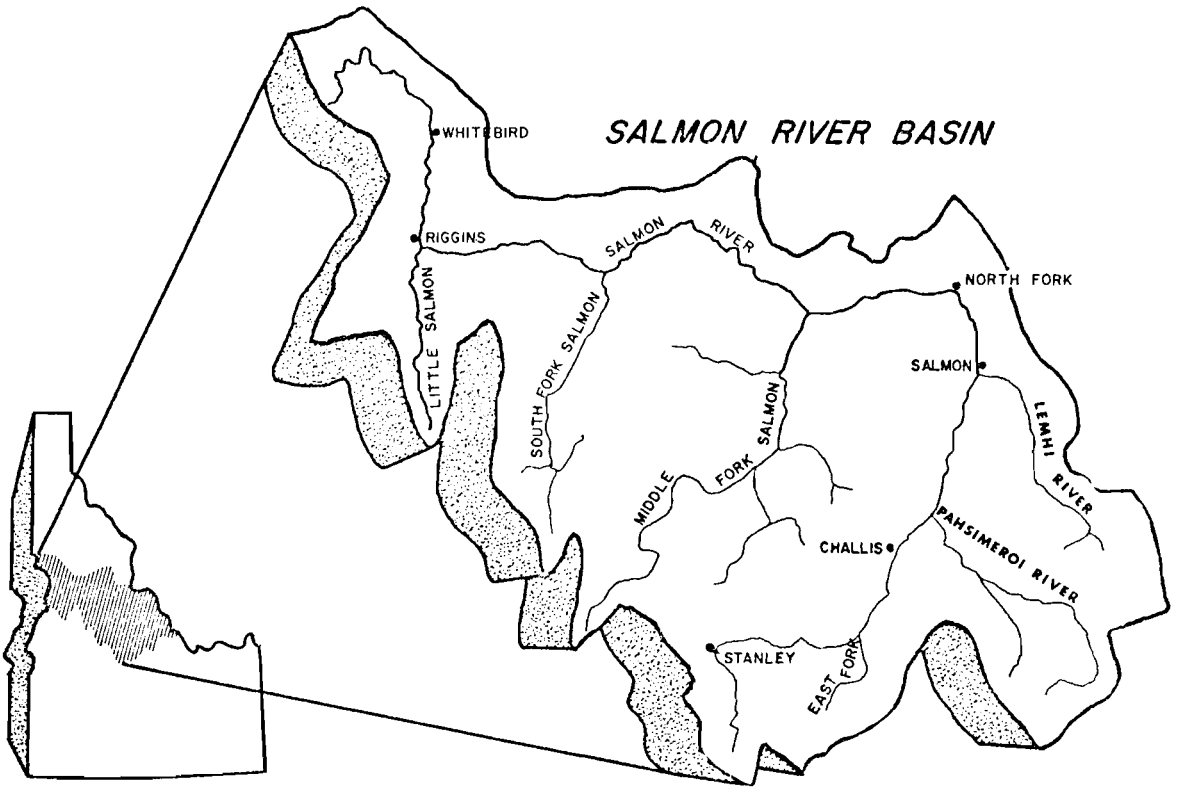
# A Methodology Study To Develop Evaluation Criteria For Wild And Scenic Rivers




Report of

## Navigation Subproject

by

John J. Peebles

Water Resources Research Institute
University of Idaho
Moscow, Idaho

October, 1970

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REPORT OF NAVIGATION SUBPROJECT

ERRATA

Page 22. Seventh line under Forestry; "Idaho Wilderness Area" should read "Idaho Primitive Area".

Page 26. Fifth paragraph; sentence beginning on third line should read: "The Calera Mine in the Blackbird District, Lemhi County, and the Clayton Mine in the Bayhorse District, Custer County, are the principal by-product gold producers.

Page 31. Third line; "traffice" should be "traffic".

# A METHODOLOGY STUDY TO DEVELOP EVALUATION CRITERIA FOR WILD AND SCENIC RIVERS

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# I. INTRODUCTION

On October 2, 1968, Public Law 90-542, was passed by the 90th Congress. This public law provides for a National Wild and Scenic Rivers System. It also indicates that the policy of the Federal Government is to include selected rivers, which with their immediate environment possess outstanding scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, and that these rivers shall be preserved in their free flowing condition and shall be protected for the benefit and enjoyment of present and future generations.

The act provides for two categories under which specific rivers will be preserved or studied for possible preservation. Included in the first category are rivers authorized for immediate inclusion in the National Wild and Scenic Rivers System ("Instant Rivers"). Two such rivers, Middle Fork Salmon River and Middle Fork Clearwater River are located in Idaho. The second category includes rivers designated to be studied for possible inclusion in the System ("Study Rivers"). Five rivers in Idaho qualify for study under the second category, namely the main stem of Salmon River, and Bruneau, St. Joe, Priest, and Mcyie Rivers.

The act specifies three classes of wild rivers: wild, scenic, and recreational. A wild river is one which applies to a river free from impoundments, with shorelines essentially primitive, and with waters non-polluted. A scenic river is a river free from impoundments, with shorelines or watersheds still largely primitive and undeveloped, but which is accessible in places by roads. A recreational river is one which is readily accessible by roads and railroads, which may have development along the shorelines, and which may have undergone some impoundment or diversion in the past. Public Law 90-542 sets a ten-year time limit on classification studies after which recommendations on the disposition of the study rivers are to be made to the Congress.

It is recognized that little valid methodology has been developed for evaluating rivers for wild or scenic classification. While methodology is a means to an end, it is none-the-less the key to developing techniques and criteria for classifying rivers for potential inclusion into a wild or scenic rivers system.

The Water Resources Research Institute at the University of Idaho has organized a Scenic Rivers Study Unit. This study unit has as its goal establishing criteria which can be used to identify and estimate economic, aesthetic, social, and other values for study rivers. Four objectives have been established to meet this goal:

1. Inventory the natural and human resources of the area and estimate future demands for, and potentials of, these resources.
2. Identify, describe, and quantify, where possible, benefits from scenic beauty, personal enrichment, and other aesthetic experiences derived from the river.
3. Develop a series of models to evaluate resource use patterns with and without the river classified in the National System.
4. Present alternatives for resource uses compatible with the possible river classifications and outline the economic and social ramifications for each alternative.

Salmon River has been selected as a test river for the Wild and Scenic Rivers Methodology Study. It flows into Snake River 49 miles above Lewiston, Idaho. Its headwaters are 420 river miles distant in the Smoky Mountains south of Stanley Basin. Only the lower 237 miles - from the town of North Fork to the mouth - are in the study category. The river basin lies entirely within Idaho and drains approximately 14,100 square miles. The average annual runoff of the river, measured at White Bird, is about 8,000,000 acre feet. The quality of the water is high, although the presence of man is becoming increasingly apparent. Most of the land is administered by the U. S. Forest Service and the U. S. Bureau of Land Management. Private lands are concentrated along the river on both the east and west sides of the basin. These holdings are used primarily for agriculture, mining, and recreation. The relationship of Salmon Basin to other drainage basins in Idaho is shown in Figure 1.

The procedure adopted is to study - more or less independently at first - 14 subprojects each involving an activity related to the river.

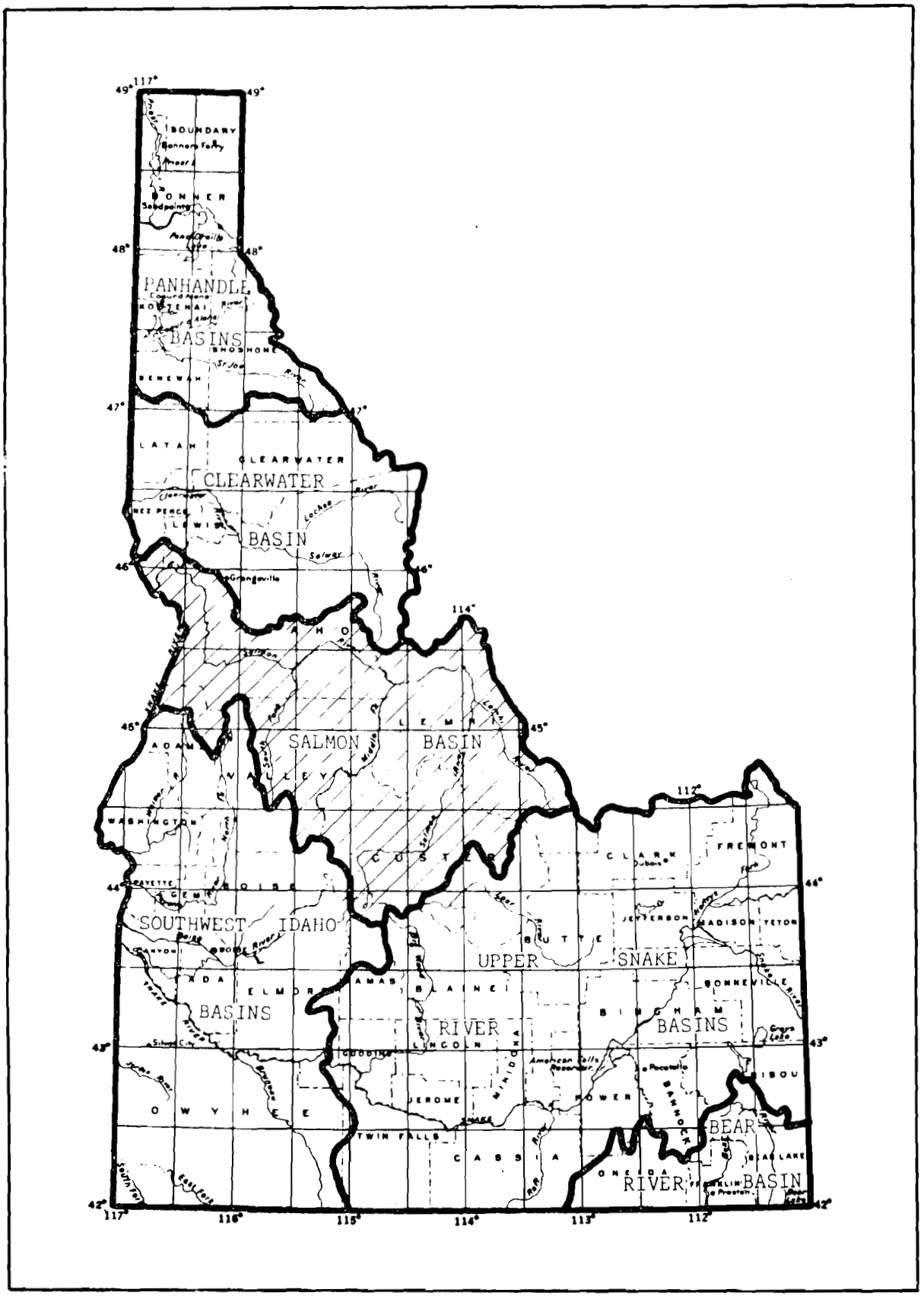


Figure 1. Relationship of Salmon Basin to other drainage basins in Idaho

1. Forest and range resources
2. Minerals
3. Outdoor recreation
4. Commercial fisheries
5. Irrigation
6. Water for municipal and industrial use
7. Water quality control
8. Hydroelectric power
9. Flood control
10. Navigation
11. Transportation and access
12. Archaeology
13. History
14. Agriculture

Basically three steps will be involved in preparing reports for these subprojects. First, individual researchers will inventory the physical, biological, institutional, and human resources affecting each subproject. Second, the inventory data obtained will be used to make an economic evaluation of the current use of these resources and the potential benefits available from them. Third, these data will be used as a basis for projecting future resource use and values under varying alternatives ranging from non-inclusion in the System to inclusion in the System under various classifications.

Data from the subprojects will be used in various models to evaluate alternative resource uses. Two types of models are presently planned for making these evaluations. The first model will be a small area input-output model which will be used to establish benchmark values for all of the economic activity in the area. The second model is a linear programming model which will be used to estimate the benefits for various areas of development.

Efforts will be made throughout the study to identify and quantify the aesthetic and personal enrichment values of the river basin.

Estimates will be made for 1980, 2000, and 2020 consistent with the water resource planning done by the Pacific Northwest River Basins Commission under the Water Resources Planning Act of 1965.

The Methodology Study, then, is concerned with the evaluation process. Upon completion in July, 1971, it will provide input for the "joint" studies by Federal and State agencies. These joint studies will result in recommendations to the Congress.

The writer has been assigned the task of preparing information for the flood control, history, and navigation subprojects, the latter being the subject of this report. The objectives of the navigation study are:

1. To determine the navigation potential within the Salmon River area.
2. To determine the value and need for regulation of Salmon River to enhance downstream navigation on Snake and Columbia rivers.
3. To determine the impact of navigation or regulation of water on Salmon River as a wild river either in total or in segments.

The value of navigation to the economy of Idaho in connection with the presently authorized Snake River waterway to Lewiston is discussed in Planning Report No. 7 of the Idaho Water Resource Board (CH2M, 1970).

## II. GEOGRAPHY OF SALMON BASIN

The Salmon drainage basin (Figure 2) is situated entirely within the State of Idaho and comprises some of the most rugged topography in western United States. The basin is bounded on the east by the Beaverhead Mountains which form the boundary between Idaho and Montana; on the south by the Lemhi, Lost River, and Sawtooth ranges; on the north by the Clearwater drainage basin; and on the west by Snake River. Elevations on the land surface in Salmon Basin vary from a high of 12,662 feet at the peak of Mount Borah in the Lost River Range to a low of 902 feet at the confluence of Salmon and Snake rivers. The mean elevation of the basin is about 7,000 feet.

Salmon River heads in the Smoky Mountains at approximately elevation 8,000. From the headwaters, it flows north and west a distance of about 30 miles and enters the lower end of Stanley Basin near the town of Stanley. Downstream from Stanley, the river enters a reach composed of alternating valleys and rocky canyons through which it flows easterly a distance of 35 miles to the confluence with the East Fork. The stream then flows generally north through large valleys in the vicinity of Challis and Salmon 106 miles to North Fork. From North Fork the river, turns westerly and flows in this general direction to Riggins, a distance of 150 miles. This central portion is characterized by narrow and precipitous canyons with only occasional widenings containing small bench lands. At Riggins, the river turns sharply to the north and continues generally in this direction for about 40 miles. It then veers to the west, bypasses the Seven Devils Mountains, and enters Snake River from the northeast. The upper half of this 87-mile reach contains alternating small valleys and canyons. The lower half consists mostly of narrow rocky canyons.

The main tributaries of Salmon River are shown on Figure 2 and in Table 1. Approximately fifty percent of Salmon Basin is drained by six major tributaries. The East Fork, Pahsimeroi, and Lemhi rivers drain the southeastern part of the basin, while the Middle Fork, South Fork, and Little Salmon rivers drain the large central area.

The orientation and location of Salmon Basin are such that moist air moving from the Pacific Ocean is subjected to orographic lifting before

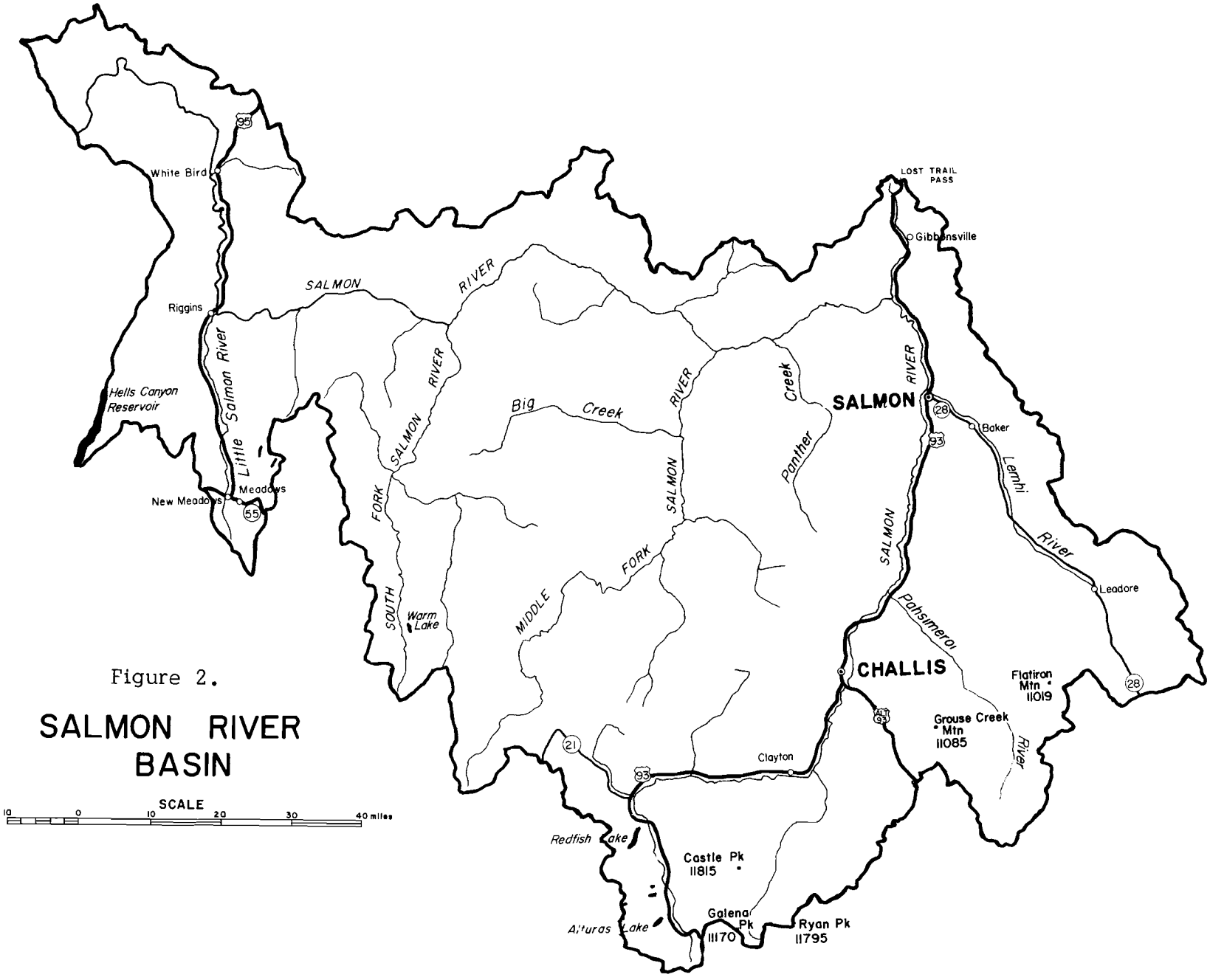


Figure 2.

