriptions which include the status of activities for each system[1/] component under construction or completed since June 30, 1940:

Substation Activities

North Bonneville Substation: The North Bonneville substation, located in the vicinity of North Bonneville, Skamania county, Washington, is a 230 kv switching station providing facilities necessary to control and dispatch power to eastern and western Washington. The only transformer which will be installed at this station at present will be a small 13.8 kv bank for serving Skamania county loads. A control house is under construction to provide all necessary controls, meters, and relays for complete operation of the switchgear. Temporary facilities are being used for the control of the No. 2 Bonneville-Vancouver line, which is now energized at 230 kv, and the Bonneville-Coulee line, which is energized at 115 kv. This station is now approximately 60 per cent completed and will be finished in the spring of 1941. In order to provide a 13.8 kv feeder for the Skamania P.U.D. at the North Bonneville substation and to provide remote control of the substation from the Bonneville powerhouse, a cable installation has been designed. This installation includes a 15 kv three-conductor 250,000 circular mill power cable, a forty-conductor control cable, and a sixteen-pair telephone cable, the installation of which will start in January, 1941.

North Vancouver Substation: The North Vancouver substation, located on U. S. Highway No. 99 immediately north of Vancouver, Clark county, Washington, serves as the main dispatching center of

---

1/ For summary of approved construction program in 1941, see Plate XXXVIII.

CONSTRUCTION PROGRESS CHART
1941 PROGRAM

W.O. No.	Nature of Construction	Miles Line	Approved Amounts	Oct. 15	Oct. 31	Nov. 15	Nov. 30	Dec. 15	Dec. 31	Jan. 15	Jan. 31	Feb. 15	Feb. 28	Mar. 15	Mar. 31	Apr. 15	Apr. 30	May 15	May 31	June 15	June 30	July 15	July 31	Aug. 15	Aug. 31	Sep. 15	Sep. 30
	PERIOD ENDING-			(- 1940 -)						(- - - - 1941 - - - -)																	
	TRANSMISSION SYSTEM (230 KV)																										
32	Chehalis Sub.&Radio Station		1,860,700													(230 KV)											
76	Covington Substation Site		60,000																								
47	Chehalis-Covington Line	69.4	1,740,970																								
120	Control Line No. Bonneville		64,430																								
83	No.Vanc.Sub-2nd Trans.Bk.etc.		1,119,820																								
16	Midway Sub & Radio Station		1,315,190													(115 KV)				(230 KV)							
113	Covington Seattle Line	11.2	217,000																								
96	Seattle Tie		76,620																								
131	Midway Substation Addn's.		75,000																	(Const'n not sched.							
110	Covington Sub.(Const.& Addn's)		1,600,000																	(Completion date not yet determined)							
48	Covington Grand Coulee Line(Surv.)		444,000	(Includes Sponsor's Contribution for Clearing - Not scheduled)																							
139	Covington-Grand Coulee Line#	183.	1,500,000																	(Completion date not yet determined)							
	TRANSMISSION SYSTEM (115 KV)																										
	N.W.Oregon and Willamette Valley																										
23	Salem Substation		951,320													(Temp.12000 KVA Bank)											
21	St.Johns Substation		1,113,440									(2nd Bank)															
64	St.Johns-Astoria Line	82.2	1,147,550																								
53	Astoria Substation		217,420																								
34	Bonneville-Ore.City Line #1	51.2	1,577,340																								
112	Oregon City-Salem Line	35.7	299,160																								
	Eastern Washington																										
43	Midway Sub.Addn.for Ellensburg		51,640																								
42	Midway-Yakima-Ellensburg Line	64.0	433,510																								
44	Ellensburg Substation		76,330																								
75	Midway-Hanford Line	19.2	129,020																								
102	Hanford-Pasco Line	34.9	250,670																								
97	Pasco-Walla Walla Line	32.5	279,370																								
94	Walla Walla Substation		239,000																								
125	Walla Walla-Lewiston Line	85.	706,100																								
93	Lewiston Substation		105,000													(Construction not scheduled)											
127	Lewiston-Colfax Line	42.	388,900																								
92	Colfax Substation		46,000																								
	Eastern Oregon																										
35	Bonneville-The Dalles Line	38.8	755,740																								
37	The Dalles Substation		49,000																								
119	Walla Walla-Pendleton Line	39.2	203,990																								
106	Pendleton Substation		36,000																								
	FEEDER LINES-SERVICE CONNECTIONS TO LOAD AREAS																										
105	Covington-Tacoma Line	13.1	133,230																								
128	Tacoma Metering		6,500																								
90	Chehalis-Mossy Rock Line	26.0	67,320																								
138	Alcoa Substation Additions		788,000																					(Various			
124	Rehab.of Willapa Properties		28,220																					(Facilities)			
	SURVEYS																										
86	Corvallis-Newport-Waldport Srv.		38,900																								
88	The Dalles-Redmond-Rend Surv.		6,000																								
101	Pendleton-LaGrande Survey		1,730																								

Design Starts (Surveys,Design,Land,Proc.etc.)
Construction Starts (Clearing,Const'n,etc.)
Energization Date
Accumulative Progress - Design
" " - Construction

LINES AND SUBSTATIONS PLACED IN SERVICE

W.O.	Nature	Date	W.O.	Nature	Date
12	Bonneville-Cascade Locks Line	7-25-38	27	Vancouver-Kelso 230 KV Line	10-30-40
103	Forest Grove Substation Addition	11-28-39	30	Kelso-Chehalis-Raymond Line	10-30-40
5	Bonneville-Vanc.230 KV Lines No. 1 & 2	12- 1-39	33	Raymond Substation	10-30-40
8	Vancouver Substation	12- 1-39	67	Klickitat County Extension	11- 6-40
15	Bonneville-Grand Coulee 230 KV Line	8- 4-40	25	Eugene Substation	11-28-40
129	Wash.Water Power Co-Interconnection	8- 4-40	20	Vancouver Eugene 115 KV Line (Eugene-	11-28-40
71	Alcoa Service	8-31-40		(Salem -	5-10-40
122	Albany Substation Additions	10-12-40	116	Service to Monmouth	12- 5-40
77	Salem-McMinnville 69 KV Line	10-18-40	7	No. Bonneville Substation	12-22-40
78	McMinnville Substation	10-18-40	99	Bradford Island Crossing No. 3	12-22-40
123	Raymond Substation Addition	10-30-40	79	Centralia Metering	1- 1-41
80	Rehabilitation West Coast Property	10-30-40	81	Chehalis-Centralia Line	1- 1-41

PLATE XXXVIII

Issued by Office of Executive Assistant
Bonneville Power Administration

the Bonneville system. Energy for this substation is provided over the two 230 kv lines from the Bonneville powerhouse, one of these lines being temporarily operated at 115 kv. One 75,000 kva transformer bank steps the voltage down from 220 to 115 and 13.2 kv. An additional 75,000 kva transformer bank of the same voltage ratios is being installed to provide a total capacity for this station of 150,000 kva. This work will be completed in March, 1941. One 230 kv line connects this station with the Chehalis substation, and there is provision for six 115 kv outgoing lines. Two of these serve the Aluminum Company of America, two the St. Johns substation, and two provide for future loads. A 35,000 kva synchronous condenser now being installed is scheduled for service early in 1941. The substation includes a control house with a dispatcher's room, an oil house, and transformer untanking tower. A portion of this station was connected for 230 kv operation during the month of December, 1940. With the exception of transformer bank No. 2, the Chehalis switching equipment, the condenser, and yard lighting and drainage, the construction called for under present work orders is complete. A large reinforced concrete warehouse, and shop and service buildings are located on this substation site. The warehouse houses the line and substation equipment and construction material for use on the entire transmission system. The shop provides for storage and repair of automobiles, and wood, metal-working, meter, and radio work shops. These buildings were completed in September, 1940.

