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UNITED STATES DEPARTMENT OF THE INTERIOR
Oscar L. Chapman, Secretary

BUREAU OF RECLAMATION
Michael W. Straus, Commissioner

ALASKA DISTRICT OFFICE
Joseph M. Morgan, District Manager

SUSITNA RIVER BASIN

A Report on Potential
Development of Water Resources in the
Susitna River Basin of Alaska

August 1952

Serial No. 9

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By THE UNITED STATES DEPARTMENT OF THE INTERIOR

Oscar L. Chapman, Secretary

Sponsored By and Prepared Under the General Supervision of

THE BUREAU OF RECLAMATION

Michael W. Straus, Commissioner

ALASKA DISTRICT OFFICE

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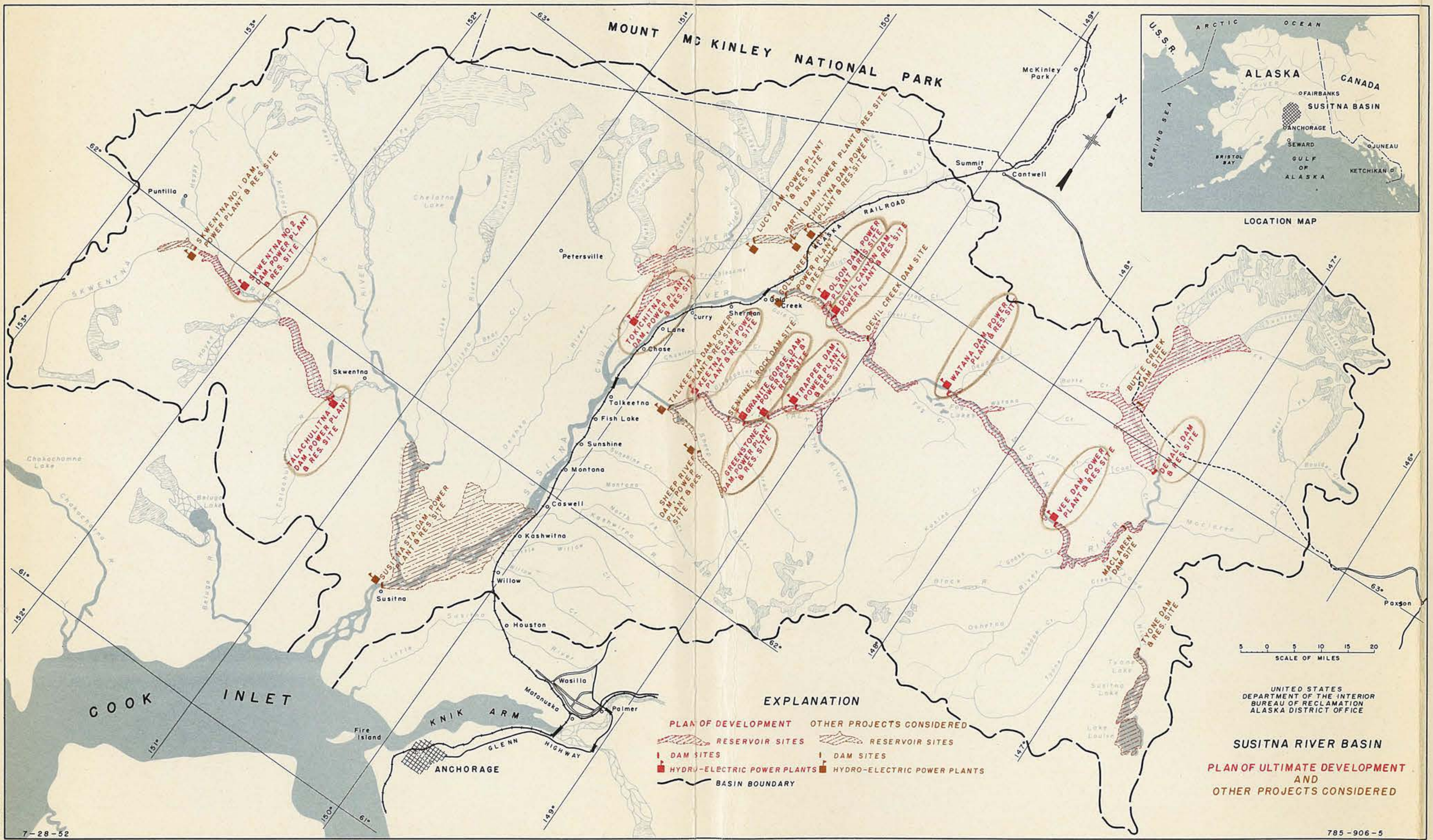

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
Alaska District Headquarters
Juneau, Alaska

June 15, 1953

To: Commissioner, Washington 25, D. C.