SALMON RIVER BASIN

Table 1. Principal tributaries of Salmon River

| Tributary | Area drained sq. miles | Enters Salmon River | | |
|---|---|---|---|---|
| | | At water elev. | From | At river mile |
| Little Salmon River | 580 | 1710 | South | 86.7 |
| South Fork | 1300 | 2145 | South | 133.9 |
| Middle Fork | 2830 | 3005 | South | 198.5 |
| Panther Creek | 530 | 3195 | South | 210.1 |
| Lemhi River | 1270 | 3905 | East | 258.5 |
| Pahsimeroi River | 845 | 4625 | East | 304.0 |
| East Fork | 540 | 5350 | South | 343.0 |
| Yankee Fork | 195 | 5905 | North | 367.1 |
| Valley Creek | 147 | 6210 | West | 378.5 |

entering the area. The topography, moreover is such that little additional rise is occasioned in air-mass movement across the region. Over part of the basin, topographic features favor down-slope movement. These several stabilizing influences combine in such a manner as to result in a relatively low normal annual precipitation value. Over the more sheltered areas that are also of lower elevation, normal annual precipitation is less than 8 inches. Maximum annual values in excess of 50 inches occur over points of highest elevation. The greater part of the annual precipitation occurs during the winter months and thus shows the direct influence of the Pacific air masses. The average annual volume of precipitation on the basin is 20,047,000 acre-feet, which, if spread over the entire basin, would result in a depth of 25.8 inches. The greatest one-day total rainfall of record, 2.62 inches was observed at Big Creek in December of 1963. However, a one-day total of 3.01 inches in September of 1955 was observed at Grangeville, which is slightly outside of Salmon Basin.

Except for brief periods when the basin is under the direct influence of continental air masses, temperatures are relatively mild. The highest temperature ever recorded was 115 degrees at Slate Creek in August of 1961. The lowest recorded temperature was -49 degrees at New Meadows in December of 1919.

Because of the wide range of elevations in Salmon Basin, snow depths vary from a few inches adjacent to the lower Salmon River to a maximum recorded depth of 139 inches in March at the Vienna Mine near the headwaters of the river. The recorded water equivalent of the snow pack measured as a percentage of the snow depth, has varied from a low of about 15 percent to a high of about 48 percent with an average value of 32 percent.

The annual discharge pattern of Salmon River is very regular. High flows occur from April through July and low flows occur from August through March. Annual peak discharges occur in May or June, while minimum flows occur in the fall or winter. Practically all precipitation during the winter falls in the form of snow. No floods are known to have occurred as a result of rain runoff. The largest known flood on Salmon River occurred in June of 1894. The estimated peak discharge of this flood was 120,000 cubic feet per second (cfs) at the White Bird gauging station. The minimum observed flow of 1,580 cfs occurred at White Bird in December of 1932. Based on a 55-year period of record, Salmon Basin has an average annual runoff of 7,971,000 acre-feet, at the White Bird gauge. Maximum and minimum annual runoffs during that period were, respectively 12,470,000 acre-feet in 1965 and 4,200,000 acre-feet in 1931.

Salmon Basin, as delineated by the Idaho Water Resource Board, covers portions of nine counties, as shown in Figure 1 and in Table 2. The total area of the basin, which includes about 450 square miles draining directly into Snake River, is 14,557 square miles.

With a population density of only 0.7 persons per square mile, Salmon Basin is one of the most sparcely populated areas in the United States. The estimated 1960 population of the basin is 9,960 and the distribution of population is approximately as shown in Figure 3. Each dot in Figure 3 represents about 10 people. The urban population comprises 65 percent and the rural population comprises 35 percent of the total basin population. Of the 25 communities in Salmon Basin one community has a population greater than 1,000, ten communities have populations between 100 and 1,000, and 14 communities have populations less than 100. The largest communities are Salmon, Challis, New Meadows, and Riggins. The 1965 estimated populations of the ten largest communities are as follows:

Table 2. Land and water areas of Salmon Basin by counties. Data from Idaho Water Resource Board (1968).

| County | WATER AREA | | LAND AREA | | TOTAL AREA | |
|---|---|---|---|---|---|---|
| | Sq. Mi. | Acres | Sq. Mi. | Acres | Sq. Mi. | Acres |
| Adams | 1.8 | 1,100 | 421.5 | 269,800 | 423.3 | 270,900 |
| Blaine | 6.0 | 3,900 | 127.4 | 81,500 | 133.4 | 85,400 |
| Boise | 0.0 | 0 | 1.9 | 1,200 | 1.9 | 1,200 |
| Custer | 6.4 | 4,100 | 3,570.0 | 2,284,800 | 3,576.4 | 2,288,900 |
| Idaho | 2.2 | 1,400 | 3,616.7 | 2,314,700 | 3,618.9 | 2,316,100 |
| Lemhi | 0.6 | 400 | 4,193.0 | 2,683,500 | 4,193.6 | 2,683,900 |
| Lewis | 0.1 | 100 | 59.6 | 38,200 | 59.7 | 38,300 |
| Nez Perce | 0.9 | 600 | 146.5 | 93,800 | 147.4 | 94,400 |
| Valley | 6.0 | 3,800 | 2,396.5 | 1,533,800 | 2,402.5 | 1,537,600 |
| TOTAL | 24.0 | 15,400 | 14,533.1 | 9,301,300 | 14,557.1 | 9,316,700 |

| | | | |
|---|---|---|---|
| Salmon | 2,944 | Meadows | 250 |
| Challis | 732 | Baker | 200 |
| New Meadows | 647 | Clayton | 125 |
| Riggins | 588 | Gibbonsville | 125 |
| White Bird | 253 | Leadore | 112 |

Most of the population of the counties included within Salmon Basin is located outside of the basin. The total urban and rural population of the nine counties is shown in Table 3.

Because Salmon Basin is so mountainous, only a small part of the basin is suitable for agriculture. Most agricultural development has taken place above Salmon City which is situated at an elevation of 4,000 feet. The relatively high elevation of the farmlands results in a short growing season. About two-thirds of Salmon Basin is covered with coniferous forests of which about half is used for grazing purposes. Figure 4 shows the general pattern of land use in Salmon Basin and Table 4 shows the acreage in the various categories:

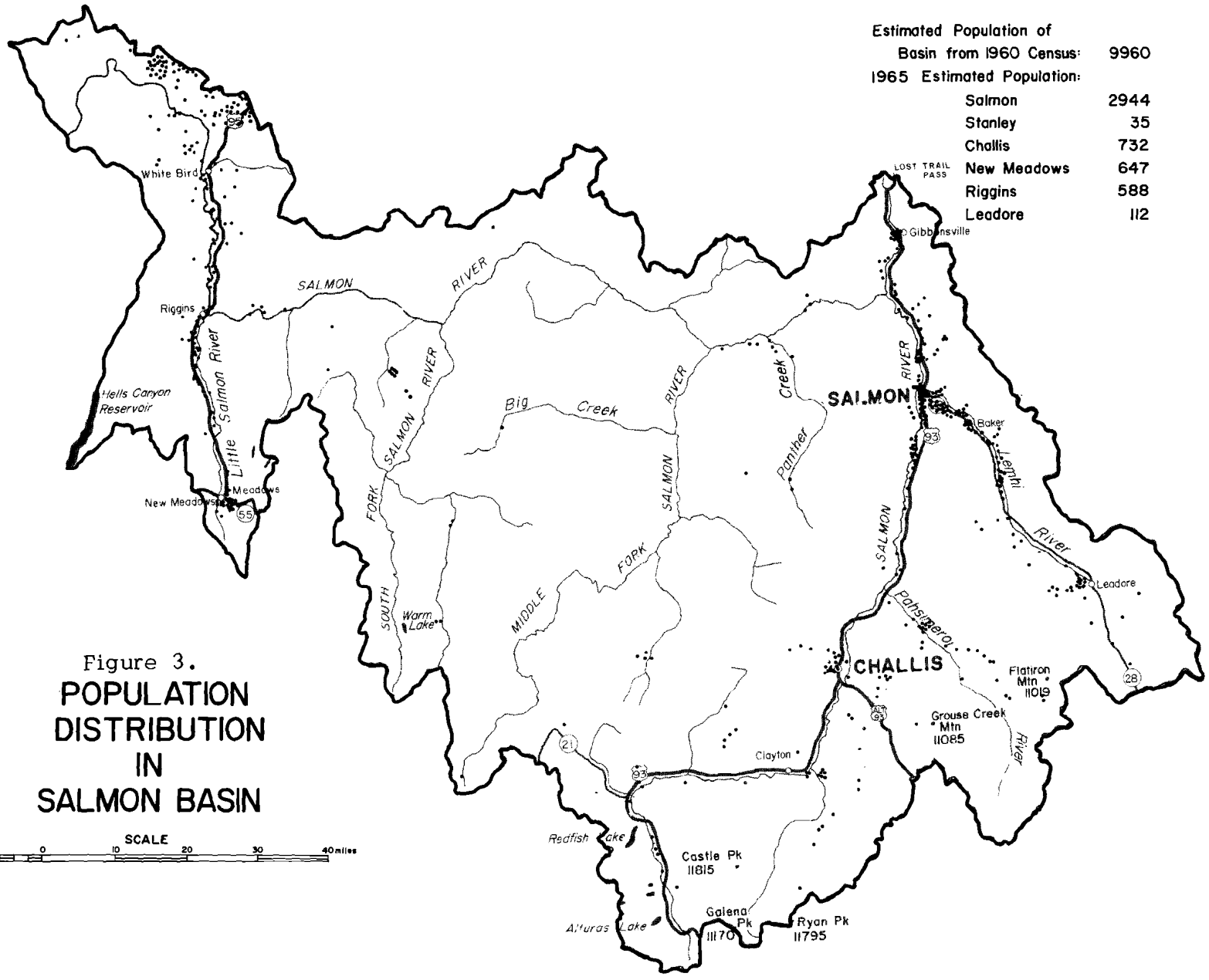


Figure 3.
POPULATION DISTRIBUTION IN SALMON BASIN

Table 3. Total urban and rural population of counties included within Salmon Basin. Data from 1970 Census.

| County | Total population | Area in square miles | Persons per square mile |
|---|---|---|---|
| Adams | 2,877 | 1,379 | 2.1 |
| Blaine | 5,749 | 2,668 | 2.2 |
| Boise | 1,763 | 1,917 | 0.9 |
| Custer | 2,967 | 4,940 | 0.6 |
| Idaho | 12,891 | 8,522 | 1.5 |
| Lemhi | 5,566 | 4,587 | 1.2 |
| Lewis | 3,867 | 478 | 8.1 |
| Nez Perce | 30,376 | 854 | 35.5 |
| Valley | 3,609 | 3,739 | 1.0 |
| TOTAL | 69,665 | 29,084 | 2.4 |

Table 4. Land use acreages in Salmon Basin. Data from U. S. Soil Conservation Service.

| Type of Land | | Area in acres |
|---|---|---|
| Forested | | 5,973,000 |
| | Grazed | 2,685,000 |
| | Not grazed | 3,288,000 |
| Cropland | | 168,000 |
| Rangeland | | 2,620,000 |
| Other | | 556,000 |
| TOTAL | | 9,317,000 |

In Table 4, forested land is identified as any land with more than 10 percent cover of trees. This generally conforms with areas colored green on U. S. Geological Survey topographic maps. Cropland is classified as all land used for growing crops and all native greenland pasture that is suitable for plowing and planting to improve species of grasses. Areas such as the seasonably wet meadows of the Pahsimeroi and Lemhi valleys are included in this classification. Rangeland is classified as all non-

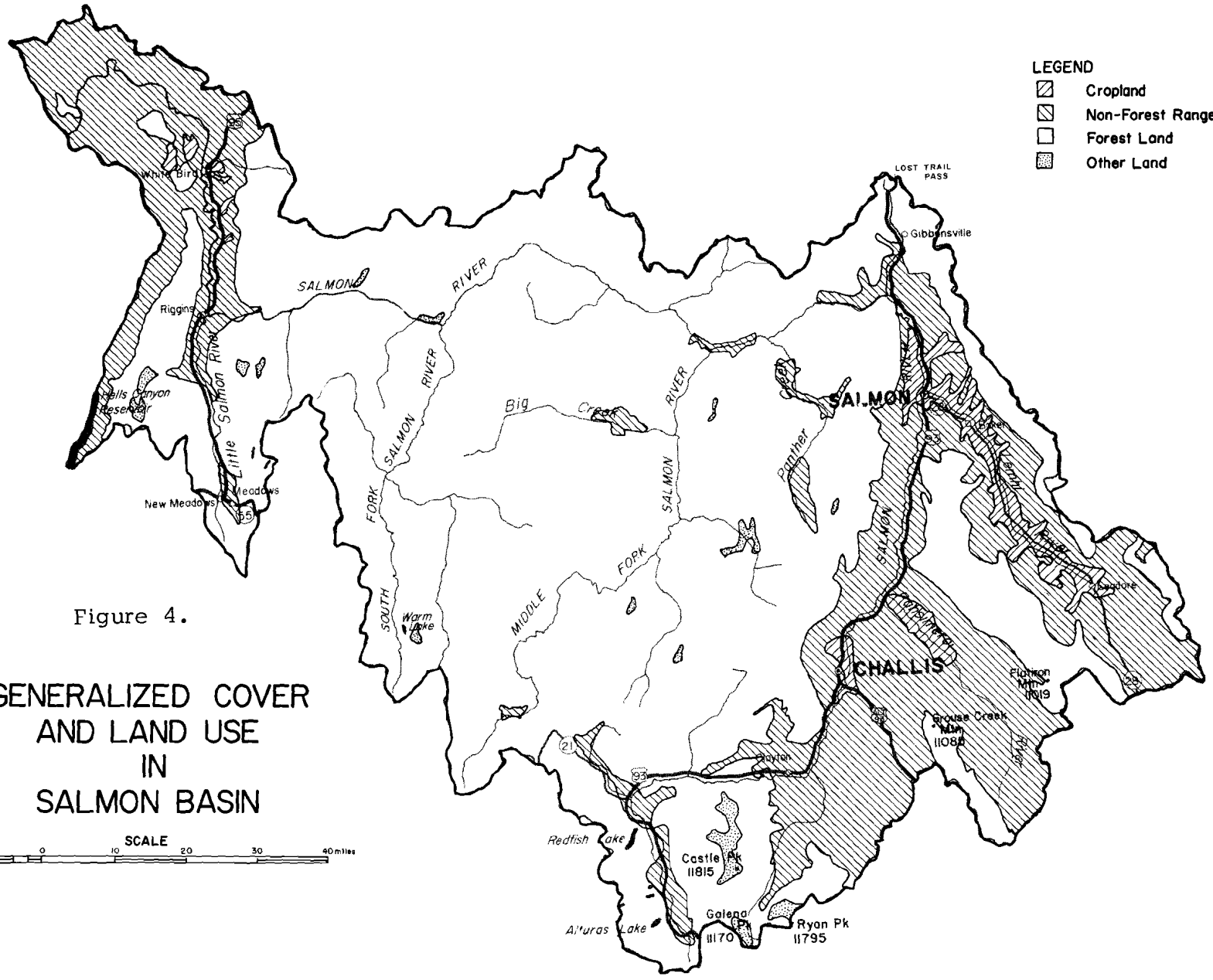


Figure 4.

GENERALIZED COVER AND LAND USE IN SALMON BASIN

forest and non-cropland that is suitable for grazing by domestic livestock. The "other" land classification includes barren rock, very steep land, roads, towns, farmsteads, water surfaces, and other miscellaneous areas.

# III. BASIC ECONOMICS OF SALMON BASIN

In Planning Report No. 2 of the Idaho Water Resource Board (Wells and others, 1969), Salmon Basin, for purposes of an economic studies area, is assumed to cover only Custer and Lemhi counties. By this means, the vast amount of information collected in the 1960 Census could be used. There was, in most instances, no logical way of breaking down the information to conform to the hydrologic boundaries of Salmon Basin. Most of the economic activity in Custer and Lemhi counties is situated within Salmon Basin, while most of the economic activity of the other counties in the area is situated outside of the basin. In the following discussion, the term "area" when referring to the Salmon River portion of Idaho will mean the Salmon economic studies area (Custer and Lemhi counties) and the term "basin" will mean the Salmon hydrologic basin.

The area of Custer County is 4,940 square miles and that of Lemhi County is 4,587 square miles, making a total of 9,527 square miles in the Salmon economic studies area. Some of this area, totalling 1,757 square miles, falls outside of the Salmon hydrologic basin on the southeast as shown in Figure 1. Approximately 95 percent of the total area in the Salmon economic studies area is under Federal ownership.