Alcoa Substation: The Alcoa substation, providing service to the Aluminum Company of America, is located four and one-half miles southwest of the Vancouver substation adjacent to the customer's site in Clark county, Washington. It consists of two 37,500 kva transformer banks with the necessary bus and control equipment. The switchboards are now housed in a temporary structure, but a permanent control house is scheduled for completion in the spring of 1941. This station is being increased to a total of six 37,500 kva transformer banks and the necessary bus and switching equipment, which will provide a total capacity of 225,000 kva. Funds for the construction of this addition were in part made available through the deficiency appropriation.

Chehalis Substation: The Chehalis substation forms a part of the main 230 kv loop. It is located near Chehalis, Lewis county, Washington, and provides service to Raymond, Centralia, and Mossy Rock substations. Switching facilities have been provided for an incoming 230 kv line from North Vancouver substation, and an outgoing line to the Covington substation. The main transformer bank with a 75,000 kva, 220-115-13.2 kv rating is being installed. A 12,000 kva 115-66 kv bank provides service to the city of Centralia and will feed the Mossy Rock line on its completion. Temporary facilities are installed for serving the Raymond and Centralia

substations in accordance with executed power contracts. Construction of the entire substation is about 75% completed. Construction of the control house and untanking tower buildings is 80% completed.

Raymond Substation: Raymond substation, near Raymond, Pacific county, Washington, provides service to Grays Harbor, Pacific and Wahkiakum counties by means of recently acquired facilities at Naselle Junction, Ilwaco, Cathlamet, Svenson, and Puget Island. Energy received over a 115 kv line from the Chehalis substation is stepped down to 23 kv and 34.5 kv by two transformer banks. The larger bank is rated 12,000 kva and the smaller bank 3,000 kva. A 7,500 synchronous condenser, which is installed for voltage and power factor control, also improves the system stability. A control house at this station is provided with switchboards, meters, and relays for control of the switchgear. This station is now complete with the exception of landscaping. A further addition, to provide switching facilities and a feeder position for serving the city of Cosmopolis, is scheduled for construction in the spring of 1941.

Centralia Metering Equipment: This installation provides a means for metering the interchange of energy to the city of Centralia at 66 kv and it is located in the switchyard of Centralia's substation. This work was completed in December.

Covington Substation: The Covington substation, located near Covington, King county, Washington, will be a part of the main 230 kv loop, and will tie the Bonneville system with Seattle City Light and Tacoma City Light in the near future. Energy received over a 230 kv line from the Chehalis substation will be transmitted to Seattle at 230 kv and to Tacoma at 115 kv. A 75,000 kva, 220-115.5-13.2 kv transformer bank will provide the necessary voltage transformations. In order to serve Seattle and Tacoma prior to completion of this substation, it will be necessary to install a temporary by-pass arrangement, the design for which already has been completed. Design of the permanent substation is about 15% complete; the only construction activity so far has been clearing of the substation site. Money for the purchase and installation of a portion of the equipment for this station has been provided by deficiency appropriation 14X1225.

Tacoma Metering: This installation provides facilities for metering and the interchange of energy to the city of Tacoma at 115 kv. The metering equipment was purchased by the Bonneville Power Administration, but will be installed by the city of Tacoma.

Midway Substation: The Midway substation, on the main 230 kv loop midway between Bonneville and Grand Coulee dams, is located near Vernita, Benton county, Washington. It includes a 50,000 kva

220-115-13.2 kv transformer and will provide the power requirements of the Yakima valley, southeastern Washington, and northeastern Oregon. Switching facilities for the incoming and outgoing 230 kv lines, and for 115 kv lines to Ellensburg and to Walla Walla are provided. It will be an essential point in the communication system for dispatching power and patrolling the transmission lines. Equipment will include a 50,000 kva 220-115-13.2 kv transformer bank and two outgoing 110 kv feeders. Construction on December 31, 1940, was about 35% complete.

Ellensburg Substation: The Ellensburg substation, located at Ellensburg, Washington, will provide service to the city of Ellensburg, to Kittitas county, and to its adjacent area. Included in the substation design is an incoming 115 kv line from the Midway substation, a 4,000 kva 110-7.2 kv transformer bank and two 7.2 kv outgoing feeders. For housing the necessary control equipment and the station battery, a small control house will be built. Construction of this station started during the month of December and will be completed in the spring of 1941.

Walla Walla Substation: The Walla Walla substation, located adjacent to Walla Walla, Washington, will provide service for the Walla Walla area and territory in northern Oregon. The incoming 115 kv transmission line from Midway will continue eastward to Lewiston and Colfax. A 69 kv line will provide service southward to Pendleton. A 12.45 kv feeder will serve local areas. This station will include a 7,500 kva 115-69 kv transformer bank, and a 1,000 kva 69-12.5 kv transformer bank; a permanent control house will contain the switchboards, relays, and control equipment. Construction of this station was started in December, and will be completed in the spring of 1941.

Pendleton Substation: The Pendleton substation, located adjacent to Pendleton, Umatilla county, Oregon, will provide service for the area in the vicinity of Pendleton. Energy received from the Walla Walla substation at 69 kv will be transformed by a 1,000 kva three-phase transformer bank for delivery at 12.5 kv. At the present time this substation is in the early design stage with a scheduled completion date of September, 1941.

Lewiston Substation: The Lewiston substation, located adjacent to Lewiston, Idaho, will provide service to the surrounding area. Power supplied to this station at 115 kv from Walla Walla will be transformed by a 1,000 kva three-phase transformer bank for delivery at 12.5 kv. An outgoing 115 kv feeder will transmit energy to the Colfax substation. This station will be completed in the fall of 1941.

Colfax Substation: The Colfax substation, located near Colfax, Whitman county, Washington, will provide service in the vicinity of Colfax. Energy will be received from the Lewiston substation at 110 kv, and the voltage is stepped down through a 1,000 kva three-phase transformer bank and power delivered at 12.5 kv. This station will be completed in the early fall of 1941.

St. Johns Substation: The St. Johns substation, located approximately three-quarters of a mile north of the city limits of Portland, Multnomah county, Oregon, provides service to Portland, Oregon, and its adjacent area, and further provides switching facilities for the Vancouver-Eugene and St. Johns-Astoria 115 kv lines. Power is being delivered from this substation to the Salem, Albany, and Eugene substations, and to the Portland General Electric company. Energy is received from two 115 kv lines from North Vancouver substation. One of the two 30,000 kva 110-57-13.2 kv transformer banks which have been installed was put in operation during December; the other bank is to be placed in service in January, 1941. There are six 57 kv outgoing feeders, five to serve the Portland General Electric company, and the sixth to serve Forest Grove. At present only four of the Portland General Electric feeders are energized. This station is located in a concentrated load center and provides all of the switching facilities for the Portland area. Prior to the installation of the transformer bank, temporary facilities for serving the Portland General Electric company included the delivery of energy at 57 kv over one of the 115 kv lines from Vancouver. A control house contains switchboards, meters, and relays to control the many oil circuit breakers located in the switchyard. This station is complete with the exception of the energization of the second transformer bank and the yard lighting and landscaping.