From: District Manager, Juneau, Alaska

Subject: Reconnaissance Report on Development of Water Resources--Susitna River Basin--Alaska

Transmittal

1. Herein is a reconnaissance report by the Department of the Interior on a plan for development of the water resources of the Susitna River Basin in Alaska. It was sponsored by, and prepared under, the general supervision of this office.

Authority

2. This report is authorized by virtue of Interior Department's Appropriation Act for the Fiscal year 1953, which provided $250,000 for "engineering and economic investigations, as a basis for legislation, and for reports thereon to Congress, relating to projects for the development and utilization of the water resources of Alaska."

Cooperation and Acknowledgments

3. Federal, Territorial, and local agencies gave valuable assistance in the collection and preparation of basic data necessary to compile this report.

Geographic and Economic Scope

4. This is a report on the potential development of the natural resources of the Susitna River Basin. The report reveals that utilization of these resources within the Basin itself is limited. However, there is an urgent need in contiguous areas outside the Basin for development of Susitna River Basin resources. Therefore, it was necessary to extend the geographic and economic scope of this report beyond the confines of the Basin boundary to include the Railbelt area, which extends from the seaport of seward and Kenai Peninsula northward throughout the Anchorage area and Matanuska Valley, across the Susitna River Basin, and down the north slope of the Alaska Range to the Fairbanks area.

THE BASIN

5. Susitna River Basin is located in South Central Alaska. Roughly oval shaped, it is 250 miles long and 100 miles wide. The southwest border is in the Mount Torbert-Mount Spurr region; the northwestern and northern borders are the crestline of the Alaska Range; the eastern border is the Copper River Plateau; and the southeastern border is the crestline of the Talkeetna Mountains. The area of the Basin is 19,900 square miles.

6. Susitna River heads near the east end of the Alaska Range in a series of lofty peaks located 200 miles northeast of Anchorage. The river runs generally southward for 50 miles, then turns sharply westward for 80 miles, thence southward for 120 miles. Only 25 miles west of the City of Anchorage the river empties into Cook Inlet, an arm of the Pacific Ocean.

7. The principal tributaries entering the Susitna River from the east are: Maclaren from the Alaska Range, Tyone from the Copper River Plateau, and Talkeetna River from the Talkeetna Mountains. Principal tributaries from the west are the Chulitna, which drains the southeast slopes of the high mountains of the Mount McKinley National Park area; and the Yentna River system, with its fingers in the Alaska Range to the west.

Climate

8. The climate of the Basin is continental. July daily maximum temperatures average about 70°, with July daily minimum averaging about 47°. The mean January temperature averages about 8°, with a recorded minimum of -50°.

9. The freeze-up in the Susitna Basin starts early in October in the highest regions, and by the last of November or the first of December, the lower reaches of the Susitna River are completely ice-bound. The rivers free themselves late in April or early in May. Generally, the snow--except for that on the mountains--has disappeared by early June.

10. Recorded precipitation in the Basin varies from 14 inches to 44 inches annually, half of which appears as snow. Heaviest seasonal snowfall recorded in the Basin was 232 inches at Talkeetna.

11. The Basin has frequent heavy rainstorms in the late summer. These are the direct result of low-pressure systems moving from the North Pacific Ocean or the Bering Sea into the vicinity of Bristol Bay or the lower Kuskokwim Valley.

History and Settlement

12. The first white man known to visit Cook Inlet and the mouth of the Susitna River was Captain James Cook, in the year 1778. Following Cook's visit, Russians traded with Indians near the mouth of the river.

13. Americans, searching for gold, first entered the Basin in the late 1880's, but returned to Cook Inlet after exploring only the lower reaches of the river. In the early 1890's, a prospector named Frank Densmore was the first white man to see Mount McKinley, called Denali by the Indians, or "Home of the Sun." The first scientific expedition to enter the valley was made by Geological Survey in 1898. The party made a reconnaissance of the geology and mapped a trail along the river to the divide at Broad Pass and down the northern slope of the Alaska Range into the Tanana Valley. In the next decade placer gold was found in the Basin and actively mined in two areas, Valdez Creek and the bed of the Yentna River.

14. In the meantime, important gold discoveries had been made in the Fairbanks area and as a result there was considerable agitation for construction of a railroad from tidewater to the new mining district. On March 14, 1914, President Wilson signed a bill to construct the railroad, which was completed on July 15, 1923. Construction of the railroad led to the establishment of such important cities as Seward and Anchorage, but in the Basin led to an increase in permanent population of only about 350 people.

Communities in the Basin

15. There are no large communities in the Basin. Population of about 400 is distributed chiefly along the Alaska Railroad, which lies within the Basin from Willow to Broad Pass. Talkeetna and Curry are the largest villages in the Basin along the railroad. The village of Susitna at the mouth of the Yentna River and the abandoned mining camp of Denali in the upper Basin are not situated on the railroad. Population fluctuates with hunting, trapping, and mining seasons, and the volume of construction on the railroad.

