PART 3

REPORT OF THE DISTRICT ENGINEER, PORTLAND, OREG.

SYLLABUS

For the development of the Columbia River below the mouth of the Snake the district engineer recommends the adoption of a comprehensive plan comprising two power developments, one at The Dalles and one at the Warrendale site, with pool elevations, respectively, 330 feet and 54 feet above sea level. This plan would permit the ultimate irrigation of 378,000 acres by pumping from the pool created by the power dam at The Dalles. The district engineer is of the opinion that there would be benefits to navigation from such plan. He finds that works for flood control cannot be considered an element of a comprehensive plan.

WAR DEPARTMENT,
OFFICE OF THE DISTRICT ENGINEER,
Portland, Oreg., July 31, 1931.

Subject: Report on Survey of Columbia River (below Snake River).
To: The Chief of Engineers, United States Army.
(Through the Division Engineer.)

CHAPTER I. INTRODUCTION

1. This is part 3 of a report in three parts on Columbia River submitted in compliance with Department letter dated April 8, 1929, and the River and Harbor Act approved January 21, 1927. The River and Harbor Act approved January 21, 1927, authorized Surveys in Accordance with House Document 308, Sixty-ninth Congress, first session. That document included Columbia River and minor tributaries, as follows: Cowlitz, Lewis, Willamette, and John Day Rivers.

2. This report (part 3 of a report on the entire section of Columbia River and minor tributaries within the United States) deals with the section of the river below the mouth of Snake River. This treatment of the subject was authorized by the Chief of Engineers on May 17, 1927, when it was directed that the Seattle, Wash., district make the survey of Columbia River above the mouth of Snake River, and the Portland, Oreg., district make the survey of the stream below that point. This assignment corresponds to the existing division of waterway between the two districts for navigation improvements and power development investigations.

3. Each of the tributaries named in paragraph 1 has been, or will be, made the subject of a separate report. The report on Cowlitz River has been printed as House Document 666, Seventy-first Congress, third session; that on Lewis River as House Document 680, Seventy-first Congress, third session; that on Willamette River as House Document 263, Seventy-second Congress, first session. Completion of the report on John Day River has been deferred owing to its dependence on the findings of the present report. Snake River, another tributary of Columbia River, is likewise the subject of a separate report under House Document 308. My report on Snake River was submitted to the Chief of Engineers under date of May 31, 1929. This report has not yet been printed. Unnamed tributaries of the Columbia are considered only insofar as they affect the problem of the main Columbia.

While separate reports for the five tributaries named above have been or will be submitted, the effects of these streams and of all other

tributaries on the hydraulics of Columbia River below mouth of Snake River are considered in this report.

4. A preliminary study of Columbia River and its minor tributaries was conducted during the period from June 8, 1928, to February 11, 1929, at a cost of $17,220 for field and office work in order to determine the surveys and studies required for preparing a comprehensive plan.

The field work consisted of gagings on Columbia River, reconnaissance and low-water period gagings on its minor tributaries, reconnaissances in connection with power sites, districts subject to overflow, and areas to be surveyed.

The office work comprised the compilation of information from field work, the compilation of existing maps, profiles, and other related data, and the preparation of plans for the conduct of further study, together with an estimate of the cost involved.

5. As a result of the preliminary study, additional field and office work was authorized by the Chief of Engineers on June 1, 1929. The additional work was completed on July 31, 1931, at a cost of about $215,000. It comprised general and detailed surveys, foundation investigations, and studies sufficient to determine:

The discharge of the stream.
The locations and capacities of reservoir sites.
The locations and practicability of dam sites.
The capacities of power sites.
The present and prospective power markets available.
The best plan of improvement for all purposes.

6. The additional field work comprised:

(1) Topographic surveys.
   a. 300 square miles on Columbia River to elevation 100 feet above low-water profile.
   b. 6½ square miles detailed topography of dam sites.
   c. 30 square miles detailed topography adjacent to Columbia River for irrigation projects.
(2) One hundred and twenty square miles hydrographic surveys on Columbia River.
(3) Subsurface investigations for power sites; 34 holes, totaling about 4,500 linear feet of drilling.
(4) Stream flow determination on Columbia River and tributaries.
(5) Field reconnaissance of irrigable areas, existing irrigation projects, and areas subject to flood.
(6) Supervision of field parties.

Most of the topographic surveying and all of the stream-flow gaging were conducted by the United States Geological Survey. Funds were transferred from this office to the United States Geological Survey to cover cost of the work.

7. The additional office work comprised:

(1) Drafting of maps and charts.
(2) Preparation of detailed plans and estimates for structures.
(3) Economic studies of resources, traffic, markets for power and irrigable area products, and benefits from possible improvement.
(4) Compilation of data from field work.
(5) Assembling and preparing the above items for the report.

Valuable assistance was given by the Portland district office of the Bureau of Foreign and Domestic Commerce, United States Department of Commerce.

The following personnel of the district engineer office who have had direct charge of the compilation of this report and of the various major studies connected therewith have rendered particularly efficient service:

Robert M. Copeland, captain Corps of Engineers.
Edwin P. Lock, Jr., first lieutenant Corps of Engineers.
Harold A. Rands, senior hydraulic engineer.
Fred C. Schubert, senior engineer.
A. L. Alin, hydraulic engineer.
Allen L. Darr, associate hydraulic engineer.