Forest Grove Substation: The Forest Grove substation, located near Forest Grove, Washington county, Oregon, supplies facilities for connection to the electric system of the city of Forest Grove. A 1,500 kva 24-2.4 kv transformer bank is installed. Energy is received over the 24 kv facilities of the Portland General Electric company, through a power transfer arrangement.

Salem Substation: The Salem substation, located approximately two and one-half miles west of Salem, Oregon, in Polk county, is the energy distribution center for the cities of Monmouth and McMinnville and for load in and near the city of Salem, Oregon. Installation includes one incoming 115 kv line from St. Johns; one outgoing 115 kv line to Eugene; three 57 kv feeders, two of which will serve the Portland General Electric company, and one the city of McMinnville; and one 12.5 kv feeder for delivering energy to Monmouth. A 30,000 kva 110-57-13.2 kv transformer bank will supply

the 57 kv outgoing feeders; a 1,000 kva 57-12.5 kv transformer bank now installed supplies the Monmouth feeder. A 20,000 kva synchronous condenser being installed will permit power factor and voltage control, and will increase system stability. In order to supply power to the Portland General Electric company and to furnish a stand-by for the Mountain States Power company, a temporary 7,500 kva transformer bank was installed early in the year of 1940. Because of delayed delivery of the 30,000 kva bank it will be necessary to increase the station capacity by the addition of a 12,000 kva temporary transformer bank which is to be installed in January. A combination condenser building, untanking tower, and control house being constructed at this station is now about 55% complete. This substation is scheduled for completion in the spring of 1941.

McMinnville Substation: The McMinnville substation, located in the city of McMinnville, Yamhill county, Oregon, provides service to the city of McMinnville at 2,400 volts. Supply is received from the Salem substation at 66 kv, which will later be changed to 57 kv. A 3,000 kva transformer bank steps down the voltage to 2.4 kv. This substation was placed in service in October.

Albany Substation: The Albany substation, located adjacent to the city of Albany, Oregon, is serving the Benton-Lincoln County cooperative. Included in the substation installation are one incoming 115 kv line, one outgoing 115 kv line to Eugene, and one 12.5 kv feeder, and a 1,000 kva 110-12.5 kv transformer bank. This substation, with the exception of the 115 kv bus, is a temporary installation. It will be reconstructed as soon as the load warrants.

Eugene Substation: The Eugene substation, located near Eugene, Lane county, Oregon, provides service to its area and an interconnection with the city of Eugene. It is supplied by a 115 kv line from the Salem substation. A 12,000 kva transformer bank steps down the voltage to 11.5 kv for connection with the Eugene system. This station, including the control house, is complete with the exception of the landscaping. The station was energized in November, 1940.

Astoria Substation: The Astoria substation, located at Astoria, Clatsop county, Oregon, will provide service to the Pacific Power & Light company in Astoria and to R.E.A. projects in the vicinity. Power will be supplied from the St. Johns substation at 115 kv. A 12,000 kva transformer bank will supply one outgoing feeder to the Pacific Power & Light company with energy at 23 kv and one feeder to the P.U.D. at 12.5 kv. Construction of the switching station was started in the late fall of 1940, and construction of the control house was started in December.

The Dalles Substation: The Dalles substation, located near The Dalles in Wasco county, Oregon, will provide service to the Wasco county R.E.A. This station will include a 115 kv incoming line, a 1,000 kva 110-12.5 kv transformer bank, and a 12.5 kv outgoing feeder for the R.E.A. Construction was scheduled in January, 1941.

South Bank Underground 13.8 Kv Feeders: In August, 1940, a double circuit 13.8 kv 250,000 CM lead covered three-phase underground feeder approximately one-quarter mile in length was installed between the South Bank substation and the overhead line serving the city of Cascade Locks. The South Bank substation is an indoor 13.8 kv station with four feeder positions located adjacent to Bonneville dam on the south side of the Columbia river and was completed in March, 1940.

Transmission Line Activities

Bonneville-Vancouver Lines #1 and #2: The Bonneville-Vancouver lines #1 and #2 connect the power plant at the Bonneville dam with the North Vancouver substation, located near Vancouver, Washington. They are single-circuit, 230 kv transmission lines of steel tower construction, supporting high strength aluminum cable steel reinforced conductors, and are built on the same 300 foot right-of-way. The length of each circuit, including the Bradford Island crossing, is approximately 36.5 miles. The terrain traversed changes from rough and mountainous country covered with heavy timber, at the eastern end of the line, to rolling and comparatively flat lands, both unimproved and cultivated, at the western end of the line. The right-of-way was cleared by W.P.A. forces. Both circuits are in operation, one at 115 kv and the other at 230 kv. In the future both lines will be operated at 230 kv as part of the main 230 kv transmission loop.

Bonneville-Grand Coulee Lines #1 and #2: The Bonneville-Grand Coulee lines #1 and #2 connect the power plant at the Bonneville dam with the switching structure at the Grand Coulee dam. They are single circuit 230 kv transmission lines of steel tower construction, designed to support high-strength aluminum cable steel reinforced conductors, and located on the same right-of-way 250 to 300 feet wide. The length of each circuit, including the Bradford Island crossing, is approximately 234.5 miles. The terrain traversed changes from heavily timbered, rough mountainous country (about 100 miles) to relatively flat sage brush lands. Part of the line runs through Indian territory. The right-of-way was cleared by W.P.A. forces. The design and construction of line #1 have

been completed. The line is at present operating at 115 kv. Field surveys are nearing completion on line #2. In the future both lines will be operated at 230 kv as part of the main 230 kv transmission loop.

Vancouver-Alcoa Lines #1 and #2: The Vancouver-Alcoa lines #1 and #2 extend from the North Vancouver substation to the Alcoa substation, located approximately two miles west of Vancouver, Washington. The total length is 4.2 miles. The line is of 115 kv double circuit steel tower construction, supporting aluminum cable steel reinforced conductors. Design and construction have been completed and both lines are now supplying power at 115 kv to the new plant of the Aluminum Company of America on the Columbia river.

Vancouver-Kelso-Chehalis Lines #1 and #2: The Vancouver-Kelso-Chehalis lines #1 and #2 will connect the North Vancouver substation with the Chehalis substation located south of Chehalis, Washington. They are single circuit, 230 kv transmission lines of steel tower construction, designed to support high-strength aluminum cable steel reinforced conductors, and are located on the same right-of-way, 250 to 300 feet wide. Length is approximately 71.7 miles. Most of the terrain traversed is hilly and heavily timbered. The design and construction of line #1 has been completed; it is at present operating at 115 kv. Field surveys on line #2 have been completed for approximately 44 miles. In the future both lines are intended for operation at 230 kv as a part of the main 230 kv transmission loop.