Accessibility

16. Before construction of the railroad and airports, access to the Basin was by means of low-draft boats for about 120 miles up the Susitna River and for short distances up the tributaries—and by dog teams in the winter. Horses had very limited use. The completion of the railroad from Seward to Anchorage and Fairbanks in 1923 facilitated access to a portion of the Basin, but no spurs to the main line lie within the Basin.

17. A larger portion of the Basin is accessible by air than by rail. There are several short landing strips in the Basin, but facilities are limited; most of the fields are merely rough graded strips. Talkeetna and Skwentna are the only fields with airport lighting and radio communications. Alaskan "bush pilots" have landed and taken off from river bars, but usually only in emergencies. During the winter, land-based ski planes have more choice of areas in which to land. Float planes or amphibian planes land on many of the lakes or larger streams of the Basin when unfrozen. Most of the lakes, however, are small and are not strategically located for persons other than hunters, trappers, or prospectors.

18. There is no all-year road in the Basin. Willow Creek mines are accessible by motor vehicle from Anchorage, but only during the summer. A road with limited summer use extends from the Susitna River at Talkeetna westward to Peters Creek. Outside of the Basin a road from Cantwell on the Alaska Railroad is now under construction and ultimately will connect with Richardson Highway at Paxson. This road will cross the headwaters of the Susitna River by bridge near Butte Creek.

The Land

19. The United States Government owns practically the entire Susitna River Basin. Only 5,000 acres, or four one-hundredths of 1 percent of the entire area of 12,700,000 acres in the Basin are privately owned. Only 1 percent of the entire Basin is surveyed land. In this vast domain there is not a single grazing lease or timber sales contract in existence.

20. The Department of Agriculture estimates there are about 600,000 acres of potential farm land and over 400,000 acres of grazing land in the Susitna Basin, if climatic conditions do not prohibit its use. All of this potential agricultural land lies below 500 feet elevation. No data are available on potential agricultural land in the Basin above this elevation. Other than a few household gardens, there is no land under cultivation in the entire Basin. However there is considerable wildlife in the Basin.

Timber Resources

21. Susitna River Basin contains the largest commercial stand of birch timber in North America, west of the Mississippi River. Known merchantable birch timber covers more than 150,000 acres. This does not include large areas of birch seen from the air in the more inaccessible parts of the Basin.

22. White spruce in merchantable stands covers thousands of acres. The volume and acreage of cottonwood is not now known, but it is certain to run into many millions of board feet and thousands of acres.

Mineral Resources

23. Due to the relative isolation and inaccessibility of most of the Susitna River Basin, gold which could be easily carried out of the wilderness, was the only mineral actively sought; although a variety of other minerals are known to occur. Gold has been mined in the Willow Creek, Yentna-Cache Creek, and Valdez Creek districts. Occurrences of copper are known around Iron Creek and the West Fork of the Susitna River. There is a silver prospect on Portage Creek. There are numerous beds of coal and lignite, some as thick as 10 feet. The Dunkle coal mine, located 11 miles west of Colorado station, is now producing a substantial daily tonnage of coal under a 40,000-ton Government contract. The Basin is promising for construction materials, such as gravel, shale for Haydite, and clay for Haydite, and brick. The Basin contains numerous mineral prospects; however, the only production at present is from several small placer gold operations in the Yentna-Cach Creek district and the Dunkle coal mine.

24. Last, but certainly not the least to be considered, is petroleum. A large anticline extending from the Alaska Peninsula through Cook Inlet, across the lower end of the Susitna River Basin, and into the Nelchina district is regarded by geologists as having definite oil-bearing possibilities. At the present time, three major oil companies are exploring the area.

Water Resources

25. The Susitna River is regarded as the fourth largest in the Territory. The average flow is larger than the virgin flow of the Colorado River, but smaller than that of the Susquehanna River. It is about one-third that of the Missouri at St. Louis, one-eighth of the Columbia, and one-tenth of the Ohio Rivers. No data are available on underground water supplies. There is no present utilization of water resources of the Basin, except for isolated domestic water supply.

Fish and Wildlife Resources

26. The Susitna River contributes substantially to Alaska's fisheries industry. The value of the annual salmon pack attributable to the Susitna River salmon run is estimated by the Fish and Wildlife Service at $2,000,000. The valuable fur animals, big game, and fish represent the greatest present utilization of the Basin's natural resources. The Susitna Valley supports the largest moose herd in Alaska.