The land resource includes: (1) the steep canyon areas of Salmon River and its tributaries that are mainly suited to rangeland use, but have isolated small bottomland and alluvial terrace areas devoted to rather intensive cropland use under irrigation. (2) The granitic soils on the west side of the area which are mainly grass covered below elevation 3500. Timber production and grazing are the principal land uses. A major value of this land is for recreation, wildlife, watershed, and aesthetics. (3) The high, dry basins of the Pahsimeroi, Lemhi, Big Lost, and Little Lost rivers and Birch Creek, with soils formed in alluvial material and in mixed material related to underlying sedimentary and acid and basic igneous bedrock. Most of this land is devoted to forest and range uses; however, some of the alluvial terraces adjacent to drainage ways are irrigated for the production of hay, grain, and potatoes. Problems of land use in Salmon economic studies area relate to the long severe winters, short growing season, droughtiness, steep and precipitous slopes, and shallow and rocky soils that are in many places highly erosive.

Table 5 shows the historical population of the counties comprising the Salmon economic studies area. It should be noted that since 1940 there has been a small but steady decline in the population of both counties.

Table 5. Population of counties in Salmon economic studies area by decade*

| County | 1890 | 1900 | 1910 | 1920 | 1930 | 1940 | 1950 | 1960 | 1970 |
|---|---|---|---|---|---|---|---|---|---|
| Custer | 2,176 | 2,049 | 3,001 | 3,550 | 3,162 | 3,549 | 3,318 | 2,996 | 2,967 |
| Lemhi | 1,915 | 3,446 | 4,786 | 5,164 | 4,643 | 6,521 | 6,278 | 5,816 | 5,566 |
| TOTAL | 4,091 | 5,495 | 7,787 | 8,714 | 7,805 | 10,070 | 9,596 | 8,812 | 8,533 |

*Adapted from Wells and others (1969, vol. I, p. 45).

Table 6 shows 1960 Census data for the Salmon economic studies area. About 70 percent of all employment is in agriculture, retail trade, services, and manufacturing. The remaining 30 percent is in transportation and miscellaneous employment.

Table 6. 1960 Census data for Salmon economic studies area which includes only Custer and Lemhi counties.*

| | |
|---|---|
| Area in square miles | 9,527 |
| Population | 8,812 |
| Population density per square mile | 0.9 |
| Annual population growth | -0.9 % |
| Total employment | 3,065 |
| Percent of employment in: | |
| Agriculture | 32.9 |
| Retail trade | 16.6 |
| Services | 15.3 |
| Manufacturing | 5.1 |
| Median income | $3,603 |

*Adapted from Wells and others (1969, vol. I, p. 19).

The Salmon economic studies area, with 6,097,000 acres, covers about 11 percent of Idaho. The approximate land use pattern of the area is three percent agricultural crop-producing land, 44 percent rangeland, 47 percent forested land, and six percent miscellaneous land (that is, urban, barren areas, roads, etc.). Of the approximately 160,000 acres of crop-producing land, 54 percent is devoted to hay, principally alfalfa, and 38 percent is devoted to irrigated pasturage. Other crops include feed grains and vegetables. Agriculture constitutes a substantial part of the area's economy. The 1960 total employment in all occupations was 3,065. Of this total, 1008 were employed in agriculture, 510 in retail trade, 469 in services, 155 in manufacturing, 139 in administration, 78 in transportation, and 706 in miscellaneous employment. Forest products made up 70 percent of all manufacturing. Table 7 shows the distribution of the labor force.

The methodology used by Wells and others (1969) to study the relationship between population and employment in Idaho, both present and future, was based on the application of the employment base model. The model rests on the assumption that: (1) Population in a given region is primarily a function of employment opportunities; (2) Employment opportunities in a given region are primarily a function of jobs in industries which are engaged in the export of commodities outside the region (basic employment jobs); and (3) Employment can be separated into the two types (a) basic employment and (b) dependent or service employment and these can be used to generate a base-ratio. In the dependent basic ratio, the dependent or service employment level is the numerator and the base employment level is the denominator.

Table 8 shows a breakdown of population and the labor force in Salmon economic studies area for 1940, 1950, and 1960. This area shows the lowest dependent basic ratio in the state. One reason for this low dependent basic ratio is the lack of development of internal markets. An urbanized establishment does not exist which might provide the shopping goods for purchase by residents of the area. For this reason, the dependent basic ratio has not developed. The labor force participation rate has varied from 0.35 to 0.38 over the historical time span (Wells and others, 1969, vol I, p. 57).

TABLE 7

EMPLOYMENT AND COMPONENTS OF EMPLOYMENT CHANGE

SALMON ECONOMIC STUDIES AREA[1]
(Custer and Lemhi Counties

| INDUSTRY | EMPLOYMENT IN | | | COMPONENTS OF EMPLOYMENT CHANGE | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 1940-1950 | | | | 1950-1960 | | | |
| | 1940 | 1950 | 1960 | National Growth | Industrial Mix | Regional Share | Total Change | National Growth | Industrial Mix | Regional Share | Total Change |
| Agriculture | 1,440 | 1,424 | 1,008 | 384 | -542 | 242 | -16 | 221 | -770 | 133 | -416 |
| Forestry and fisheries | 54 | 68 | 114 | 14 | -6 | 6 | 14 | 11 | -28 | 63 | 46 |
| Mining | 456 | 334 | 122 | 122 | -15 | -129 | -122 | 52 | -152 | -112 | -212 |
| Contract construction | 106 | 237 | 172 | 28 | 43 | 60 | 131 | 37 | -12 | -90 | -65 |
| Food and kindred products manufacturing | 14 | 18 | 21 | 4 | 0 | 0 | 4 | 3 | 2 | -2 | 3 |
| Textile mill products manufacturing | 1 | 0 | 0 | 0 | 0 | -1 | -1 | 0 | 0 | 0 | 0 |
| Apparel manufacturing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lumber, wood products, furniture manufacturing | 42 | 55 | 109 | 11 | 0 | 2 | 13 | 8 | -12 | 57 | 53 |
| Printing and publishing manufacturing | 10 | 14 | 10 | 3 | 1 | 0 | 4 | 3 | 3 | -10 | -4 |
| Chemicals and allied products manufacturing | 0 | 4 | 4 | 0 | 0 | 4 | 4 | 1 | 1 | -2 | 0 |
| Electrical and other machinery manufacturing | 1 | 4 | 0 | 0 | 1 | 2 | 3 | 1 | 1 | -6 | -4 |
| Motor vehicles and equipment manufacturing | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Other transportation equipment manufacturing | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | -1 | -1 |
| Other and miscellaneous manufacturing[2] | 4 | 5 | 12 | 1 | 0 | 0 | 1 | 1 | 0 | 6 | 7 |
| Railroads and railway express | 7 | 6 | 3 | 2 | 0 | -3 | -1 | 1 | -3 | 4 | 2 |
| Trucking and warehousing | 54 | 57 | 54 | 14 | 7 | -18 | 3 | 9 | 8 | -20 | -3 |
| Other transportation | 8 | 26 | 16 | 2 | 3 | 13 | 18 | 4 | -3 | -11 | -10 |
| Communications | 16 | 21 | 22 | 4 | 9 | -8 | 5 | 3 | 0 | -2 | 1 |
| Utilities and sanitary service | 17 | 33 | 22 | 5 | 3 | 8 | 16 | 2 | 0 | -13 | -11 |
| Wholesale trade | 10 | 23 | 54 | 3 | 4 | 6 | 13 | 4 | -1 | 28 | 31 |
| Food and dairy products stores | 71 | 72 | 63 | 19 | -8 | -10 | 1 | 12 | -13 | -8 | -9 |
| Eating and drinking places | 96 | 157 | 169 | 26 | 24 | 11 | 61 | 24 | -14 | 2 | 12 |
| Other retail trade | 174 | 230 | 278 | 46 | 21 | -13 | 56 | 36 | 4 | 8 | 48 |
| Finance, insurance and real estate | 22 | 46 | 47 | 6 | 1 | 17 | 24 | 7 | 11 | -17 | 1 |
| Hotels and other personal services | 89 | 95 | 98 | 24 | -15 | -3 | 6 | 15 | -11 | -1 | 3 |
| Private households | 54 | 45 | 49 | 14 | -31 | 8 | -9 | 7 | 1 | -4 | 4 |
| Business and repair services | 62 | 104 | 28 | 17 | 15 | 10 | 42 | 16 | 7 | -99 | -76 |
| Entertainment, recreation services | 30 | 24 | 20 | 8 | -1 | -13 | -6 | 4 | -3 | -5 | -4 |
| Medical, other professional services[3] | 124 | 195 | 301 | 33 | 21 | 17 | 71 | 30 | 83 | -7 | 106 |
| Public administration | 100 | 115 | 139 | 27 | 43 | -55 | 15 | 18 | 14 | -8 | 24 |
| Armed forces | 0 | 5 | 0 | 0 | 0 | 5 | 5 | 1 | 3 | -9 | -5 |
| Industry not reported | 40 | 36 | 126 | 11 | -2 | -13 | -4 | 6 | 70 | 14 | 90 |
| TOTAL | 3,102 | 3,454 | 3,065 | 828 | -622 | 146 | 352 | 537 | -814 | -112 | -389 |

[1]Wills and others (1969, vol I, p. 23).

[2]Includes Primary metals, Fabricated metals (including Not Specified metals) Other Durable Goods and other Nondurable Goods including Not Specified.

[3]Includes Hospitals; Educational Services, Government and Private; Welfare, Religious and Non-Profit Membership Organizations; and Other Professional and Related Services.

Table 8. Population and employment in Salmon economic studies area.*

| Category | 1940 | 1950 | 1960 |
|---|---|---|---|
| Population | 10,070 | 9,596 | 8,812 |
| Labor force | 3,513 | 3,675 | 3,207 |
| Basic employment | 2,096 | 2,081 | 1,572 |
| Dependent employment | 1,006 | 1,368 | 1,493 |

*Wells and others (1969, vol. I, p. 58).

Agriculture

The Salmon area has been dominated by agriculture for many years as a result of the decline in early-day mining activity. The principal farm lands are situated in the bottomlands along the Lemhi, Pahsimeroi, Big Lost, and Little Lost rivers, along Birch Creek and in Stanley Basin.

The valleys of the Lemhi, Pahsimeroi, Big Lost, and Little Lost rivers and Birch Creek consist of silty and sandy soils with coarse fragments formed in glacial materials on fans and terraces between elevations of 4000 and 6000 feet. Major uses of the soil are for rangeland and cropland. Cereals, hay, and potatoes are produced by irrigation. Droughtiness and the susceptibility of the soil to erosion are problems in these valleys.

Stanley Basin consists of generally silty and sandy soils formed in alluvial sediments on fans, low terraces, and flood plains between elevations of 4800 and 6800 feet. Some of the land is forested and the major uses are for rangeland and cropland. Of the cropland about 80 percent is irrigated and the principal crops are cereals and hay. Major problems in this basin are droughtiness, erosion, and wetness.

From the farming standpoint, the climate upstream from Salmon City, where most agricultural activity takes place, is considered arid. This is true because of the low average annual precipitation (8.93 inches at Salmon and 6.93 inches at Challis). For this reason, irrigation is a necessity for raising most crops. Of the crop-producing land in the Salmon economic studies area, 158,165 acres were being irrigated by gravity and 1,760 acres by sprinkler in 1967, making a total of 159,925 acres under irrigation.

Table 9 shows classes of potentially irrigable soil in the Salmon economic studies area. The values given are potential, rather than actually irrigated, acreages. Class 1 land has the highest potential for irrigation. These lands usually are well drained, have smooth topography, are productive, and have only slight limitations for irrigated agriculture. Class 2 land can be expected to produce somewhat lower yields than Class 1 land or produce equal yields at a higher cost. These lands are of good quality and are capable of producing most climatically adapted crops. Class 3 land is capable of being irrigated but has more severe limitations than those associated with Class 2 land. The majority of Class 3 lands are best suited for small grains or forage production. Satisfactory economic returns may be achieved with proper management practices. Compared with the total amount of land in the Salmon area, there is little irrigable soil. Most of the irrigable land is classified as Class III. Only about 44,000 acres are classified as Class 1 or Class 2 land.

Table 9. Classes of potentially irrigable soil in Salmon economic studies area, 1968.*

| | Area in acres | | | | |
|---|---|---|---|---|---|
| County | Class 1 | Class 2 | Class 3 | Total classes 1,2,3, | Total classes 1,2 |
| Custer | 1,300 | 4,100 | 264,500 | 269,900 | 5,400 |
| Lemhi | --- | 38,500 | 81,000 | 119,500 | 38,500 |
| TOTAL | 1,300 | 42,600 | 345,500 | 389,400 | 43,900 |

*Wells and others (1969, vol. II, p. 53).

Table 10 shows percentages of estimated crop distribution by common crops in Salmon economic studies area. Table 11 shows the past value of crops, livestock, and livestock products in Salmon economic studies area and in Salmon hydrologic basin for 1949, 1954, 1959, and 1964.

Table 10. Percentages of estimated crop distribution by common crops in Salmon economic studies area, 1966. Values are percent of total crop-producing area for each category.[1]

| Crop | Custer County | Lemhi County | Area total |
|---|---|---|---|
| Corn-all feed purposes | 0.02 | - | 0.01 |
| Wheat-all | 3.15 | 0.66 | 1.62 |
| Oats | 1.61 | 1.14 | 1.33 |
| Barley | 3.77 | 1.79 | 2.55 |
| Rye | - | - | - |
| Other grains | - | - | - |
| Alfalfa[2] | 30.33 | 27.43 | 28.56 |
| Clover hay[3] | 7.00 | 16.53 | 12.85 |
| Grain hay[4] | 2.08 | 0.36 | 1.03 |
| Wild hay | 11.71 | 11.73 | 11.72 |
| Other hay | 0.17 | 0.12 | 0.14 |
| Grass silage[5] | 0.09 | 0.20 | 0.15 |
| Irrigated pasture | 36.86 | 38.98 | 38.16 |
| Alfalfa seed | 0.02 | - | 0.01 |
| Alsike clover seed | - | - | - |
| Red clover seed | 0.03 | - | 0.01 |
| Hops | - | - | - |
| Potatoes | 2.71 | 1.01 | 1.66 |
| Mint | - | - | - |
| Dry beans | - | - | - |
| Dry peas | - | - | - |
| Sugar beets | 0.05 | - | 0.02 |
| Sweet corn seed | - | - | - |
| Vegetables | - | - | - |
| Fruit | 0.01 | 0.05 | 0.03 |
| Other[6] | 0.39 | - | 0.15 |
| TOTAL | 100.00 | 100.00 | 100.00 |

[1]Source: Census of Agriculture - Idaho, 1964. Statistical Reporting Service, Idaho Annual Crop Summary, 1966.

[2]Alfalfa and alfalfa mixtures cut for hay and for dehydrating.

[3]Clover, timothy and mixtures of clover and grasses cut for hay.

[4]Oats, wheat, barley, rye or other small grains cut for hay.

[5]Grass silage made from grasses, alfalfa, clover, or small grains.

[6]Other crops include "all other crops" not specifically listed and also includes those listed crops not readily categorized.

Table 11. Past value of crops, livestock, and livestock products in Salmon economic studies area and in Salmon hydrologic basin in millions of dollars.*

| Area | Trend in value | | | |
|---|---|---|---|---|
| | 1949 | 1954 | 1959 | 1964 |
| Economic studies | 6.08 | 5.15 | 7.66 | 6.93 |
| Hydrologic basin | 11.62 | 11.89 | 13.30 | 12.97 |

*Adapted from Wells and others (1969, vol. II, p. 80 and 86).

Forestry

The manufacture of timber products is an important industry in the Salmon area. Although about 47 percent of the area is forested, poor accessibility has resulted in a relatively small portion of the area being logged.

Over two million acres of forested land in the Salmon economic studies area is classed as commercial. Not included are tracts of reserved land which lie within the Idaho Wilderness Area and non-productive areas found near timberline and along the desert fringes. Commercial forest land includes land capable of, and available for, producing commerically valuable tree crops. Douglas fir and the true fir-spruce type predominate. Other species of commercial value are ponderosa and lodgepole pine. Table 12 shows the commercial volume of timber in the Challis and Salmon national forests and in that portion of the Sawtooth National Forest lying within Salmon Basin. The boundaries of these forest areas follow quite closely the boundaries of the Salmon economic studies area. About three-fourths of the total volume of commercial timber is classed as sawtimber which includes trees 11 inches and larger in diameter at breast height.

Table 13 shows lumber production in Salmon economic studies area for 1964, 1965, and 1966. These values represent actual production rather than allowable cut or maximum sustained-yield cut.

Table 12. Commercial volume of timber in Challis and Salmon national forests and in a portion of Sawtooth National Forest.[1]

| National Forest | Commercial volume of timber in millions of board feet | | | | | | |
|---|---|---|---|---|---|---|---|
| | Douglas fir and larch | Engelmann spruce | Subalpine fir | Ponderosa pine | Lodgepole pine | Other | Total |
| Challis | 4,270 | 1,600 | 590 | - | 310 | 50 | 6,820 |
| Salmon | 2,920 | 290 | 580 | 400 | 520 | 120 | 4,830 |
| Sawtooth[2] | 450 | 180 | 80 | - | 160 | 50 | 920 |
| | 7,640 | 2,070 | 1,250 | 400 | 990 | 220 | 12,570 |

[1]Data compiled by John R. Herbst.

[2]Includes only portion lying within Salmon Basin.

Table 13. Lumber production in Salmon economic studies area in thousands of board feet.*

| Year | Production, Mfbm |
|---|---|
| 1964 | 30,000 |
| 1965 | 37,600 |
| 1966 | 38,200 |

*Adapted from Wells and others (1969, vol. II, p. 302)

In addition to the lumber production in the Salmon economic studies area, a significant amount of lumber is produced in the western part of the Salmon hydrologic basin. In some places large quantities of timber are hauled out of the basin for processing elsewhere. Table 14 shows the commercial volume of timber on non-reserved lands in the Salmon hydrologic basin which also includes most of Custer and Lemhi counties.