Chehalis-Raymond Line: The Chehalis-Raymond line extends from the Chehalis substation, by way of Pe Ell, Washington, to the Raymond substation located north of Raymond, Washington, a total distance of approximately 45.5 miles. The right-of-way is 100 feet wide. This line is of single circuit 115 kv H-frame wood pole construction designed to support expanded copper conductors. The line traverses heavily timbered hills. Clearing was done by W.P.A. forces. Design and construction have been completed. Power is now being supplied to the Raymond substation at 115 kv.

Chehalis-Centralia Line: The Chehalis-Centralia line extends from the Chehalis substation to the substation of the city of Centralia, Washington, a total distance of approximately 11.4 miles. A 5½ mile section of this line was built on the right-of-way of the Chehalis-Covington line and the remainder constructed along existing roads and on a 50-foot right-of-way. This line traverses fairly level country with only occasional timber encountered. Clearing operations were handled jointly by the W.P.A. and Bonneville Power Administration forces. The line is of 69 kv, single pole, wishbone type of construction, designed to support aluminum

cable steel reinforced conductors. Design and construction have been completed and the line is supplying power to the city of Centralia at 69 kv.

Chehalis-Covington Line: The Chehalis-Covington line connects the Chehalis substation with the Covington substation located approximately five miles east of Kent, Washington. It is a single circuit 230 kv transmission line of steel tower construction, designed to support high strength aluminum cable steel reinforced conductors, and located on a right-of-way 250 to 300 feet wide, which will ultimately accommodate a second circuit. The length of the line is approximately 69.4 miles. The line traverses fairly level terrain. The moderate amount of clearing required was handled by W.P.A. forces. Design and construction have been completed. The line is scheduled to be energized at 115 kv early in 1941. The Chehalis-Covington line is intended for operation at 230 kv as a part of the main 230 kv transmission loop.

Covington-Seattle Line: The Covington-Seattle line will connect the Covington substation with the transmission system of the city of Seattle in the vicinity of Renton, Washington. A major purpose of this tie is to obtain the benefits of interconnection between the Seattle and the Bonneville systems. It is a single circuit, 230 kv transmission line of steel tower construction, designed to support high strength aluminum cable steel reinforced conductors, and located on a right-of-way 250 feet wide, which will ultimately accommodate a second circuit. The present length of the line is approximately 11.2 miles. The line is located through fairly level terrain, the moderate amount of clearing required being done by W.P.A. forces. Design is completed and construction scheduled for the immediate future.

Covington-Tacoma Line: The Covington-Tacoma line extends from the Covington substation to the city limits of Tacoma, Washington, a distance of approximately 13.1 miles, from which point the city of Tacoma will extend the circuit to its Tide Flats substation. The line traverses fairly level country, part of which is timbered. The line is of single circuit, 115 kv. H-frame, wood pole construction, designed to support aluminum cable steel reinforced conductors. Completion is scheduled in February, 1941. When energized, the line will be used for interchange of power between the Bonneville Power Administration and the city of Tacoma.

Covington-Coulee Line: The Covington-Coulee line will connect the Covington substation with the bus structure at the Grand Coulee dam. It is a single circuit 230 kv transmission line of steel tower construction, designed to support high-strength

aluminum cable steel reinforced conductors and located on a right-of-way 250 to 300 feet wide, which will ultimately accommodate a second circuit. The length of the line is approximately 182.6 miles. The terrain traversed changes from heavily timbered, rough mountainous country to relatively flat sage brush lands. The line crosses the Cascade mountains by way of the Stampede and Colockum passes. The right-of-way will be cleared by W.P.A. forces. Surveys have been completed. Design work and procurement of materials are in progress. The line will be operated at 230 kv as part of the main 230 kv transmission loop.

Midway-Yakima-Ellensburg Line: The Midway-Yakima-Ellensburg line extends from the Midway substation, by way of Yakima, Washington, to the Ellensburg substation west of Ellensburg, Washington. The total length of the line is approximately 64.1 miles; the right-of-way is 100 feet wide. The line is of single circuit 115 kv H-frame wood pole construction designed to support expanded copper conductors. Part of the line traverses sandy sage brush country. while the remainder runs through low rocky hills sparsely covered with timber. Design of the line has been completed. Construction is well under way. There have been over 10 miles of poles erected. This line is scheduled for completion in February, 1941.

Midway-Hanford-Pasco-Walla Walla Line: The Midway-Hanford-Pasco-Walla Walla line extends from the Midway substation, near Vernita, Washington, by way of Hanford and Pasco to the Walla Walla substation west of Walla Walla. Total length, including the specially designed single-circuit steel tower crossings over the Columbia and Snake rivers, is approximately 81.8 miles; the right-of-way varies in width from 100 to 300 feet. The single circuit, 115 kv, H-frame, wood pole construction is designed to support expanded copper conductors. The line traverses sandy, sage brush country and rolling wheat lands. No clearing will be necessary. Design has been completed and construction will start in the immediate future.

Walla Walla-Pendleton Line: The Walla Walla-Pendleton line extends from the Walla Walla substation to the Pendleton substation, located east of Pendleton, Oregon, a total distance of approximately 39.2 miles. A considerable portion of this line will be built across wheat lands and sub-marginal lands on a right-of-way 50 feet wide. The remainder will follow along existing roads. No clearing will be necessary. The line will be of single circuit 69 kv wood pole construction employing H-frame and single pole wishbone types of structures, designed to support aluminum cable steel reinforced conductors. Surveys have been completed; design and procurement of materials were well under way in December, 1940.

Walla Walla-Lewiston-Colfax Lines: The Walla Walla-Lewiston-Colfax lines extend from the Walla Walla substation, by way of Lewiston, Idaho, to the Colfax substation near Colfax, Washington. Total length, including a crossing over the Snake river, is approximately 121 miles. Right-of-way is 60 feet wide. For their entire length the lines traverse rolling hills, a considerable portion of which is under cultivation. No clearing will be necessary. The 115 kv single circuit H-frame wood pole construction is designed to support expanded copper conductors. Surveys are nearly completed. Design and procurement of materials are in progress.

Bonneville-Oregon City Lines #1 and #2: The Bonneville-Oregon City lines #1 and #2 will extend from the powerhouse at the Bonneville dam, through the Tanner Creek gorge, to the Oregon City substation site located near Wilsonville, Oregon. Total length, including the specially designed ship canal crossing, is approximately 51.2 miles. The right-of-way varies in width from 100 to 300 feet. Terrain traversed changes from extremely rough, mountainous and heavily timbered areas, near Bonneville, to rolling hills and some cultivated lands. Right-of-way clearing is being done by W.P.A. forces. The 115 kv double circuit steel tower construction will support both high-strength aluminum cable steel reinforced and expanded copper conductors. Surveys have been completed, design and procurement of materials are well under way. When energized, this double circuit will serve as part of the major Bonneville network assuring service to the Willamette valley.

Bonneville-The Dalles Line: The Bonneville-The Dalles line will extend from the powerhouse at the Bonneville dam, by way of Hood River, Oregon, to The Dalles substation west of The Dalles, Oregon. Total length, including the specially designed single circuit steel tower ship canal crossing, is approximately 38.7 miles. Width of the right-of-way is 150 feet. The west portion traverses rough and heavily timbered terrain along the south side of the Columbia gorge. Clearing of the right-of-way was done by W.P.A. forces. The line is of 115 kv single circuit construction. Portions difficult of access will employ H-frame latticed steel structures designed to support high-strength aluminum cable steel reinforced conductors; wood pole H-frames designed to support expanded copper conductors are used on the balance of the line. Design has been completed. All but one mile of clearing has been completed. Over two miles of poles have been erected.