Recreational Resources

27. Susitna River Basin is a sportsman's paradise. Although relatively inaccessible, many people fish and hunt in the upper reaches of the river. The high mountain scenery is magnificent. Its deep canyons are spectacular. At Talkeetna, professional guides are available for trips into the best hunting and fishing areas. The Alaska Railroad operates a very comfortable hotel at Curry, the principal recreation center in the Basin. On summer weekends, the railroad operates a fishing excursion, rail motor coach out of Curry that will accommodate fishermen by stopping to discharge passengers at any stream between Curry and Summit. As more is known of the Basin, it is certain to have tremendous recreational value.

RAILBELT ECONOMIC ACTIVITIES

28. The Susitna Basin borders the greater Anchorage and Fairbanks districts which are the most spectacularly developing areas of the fast-growing Territory. It is the Basin's future roll of supplying these two vital areas with the large quantities of inexpensive power they must have for their continued development, which turns the spotlight on the Basin today.

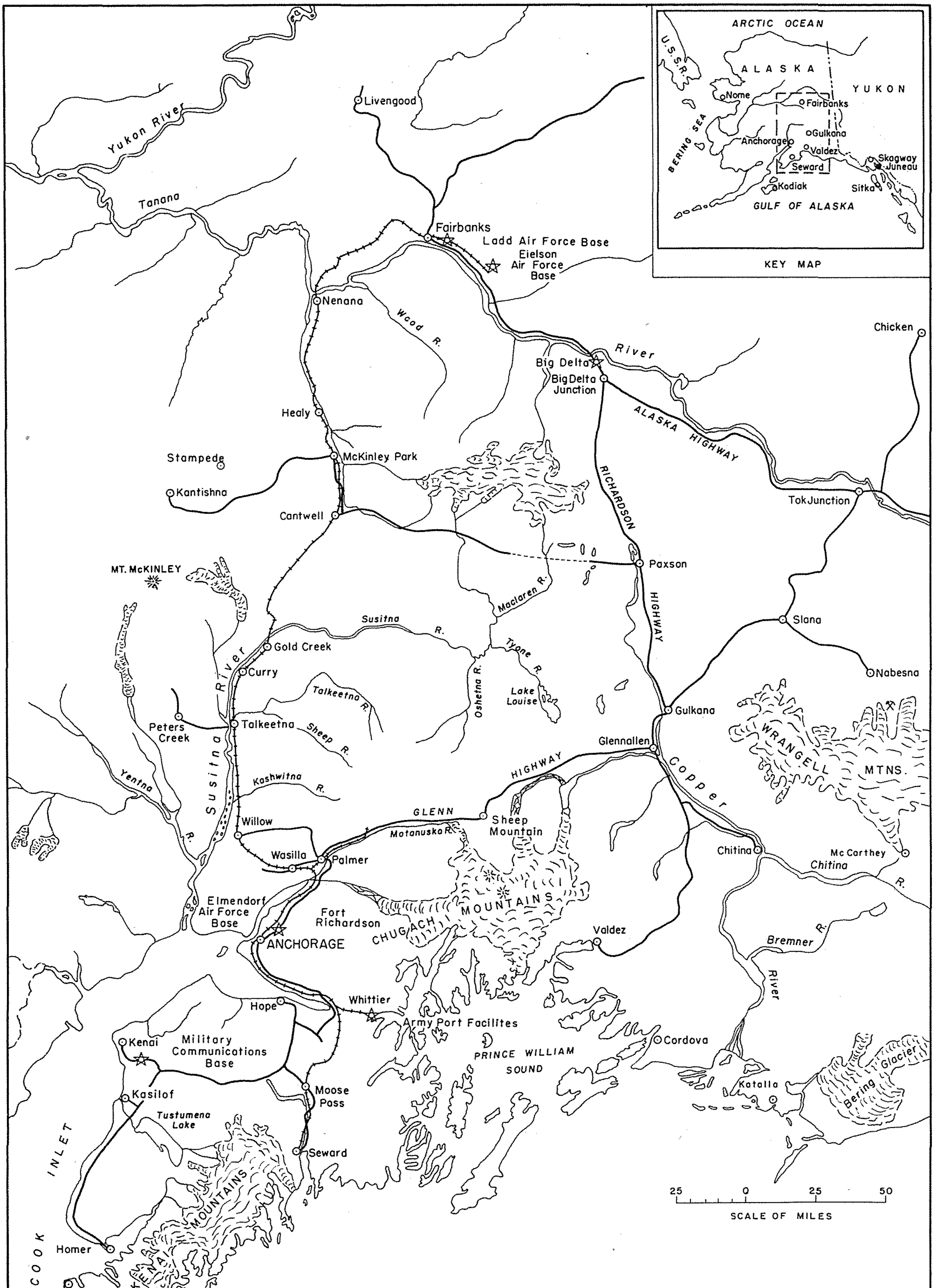
29. The recent growth of both the Anchorage and Fairbanks areas is impressive indeed, but no more impressive than the outlook for their continued development in the days immediately ahead and far into the future.