Table 14. Commercial volume of timber in Salmon hydrologic basin in millions of board feet.*

| Douglas fir | Engelmann spruce | Subalpine fir | Grand fir | Ponderosa pine | Lodgepole pine | Other | Total |
|---|---|---|---|---|---|---|---|
| 10,750 | 4,100 | 2,740 | 1,030 | 2,910 | 1,680 | 610 | 23,820 |

*Data compiled by John R. Herbst.

Table 15 shows lumber production in Adams, Idaho, and Valley counties for 1964, 1965, and 1966. All of this production, especially in Idaho County, does not come from Salmon Basin. However, timber is removed from Salmon Basin lands in all of these counties for processing by mills located within the basin and outside of the basin.

Table 15. Lumber production in Adams, Idaho, and Valley counties in thousands of board feet.[1]

| County | Production in thousands of board feet | | |
|---|---|---|---|
| | 1964 | 1965 | 1966 |
| Adams[2] | 41,000 | 51,000 | 54,000 |
| Idaho | 215,200 | 202,400 | 198,800 |
| Valley | 52,000 | 68,000 | 71,400 |
| TOTAL | 308,200 | 321,400 | 324,200 |

[1]Adapted from Wells and others (1969, vol. II, p. 280).

[2]Estimated.

Table 16 shows the locations, names, capacities, and products of forest products industries for which sawtimber comes wholly or in part from Salmon Basin.

Table 16. Forest products industries for which sawtimber comes wholly or in part from Salmon Basin.[1]

| Location[2] | Name of industry | Type of sawtimber processed[3] | Daily capacity Mfbm | Products |
|---|---|---|---|---|
| Keuterville | Poxleitner and Sons | DF, ES, L, PP, WF | 15 | Green dim., 24' |
| Grangeville | Idapine Mills, Inc. | DF, L, PP, WF, WRC | 350 (2mills) | Kiln-dried lbr.; upper grades; panelling |
| WhiteBird | | | | |
| Elk City | Shearer Lbr. Products, Inc. | DF, ES, L, LPP, PP, WF | 125 | Green dim., 24'; kiln-dried |
| Riggins | Brown's Industries, Inc. | DF, ES, L, PP, WF | 75 | Kiln-dried lbr.; upper grades; roof decking; box and pattern stock |
| Riggins | Salmon River Lumber Co. | DF, ES, L, PP, WF | 75 | Upper grades; dim., 18' |
| New Meadows | Evergreen Forest Products | DF, ES, L, LPP, PP, WF | 50 | Upper grades; dim., 20' |
| Tamarack | Evergreen Forest Products | DF, ES, L, LPP, PP, WF | 100 | Kiln-dried lbr.; upper grades |
| McCall | Boise Cascade Corp. | DF, ES, L, PP, WF | 150 | [4] |
| Cascade | Boise Cascade Corp. | DF, ES, L, PP, WF | 130 | [4] |
| Darby (Mont.) | Bitterroot Timber Ind., Inc. | DF, ES, PP | 100 | Studs; kiln-dried; upper grades; RR ties; long dim. |
| Darby (Mont.) | Conner Lumber Co., DEL | DF, ES, L, LPP, PP, WF | 75-100 | Upper grades; studs; green dim., 20'; RR ties |
| Darby (Mont.) | S and W Sawmill, Inc. | DF, ES, LPP, PP, WF | 100 | Upper grades; studs; dim., 24'; green dim.; roof decking; mine timbers; RR ties ; stepping |
| North Fork | North Fork Lumber Co. | DF | 25 | Green dim., 20'; mine timbers |
| Salmon | Intermountain Lumber Co. | DF, ES, PP | 42 | Dim., 24'; mine timbers |
| Salmon | Robinson Lumber Co. | DF, PP | 15 | [4] |
| Clayton | Central Idaho Lumber Co. | DF, ES | 25 | Green dim., 20'; mine timb. |
| Stanley | Valley Creek Sawmill | DF | 4 | Dim., 16' |

[1] Miller Freeman Publications (1969).

[2] All locations are in Idaho unless shown otherwise.

[3] DF = Douglas fir; ES = Engelmann spruce; L = Larch; LPP = Lodgepole pine; PP = Ponderosa pine, WF = White fir, WRD = Western red cedar.

[4] Not reported

Mining

In the early history of Salmon Basin, mining was the most important economic activity. Since the turn of the Century, however, there has been a steady decline in mining in the area until by 1960 there were only 122 people engaged in this activity.

About one-half of the Salmon hydrologic basin is underlain by the Idaho batholith, a great mass of intrusive granitic-type rocks of late Mesozoic and early Tertiary age. This batholith, with its marginal zone of altered rocks, includes Idaho and Valley counties and the western parts of Lemhi and Custer counties. On the east in Lemhi and Custer counties the batholith is flanked by the Challis Volcanics of Tertiary age and sedimentary rocks of Precambrian and Paleozoic age. On the west, a small area in western Idaho and Valley counties is underlain by volcanic and sedimentary rocks of Triassic or Permian age. Also on the west, Nez Perce and Lewis counties are underlain by Columbia River basalt flows of middle Tertiary age.

The Idaho batholith and its marginal zone, together with the Challis volcanics and metasediments in Lemhi and Custer counties, contain a wide variety of metallic mineral deposits, some of which have a record of substantial past production and many of which have potential for future development and production. In contrast, the parts of the basin underlain by basalt contain few metalliferous deposits; production has been limited mostly to stone, gravel, and a few other non-metallic minerals.

Salmon Basin contains many of the best known mining districts in Idaho. Figure 5 shows the location of the principal mineral resources of the basin.*

Currently, the production of gold in Salmon Basin is at an all time low. Present gold production is chiefly that recovered as a byproduct from ores containing copper, cobalt, silver, lead, and zinc. The Calera Mine in the Bayhorse District, Custer County, are the principal byproduct gold producers. With a change in the unfavorable economic climate for gold similar to that during the 1930's and early 1940's, gold production would doubtless increase substantially in the basin.

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*Discriptions of metals and nonmetals which follow are adapted from Pacific Northwest River Basins Commission (1969).

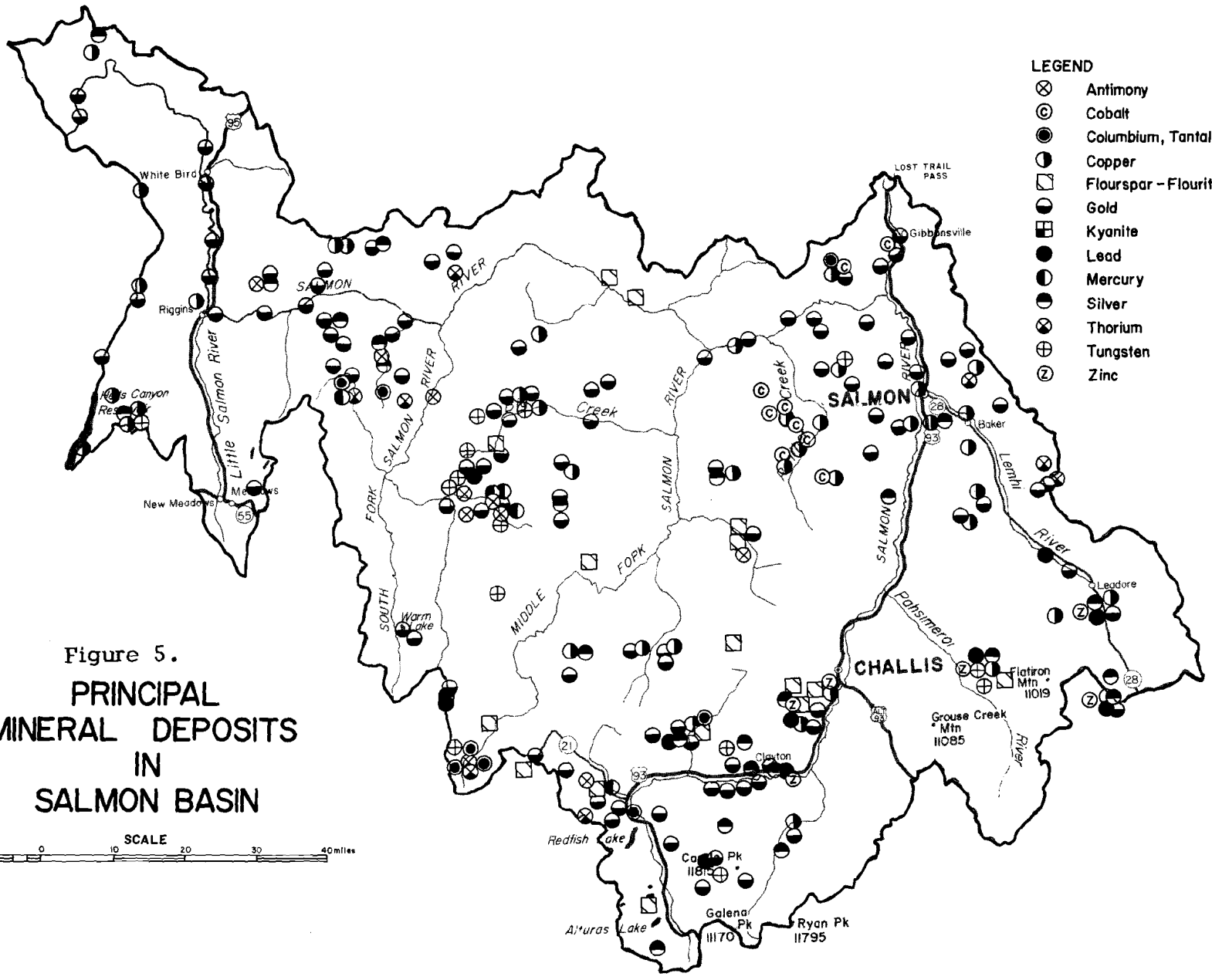


Figure 5.

PRINCIPAL MINERAL DEPOSITS IN SALMON BASIN

Silver production in the basin is mostly from the Clayton Mine. Currently, much interest in silver production has been caused by the decreasing world stocks of silver and the recent price increases. Exploration projects have been active in the Texas District, Lemhi County, and in other parts of the basin. The Texas, Yankee Fork, and Bayhorse districts have the greatest future potential. A further increase in price would result in increasing activity.

Principal copper producer in the basin is the Calera Mine, Lemhi County. Production is on a much lower scale than during the period 1951-1959. The Blackbird, Eureka, and McDevitt districts, all in Lemhi County, and the Bayhorse and Loon Creek districts in Custer County have the grestest potential for future copper production in the basin.

Clayton Mine, Custer County, is the principal lead and zinc producer in the basin. In 1964 it produced 689 tons of lead and 103 tons of zinc. The Bayhorse, Yankee Fork, and Texas districts have the greatest potential for lead and zinc production.

The Blackbird District, Lemhi County, contains one of the world's largest resources of cobalt along with a minor amount of nickel and bismuth. During the period 1951-1959 nearly 14,000,000 pounds of cobalt was produced at the Calera Mine. Currently, the mine is producing copper but the metallurgical difficulties and cost of separating cobalt from the copper makes it uneconomic to recover cobalt at present prices. Future production will depend on improved metallurigcal processes, or unavailability of cobalt from other world sources.

The Yellow Pine District, Valley County, was the major producer of antimony from stibnite ores from 1932 to 1952. Low market prices and declining grade were responsible for closing the largest antimony producer in the district in 1952. Large reserves of antimony ores remain in the district and production will likely increase when economic conditions are more favorable, or other world sources become unavailable.

Nearly ten percent of all tungsten produced in the United States since 1900 has come from the Ima Mine in the Blue Wing District, Lemhi County, and the Yellow Pine Mine, both of which are closed at the present time. There is a good potential for future production in the Yellow Pine and Big Creek districts, Valley County; Ten mile and Warren districts, Idaho County; and Mineral Hill, Blue Wing, Bayhorse, and East Fork districts in Lemhi County. The resources are regarded as very large.

The mercury deposits in the Yellow Pine District, Valley County, have accounted for about 50 percent of all the mercury produced in Idaho. The Hermes Mine produced 10,700 flasks of mercury between 1942 and 1948. Considerable resources of mercury-bearing rock remain in the Yellow Pine District; however, it seems unlikely at the present time that future production will equal that of the past.

Thorium, with associated rare earth minerals, occurs in the placer deposits of Bear Valley, and in monazite deposits of Ruby Meadows, and some production has come from these sources. However, veins containing thorium and rare earth minerals in the Lemhi Pass area of Lemhi County are probably one of the greatest known resources of thorium in the United States.

Production of columbium and tantalum during the period 1956-1959, mostly from the Bear Valley placers on Bear Valley Creek, Valley County, accounted for at least 95 percent of the domestic production. Large reserves of these metals are still present in the placer deposits remaining in Bear Valley.

Principal production of fluorspar has come from Lemhi and Custer counties. Output was during the period 1951-1953. Since that time, economic conditions have deferred continued operations. Adequate reserves remain in high grade deposits.

Not shown on Figure 5 is the location of large reserves of molybdenum near Castle Peak in the White Cloud Mountains southwest of Clayton. The future mining of molybdenite by open-pit methods is presently a subject of controversy between mining interests, Federal and State officials, environmentalists, and local citizens.

Table 17 shows the value of mineral production in Custer, Idaho, Lemhi, and Valley counties for 1962 and 1968 and principal minerals produced in 1968.

Table 17. Value of mineral production in Custer, Idaho, Lemhi, and Valley counties.[1]

| County | Value in thousands of dollars | | Minerals produced in 1968 in order of value |
|---|---|---|---|
| | 1962 | 1968 | |
| Custer | $459 | $1,506 | Silver, lead, sand and gravel, zinc, copper, tungsten, gold |
| Idaho | 571 | 111 | Sand and gravel, stone, gold |
| Lemhi | 376 | W[2] | Copper, sand and gravel, gold, silver, lead, zinc |
| Valley | 81 | 35 | Tungsten, iron ore, mercury, stone, gold, silver |

[1]U. S. Department of the Interior (1970).

[2]Withheld to avoid disclosing individual company confidential data. Production in 1967 was $1,211,000.

Other forms of transportation

Salmon Basin is fairly well provided with landing fields for light aircraft, but the basin is not well-served by surface transportation facilities. Large tracts of the mountainous timbered portions of the basin remain remote from all surface transportation routes.

The only railroad in Salmon Basin is a branch of the Union Pacific from Weiser which terminates at New Meadows. This line provides triweekly freight service. The principal commerce is the transportation of sawtimber and timber products.

Major highways in the basin are shown on Figure 1. U. S. 93 enters the basin at Galena Summit south of Stanley, follows down Salmon River to North Fork, and enters Montana by way of Lost Trail Pass. U. S. 93 Alternate enters the basin at Willow Creek Summit and joins U. S. 93 at Challis. U. S. 95 enters the basin west of New Meadows, follows the Little Salmon River to Riggins, continues down the main stem of the Salmon to White Bird and then leaves the basin south of Grangeville.

State-designated highways in the basin are Nos. 21, 28, and 55. Idaho 21 enters the basin at Banner Summit southwest of Cape Horn and joins U. S. 93 at Stanley. Idaho 28 enters the basin south of

Leadore and joins U. S. 93 at Salmon. Idaho 55 enters the basin west of McCall and joins U. S. 95 at New Meadows. Table 18 shows 1969 average annual daily vehicular traffice (ADT) on the highways described above.

Table 18. 1969 average annual daily vehicular traffic on U. S. 93, U. S. 93 Alt., U. S. 95, Idaho 21, Idaho 28, and Idaho 55.

| Highway | Section | ADT |
|---|---|---|
| U. S. 93 | Galena Summit to Stanley | 430 |
| | Stanley to Challis | 520 |
| | Challis to Salmon | 920 |
| | Salmon to Lost Trail Pass | 780 |
| U. S. 93 Alt. | Willow Creek Summit to Challis | 370 |
| U. S. 95 | Tamarack to New Meadows | 780 |
| | New Meadows to Grangeville | 870 |
| Idaho 21 | Banner Summit to Stanley | 260 |
| Idaho 28 | Lemhi County line to Lemhi | 330 |
| | Lemhi to Salmon | 710 |
| Idaho 55 | McCall to New Meadows | 1,180 |

In addition to the U. S. and State designated systems described above, there are several thousand miles of lower class roads in Salmon Basin that are maintained by either the counties, the U. S. Forest Service, or, in a few instances, by the principal users. The most important of these are the McCall-Stibnite road, the Cascade-Warm Lake-Johnson Creek road, the Deadwood Reservoir-Yellow Pine-Big Creek road, the Lowman-Bear Valley-Cape Horn road, the North Fork-Shoup-Corn Creek road along Salmon River, the Panther Creek-Cobalt-Morgan Creek road, the Salmon-Cobalt road and roads in the Lemhi and Pahsimeroi river valleys.

There are 27 landing fields in Salmon Basin suitable for light aircraft. Many of these are located in isolated portions of the basin where the only other means of transportation is by trail. A large number of the landing areas are nothing more than strips cleared of timber and large obstructions and require considerable skill on the part of the pilot to

negotiate. The only scheduled air service in the basin is at the Salmon airport.

## Economic outlook

The principal industry in the Salmon economic studies area is agriculture, with employment in mining showing definite decreases over the past 30 years. This decline in mining employment is expected to reverse in the next 100 years and to have a definite impact on the future growth and development of the area. One mineral of specific interest is thorium, which may have a significant influence on the development of the area because its potential is considerable. The tourist-oriented retail trade and service sector also is expected to have some importance in future development of the area (Wells and others, 1969, vol. I, p. 57). However, both population and total employment in Salmon economic studies area are projected to grow at rates substantially less than in other areas of Idaho. Table 19 shows projections of population and employment in Salmon economic studies area for 1980, 2000, 2020, and 2070.