Vancouver-Eugene Lines #1 and #2: The Vancouver-Eugene lines #1 and #2 connect the North Vancouver substation with the St. Johns substation in northwest Portland, Oregon. From Portland line #1 proceeds to the Eugene substation, north of Eugene, Oregon, by way of the Salem and Albany substations. The length of line #1,

including specially designed, double circuit steel tower crossings over the Columbia and Willamette rivers, is approximately 127.7 miles. Present length of line #2 is approximately 7.5 miles. These lines are of single circuit, 115 kv wood pole construction, employing H-frame and single pole wishbone types of structures. Both high-strength aluminum cable, steel reinforced, and expanded copper conductors are used. The right-of-way varies in width from 50 to 180 feet; a considerable part of line #1 is located on the right-of-way of the Oregon Electric railway. Most of the line runs through the Willamette valley. Necessary clearing was done by W.P.A. forces. Design and construction have been completed. Both circuits are in operation at 115 kv.

Oregon City-Salem Line: The Oregon City-Salem line extends from the Oregon City substation, located near Wilsonville, Oregon, to the Salem substation, a distance of approximately 35.7 miles. The single circuit, 115 kv wood pole construction employing H-frame and single pole wishbone types of structures, is designed to support expanded copper conductors. It will parallel the Vancouver-Eugene line #1. Surveys have been completed. Design and procurement of materials are well under way.

Salem-McMinnville Line: The Salem-McMinnville line extends from the Salem substation to the substation of the city of McMinnville, Oregon, a distance of approximately 21.7 miles. Right-of-way varies in width from 60 to 100 feet. It is of single circuit, 69 kv wood pole construction, employing both H-frame and single pole wishbone types of structures, designed to support aluminum cable, steel reinforced conductors. Part of the line traverses rolling hills which are heavily wooded. Necessary clearing was done by W.P.A. forces. Design and construction have been completed. It is now operating at 60 kv supplying power to McMinnville.

Corvallis-Newport-Waldport Line: The Corvallis-Newport-Waldport line will extend from the Albany substation and will proceed by way of Toledo, Oregon, to substations near Newport and Waldport, Oregon. Total length will be approximately 60 miles. Right-of-way will be 100 feet wide. The line will traverse mountainous country, a portion of which is timbered. It will be of 69 kv single circuit H-frame wood pole construction. Surveys have been started.

St. Johns-Astoria Line: The St. Johns-Astoria line will extend from the St. Johns substation, by way of St. Helens, Rainier, and Clatskanie, Oregon, to the Astoria substation, located adjacent to the southwestern city limits of Astoria, Oregon. Total length, including the specially designed double circuit steel tower crossing over the Willamette river and the single circuit

steel tower crossing over the John Day river, is approximately 82.2 miles. Right-of-way is 100 feet wide. Terrain is rough and difficult of access throughout the entire line. A considerable portion is heavily timbered. Clearing is being done by the Bonneville Power Administration. The 115 kv single circuit H-frame wood pole construction will support expanded copper conductors. Design and over 50 miles of clearing have been completed. Pole erection has started. The line is to be completed in April, 1941.

Subtransmission Activities

Service to Pacific County Public Utility District: The facilities for serving Pacific county were acquired from both the Willapa Electric and West Coast Power companies. Those acquired from the Willapa Electric company are the Tide Flats substation at Raymond and a section of steel tower line from this substation to the 115 kv Raymond substation constructed by Bonneville. The Tide Flats substation includes a steel structure and three 1,000 kva, 3-winding transformers rated 22/66-6.9-2.3 kv. The steel tower line has been reconstructed to support two three-phase circuits, using 4/0 stranded copper conductors. One is a 33 kv circuit and the other, designed for 66 kv, operates at 22 kv. The facilities acquired from the West Coast Power company include substations at Naselle Junction and Ilwaco, and two transmission lines which operated at 13 and 33 kv. The Naselle Junction substation comprises a wood pole structure and three 150 kva transformers with 33-6.9/13.8 kv windings. The Ilwaco substation is of steel construction and, as acquired, contained two 200 kva, 33-2.3/6.9 kv transformers operating at 6.9 kv. A third transformer was added to this installation. The acquired 13 kv transmission line was of wood pole construction, using No. 4 and No. 6 copper conductors, extending approximately 27 miles from a point south of Raymond to Naselle Junction. This line has been reconstructed for 33 kv operation and has been extended 2.5 miles to where it contacts the steel tower line to the Bonneville Raymond substation. The existing 13 kv circuit was lowered and the supporting poles used jointly with the 33 kv circuit. The acquired 33 kv line is also of wood pole construction, using No.2 and No. 4 conductors. This line extends from Naselle Junction to Ilwaco, a distance of approximately 14.5 miles. Some rehabilitation work to improve the reliability of this line has been performed.

Service to Wahkiakum County Public Utility District: The facilities for serving Wahkiakum county were acquired from the West Coast Power company. These include substations at Svenson and Cathlamet, and transmission facilities. At Svenson, the

substation consists of a wood pole structure and three 37½ kva, 33-6.9/13.8 kv transformers connected for 6.9 kv operations. The Cathlamet substation includes a steel structure and three 333 kva, 36.3-7.2/12.4 kv transformers which deliver power at approximately 11 kv. The acquired 37 mile 33 kv line from Naselle Junction to Cathlamet is of wood pole construction, using No. 2 copper conductors. This line has been rehabilitated as required to insure service reliability. From the Cathlamet substation, an 11 kv line of wood pole comstruction, using No. 2 copper conductors provides service to Puget Island in the Columbia river. A submarine cable is used between the island and the transmission line from Cathlamet. A second cable to the Oregon shore provides a standby connection with the West Coast Power company.

Service to Grays Harbor County Public Utility District: Bonneville energy to Grays Harbor county is supplied from the Raymond substation by means of a line extending approximately 23 miles northward to Cosmopolis, where contact is made with facilities of the Grays Harbor Public Utility District. The Raymond-Cosmopolis line, which was acquired from the Willapa Electric company, is of steel tower construction. It is designed for 66 kv service, but now operates at 22 kv. Some reconstruction work is to be performed on this line to improve its service reliability.

Service to Mossy Rock: This is a 69 kv line fed from the Chehalis substation. The line is approximately 25.6 miles long, and uses No. 2 ACSR conductor. This line, which terminates just west of the town of Mossy Rock, Washington, will serve all existing and future PUD and REA distribution lines in eastern and central Lewis county. These consist of the Alpha REA project, the lines formerly owned by the Cowlitz Valley Light & Power company, the Randall Section REA lines, the Parkwood Electric company, and those Washington Gas & Electric company lines which have been acquired by the PUD. Design work has been completed, and construction has started, with the delivery of poles to the site and with pole erection under way.

Service to Monmouth: This service includes a 7.2/12.45 kv line from the Salem substation to the Monmouth substation. The line, which is of the REA type, using 1/0 ACSR conductor, is approximately 13.6 miles long. Construction started October 14, 1940, and the work was completed and the line energized December 4, 1940. The Monmouth substation is a two pole structure with three 150 kva, 7.2/2.3 kv transformers. This substation feeds the municipally owned power system of the town of Monmouth, Oregon.