30. Both of these areas are short of power now, and until this deficiency is made up and additional power supplied for future needs, the growth of these most important areas of the Territory will be seriously retarded.

31. The following paragraphs summarize economic activities of the entire Railbelt area, including the Kenai Peninsula, the Anchorage area, Matanuska Valley, the River Basin, and the greater Fairbanks area: which, taken together, comprise the power market area to be served by the development of the Basin.

Population

32. The population of the Railbelt was recorded at 17,345 in 1939 in the quiet unhurried days before World War II. The next official count in 1950 recorded 59,520 persons in the area--an



GENERAL MAP

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increase of 242 percent. After the outbreak of World War II, large military installations grew up overnight and the small villages nearby grew so fast they literally burst at the seams. After the war, people were predicting a mass exodus from the area--which never occurred. True, there were some population losses and shifts, but none was extensive. As the importance of Alaska in the future defense of the country was fully realized, a large expansion of military establishments started, and promises to continue for some time into the future.

33. Changes and growth are still so rapid as to make estimates of present population in the Railbelt area hazardous. However, the best estimate of the present permanent year-round population is around 75,500. The major industries of the area are seasonal in nature. Large numbers of workers come into the Territory in the spring to provide the labor for these industries, and leave in the fall. In addition to seasonal labor, the summer population ranks are swelled by large numbers of tourists and vacationists. The effect of these seasonal immigrations is to greatly increase the population during the summer months. It is estimated that the permanent year-round population of 75,500 may be increased to as much as 90,000 during the summer.

Industry

34. Major activities in the area are: transportation, construction, agriculture, lumber, commercial fisheries, trapping, mining, and tourist trade. A large number and variety of service and distribution businesses serve the needs of these industries, the requirements of the Military, and the needs of the civilian population.

35. Every phase of economic activity has been expanding and will continue to expand; but continued growth is and will continue to be limited by many factors. Of these, the shortage of electric energy is a most important one at the present time.

Transportation

36. Anchorage and Fairbanks are the two important transportation "nerve centers" of Alaska. Both connect with the Alaska Highway--the vital land link between Alaska and the United States. The Glenn and Richardson Highways provide road transportation between Anchorage and Fairbanks and between both cities and the ice-free

ocean ports of Seward and Valdez. A road connecting Cordova with the Richardson Highway, now terminating at Valdez, should be completed within the next 4 years.

37. The Alaska Railroad provides dependable year-round freight and passenger service between the ocean ports of Seward and Whittier through Anchorage to Fairbanks.

38. From Anchorage and Fairbanks a vast airline network fans out to connect virtually every part of Alaska with every other part, and with the United States, Canada, and Asiatic nations.

39. The furnishing of transportation services has therefore been a vital part of the economic growth of the Railbelt area. A major development in this field which is in prospect is the provision of year-round port facilities at Anchorage. Another possible development in the future, if loads justify such a move, is the electrification of The Alaska Railroad—a conversion which would require large quantities of low-cost power.

Construction

40. The rate of construction, both military and nonmilitary, in the greater Anchorage and Fairbanks areas is phenomenal. Even Alaskans who travel regularly around the Territory are amazed at the number of new buildings that have "appeared" since their last visit.

41. Construction is the leading industry of the Territory, employing an estimated 33-1/2 percent of the total Territorial labor force. Anchorage, with 70 listed contracting firms, is the center of construction activity.

42. Military construction has constituted much the largest part of total construction in the Territory, particularly in the Anchorage and Fairbanks areas; and it is conservatively estimated that it will continue at an annual rate of 75 to 80 million dollars for at least the next 4 or 5 years. Nonmilitary construction exceeded an estimated 40 million dollars in 1952 and is expected to continue at high levels in the years ahead.

43. Although the large bulk of building and construction materials is imported from the States, an increasing quantity of certain of these materials, such as building blocks and lumber, is being produced in Alaska. Many more could and would be supplied locally if the cost of producing them in the Territory could be reduced. Inexpensive power would be a boon to the development of this industry.

Agriculture

44. Agriculture in the Territory is centered in the Matanuska Valley northeast of Anchorage, and is a growing industry in the Tanana Valley near Fairbanks. There are only about 12,500 acres of land in the Territory under cultivation at the present time, 90 percent of which are in the Matanuska Valley. There are millions of acres of land in the Territory suitable for farming, but the high cost of clearing the land and the short growing season have discouraged rapid development of agriculture. The Department of Agriculture has been actively engaged in testing and classifying soils and determining the crops most adaptable to growing conditions to further encourage agricultural development in the Territory.

45. Principal crops grown are: potatoes, peas, carrots, spinach, cabbage, cauliflower, lettuce, rutabagas, broccoli, beets, chard, radishes, oats, barley, and wheat. Potatoes are a particularly important money crop. Dairy farming is one of the principal agricultural pursuits in the Valley. Agricultural products of the Matanuska Valley are marketed, with minor exceptions, through the Matanuska Valley Farmers Cooperating Association which does an annual business of about 3 million dollars.