Table 19. Projections of population and employment in Salmon economic studies area.*

| Category | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|
| Population | 11,469 | 16,128 | 19,006 | 31,139 |
| Labor Force | 4,129 | 5,806 | 6,842 | 11,210 |
| Basic employment | 1,982 | 2,787 | 3,284 | 5,381 |
| Dependent employment | 1,982 | 2,787 | 3,284 | 5,381 |

*Wells and others (1969, vol. I, p. 58).

Because there is only a relatively small quantity of productive soil in the Salmon area and the growing season is short, the potential for agricultural growth is not great. Table 20 shows projections of agricultural production in the Salmon economic studies area for 1980, 2000, 2020, and 2070.

Table 20. Projections of agricultural production in Salmon economic studies area*.

| Product | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|
| Wheat, 1,000 bu | 170 | 190 | 240 | 880 |
| Barley, 1,000 bu | 430 | 580 | 720 | 1,270 |
| Potatoes, 1,000 cwt | 550 | 680 | 770 | 1,280 |
| Cattle and calf slaughter, 1,000 lbs | 10,710 | 16,368 | 21,974 | 27,958 |
| Sheep and lamb slaughter, 1,000 lbs | 60 | 101 | 151 | 344 |
| Hog and pig slaughter, 1,000 lbs | 548 | 617 | 702 | 1,027 |
| Milk, 1,000 lbs | 6,000 | 6,000 | 6,000 | 6,000 |

*Adapted from Wells and others (1969, vol. II, p. 44-52).

Table 21 shows projections of agricultural production in the Salmon hydrologic basin for 1980, 2000, 2020, and 2070. The differences between the values in this table and those in Table 20 are small because most of the agricultural activity in the basin is in Custer and Lemhi counties.

Table 21. Projections of agricultural production in Salmon hydrologic basin.*

| Product | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|
| Wheat, 1,000 bu | 171 | 172 | 181 | 380 |
| Barley, 1,000 bu | 419 | 488 | 729 | 1,762 |
| Potatoes, 1,000 cwt | 458 | 577 | 702 | 874 |
| Cattle and calf slaughter, 1,000 lbs | 11,353 | 17,350 | 23,292 | 29,635 |
| Sheep and lamb slaughter, 1,000 lbs | 43 | 73 | 109 | 248 |
| Hog and pig slaughter, 1,000 lbs | 570 | 642 | 716 | 1,068 |
| Milk, 1,000 lbs | 4,344 | 4,344 | 4,344 | 4,344 |

*Adapted from Wells and others (1969, vol. II, p. 62-69).

Table 22 shows the trends in value of crops, livestock, and livestock products in both the Salmon economic studies area and in the Salmon hydrologic basin for 1970, 1980, 2000, 2020, and 2070.

Table 22. Trends in value of crops, livestock, and livestock products in Salmon economic studies area and in Salmon hydrologic basin in millions of dollars.*

| Area | 1970 | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|---|
| Economic studies | 7.70 | 8.70 | 10.70 | 12.70 | 17.70 |
| Hydrologic Basin | 13.59 | 14.50 | 16.32 | 18.15 | 22.71 |

*Adapted from Wells and others (1969, vol. II, p. 81 and 87).

Tables 23 and 24 are projections of production for nine food processing categories in the Salmon economic studies area and in the Salmon hydrologic basin, respectively, for 1980, 2000, 2020, 2070. The nine categories follow the Standard Industrial Classification (SIC) system.

Table 23. Projections of production for nine food processing categories in Salmon economic studies area.*

| Product | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|
| Meat (SIC 201), 1,000 lbs | 10,237 | 15,482 | 20,387 | 26,236 |
| Dairy (SIC 202), 1,000 lbs | 2,008 | 2,168 | 2,336 | 2,752 |
| Canning and preserving (SIC 203), lbs | - | - | - | - |
| Grain mill (SIC 204), lbs | - | - | - | - |
| Bakery (SIC 205), 1,000 lbs | 31 | 38 | 44 | 74 |
| Sugar (SIC 206), lbs | - | - | - | - |
| Confectionary and related (SIC 207), lbs | - | - | - | - |
| Beverage (SIC 208), 1,000 lbs | 239 | 346 | 433 | 546 |
| Miscellaneous food (SIC 209), lbs | - | - | - | - |

*Adapted from Wells and others (1969, vol. II, p. 110-112).

Table 24. Projections of production for nine food processing categories in Salmon hydrologic basin.*

| Product | 1980 | 2000 | 2020 | 2070 |
|---|---|---|---|---|
| Meat (SIC 201), 1,000 lbs | 10,237 | 15,482 | 20,387 | 26,236 |
| Dairy (SIC 202), 1,000 lbs | 3,012 | 3,523 | 3,504 | 4,128 |
| Canning and preserving (SIC 203), lbs | - | - | - | - |
| Grain mill (SIC 204), lbs | - | - | - | - |
| Bakery (SIC 205), 1,000 lbs | 66 | 92 | 125 | 252 |
| Sugar (SIC 206), lbs | - | - | - | - |
| Confectionery and related (SIC 207), lbs | - | - | - | - |
| Beverage (SIC 208) 1,000 lbs | 491 | 778 | 1,081 | 2,321 |
| Miscellaneous food (SIC 209), lbs | - | - | - | - |

*Adapted from Wells and others (1969, vol. II, p. 116-117).

Studies by Wells and others (1969, vol. II, p. 274) indicate that employment in forestry in the Salmon economic studies area will increase significantly from 1970 to 2070. Employment in the area should rise to a level of 840 in 2070 as compared to 188 employees projected for 1970. This represents an increase of 347 percent. Table 25 shows projected lumber production in the Salmon economic studies area for 1970, 1980, 2000, 2020, and 2070.

Table 25. Projected lumber production in Salmon economic studies area in thousands of board feet.*

| Year | Production Mfbm |
|---|---|
| 1970 | 39,600 |
| 1980 | 48,400 |
| 2000 | 61,600 |
| 2020 | 77,000 |
| 2070 | 116,000 |

*Adapted from Wells and others (1969, v. II, p. 302).

With the rapid changes that have taken place in commodity prices in recent years and that likely will continue to take place for some years to come, it is difficult to place a monetary value on the timber and mineral resources of Salmon Basin. However, in order to make a rough benefit-cost analysis in Chapter VII relative to the feasibility of a navigation project on Salmon River, some hypothetical production situations involving timber and minerals are shown below. In general, the total production level is considered to be a theoretical maximum and the chance of attaining this level is probably quite remote. Average 1970 prices are used as a basis of comparison.

Table 26 is an economic analysis of a hypothetical situation involving full production of timber products in Salmon Basin on a sustained-yield basis. A rotation cycle of 115 years was used and it was assumed that only one-half of the commercial timber listed in Table 14 would be harvested. This value corresponds roughly to the projection in Table 25 for the year 2070. Unit prices are based on timber sale appraisals for areas in, and adjacent to, Salmon Basin in the period 1960 to 1968. Prices have been adjusted to 1970 using the Engineering News-Record cost index for lumber and wood products. The selling price is for rough-sawed lumber at the sawmill before grading and finishing.

Minerals have played an important part in the development of Idaho and are likely to play an important role in the State's future. The relative impact of mineral development on Salmon Basin is closely related to national demand, reserves in other areas, and the relative costs of production and transportation in other areas. Employment in mining in the basin continues to show steady decreases which are, in a few instances, the result of increases in productivity.

Great potential exists in Salmon Basin for the production of certain minerals, including gold, silver, copper, lead, zinc, cobalt, antimony, tungsten, mercury, thorium, columbium, tantalum, fluorspar, and molybdenum. However, the vagaries of the minerals industry make the projection of future mineral production in Salmon Basin unduly speculative. Whether or not a mineral can be profitably mined and marketed depends on many factors including the current demand and price for the mineral, the condition of the world market, the costs of mining, concentrating, and transporting the ore, and the costs of final extraction of the mineral from the concentrates. Using

Table 26. Estimated annual production costs and gross returns for marketing commercial timber stands in Salmon Basin using average 1970 cost figures.[1]

| Cost factor | Douglas fir | Engelmann spruce | Subalpine fir | Grand fir | Ponderosa pine | Lodgepole pine | Other | Total |
|---|---|---|---|---|---|---|---|---|
| Transportation cost | $610,000 | $250,000 | $170,000 | $70,000 | $180,000 | $100,000 | $40,000 | $1,420,000 |
| Other logging costs | 1,350,000 | 500,000 | 360,000 | 130,000 | 430,000 | 210,000 | 80,000 | 3,060,000 |
| Manufacturing costs[2] | 2,150,000 | 820,000 | 600,000 | 220,000 | 580,000 | 370,000 | 110,000 | 4,850,000 |
| Total production cost | 4,110,000 | 1,570,000 | 1,130,000 | 420,000 | 1,190,000 | 680,000 | 230,000 | 9,330,000 |
| Gross return at 1970 selling price[3] | 4,350,000 | 1,670,000 | 970,000 | 360,000 | 1,290,000 | 660,000 | 220,000 | 9,520,000 |
| Net return at 1970 selling price[3] | $ 240,000 | $ 100,000 | (-)$160,000 | (-)$60,000 | $ 100,000 | (-) $ 20,000 | (-)$10,000 | $ 190,000 |

[1] Volume of timber based on quantities listed in Table 14 using rotation cycle of 115 years and assuming that only one-half of the volume would be harvested. Unit prices based on U. S. Forest Service timber sale appraisals for areas in, and adjacent to, Salmon Basin.

[2] Sawmill costs to product rough-sawed lumber.

[3] Rough-sawed lumber at mill.

a purely hypothetical set of conditions, Table 27 was prepared to show what the annual market return for mineral production in Salmon Basin could be. This table is based on several rather tenuous assumptions. It is assumed that the world supply of strategic minerals has been cut off and that there is a simultaneous demand for all of the minerals listed. For some minerals, production is based on past records (Savage, 1970), and for other minerals a hypothetical future production is assumed. Prices are based on average 1970 values except that some have been increased where it was obvious that higher prices would be necessary to stimulate mining (for example, the price of gold was increased to $75.00 per troy ounce and the price of mercury was increased to $600.00 per flask). Information was not available for estimating production costs for the hypothetical production figures shown in Table 27 from which estimated net returns could be obtained. However, based on 1970 prices, it probably can be safely assumed that net returns would be small, if not negative. Otherwise, there would be more current mining activity in the basin.

Table 27. Hypothetical annual mineral production in Salmon Basin.

| Mineral | Hypothetical annual production | Unit Price | Hypothetical annual value |
|---|---|---|---|
| Gold | 30,000 troy ounces[1] | $ 75.00 | $2,250,000 |
| Silver | 600,000 troy ounces[1] | 1.87 | 1,120,000 |
| Copper | 3,000,000 lb. | 0.75 | 2,250,000 |
| Lead and zinc | 2,000,000 lb. | 0.16 | 320,000 |
| Cobalt | 2,000,000 lb. | 2.20 | 4,400,000 |
| Antimony | 4,000,000 lb. | 1.05 | 4,200,000 |
| Tungsten | 15,000 short tons[2] | 43.00 | 640,000 |
| Mercury | 2,000 flasks[3] | 600.00 | 1,200,000 |
| Thorium | 1,000,000 lb. | 2.25 | 2,250,000 |
| Columbium and tantalum | 3,000,000 lb. | 1.20 | 3,600,000 |
| Fluorspar | 20,000 short tons[2] | 60.00 | 1,200,000 |
| Molybdenum | 2,000,000 lb.[4] | 1.72 | 3,440,000 |
| TOTAL | | | $26,870,000 |

[1]One troy ounce = 1/12th of a pound

[2]One short ton = 2,000 pounds

[3]One flask of mercury = 76 pounds

[4]Concentrate

## IV. PRESENT NAVIGATION ON SALMON RIVER

The only definition of a navigable stream presented by Congress appears in the Federal Power Act of 1920, which states that " 'Navigable waters' means those parts of streams or other bodies of water over which Congress has jurisdiction under its authority to regulate commerce with foreign nations and among the several States, and which either in their natural or improved condition, not withstanding interruptions between the navigable parts of such streams or waters by falls, shallows, or rapids compelling land carriage, are used or suitable for use for the transportation of persons or property in interstate or foreign commerce, including therein all such interrupting falls, shallows, or rapids; together with such other parts of streams as shall have been authorized by Congress for improvement by the United States or shall have been recommended to Congress for such improvement after investigation under its authority."

It should be noted in the above definition that even though a stream may not be classed as navigable in its natural state, if improvements can make it navigable, it is considered to be a navigable stream. The economic feasibility of the required improvements does not enter into the decision. Although a common criterion for classifying a stream as navigable or not navigable is whether or not the stream can float a sawlog, when the term navigation is used, most people envision commercial traffic involving barges or ocean-going vessels. However, the definition of commerce is broad so that if a stream is capable of supporting almost any kind of waterborne transportation it is classified as navigable. Thus, Salmon River, although its waterborne transportation so far has consisted only of small boats and rafts associated primarily with recreational activities, is classified as a navigable stream.

For all practical purposes, Salmon River is a free-flowing stream. There are no extensive flood protective or regulatory works in the basin. The only dam ever constructed on the main stem of Salmon River was a concrete and timber structure about 25 feet high at mile 367.3 near the mouth of Yankee Fork. This dam was used in connection with a small hydroelectric plant to furnish power for the Sunbeam Mine. Mining activity ceased prior to

1930 and since then the dam has been breached and only a portion of the left abutment remains intact. There are many small storage reservoirs in the basin that are used for stock watering and for irrigation. However, these reservoirs are situated on small tributaries and do not significantly effect the pattern of discharge in Salmon River.

Figure 6, 7, 8, and 9 show the profile of Salmon River from its mouth to Fourth of July Creek at mile 391.6. From these figures it is immediately apparent that Salmon River is a steeply flowing stream, the average gradient for the entire stream below Fourth of July Creek at mile 391.6 being about 15 feet per mile. Table 28 shows average gradients for several reaches of the stream.

Table 28. Average gradients of Salmon River in feet per mile.

| Reach of River | Gradient ft/mile |
|---|---|
| Mouth (M0.0) to Slate Creek (M66.1) | 9.7 |
| Slate Creek (M66.1 to South Fork (M133.9) | 9.0 |
| South Fork (M133.9) to Middle Fork (M198.5) | 13.5 |
| Middle Fork (M198.5) to North Fork (M237.1) | 14.8 |
| North Fork (M237.1) to Pahsimeroi River (M304.0) | 15.6 |
| Pahsimeroi River (M304.0) to Yankee Fork (M367.1) | 20.1 |
| Yankee Fork (M367.1) to Fourth of July Creek (M391.6) | 34.7 |

Table 29 shows major rapids and falls in Salmon River. The rapids vary in length from a few hundred feet to over a mile. The mileage values shown in the table refer to the upstream end of the rapids. The locations of these rapids with respect to tributaries of Salmon River can be ascertained by referring to Figures 6 to 9, inclusive. The difficulty rating refers to the relative difficulty of negotiating the rapids in small boats and rafts. A section of river is difficult - and dangerous - to navigate in proportion to its rate of descent, the volume of water that it carries, and the tortuosity of its course. Of these, the volume of water carried at the time is a vital determinant of a river's difficulty. A stream

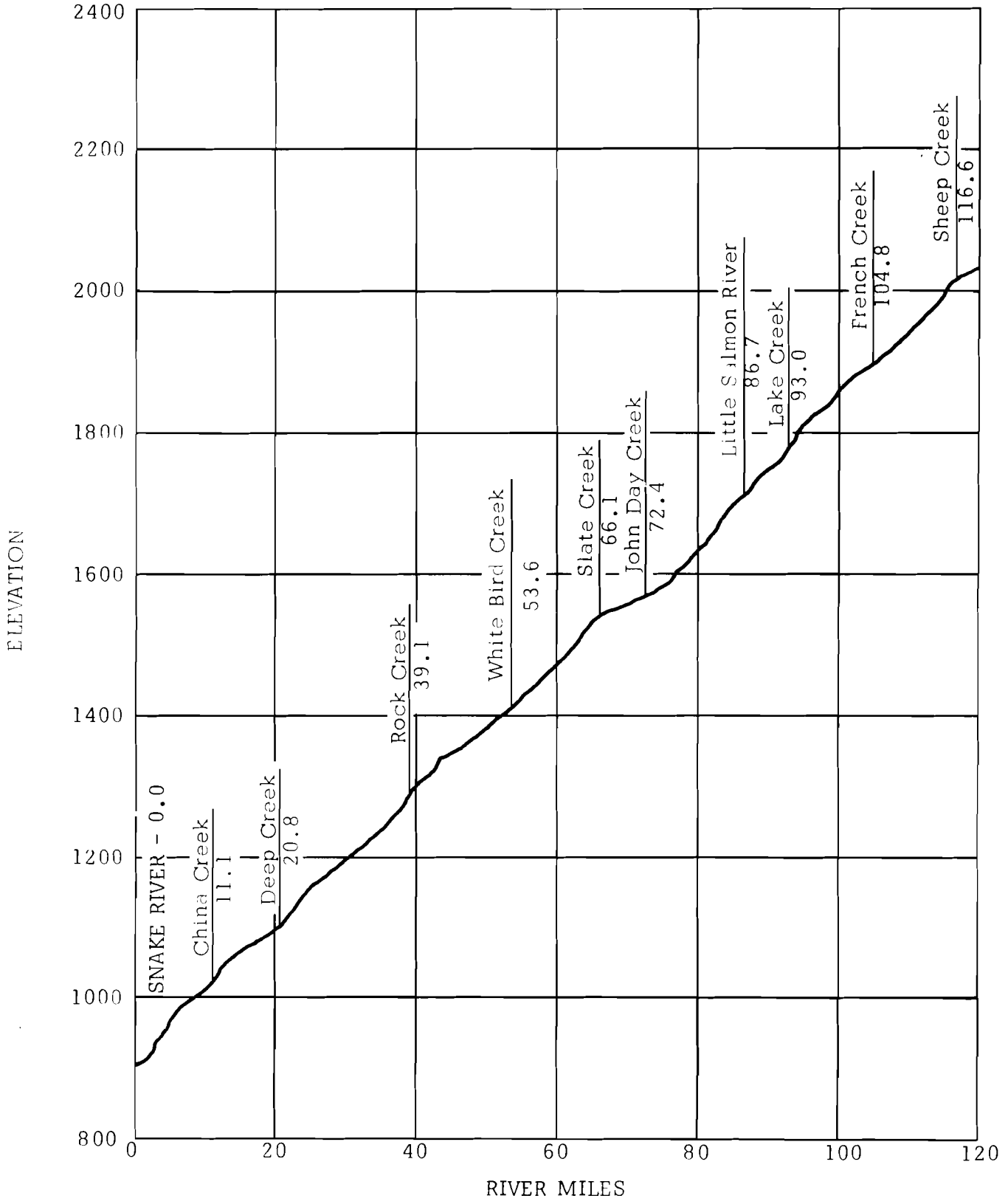


Figure 6. Water surface profile of Salmon River from mouth to Sheep Creek.