Klickitat County Extension: The Klickitat county extension includes a substation at Conmit, Washington, to supply a 22.8 mile

line which terminates at a substation at Glenwood, Washington. This extension provides service to the Klickitat county REA. The Condit substation consists of a 600 kva, 2.3-7.2-12.45 kv transformer bank, an automatic reclosing circuit breaker, and disconnecting switches. It is supplied with energy by facilities of the Northwestern Electric company in accordance with power transfer arrangements. The Condit-Glenwood transmission line is of REA construction, using No. 1/0 ACSR except for a section designed for 33 kv operation. The Glenwood substation consists of a 150 kva, 7.2-12.5 kv to 110-220 volt transformer, a 12.45 kv disconnecting switch, and a low voltage circuit breaker. This service was completed in July and energized in August, 1940.

Operations in Fiscal 1941

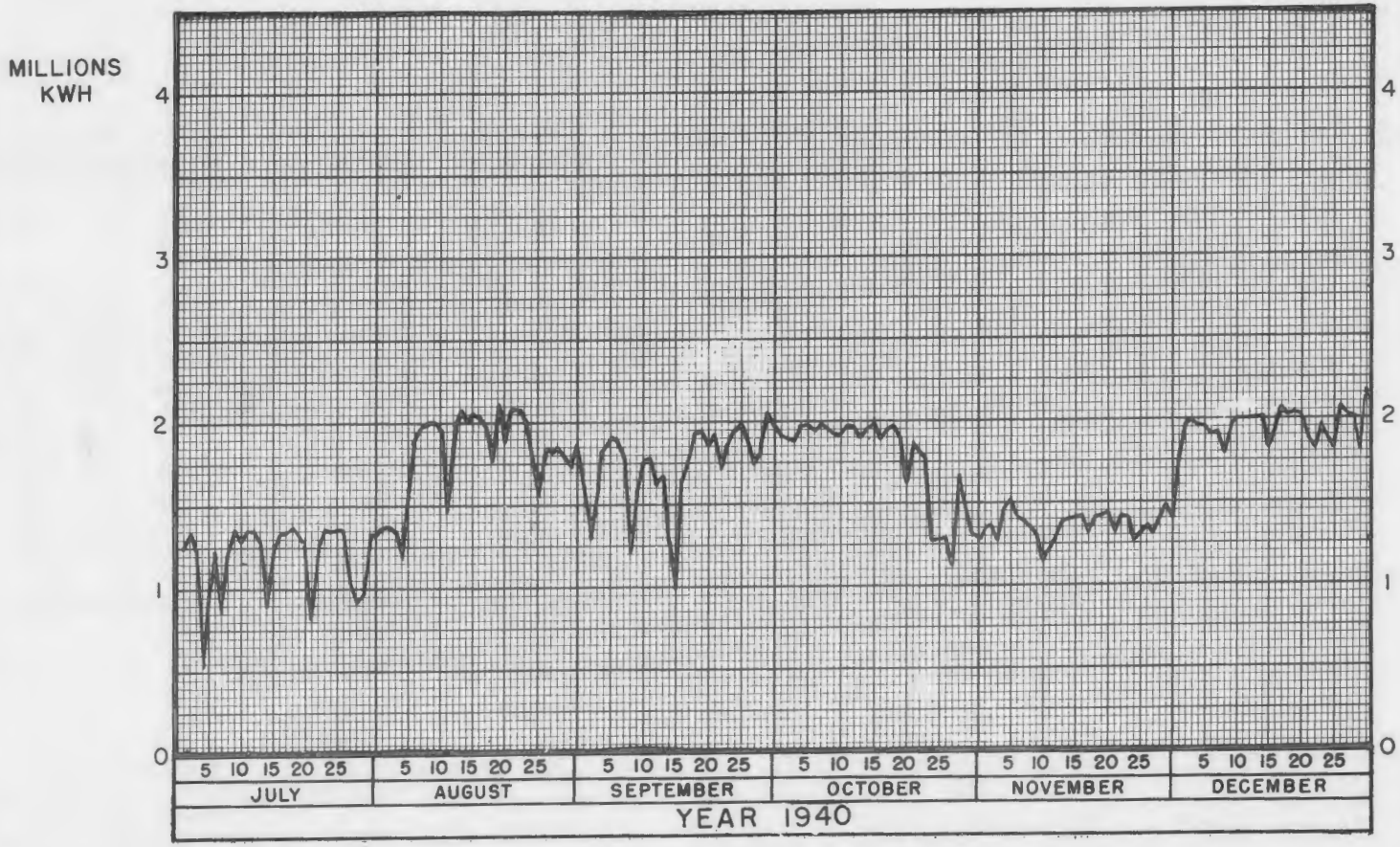
Following July 1, 1940, there was a heavy demand for energy,[1/] which required operation of the available generators at the Bonneville power plant at a very high load factor. This condition was due in part to a dry summer season, which reduced the output of hydro plants of the Portland General Electric company to a minimum much earlier than usual. That company, therefore, was taking Bonneville energy up to the capacity of the interchange facilities during the months of July, August, and September. Thunder storms in September marked the beginning of the rainy season, which relieved this condition. However, during December the Portland General Electric company was again using up to the full interchange capacity during peaking periods.

During August an interchange interconnection was made with the Washington Water Power company at Rocky Junction, located about 40 miles southwest of Grand Coulee dam, by means of the Bonneville-Coulee line. Beginning August 5, 1940, the Power Administration transmitted all its available off-peak energy during August and September to the Washington Water Power company, thereby permitting that company to preserve the storage at its hydro plants. This energy, which was delivered on balance, that is, subject to call during the succeeding year, was returned in part during the month of December, when the Bonneville generating facilities were loaded to a maximum.

Transmission line and substation additions to the Bonneville system following June 30, 1940, made service available in accord