46. There are thousands of acres of potential agricultural land in the lower Susitna Basin which may be brought under cultivation in the years ahead after more suitable lands in Matanuska Valley and the Kenai Peninsula have been developed. Expanded agricultural production would go far in stabilizing Alaska's economy and should be encouraged in every way. Isolated experiments have indicated the possible desirability of providing irrigation to certain areas to supplement the precipitation during the dry season for producing maximum yields. Irrigation at costs farmers could afford might be made available from Susitna Basin power.

Mining and Minerals

47. Alaska has a great variety of minerals. However, the extent of many deposits is not known.

48. It is well to point out that hydroelectric power which could be generated in Susitna Basin, could result in development of the mining industry not only in the Basin but principally outside the Basin within reach of the ultimate power transmission grid extending from Fairbanks to Seward.

49. Along the Railbelt are two large coal areas--at Matanuska, 200 miles from the ocean terminus, and at Healy, in the Interior. These mines produce chiefly a sub-bituminous coal. Some high grade anthracite has been found but is not known to exist in commercial quantities.

50. Other mineral resources are present in the Railbelt. Copper, gold, antimony, and tungsten are known to occur. Recent investigations indicate sufficient deposits of minerals suitable for building materials to support a building materials industry in the Railbelt.

51. At present, mining is at a relatively low ebb in the Railbelt of Alaska. A major factor militating against further development is the unprecedentedly high wages offered on military projects in the Territory which have prevented most mines from successfully competing for necessary labor. Few mines can meet the pay scale offered by contractors on defense projects and still buy black ink.

52. Modern electric-driven coal mining and coal handling machinery is a substitute for high-cost mine labor. At the present time there is insufficient low-cost electric energy to supply the requirements of mining modernization and mechanization.

<u>Lumber</u>

53. The bulk of Alaska-produced lumber comes from Southeast Alaska. However, Whittier, located southeast of Anchorage on the Alaska Railroad, is the site of one of the four largest sawmills in the Territory. During the past season the Whittier mill cut a record 13 million board feet of lumber and expects to expand its facilities and output in the coming season.

54. Large commercial stands of spruce and hemlock are contained in the Chugach National Forest bordering Cook Inlet and supply a large part of the logs used by the sawmill at Whittier. In addition to the sawmill, there are attractive opportunities around Whittier for pole treating plants, and other woodworking enterprises.

55. In addition to the large spruce and hemlock stands of the Chugach National Forest, large commercial stands of birch grow virtually untouched in the Susitna Basin which could contribute substantially toward satisfying the many varied needs of the construction industry.

56. Dr. Lutz of the Yale School of Forestry, in a study of Alaska's Interior forests concluded that volumes obtained in our Interior stands are as good or better than many regions having large forest industries such as Norway, Sweden, and Finland.

57. The Alaska Development Board and other organizations interested in the growth of industry and employment in the Territory state that an abundance of low-cost power could go far in encouraging the utilization of timber resources in the power market area.

Commercial Fisheries

58. The Cook Inlet area at the southern end of the Railbelt is an important contributor to Alaska's foremost productive industry--commercial fisheries. There are about 21 salmon canneries on Cook Inlet producing an annual pack of around 278,000 cases valued at some 7 million dollars. In addition to the canneries, there are 5 fresh- and frozen-salmon distributors.

59. In addition to the processing of salmon, promising opportunities exist on the Kenai Peninsula for the processing of crab, shrimp, clams, and halibut fillets.

Recreation and Tourist Trade

60. The tourist trade is an increasingly important business in the Territory and particularly in the Railbelt area.

61. This year for the first time, Alaska has a full-time visitors' association which has done much to promote the Territory. Alaska is now included in Cooks' Tours, and the American Express Company has indicated its intention of including Alaska in its tours beginning next season.

62. Parts of the Kenai Peninsula are gaining popularity as resort areas. Additional facilities for accommodating tourists, vacationists, and sportsmen are under construction in the Peninsula and more are contemplated for the immediate future. Roads now under construction or planned for the next few years will go far in promoting the recreation and tourist attractions of the area.

63. Mount McKinley National Park is a popular attraction for thousands of visitors each year. It is easily accessible by the Alaska Railroad and has comfortable accommodations for tourists.

64. Sportsmen come from many parts of the country to enjoy the fishing and hunting which the Railbelt offers. Further investigations may indicate that the reservoirs, which will be a part of the proposed development of the Susitna River, could be stocked with game fish to further enhance the recreational attractions.

Need for Power

65. While the preceding discussion outlines the economic activities that support the Railbelt at the present time and the areas in which future development is expected, it should not be inferred that the pattern of economic activity will remain the same in the future or that the economic activities discussed will share equally in the utilization of hydropower to be developed in the Susitna Basin.