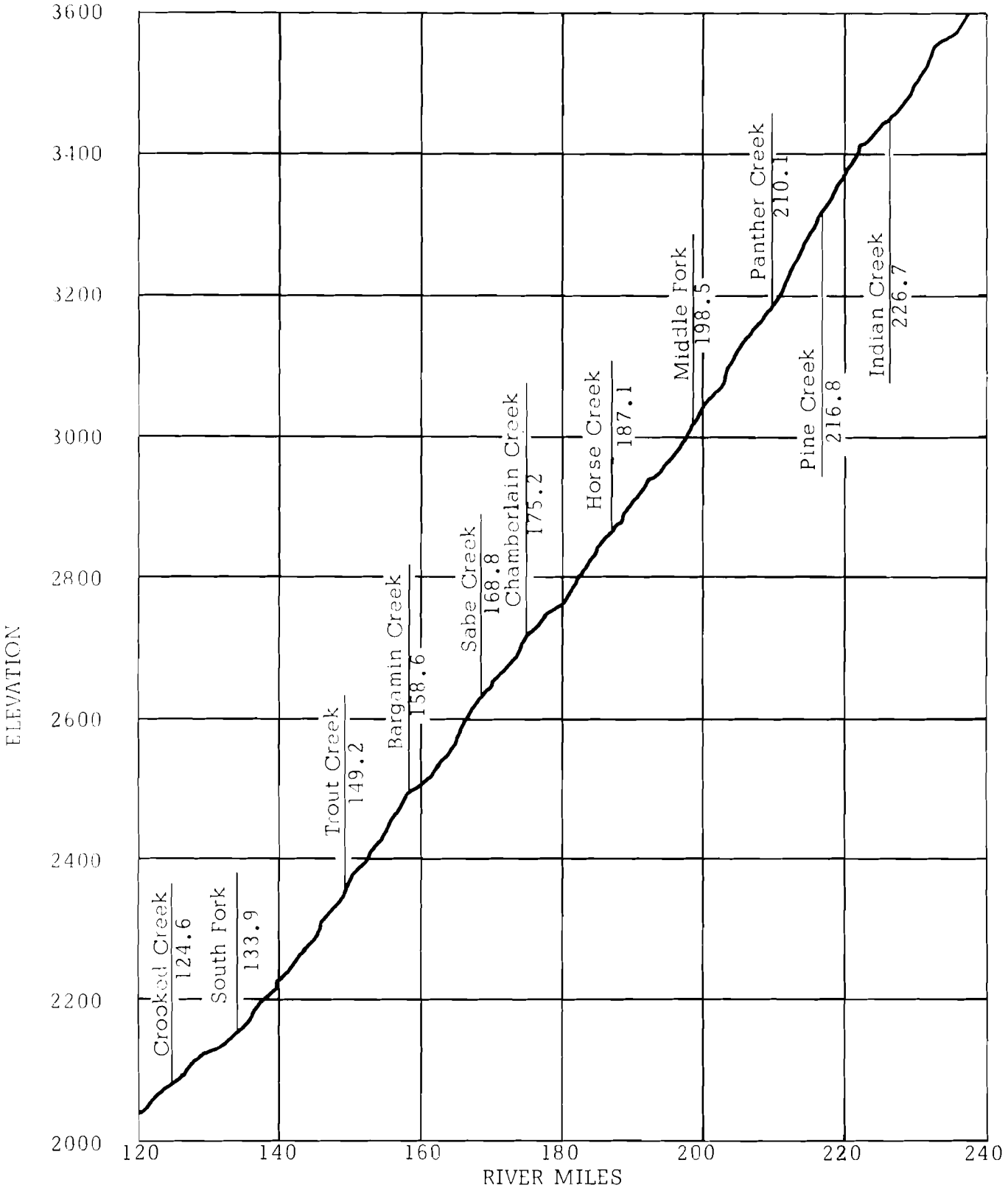


Figure 7. Water surface profile of Salmon River from Sheep Creek to North Fork.

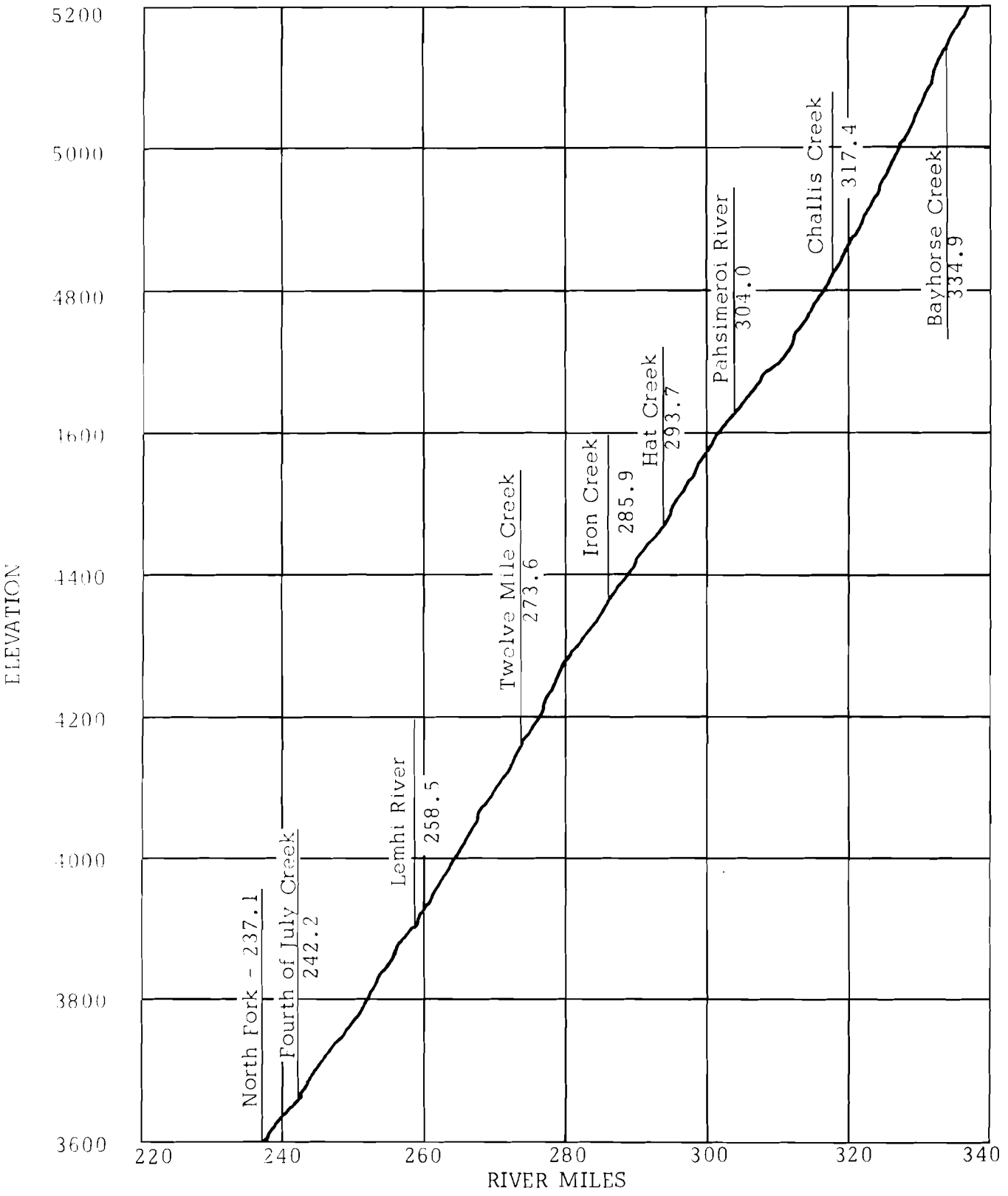


Figure 8. Water surface profile of Salmon River from North Fork to Bayhorse Creek.

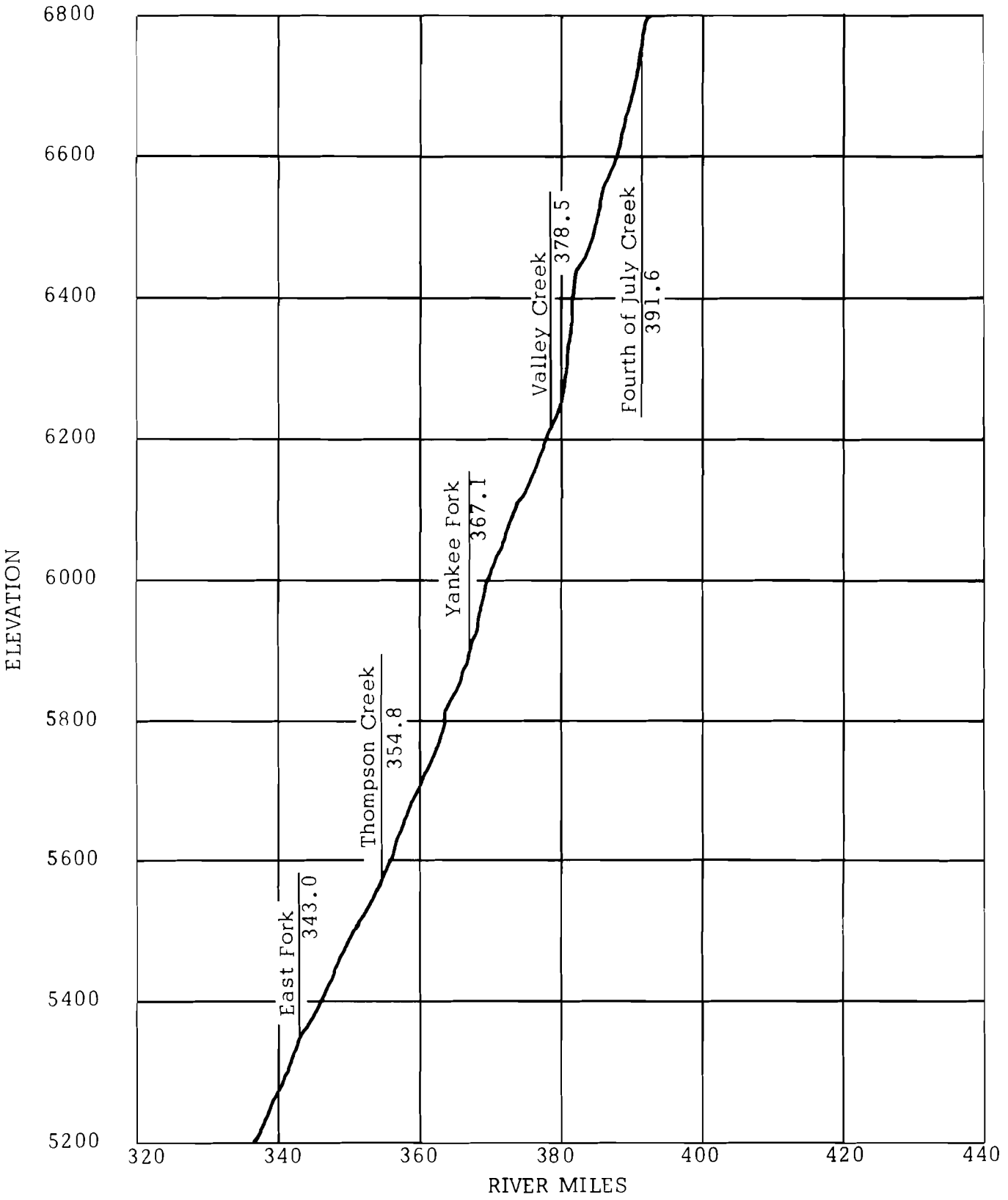


Figure 9. Water surface profile of Salmon River from Bayhorse Creek to Fourth of July Creek.

Table 29. Major rapids and falls in Salmon River.

| River | Name | Difficulty rating* |
|---|---|---|
| 0.3 | | |
| 1.3 | | |
| 2.5 | | |
| 4.8 | | |
| 5.5 | | |
| 8.3 | Wapshilla Rapids | |
| 10.1 | | |
| 10.9 | | |
| 13.8 | | |
| 18.9 | China Rapids | |
| 21.1 | | |
| 23.5 | Snow Hole Rapids | |
| 24.6 | | |
| 29.8 | | |
| 33.6 | | |
| 34.4 | | |
| 37.5 | | |
| 41.1 | | |
| 42.8 | Pine Bar Rapids | |
| 45.3 | | |
| 48.7 | | |
| 52.4 | | |
| 62.7 | Blackhawk Rapids | |
| 68.1 | | |
| 77.0 | | |
| 78.5 | | |
| 80.5 | Fiddle Creek Rapids | |
| 82.3 | | |
| 93.0 | | |
| 94.1 | Ruby Rapids | 4 |
| 96.1 | | |
| 97.7 | | |
| 99.8 | The Crevice | 3 |

| River mile | Name | Difficulty rating* |
|---|---|---|
| 100.6 | | 3 |
| 106.2 | | 3 |
| 107.0 | Vinegar Creek Rapids | 9 |
| 110.1 | Carey Falls | 4 |
| 112.6 | Chittam Rapids | |
| 114.9 | Dry Meat Rapids | 3 |
| 115.5 | Sheep Creek Rapids | 3 |
| 119.3 | | |
| 122.8 | | |
| 134.4 | | 3 |
| 135.9 | Three Mile, Ludwig, or Hot Number Rapids | 4 |
| 136.2 | | 3 |
| 136.8 | | 3 |
| 149.0 | Growler Rapids | 4 |
| 150.7 | Elkhorn Rapids | |
| 151.6 | Little Mallard Rapids | 4 |
| 153.5 | Big Mallard Rapids | 6 |
| 155.2 | | 4 |
| 155.5 | Myers Rapids | 4 |
| 156.4 | Five Mile Rapids | |
| 156.7 | Big Eddy Rapids | |
| 156.8 | Split Rock Rapids | |
| 158.2 | Bailey Rapids | 6 |
| 160.7 | | 3 |
| 163.9 | | |
| 164.7 | Long Pitch Rapids | 3 |
| 165.2 | Hancock Rapids | |
| 168.7 | Funnel Rapids | 3 |
| 169.2 | Swing Rapids | 3 |
| 169.6 | | 3 |
| 170.3 | Salmon Falls | 5 |
| 174.1 | Little Devils Teeth Rapids | |
| 177.3 | Devils Teeth Rapids | 4 |
| 179.2 | Lantz Rapids | |

| River mile | Name | Difficulty rating* |
|---|---|---|
| 182.7 | Rainier Rapids | 5 |
| 185.8 | | 3 |
| 188.5 | Gun Barrel Rapids | |
| 194.1 | Kitchen Creek Rapids | 4 |
| 199.3 | Long Tom Rapids | |
| 211.9 | | |
| 216.8 | Pine Creek Rapids | |
| 217.6 | | |
| 218.7 | | |
| 294.4 | | |
| 352.6 | | |
| 360.4 | | |
| 364.8 | Indian Riffles | |
| 368.1 | | |
| 370.8 | | |
| 373.6 | | |
| 383.6 | | |

*Difficulty rating obtained from Jones (1956). At the time of rating the river discharge was about 4,000 cfs.

Difficulty rating (American rating system):

| | |
|---|---|
| 1,2 | Easy |
| 3,4 | Some problems |
| 5,6 | Medium difficulty |
| 7,8 | Very difficult |
| 9,10 | Most difficult. Runnable with best-suited boat and operator having over 50-50 chance of success |
| U | Not runnable |

which is considered to be easy to negotiate at normal flows may, in high flood, present a tremendous force which even an expert would not venture to challenge. The system used to rate the various rapids, as well as the approximate discharge of the river at the time the ratings were made are shown at the bottom of the table.

Foot, pack, and road bridges across Salmon River are shown in Table 30. Although no information was available on horizontal clearances, it is assumed that for the size of craft using the river at present or in the future, horizontal clearance is not a restrictive factor. The normal water surface elevation is construed to mean the average water surface elevation for discharges occurring about 80 percent of the time.