8. Services of consultants and experts were used intermittently in various phases of the work and in arriving at the best plan for development. Among those used in a consulting capacity were:

Barry Dibble, consulting engineer, Redlands, Calif.
F. C. Dillard, consulting hydraulic engineer, Medford, Oreg.
E. C. Loew, professor, University of Washington, Seattle, Wash.
D. C. Henny, consulting engineer, Portland, Oreg.
Samuel Murray, chief engineer Oregon-Washington Railroad & Navigation Co., Portland, Oreg.
Bertha Nienburg, economic consultant, Washington, D.C.
Ira A. Williams, consulting geologist, Portland, Oreg.

CHAPTER II.—DATA

A. Columbia River Basin

(a) GENERAL

9. Columbia River rises in British Columbia. It enters the United States in northeastern Washington, flows southerly to the mouth of Snake River, thence westerly between Oregon and Washington, and empties into the Pacific Ocean 610 miles north of San Francisco Bay and 160 miles south of the Strait of Juan de Fuca. The total length of the river is approximately 1,210 miles; drainage area, 259,000 square miles; extreme low-water flow above the mouth of Willamette about 50,000, and maximum discharge of record about 1,160,000 cubic feet per second. The average summer freshet discharge due to melting snows in the upper watershed is about 660,000 second-feet. The mean low-water flow below the mouth of the Willamette is about 70,000 second-feet, exclusive of tide water. The effect of tides is observed on the Columbia to a point about 36 miles above Vancouver and on the Willamette to a point about 11 miles above Portland. (See U.S. Coast and Geodetic Survey charts nos. 5902, 6151, 6152, 6153, 6154, 6155, and 6146; also Geological Survey map of Washington.)

10. The bed and banks of the river from the International Boundary to Vancouver are composed of rock, gravel, and sand. The width varies from a few hundred feet at some of the rapids to about 15,000 at Blalock Island. Below Vancouver the bed is composed mostly of sand, and width varies from about 2,000 to 20,000 feet.

11. Usually for a period averaging about 2 weeks annually the Columbia above Vancouver is closed to navigation on account of ice.

12. The river below the mouth of Snake River is divided by physical characteristics into several sections, as shown in the following tabulation. Five of these sections are under improvement.

Section	Distance	Fall	Currents	Remarks
	Miles	*Feet*		
Snake River to head of Celilo Falls.	123.5	185	Swift and rapids	Open river improvement.
Head Celilo Falls to The Dalles	11.5	82	Rapids	Dalles-Celilo Canal and locks.
The Dalles to head of Cascades	41.5	4	Moderate	Natural 8-foot channel.
Cascades to Warrendale	7	37	Rapids	Cascades Canal and locks 4½ miles under improvement.
Warrendale to Vancouver	35.5	5	Fairly swift	Tidal, unimproved, 8-foot channel.
Vancouver to mouth	104.5	5.6	Tidal	Improved for ocean-going vessels.
Mouth of Columbia			do	Do.

13. The portion of the drainage basin of Columbia River that comes within the scope of this report (that below the mouth of Snake River) embraces approximately 46,500 square miles in Washington and Oregon. It may be considered in three sections; that east of the Cascade Range of mountains, that through the Cascade Range, and that westward from the mountains to the sea. The length of the river through these sections is 323.5 miles. (See pl. 2.)

14. The section east of the mountains to the mouth of Snake River a distance of about 146 miles, has an area of 27,000 square miles. It is, for the most part, treeless. In its natural state it was covered by bunch grass and sage brush. The rainfall is slight, except on the Blue Mountains and the slopes of the Cascade Range. The immediate valley of the river is from 2 to 5 miles in width. Steep, rocky slopes, or series of cliffs rise to a height of 500 feet or more on both the Oregon and Washington sides. An exception to this is found in Morrow and Umatilla Counties, Oreg., where low-lying country extends back from the river for a number of miles.

15. At the present time large areas on both the north and the south sides of the river in the eastern section are under plow and are devoted to the growing of grain by dry-farming methods. There is some irrigation, notably in Umatilla and Morrow Counties, in which the Umatilla project of the United States Bureau of Reclamation is located. There are also some locally managed irrigation projects along Umatilla, Deschutes, and Hood Rivers. As a rule the productive lands lie back several miles from the Columbia, and for this reason all of the larger towns above The Dalles are away from the river. Below The Dalles, scattering timber prevails. The eastern sections ends in the two fruit-growing valleys, Hood River on the south and White Salmon on the north, which lie sheltered from the cold east winds behind the foothill ridges of the mountain range.

16. The principal tributaries in the eastern section, named in order downstream, together with the area in the drainage basin of each, are as shown in following tabulation:

	Square miles
Walla Walla River, Oreg.-Wash	1,500
Umatilla River, Oreg	2,160
Willow Creek, Oreg	910
John Day River, Oreg	7,940
Deschutes River, Oreg	9,180
Klickitat River, Wash	1,150
Hood River, Oreg	366
White Salmon River, Wash	384