---

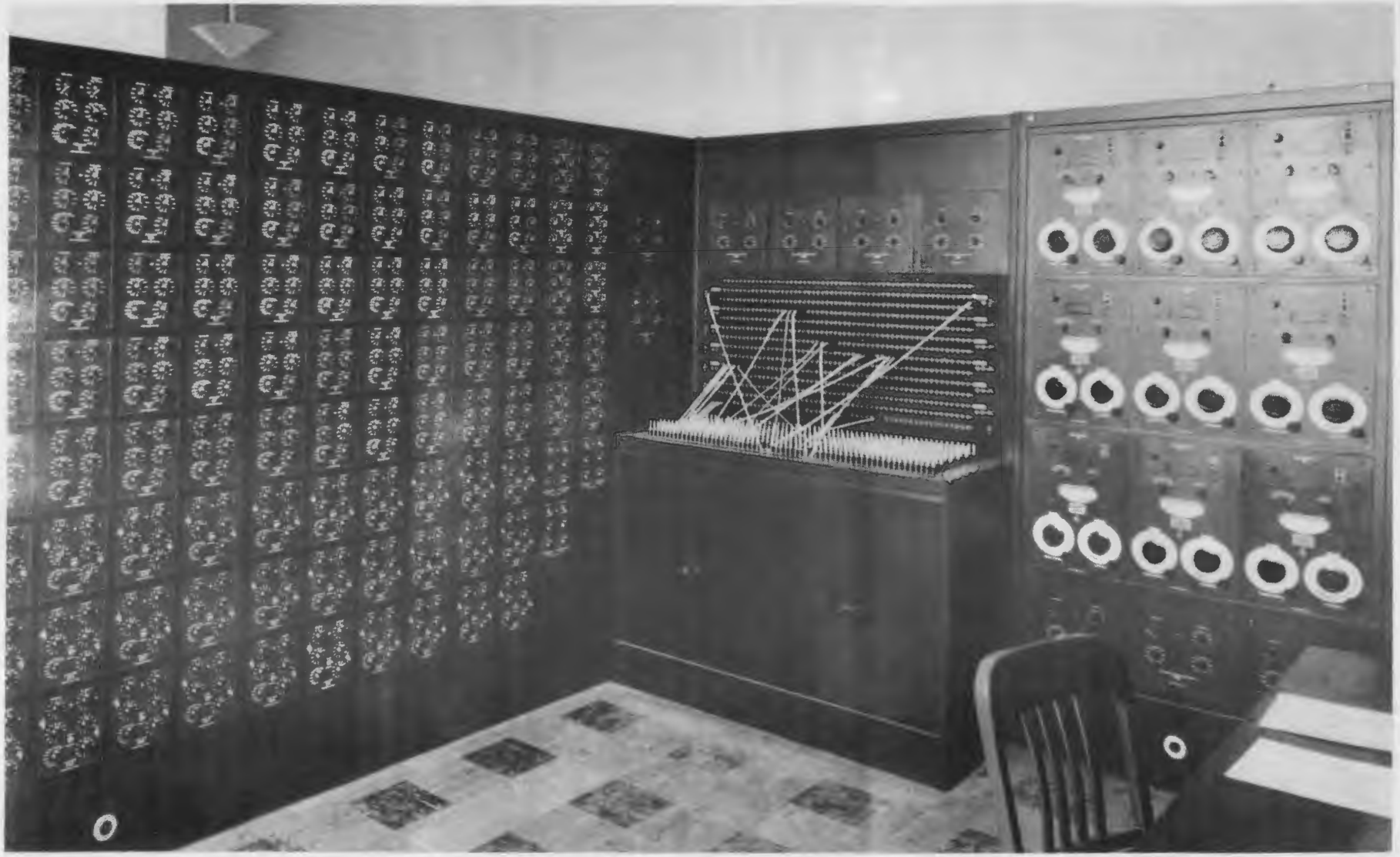
1/ See Plate XXXIX



TOTAL KWH GENERATED ON BONNEVILLE SYSTEM

DISPATCHING OFFICE
USDI - BPA

PLATE XXXIX



AC Network Analyzer

with previously executed contracts. Customers in the State of Washington added to the system included the Aluminum Company of America, the city of Centralia, and the Grays Harbor, Pacific county, and Wahkiakum county public utility districts. In Oregon, service was provided to the cities of McMinnville, Monmouth and Eugene, and to the Benton and Lincoln county electric cooperatives.

From a load standpoint, the most outstanding of the new services was that to the Aluminum Company plant. This plant ultimately will have five production units requiring 32,500 kw of energy each, or a total of 162,500 kw. Each unit was scheduled to start with a power consumption of 27,000 kw which builds up to the maximum. On September 20, 1940, the Aluminum company began taking energy for its first production unit, and on December 1, for the second unit. The remaining units were scheduled to go into operation during 1941.

The personnel engaged in operations was steadily expanded to care for the additional transmission lines and substations which were placed in service during this period. Since the end of the 1940 fiscal year, 32 employees were added to the operations staff bringing the total to 65. Twenty-one additional employees, principally substation operators, were requisitioned to meet operations requirements. Four line maintenance trucks and 14 half-ton patrol units were purchased for transmission line maintenance. Airplane patrol of faulted lines proved of particular use in locating trouble quickly. As fiscal 1941 progressed, studies were under way with a view toward utilizing this type of patrol in the less accessible areas traversed by transmission lines. The plan involved maintenance of radio contact with the airplane and vehicular patrol crews for rapid coordination of activities. Space also was provided for laboratory apparatus required for operations, and this equipment was being installed at the close of the calendar year.

System Studies in Fiscal Years 1940 and 1941

The rapid development of the Bonneville Administration's power system greatly increased the necessary studies and research peculiar to complex high-voltage transmission systems. It early became apparent that apparatus characteristics must be such as to insure a flexible system,1/ functioning properly during early development stages and providing the highest type of service as later additions

---

1/ See Plate XL, following p. 142.

were made. Accordingly system studies were instituted in fiscal 1938 and were carried on progressively through ensuing years. In general, these were of three types: Studies associated directly with the use of a network analyzer (regulation, short circuit, stability, load distribution studies, etc.), studies on system protection, and studies on system communications. By the close of 1940, these studies had developed to a point, and the problems to be solved were of such complexity, as to require new equipment.

Network Analyzer: As systems grow and interconnections become more numerous, the calculations to secure necessary basic information become more complex and require lengthy solutions. In the case of rapidly growing systems, these problems are practically impossible to solve analytically and recourse must be made to a network analyzer. Such an instrument was installed at North Vancouver substation during November, 1940. This analyzer, which cost about $85,000, is one of eight in existence and the only one west of Chicago. It comprises various components which can be adjusted to exactly simulate the generators, transmission lines, transformers, synchronous condensers, and loads of an actual system. These may be quickly connected to form an equivalent of an actual or hypothetical power system, which may then be subjected to any desired conditions. Thus, in a short time, a complete analysis of the behavior of the system can be determined, and data required for the planning and operation necessary with modern interconnected power systems can thus be obtained.

Protection: In general, initial relay protection for the Bonneville system was carefully planned so as to fit into the protective schemes for the ultimate system. All 230 kv lines are being provided with 3-cycle oil circuit breakers for quickly clearing a faulty line without causing system instability. All other breakers are of the 8 cycle type.

Long lines are protected with high speed impedance (distance) relays of the three zone type. All these relays were designed with extra terminals so that carrier current pilot relay protection could be added at a minimum expense. The carrier relays are to be installed before the first generator is placed in operation at Grand Coulee, interconnecting this power plant with the Bonneville power plant. Directional ground relays also are being installed on all high voltage power lines.

Short lines, such as the 230 kv Columbia river crossings at the Bonneville powerhouse, are protected with pilot wire relays. These 230 kv river crossings are protected with directional overcurrent relays and directional ground relays mounted on temporary panels, which were to be removed on the installation of the main

switchboard and pilot wire relays. The two short parallel 115 kv lines from Vancouver to the St. Johns substation in Portland are protected with current balance relays and with directional overcurrent and directional ground relays for back-up protection and for single line operation. Pilot wire relay protection is provided for the short 115 kv lines from the Vancouver substation to the Aluminum company plant.

All the main high voltage buses on the Bonneville system are being protected with differential relays, as are all large power transformers. Synchronous condensers have undervoltage, overvoltage, reverse phase, and ground relay protection in addition to the differential protection.