Wire rope cables across Salmon River for various purposes other than for bridges are located at the following river miles points:

| | | |
|---|---|---|
| 37.7 | 201.6 | 219.6 |
| 101.0 | 203.1 | 220.8 |
| 104.9 | 203.7 | 222.8 |
| 107.8 | 204.8 | 224.2 |
| 109.8 | 205.8 | 225.0 |
| 147.7 | 207.3 | 226.3 |
| 147.9 | 208.7 | 231.4 |
| 179.3 | 214.4 | 276.5 |
| 193.5 | 215.4 | 293.2 |
| 194.9 | 217.3 | 293.9 |

In the usual sense of the term, there is no commercial navigation on Salmon River and there are no commercial port facilities. The principal navigation at present is associated primarily with recreation and involves small craft both powered and non-powered. Charter boats, most of which are jet propelled with capacities of about 10 passengers, operate in the canyon reaches of the stream. Non-powered boats and rafts float down Salmon River from North Fork to Riggins. This activity is increasing rapidly, but is too new to have accurate growth rates established. Some idea of the recreational use of Salmon River can be gained from data compiled by the U. S. Forest Service as shown in the following tables. Table 31 shows the use in terms of visitor days of various types of sites or areas on Salmon River between Corn Creek and North Fork during 1966,

Table 30. Bridges on Salmon River.

| River mile | Name of bridge | Type of bridge | Type of travelway | Bridge deck elev.* | Normal water surface elev. |
|---|---|---|---|---|---|
| 37.6 | Rice Creek | Road | County road | 1309 | 1266 |
| 54.3 | | do | do | 1465 | 1420 |
| 62.3 | | do | U. S. 95 | 1572 | 1497 |
| 64.2 | | do | U. S. 95 | 1562 | 1523 |
| 76.5 | | do | do | 1635a | 1597 |
| 84.1 | Goff | do | U. S. 95 | 1726 | 1686 |
| 92.9 | Lake Creek | do | County road | 1797 | 1779 |
| 95.8 | | do | do | 1837 | 1819 |
| 99.0 | Partridge Creek | do | do | 1875a | 1844 |
| 99.9 | Manning | do | do | 1892 | 1855 |
| 109.8 | Wind River | Pack | Trail | 1975a | 1940 |
| 135.2 | Mackay Bar | Road | County road | 2190 | 2163 |
| 147.9 | Campbells Ferry | Pack | Trail | 2350a | 2329 |
| 187.0 | Horse Creek | do | do | 2893 | 2868 |
| 197.9 | Stoddard | do | do | 3025a | 3000 |
| 209.2 | Cove Creek | Road | County road | 3190 | 3178 |
| 216.8 | Pine Creek | do | do | 3358 | 3320 |
| 236.3 | | do | Private road | 3590a | 3578 |
| 238.5 | | do | do | 3625a | 3614 |
| 241.6 | | do | do | 3665a | 3652 |
| 254.9 | Carmen | do | U. S. 93 | 3871 | 3853 |
| 259.4 | | do | do | 3941 | 3918 |
| 265.8 | Shoup | do | County road | 4040 | 4028 |
| 278.3 | | Foot | -- | 4280a | 4250 |
| 280.3 | | Road | County road | 4300a | 4285 |
| 286.1 | Iron Creek | do | do | 4378 | 4368 |
| 287.4 | | Foot | -- | 4400a | 4388 |
| 294.8 | | do | -- | 4505a | 4493 |
| 297.8 | | do | Trail | 4555a | 4541 |
| 305.7 | | Road | County road | 4680a | 4655 |
| 311.8 | | do | U. S. 93 | 4745a | 4728 |
| 315.9 | | do | County road | 4810a | 4797 |

| River mile | Name of bridge | Type of bridge | Type of travelway | Bridge deck elev.* | Normal water surface elev. |
|---|---|---|---|---|---|
| 326.8 | | do | U. S. 93 | 5000a | 4988 |
| 334.9 | | do | County road | 5180 | 5168 |
| 338.9 | | Foot | -- | 5265a | 5250 |
| 343.2 | | Road | U. S. 93 | 5360a | 5346 |
| 345.9 | | do | County road | 5414 | 5398 |
| 347.7 | | do | U. S. 93 | 5480a | 5435 |
| 350.7 | | do | County road | 5520a | 5498 |
| 354.8 | | do | do | 5590a | 5577 |
| 357.3 | | do | U. S. 93 | 5655 | 5642 |
| 370.4 | | do | County road | 6040a | 6022 |
| 374.3 | | do | do | 6125a | 6112 |
| 378.6 | | do | -- | 6225a | 6213 |
| 379.9 | | do | County road | 6250a | 6240 |
| 381.3 | | Foot | -- | 6410a | 6360 |
| 383.7 | | Road | U. S. 93 | 6465 | 6456 |
| 393.7 | | do | do | 6830 | 6820 |
| 400.8 | | do | County road | 7205a | 7197 |
| 402.2 | | do | U. S. 93 | 7348 | 7342 |

*The letter "a" following an elevation indicates that the value is approximate.

Table 31. Visitor-day use of various sites or areas on Salmon River between Corn Creek (M190.8) and North Fork (M237.1). Data from the U. S. Forest Service.

| Kind of site or area | 1966 | | 1967 | | 1968 | |
|---|---|---|---|---|---|---|
| | Visitor-days use (thousands) | Percent of total | Visitor-days use (thousands) | Percent of total | Visitor-days use (thousands) | Percent of total |
| Boating | 0.6 | 3.4 | 0.2 | 0.2 | 0.5 | 0.5 |
| Campground family | 12.1 | 68.7 | 72.1 | 93.8 | 82.6 | 93.6 |
| Hotel, lodge, resort (private) | 3.3 | 18.7 | 4.3 | 5.5 | 4.8 | 5.4 |
| Other commercial public service | 1.6 | 9.0 | 0.1 | 0.1 | 0.2 | 0.2 |
| Recreation residence | | | 0.1 | 0.1 | 0.1 | 0.1 |
| Composite total | 17.6 | 99.9 | 76.8 | 99.9 | 88.2 | 99.9 |

Table 32. Visitor-day use of Salmon River between Corn Creek (M190.8) and North Fork (M237.1) for various activities. Data from U. S. Forest Service.

| Activity | 1966 | | 1967 | | 1968 | |
|---|---|---|---|---|---|---|
| | Visitor days use (thousands) | Percent of total | Visitor-days use (thousands) | Percent of total | Visitor-days use (thousands) | Percent of total |
| Boat, power (boat-cruise) | 0.7 | 3.9 | 0.2 | 0.2 | 0.7 | 0.7 |
| Other watercraft (row drift, raft) | 0.2 | 1.1 | 0.2 | 0.2 | 0.3 | 0.3 |
| Camping, general | 0.9 | 5.1 | 9.2 | 11.9 | 11.5 | 13.0 |
| Camping, auto | 4.2 | 23.8 | 23.3 | 30.3 | 24.5 | 27.7 |
| Camping, trailer | 4.7 | 26.7 | 35.5 | 46.2 | 41.3 | 46.8 |
| Camping, tent | 1.6 | 9.9 | 3.4 | 4.4 | 3.7 | 4.1 |
| Picnicking | 0.7 | 3.9 | 0.7 | 0.9 | 1.6 | 1.8 |
| Resort-commercial public service, general | 2.6 | 14.7 | 0.2 | 0.2 | 0.5 | 0.5 |
| Resort, lodging | 2.0 | 11.3 | 4.0 | 5.2 | 4.0 | 4.5 |
| Recreation residence | | | 0.1 | 0.1 | 0.1 | 0.1 |
| Composite total | 17.6 | 99.9 | 76.8 | 99.9 | 88.2 | 99.9 |

1967, and 1968. Table 32 shows visitor day use of Salmon River between Corn Creek and North Fork for various types of activities during 1966, 1967, and 1968. The information shown in Tables 31 and 32 consists of estimates based on the best field data available. Studies presently are being made to improve the reliability of this information. The low value for boating in 1967 is attributed to a temporary diversion of boating interest to Middle Fork Salmon River because of nationwide publicity given to the latter stream and to generally poor fishing results in the main stem that year. Table 33 shows the recreational use of Salmon River between Lantz Bar and Corn Creek in terms of number of visitors and number of visitor days for the years 1964 to 1968, inclusive. Table 34 shows the recreational use of Salmon River within the boundaries of the Idaho Primitive Area in terms of number of power-boat visitors and number of float-boat visitors for the years 1964 to 1968, inclusive. In addition to the uses listed in the above tables, other portions of Salmon River are used for boating purposes, especially in connection with sport fishing. Also, in some places the use of boats is required to cross the river to property which is inaccessible by bridges. There are no records available on these uses of the river.

Table 33. Recreational use of Salmon River between Lantz Bar (M179.9) and Corn Creek (M190.8).

| Year | Visitors | Visitor - days |
|---|---|---|
| 1964 | 4,655 | 8,236 |
| 1965 | 3,889 | 7,230 |
| 1966 | 5,487 | 9,794 |
| 1967 | 5,588 | 10,907 |
| 1968 | 6,000* | 11,500* |

*Estimated

Table 34. Recreational use of Salmon River within the Idaho Primitive Area - Fivemile Creek (M138.0) to Middle Fork (M198.5).

| Year | Power-boat visitors | Float-boat visitors |
|---|---|---|
| 1964 | 3,398 | 1,226 |
| 1965 | 2,528 | 1,221 |
| 1966 | 4,109 | 1,166 |
| 1967 | 4,300 | 1,200 |
| 1968 | 4,500 | 1,300 |

No detailed studies have been made to determine the value of boat trips on the main stem of Salmon River. Studies on Middle Fork Salmon River indicate the cost of "white water" float trips to be about $230 per person per trip. From Table 34 it may be assumed that the number of float-boat visitors on Salmon River in 1970 would be about 1,500. Because a higher percentage of float trips involve privately-owned craft on the main stem of Salmon River than on the Middle Fork, the cost per person per trip on Salmon River is estimated to be $150. Based on this figure, the total value of "white water" float trips on Salmon River in 1970 would be $225,000.

Table 34 also indicates that more than three times as many people travel Salmon River in power boats than travel in float boats. It is estimated that during the year approximately one-third of those traveling in power boats are hunters and the average cost per person per hunting trip is $800. The remaining two thirds of the people use power boats primarily for fishing and sight-seeing. The cost per person per trip for these people is estimated to be $50. Assuming that the total number of power boat visitors in 1970 would be 5,100, the value of hunter trips would be $1,360,000 and the value of the remaining trips would be $170,000, making the total value of power-boat trips on Salmon River in 1970 $1,530,000. Thus, the estimated total value of all types of boating on Salmon River within the Idaho Primitive Area for 1970 is $1,755,000. A summary of these values is shown in Table 35.

Table 35. Estimated total value of recreational boating on Salmon River within the Idaho Primtive Area for 1970.

| Type of boat trip | Total value for 1970 | |
|---|---|---|
| Float | | $ 225,000 |
| Power-hunting | $1,360,000 | |
| Power-other | 170,000 | |
| Power-total | | 1,530,000 |
| Grant Total | | $1,755,000 |

Studies are being made to determine if, in the future, limitations should be placed on the number of visitors using Salmon River for boat trips. Even now, it appears that recreational boating on some reaches of the river will have to be limited if the desire of most people for a "wilderness" experience free of congestion by other boaters is to be realized.

# V. POTENTIAL NAVIGATION ON SALMON RIVER

Commercial transportation in Salmon Basin is now limited to small aircraft and to truck routes which are confined mostly to the main valleys. There is and will continue to be a need for additional highway development in the remote timbered areas if the economic possibilities of the basin are to be realized. The commerce volume available for shipment to coastal areas is considered large (Pacific Northwest River Basins Commission, 1970). Many of the resources are not now utilized to their full potential. Commodities for downriver traffic would include agricultural and miscellaneous products, logs and other timber products, basic metal ores, and some non-metallic minerals. Basin needs would be petroleum and miscellaneous consumer goods which could move upriver. Without a waterway, most of these commodities represent resources that will not be fully developed and those that will develop will move at considerable cost by other modes of transportation.

Compared to areas along the Columbia River and Snake River waterways, the quantities of agricultural and miscellaneous products that might move down Salmon River are not considered to be large. From information contained in Table 21 (Chapter III) a rough estimate of tonnage potential can be made. It is assumed that, with the possible exception of meat, the food products listed in Table 24 of Chapter III and milk listed in Table 21 would not normally be shipped by water. It is possible that very little, if any, of the meat would be shipped by water but for the purposes of this estimate these values are included. If wheat is assumed to weigh 60 pounds per bushel and barley 48 pounds per bushel, and assuming that only half of the agricultural products would be transported by water, the projected total annual quantity of products shown in Table 21, exclusive of milk, to be moved by navigation for the year 2070 is 57,000 tons. Assuming that without a water transportation system the products would be transported out of the basin by truck, and using costs per ton-mile of $0.003 by water and $0.066 by truck (U. S. Corps of Engineers, 1970) the cost of water transportation and the benefit of transportation by water over that by truck can be computed. Using an average mileage of one-half the water distance from Salmon City to Lewiston (154

miles), and the ton-mile cost of $0.003, the annual cost of transporting agricultural and miscellaneous products by water - to be considered a revenue to the navigation system - would be $26,000. The benefit of the water transportation would be the difference between transportation costs by truck and by water or $550,000 per year.

As indicated in Table 26 (Chapter III), the transportation portion of total logging costs for a hypothetical sustained-yield timber production from Salmon Basin would be $1,420,000 per year. This cost is based almost entirely on truck transportation as very little rail transportation would be involved. Assuming that even if a water transportation system was available for rafting logs down Salmon River, one-half of the logs would still be transported by truck, and using a cost per ton-mile ratio of $0.003 by water to $0.066 by truck, the annual transportation cost by water - to be considered a revenue to the navigation system - would be $32,000. The annual cost of the water transportation could be computed in another way by assuming the logs to weight 35 pounds per cubic foot and using the cost per ton-mile of $0.003 for one-half the distance from Salmon City to Lewiston which results in an annual cost of $35,000. The benefit to the timber industry would be the difference between transportation costs by truck and by water or $675,000 per year.

Table 36 shows hypothetical annual tonnage of concentrates of minerals requiring transportation to smelters or other refineries outside of Salmon Basin. The tonnage values are based on average concentrations and the annual mineral production shown in Table 27 (Chapter III). Assuming, as for the agricultural and timber products, that one-half of the total tonnage (55,100 tons) would be transported by truck and using the cost per ton-mile of $0.003 for one-half the distance from Salmon City to Lewiston, the annual cost of transporting one-half of the mineral concentrates by water - a sum to be considered a revenue to the navigation system - would be $25,000. The corresponding cost of transporting 55,100 tons of concentrates the same distance by truck using the rate of $0.066 per ton mile would be $560,000 per year. As with the agricultural and timber products, the benefit to the minerals industry would be the difference between transportation costs by truck and by water or $535,000 per year.

Table 36. Hypothetical annual tonnage of concentrates requiring transportation to refineries outside of Salmon Basin

| Ore or mineral | Hypothetical annual tonnage of concentrates [1] |
|---|---|
| Gold | N[2] |
| Silver | I[3] |
| Chalcopyrite | 7,500 |
| Galena and sphalerite | 2,500 |
| Cobaltite | 10,000 |
| Stibnite | 5,700 |
| Scheelite | 37,500 |
| Mercury | N[2] |
| Thorite | 5,000 |
| Columbite and tantalite | 15,000 |
| Fluorspar | 25,000 |
| Molybdenite | 2,000 |
| TOTAL | 110,200 |

[1]Tonnage based on average concentrations and annual mineral production shown in Table 27. Units are short tons.

[2]N = Negligible

[3]Included with galena and sphalerite

While agricultural products, timber, and minerals represent a large part of the commercial resources of Salmon Basin, there are other resources which are of significant value in connection with potential navigation in the basin. Of these, recreational boating is probably the most important.

Somewhat of a paradox exists with respect to the development of navigation on Salmon River. Full development of the agricultural, timber, and mineral resources of the basin would be aided by improving the river for water-borne commerce. Yet, the facilities necessary for commercial navigation would be detrimental to the use of the river for "white water"

boating and for most other water activities connected with a free-flowing stream as described in Chapter IV. However, construction of a lock-and-dam navigation system would not preclude the use of the water for some water-oriented recreation activities because activities such as fishing, swimming, water skiing, and transportation of hunters are well-adapted to the still water in reservoirs.

Considering the general remoteness of the Salmon River canyon, it is difficult to predict the amount of water-oriented recreation that would be generated as the result of constructing a navigation system. A large part of the activity undoubtedly would be connected with hunting and fishing and would involve the use of power boats. For this type of activity the U. S. Water Resources Council (1970) estimates that visitor day values might range from $2.50 to $7.00. For the purpose of making a rough estimate of what could be expected for the total annual value of this water-oriented recreation, assume a visitor-day value of $10.00 because of the expected high percentage of hunters and the unusual inaccessibility of the region. According to the Pacific Northwest River Basins Commission (1970) the total annual boating-day use on the lower canyon reaches of Snake and Salmon rivers, which in the case of the Snake involves lock-and-dam facilities, is estimated to be about 63,000. Assuming that this same amount of boating-day use could take place on the central canyon reaches of Salmon River in connection with a navigation system, and assuming an average of three people per boat, the total annual value of recreational boating could be about $1,900,000.

The estimated total 1970 value of recreational boating on Salmon River as it now exists is shown in Table 35 to be about $1,800,000. The estimated total annual value of recreational boating that could exist with a navigation project was shown in the previous paragraph to be $1,900,000. Thus, although the type of boating activity in connection with the two analyses differ somewhat, it appears that very little net benefit, or loss, would accrue to recreational boating as the result of constructing a navigation system on Salmon River.

# VI. RELATION OF SALMON BASIN TO NAVIGATION ON LOWER SNAKE AND COLUMBIA RIVERS*

The Federal government has established all present navigation improvements on the lower Columbia and lower Snake rivers. The Columbia River above the Dalles is navigable for vessels with drafts to 14 feet and is used for barges hauling wheat , petroleum products, cement, and other commodities, with tows ranging to 10,000 tons capacity. The waterway is being extended to include some 460 miles of inland navigation.