66. Power is urgently needed, first, to satisfy the existing military and civilian demand and eliminate the existing power deficiency; secondly, to permit the continued growth of industries already started in the area and the resumption of industries which the availability of inexpensive power could make profitable once more; and last but not least, to encourage the development of new industries in the area.

67. Even though the Eklutna project is scheduled for completion late in 1954, its 30,000 kilowatts of power will be insufficient to supply the demand. If Eklutna were ready today, all of its power production would be consumed in this power-hungry area with the demand still unsatisfied. Moreover, the Eklutna project will do nothing to satisfy the need for power in the Fairbanks area.

68. One existing industry which could expand and develop with the availability of low-cost power is the mining industry. Here low-cost power to operate machinery, especially in coal mining, could substitute in part for the high-priced labor which has made some mining unprofitable in recent years.

69. An abundance of inexpensive electric energy would be of great value in encouraging the development of new industry in the area and in strengthening the fortress of national defense.

Power Supply and Markets

70. The Railbelt is the most power-deficient area in the Northland. Civilian power requirements increased from 10 million kilowatt-hours in 1940 to more than 100 million kilowatt-hours in 1950. If sufficient energy had been available, probably twice as much would have been used. It is anticipated that by 1970, if energy is available at low rates, over 3 billion kilowatt-hours will be needed, resulting in a minimum peak load of 550,000 kilowatts to be generated by nonmilitary plants.

71. This forecast is based on continued population increase, much greater farm loads, civilian supply of a portion of military power requirements, and greatly expanded industrial development. The expected population increase is evidenced by present trends and by the jobs created by present and planned future construction and industrialization.

72. Commercial and municipal power requirements increase proportionately with population. Farm loads will also increase considerably, not only from development of many new farms, but also from greater average usage.

73. When defense construction abates, industrial developments will take up the slack. Industrial load requirements should approximate 1-3/4 billion kilowatt-hours by 1970. Two factors, when combined in the past, have always brought about regional industrialization--vast quantities of untapped natural resources and large blocks of low-cost power. The resources, as well as the low-cost power potential, are present in the power market area. Power development is the key to Alaska's industrial future.

74. Present power supplies are small and a large percentage of the internal-combustion generating units are unreliable. With the exception of the Knik Arm steam plant, slated for initial operation in November 1952; the Eklutna hydro plant, scheduled for 1954; and the Fairbanks municipal plant, no other dependable nonmilitary power plants exist or are programed. It is inconceivable that any large load requirements can be met with the assortment of small isolated plants now existing.

75. Economic studies prove that with present costs, low rates cannot be obtained from steam generation in Alaska, regardless of plant size. Development of Susitna hydroelectric power, with initial construction of Devil Canyon project, is the solution.

Large blocks of energy could thereby be made available to a power-deficient area at rates low enough to maintain and forward the development of the Railbelt.

POTENTIAL WATER-RESOURCE DEVELOPMENT

76. The Susitna River Basin is ideally located to supply energy to the entire Railbelt. Devil Canyon project is a logical geographical site for initial development to serve the major load centers of Seward, Anchorage, and Fairbanks.

77. Field investigations of topography and geology, water supply studies, and preliminary designs and estimates on which the ultimate plan of development is based, were of a preliminary nature. They made it possible, however, to establish a framework for a comprehensive plan of water-resource development.

78. A total of 25 separate sites were examined and studied as possible projects for generation of hydroelectric power or for storage regulation for such projects. Only 12 of these sites were retained in the comprehensive plan. The remaining sites were excluded for a variety of reasons, including inundation by more desirable sites, excessive cost of energy generation, excessive reservoir sedimentation, and interference with salmon runs.

79. The plan of developing the water-power resources of the Basin includes 12 major dams. One of these dams would have a power plant, but would not impound any usable reservoir storage. Another dam would store water to provide regulated releases for downstream power plants; no power would be developed at the site. Power plants would be constructed at the other 10 dams, which would also impound water for power releases.

80. With coordinated operations of projects in the ultimate plan, the total capacity of the 11 power plants would be 1,249,000 kilowatts. Annual firm energy output would be 6,180,000,000 kilowatt-hours and average annual nonfirm output would be 336,000,000 kilowatt-hours. Total reservoir capacity would be 22,690,000 acre-feet. Net power storage capacity, after deducting storage to create power head and required reservation for sediment deposition, would be 15,890,000 acre-feet. This plan of ultimate water-power development is summarized in the accompanying table.