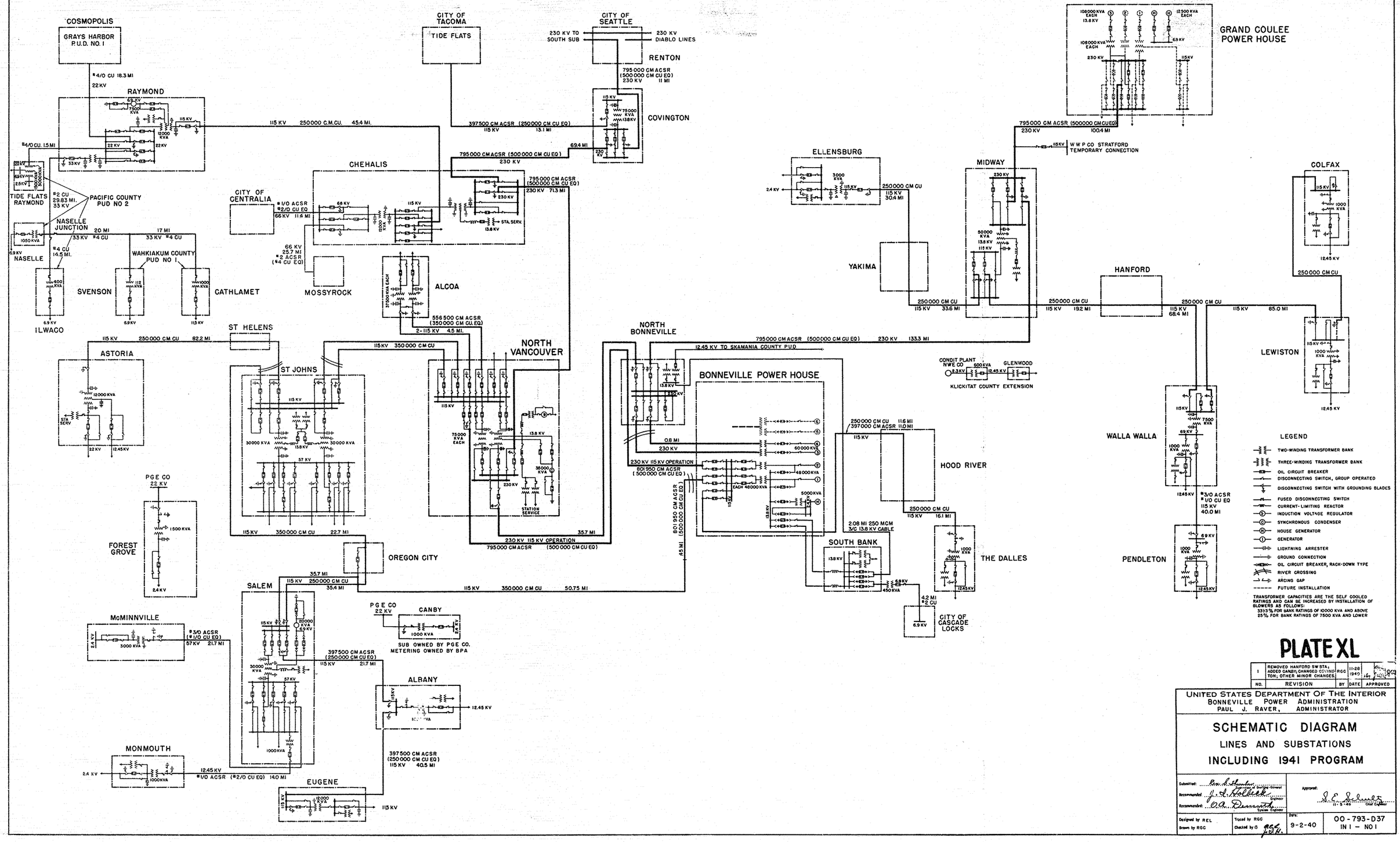
Low voltage lines are protected with overcurrent relays, and the directional control feature has been added where necessary. On all lines fed from power transformers with solidly grounded neutrals, suitable ground relays are installed. The rapid changes occurring in the development of the Bonneville system during the first six months of fiscal 1941 necessitated frequent revisions of the settings of protection relays and the use of some temporary measures. These operations affected the efficiency of the relaying to a certain extent, especially in regard to the maintenance of complete system stability during abnormal conditions. However, they did fulfil their primary purpose of providing adequate protection to equipment.

Communications: The communications system was developed to consist of power line carrier telephone equipment located in nearly all substations of the power system. Strategically located substations are to be equipped with radio transmitters and receivers to be used to communicate with construction and maintenance vehicles in the field. Some telephone equipment was scheduled for installation using wires supported on power line poles. Considerable use was planned for the facilities of the Pacific Telephone & Telegraph company.

By December 31, 1940, fifteen carrier communication transmitter-receiver sets were either installed, being installed, or on order with the manufacturers. The North Vancouver to Raymond and the North Vancouver to Bonneville dam carrier communication circuits were placed in operation, with other circuits scheduled for service at an early date.

Materials for fixed radio stations to be located at six substations were obtained and are being installed. Fifteen mobile radio stations also had been received and were being prepared for service.

Telephone equipment using conductors supported on power line poles provided communications between the Chehalis and Centralia substations, and between the Raymond, Ilwaco, and Cathlamet substations. Special leased telephone equipment for the system dispatchers was developed and placed in operation at the North Vancouver substation. Laboratory facilities were designed and constructed at North Vancouver to be used in designing and maintaining the units of the communication system.



LEGEND

- TWO-WINDING TRANSFORMER BANK
- THREE-WINDING TRANSFORMER BANK
- OIL CIRCUIT BREAKER
- DISCONNECTING SWITCH, GROUP OPERATED
- DISCONNECTING SWITCH WITH GROUNDING BLADES
- FUSED DISCONNECTING SWITCH
- CURRENT-LIMITING REACTOR
- INDUCTION VOLTAGE REGULATOR
- SYNCHRONOUS CONDENSER
- HOUSE GENERATOR
- GENERATOR
- LIGHTNING ARRESTER
- GROUND CONNECTION
- OIL CIRCUIT BREAKER, RACK-DOWN TYPE
- RIVER CROSSING
- ARCING GAP
- FUTURE INSTALLATION

TRANSFORMER CAPACITIES ARE THE SELF COOLED RATINGS AND CAN BE INCREASED BY INSTALLATION OF BLOWERS AS FOLLOWS:
33⅓% FOR BANK RATINGS OF 10000 KVA AND ABOVE
25% FOR BANK RATINGS OF 7500 KVA AND LOWER

PLATE XL

NO.	REVISION	BY	DATE	APPROVED
1	REMOVED HANFORD SW STA.; ADDED GANBY; CHANGED CONNECTION; OTHER MINOR CHANGES.	RGC	11-28 1940	

UNITED STATES DEPARTMENT OF THE INTERIOR
BONNEVILLE POWER ADMINISTRATION
PAUL J. RAVER, ADMINISTRATOR

SCHEMATIC DIAGRAM
LINES AND SUBSTATIONS
INCLUDING 1941 PROGRAM

Submitted: [illegible] Chief Engineer
Recommended: J. L. Holbrick Engineer
Recommended: Wm. A. Dennis System Engineer
Approved: [illegible] 11-5-40 Chief Engineer

Designed by REL
Drawn by RGC
Traced by RGC
Checked by G [illegible]
Date: 9-2-40

00-793-D37
IN I – NO I