The lower Snake River project provides for a navigation channel from the mouth of Snake River to Lewiston with a depth and width of 14 and 250 feet, respectively, at minimum regulated flow, and for four dams with navigation locks, each lock with clear dimensions of 86 feet wide and 675 feet long, and with 15 feet of depth over the sills. Three of the dams, Ice Harbor, Lower Monumental, and Little Goose are complete; and the fourth, Lower Granite, is scheduled for completion prior to 1980. At present there are commercial port and terminal facilities at seven locations along the river between Pasco and Lewiston.

The River and Harbor Acts of 1902 and 1935 provide for open-river navigation improvement from Lewiston (M139.6) upstream to Johnson Bar landing (M229.4). No channel dimensions have been specified for this reach of the river, but an attempt has been made to maintain a minimum depth of three feet at a controlled flow of 10,000 cfs.

Commerce on Snake River amounted to about 900,000 tons in 1967. Most of this tonnage moved on the lower eight miles of Snake River with only 210,000 tons being destined to or originating at points above Ice Harbor Dam. Agricultural products and fertilizers constituted nearly 65 percent of the total tonnage. The balance comprised petroleum products, cement, asphalt, and miscellaneous commodities. More than 80 percent of the petroleum products, about 200,000 tons, was shipped from the pipeline terminal near the mouth of Snake River downriver, either

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*A substantial portion of the information contained in this chapter was obtained from the Pacific Northwest River Basins Commission (1970).

to the Portland market area or to refineries for reprocessing. Commerce above Lewiston amounts to less than 100 tons annually of supplies to isolated ranches in the Snake River Canyon. About 3,000 passengers are carried annually on the reach of Snake River about Lewiston.

Facilities on the lower Snake River for recreational boating include five marinas with spaces for 370 boats, nine marine parks with picnic and camping facilities and a total of 42 lanes of launching ramps. It is estimated that there are 3,530 licensed boats in this area. Other boats such as kayaks and cartops, which are not registered, also make limited use of the navigable waterways. A survey of boat owners showed that boats are used an average of 40 days per year and that the primary activities are fishing, cruising and sightseeing, and water skiing.

Commerce expected to move on the slack-water project to Lewiston when completed is shown in Table 37. Commerce that would be attracted by extension of the waterway on Snake River beyond Lewiston also is considered in the analysis. The projections do not include resources that would be exploited as result of development of a navigation project on Salmon River. However, the lower Columbia-lower Snake river waterway would be capable of handling, for the foreseeable future, any commerce resulting from the development of a navigation system on Salmon River.

The navigation system for the lower Columbia and lower Snake rivers was designed so that regulation of flow on Salmon River would not be required. This system will be contained in reservoirs from Bonneville Dam to Lewiston; therefore, the actual amount of water flowing is not critical. Even in the reach below Bonneville Dam, the needs of navigation could be met by dredging, without regard to the flow in Columbia River. The minimum flows envisioned are more than enough to satisfy foreseeable navigation needs.*

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*Written communication, E. L. White, Pacific Northwest River Basins Commission, 1969.

Table 37. Projected commodity movements on Snake River Waterway to Lewiston*.

| Commodity | Volume in thousands of tons | | | | | |
|---|---|---|---|---|---|---|
| | 1980 | | 2000 | | 2020 | |
| | Upstream | Downstream | Upstream | Downstream | Upstream | Downstream |
| Chemicals including fertilizers | 95 | 18 | 194 | 20 | 280 | 25 |
| Petroleum products | 296 | 210 | 446 | 150 | 560 | 30 |
| Agricultural products | | 850 | | 1,000 | | 1,080 |
| Forest products | | 185 | | 556 | | 920 |
| Miscellaneous | 80 | 60 | 100 | 72 | 115 | 85 |
| TOTAL | 471 | 1,323 | 740 | 1,798 | 955 | 2,140 |

*Pacific Northwest River Basins Commission (1970), Table 9.

# VII. POTENTIAL NAVIGATION FACILITIES ON SALMON RIVER

The full potential of the Snake River Waterway cannot be realized prior to completion of Lower Granite Dam at mile 107.5 and extension of slack-water navigation to Lewiston. Completion of Ice Harbor, Lower Monumental, and Little Goose dams has provided slack-water navigation to the Lower Granite site, but swift water and a shallow, narrow channel limit navigation above that point. Above Lewiston swift currents and limited channel dimensions in Snake, Clearwater, and Salmon rivers restrict present navigation to special boats.

Before a navigation system on Salmon River could be integrated with the waterway on lower Snake River it would be necessary to construct several projects on Snake River above Lewiston. Of these, only Asotin Dam has been authorized by Congress. The navigation facilities in connection with this dam have not as yet been authorized and no funds have been appropriated for construction of the dam.

There are three basic methods for improving a river for navigation - open-channel, lock-and-dam, and canalization. Open-channel methods seek to improve the existing channel to the point where navigation is feasible. Dams create a series of slackwater pools through which the traffic can move, with locks to lift the vessels from one pool to the next. Canalization provides a totally new channel cut by artificial means around an otherwise impassable obstruction or between two navigable waters. Of these three methods, the lock-and-day system is considered to be the only one offering any chance of feasibility for Salmon River. The possibility exists for open-channel improvements sufficient only for floating sawlogs down the river, but no cost estimates have been made for such a system. The steep gradient and extremely rocky character of Salmon River canyon and the amount of decomposed rock material continually entering the river from its banks and tributary streams probably would render the construction and maintenance of such a system extremely costly. It seems very unlikely that the resulting flow would be placid enough to prevent excessive disintegration of logs required to travel any great distances in the river. Also, the required improvements would materially alter the hydraulic characteristics of the channel so that, at least temporarily, there would be

tremendous amounts of bed and bank erosion and deposition of sediment. In addition, the resulting system probably would be less attractive for recreational boating than either the river in its present condition or with a lock-and-dam system.

The change in elevation between the mouth of Salmon River and Salmon City is more than 3,000 feet. Several storage dams that would develop most of the reach for power and flow regulation have been studied, but navigation has not been included as a function. Most of the proposals have been for dams with high head and large reservoir fluctuations which would not easily be adaptable to navigation. To carry navigation through these dams would require multiple stage locks at each dam. No cost estimates of navigation facilities have been made and site suitability at the potential damsites has not been determined. It is not considered that slackwater navigation on Salmon River will become feasible, from either an economic or an engineering aspect, in the foreseeable future.

Information on the storage dams mentioned above, which have been studied for purposes other than navigation, is shown in Table 38. The costs of navigation facilities at Ice Harbor, Lower Monumental, Little Goose, and Lower Granite dams (U. S. Corps of Engineers, 1948) were used as a basis for making extremely rough estimates of the annual costs of navigation facilities for Salmon River. The cost of navigation works was estimated on the basis of $250,000 per foot of lift and the capital recovery factor used to compute the annual cost figures was 0.075. The results of these computations are shown in Table 39.

At Salmon, a draft of 14 feet would require a water surface elevation of 3928. From Lower Granite pool elevation 735 the total lockage lift from Lewiston to the city of Salmon would be 3,193 feet. The projects used in Table 39 to compute the total annual cost figure of $48,000,000 account for only 2,568 feet of the total required lift. Assuming that, for the purposes of providing slack-water navigation to Lime Point on Snake River, the Asotin Dam and navigation facilities, with normal pool at elevation 842.5, would be constructed independently and prior to the construction of any navigation project on Salmon River, the annual cost of navigation projects to provide the remaining 517.5 feet of lift, computed on the same basis as the values in Table 39, would be approximately $10,000,000. Thus, the estimated total annual cost of

Table 38. Potential storage sites on Salmon River.[1]

| Damsite | River mile | Effective height of dam (ft)[2] | Normal pool elevation (ft. above MSL) | Potential storage (acre-feet) | |
|---|---|---|---|---|---|
| | | | | Total | Usable |
| Lower Canyon | 0.5 | 665 | 1575 | 3,700,000 | 2,500,000 |
| Freedom | 69.3 | 222 | 1780 | 285,000 | 24,000 |
| Crevice | 99.7 | 510 | 2355 | 1,480,000 | 1,030,000 |
| Crevice (alter.)[3] | 99.7 | 725 | 2570 | 3,980,000 | 2,300,000 |
| Growler Rapids | 149.0 | 305 | 2660 | 425,000 | 300,000 |
| Black Canyon | 170.0 | 332 | 2992 | 600,000 | 425,000 |
| Pinnacle Peak | 197.1 | 376 | 3368 | 790,000 | 445,000 |
| Indianola | 230.8 | 248 | 3750 | 365,000 | 265,000 |

[1]Data from U. S. Congress (1950 and 1958)

[2]From low water elevation to normal pool elevation

[3]Crevice alternate would inundate the Growler Rapids site.

Table 39. Estimated annual costs of the navigation portion of potential storage projects on Salmon River. Cost values based on 1970 prices.

| Project | River mile | Estimated annual cost of navigation portion of project |
|---|---|---|
| Lower Canyon | 0.5 | $12,000,000 |
| Freedom | 69.3 | 4,000,000 |
| Crevice | 99.7 | 10,000,000 |
| Crevice (alter.) | 99.7 | 14,000,000 |
| Growler Rapids | 149.0 | 6,000,000 |
| Black Canyon | 170.0 | 6,000,000 |
| Pinnacle Peak | 197.1 | 7,000,000 |
| Indianola | 230.8 | 5,000,000 |
| TOTAL * | | $48,000,000 |

*Total includes alternative plan for Crevice project and does not include Growler Rapids project.

providing slack-water navigation from Lewiston to Salmon City, based on 1970 prices, would be $58,000,000.

# VIII. IMPACT OF POTENTIAL NAVIGATION FACILITIES ON WILD AND SCENIC RIVERS CONCEPT FOR SALMON RIVER

Table 38 in Chapter VII listed eight potential storage projects on Salmon River which have been studied in the past for purposes of hydroelectric power generation and stream flow regulation. Navigation facilities were not included in any of these projects. However, the impact of these storage projects on the wild and scenic rivers concept for Salmon River would be essentially the same whether or not navigation facilities were included. In addition to inundation of land and improvements upstream from the dam, the construction of these projects would, of course, cause profound changes in the regime of the stream including reductions in peak discharges, increases in low water flows, and changes of temperature and other water quality parameters in the reservoir areas and in the stream immediately below the dams. In view of these considerations, brief descriptions of the effect on Salmon River of the potential projects listed in Table 38 are given below:

Lower Canyon Project. Although the surface area of the reservoir site at maximum pool elevation 1575 is 17,150 acres, the estimated requirements for flowage are 18,500 acres based on a 5-foot freeboard and 20 percent allowance for blocked taking lines, reservoir access, and recreation areas. Most of the lands subject to inundation lie in the deep and rugged canyon of lower Salmon River and are inaccessible by ordinary means of transportation. However, about 13 miles of U. S. Highway 95 and 8 miles of county roads in the upstream portion of the reservoir area would require relocation. Relocation of the U. S. Forest Service facilities at Slate Creek would be required.

No national forest land would be inundated by the project, but the Forest Service considers that construction of the project would have an important impact on administration activities of the Service and on timber use and access to a large area. The proposed relocation of roads and administrative facilities of the Forest Service would minimize adverse effects.

The reach of the river that would be inundated by the Lower Canyon project does not contain significant spawning areas. However, it would

intercept all anadromous fish migrating into the Salmon River. Some big game inhabit the reservoir and adjacent areas, but the nature of the topography is not conducive to heavy concentrations. The gravel bars and shoal areas of the natural stream are utilized by waterfowl.

Freedom Project. The lands that would be inundated by Freedom reservoir are primarily used for grazing. Improvements within the area affected by the project consist of some ranch developments and a limited number of commercial and residential structures. Approximately 17 miles of U. S. Highway 95, 10 miles of county roads and 3 miles of Forest Service roads would be inundated by the reservoir, access to forest lands would be affected by the flooding of roads.

Salmon River in this reach is utilized by anadromous fish as a migratory route to and from their spawning areas farther upstream. Based on limited information, it is believed that little spawning takes place in the reservoir area. A few big game animals inhabit the area.

Crevice Project. As proposed in House Document 403 (U. S. Congress, 1958), the Crevice reservoir would extend upstream about 65 miles. The surface area at maximum pool would be 16,000 acres, all of which is within the Nez Perce and Payette National Forest boundaries. The portion of the reservoir from river mile 138 upstream lies within the Salmon River Breaks Primitive Area and the Idaho Primitive Area. At maximum pool elevation 2570, the reservoir would extend 27 miles into these areas and would inundate 4,000 acres. Reduction in the height of the Crevice dam by 356 feet to approximately pool elevation 2214, in order to avoid any encroachment upon the primitive areas, would result in major reductions in benefits without proportional reduction in costs.

Lands subject to inundation lie in a deep and rugged canyon with only the downstream 10 miles accessible by road. Present use is for grazing and hay production to the extent possible on the steep rocky slopes. Small irrigated tracts along the river are used primarily for raising winter feed for livestock. Improvements within the reservoir area consist of two sets of farm headquarters, one combination lodge and store, and numerous miners' and hunters' cabins. The reservoir also would inundate sections of Forest Service trails, roads, and telephone lines which would have to be relocated.

The Crevice project would intercept all anadromous fish migrating into Salmon Basin except for a small number that utilizes Little Salmon River. The limited information available indicates that very little spawning takes place within the project area, but detailed studies are needed to determine more definitely the spawning areas of the entire lower reach of Salmon River.

The valley throughout the project area is used to some extent by wildlife, especially elk and deer, during the winter months. Further studies are needed to determine the impact of the project on the wildlife resources. One likely problem would be the impediment that the reservoir would present to cross-river migration by game animals.

Growler Rapids Project. This project would inundate about 4,500 acres of land nearly all of which is within the Nez Perce and Payette National Forests. One ranch, some mining property, several cabins, and a trail along Salmon River are within the flowage area. The project occupies a steep, rugged canyon in a remote portion of central Idaho and its construction should have little effect on administrative policies of the Forest Service. All of the project lies within the Salmon River Breaks Primitive Area and the Idaho Primitive Area. Anadromous fish use this portion of the Salmon River as part of their route to upstream spawning areas. Some big game animals inhabit the area, especially in the winter season.

Black Canyon Project. The reservoir behind Black Canyon Dam would have a surface area of 6,500 acres all of which would fall within the boundaries of the Bitterroot, Payette, and Salmon National Forests. A large part of the reservoir would occupy an extremely rugged canyon with relatively no improvements. In the upper part of the reservoir a few buildings, some trails, about 6 miles of low-class Forest Service road, and a small amount of grazing land would be flooded. The south shore of the reservoir would lie within the Idaho Primitive Area. The north shore up to mile 187, would lie within the Salmon River Breaks Primitive Area. The remoteness of the project would cause little disruption to Forest Service administration practices. This portion of the Salmon River is used by anadromous fish in their journey to spawning areas. The limited information available indicates that little spawning takes place within the project area. Parts of the project area are used by wildlife, mostly for winter grazing.

Pinnacle Peak Project. This project would flood about 5,200 acres of land, nearly all of which is within the Salmon National Forest. The project occupies a remote section of Idaho, but its construction might somewhat effect administrative policies of the Forest Service in that access to timber harvesting areas would be affected by the flooding of roads. About 20 miles of medium-class and 6 miles of low-class Forest Service roads would be inundated. In addition, a small number of buildings scattered up and down the river, several bridges, and some grazing land are within the reservoir flowage. Anadromous fish use the Salmon River in the project area as part of their migratory route to spawning areas upstream. Some big game animals inhabit the low lands within the project boundaries, especially for winter grazing.

Indianola Project. The reservoir behind Indianola dam would include approximately 4,500 acres, most of which is land within the Salmon National Forest and land administered by the U. S. Bureau of Land Management. The town of North Fork, several ranches, some mining property, a number of buildings in the flood plain, and utility lines would be flooded. About 12 miles of U. S. Highway 93 and 6 miles of Forest Service road would require relocation. Most of the land that would be flooded is used for grazing purposes. This portion of Salmon River is used by anadromous fish in their journey to upstream spawning areas. Parts of the project area are used by wildlife, mostly for winter feeding.

# IX. SUMMARY AND CONCLUSIONS

In Chapter V it was shown that under hypothetical conditions of essentially maximum production of agricultural, timber, and mineral products in Salmon Basin, the revenue to the navigation system for water transportation of these commodities would be only $26,000, $35,000, and $25,000 per year, respectively, and the benefits of water transportation to these industries would be $550,000, $675,000, and $535,000 per year, respectively. In addition, it was shown in Chapter V that very little net benefit, or loss, would accrue to recreational boating as the result of constructing a navigation system on Salmon River. In Chapter VII it was shown that the annual cost of the navigation portion only of a multipurpose dam and reservoir system necessary to provide slack-water navigation from Lewiston to Salmon City would be $58,000,000. A summary of the annual benefits and costs of this navigation system are shown in Table 40. The total revenue to the navigation system is only $86,000 per year and the total benefit accruing from water transportation is only $1,760,000 per year. Considering that the annual cost of the navigation system is estimated to be $58,000,000, the benefit-cost ratio would be roughly 0.03. It is obvious that a price and value system radically different from that existing in 1970 would be necessary before construction of a navigation system on Salmon River could be justified economically, even if it could be justified from an environmental standpoint.

Table 40. Summary of annual benefits and costs of a navigation system on Salmon River. Cost values based on 1970 prices.

| Annual benefits | | | Annual costs |
|---|---|---|---|
| Commodity | Revenue to navigation system | Benefit from water-borne transportation | |
| Agricultural and miscellaneous products | $26,000 | $ 550,000 | Navigation portion only of multi-purpose dam and reservoir system. |
| Timber | 35,000 | 675,000 | |
| Minerals | 25,000 | 535,000 | |
| TOTALS | $86,000 | $1,760,000 | $58,000,000 |

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