Summary.—Plan of ultimate power development

(Based on coordinated operation)

Site	Stream	Height of dam above stream bed (ft.)	Total reservoir capacity (1,000 ac.-ft.)	Power plant capacity (kw.)	Annual energy output (million kw.-hr.) Firm	Annual energy output (million kw.-hr.) Average nonfirm
Denali	Susitna	205	6,700	—)		
Vee	Susitna	425	2,820	260,000)		
Watana	Susitna	440	3,400	310,000)	5,000	200
Devil Canyon	Susitna	500	2,930	390,000)		
Olson	Susitna	50	7	50,000)		
Tokichitna	Chulitna	150	2,530	45,000)	220	36
Trapper	Talkeetna	250	427	19,000)		
Greenstone	Talkeetna	200	62	20,000)		
Granite Gorge	Talkeetna	270	55	27,000)	600	60
Keetna	Talkeetna	345	720	56,000)		
Skwentna No. 2	Skwentna	285	670	30,000)	360	40
Talachulitna	Skwentna	155	2,370	42,000)		
Total		—	22,691	1,249,000	6,180	336

81. Initial water-resource development in the Basin would be Devil Canyon project, on the main stem of Susitna River, 12 miles above Gold Creek station on the Alaska Railroad. A 500-foot dam would permit initial installation of a 195,000-kilowatt power plant. Annual output would be 970,000,000 kilowatt-hours of firm energy and 240,000,000 kilowatt-hours of nonfirm during an average year.

82. With construction of Denali Reservoir to provide regulated storage releases to Devil Canyon Reservoir; the capacity of Devil Canyon power plant could be increased to 390,000 kilowatts. Annual firm output would be 1,850,000,000 kilowatt-hours, with an average of 200,000,000 kilowatt-hours of nonfirm output.

83. There are other possibilities of water-resource development in the Basin besides the generation of hydroelectric power. These include irrigation, flood control, drainage, recreation, and fish and wildlife. Except for one flood-control project, little detailed study has been given to these potential uses.

84. There is much land in the lower portion of the Susitna Valley which might be suitable for agriculture. Total annual precipitation averages about 25 to 30 inches per year, but the monthly distribution is not conducive to optimum production. Irrigation may be desirable during May, June, and the first part of July to assist seed germination and early season plant growth. Sprinkler irrigation has been tried with outstanding success in the Matanuska Valley. It may be a desirable method of application in the Susitna River Basin.

85. The Corps of Engineers, United States Army, has made a preliminary study of the need for flood-control projects in the Basin. They found that floods cause significant damage only near the town of Talkeetna. High flows in Susitna and Talkeetna Rivers periodically inundate portions of the town. Additional damage is caused by erosion of the left bank of Talkeetna River on the northwest side of town. The Corps has constructed a pole dike to prevent further erosion. As the town expands, protection against inundation may become justified. The lack of development in the flood plain obviates the necessity for flood protection at the present time.

86. The Basin contains extensive areas of poorly drained land, caused by tight soils and lack of a well-defined system of surface drainage. Much of this land is probably susceptible to economical drainage, and the drained areas would probably be suitable for crop production. Construction of drainage facilities probably would not be necessary until the supply of well-drained agricultural land is depleted.

87. Recreation is important to the economy of the Railbelt, with the many lakes and streams of the Susitna River Basin satisfying a large part of the need. Recreation would probably not be a major aspect of water-resource development in the Basin; however, it should nevertheless be considered during investigation of potential projects.

88. The Susitna River contributes substantially to the salmon industry, one of Alaska's important commercial assets. The average annual value of the salmon pack produced by the Susitna River is estimated at $2,000,000. Field investigation has not been sufficient to determine exactly what streams are utilized by spawning salmon and the intensity of this utilization. Major salmon runs are unknown on the Susitna River above the Devil Canyon site. In planning any water-use project in the Basin, consideration must be given to the fisheries resources, so that there will be no interference with major salmon runs. Reservoirs in the Basin would have some harmful and some beneficial effects on wildlife.

FUTURE INVESTIGATIONS

89. In order to attain optimum benefits from development of the resources of Susitna River Basin, investigations by the interested agencies must be coordinated throughout the planning stage. The following paragraphs outline the work which should constitute the next phases of study.

90. The Bureau of Reclamation has begun detailed investigation of Devil Canyon project. The work will include complete field investigations and office studies leading to a report on the engineering and economic feasibility of the project. This work will cost about $900,000 and could be completed in 3 years if funds are made available. Investigation of Denali, Vee, and Watana projects will follow, in order to have projects ready for construction as the power requirements increase. Preliminary planning of these three projects, costing about $1,700,000, is programed for completion in 1960, if adequate funds are made available.

91. If studies by other agencies show that potential agricultural land in the Basin may require irrigation or drainage, the Bureau of Reclamation should determine the feasibility of definite plans for construction of the necessary facilities.

92. The National Park Service, as explained more fully on pages 108 to 109 of this report, hopes to program studies in the Susitna River Basin concurrently and cooperatively with the work of

other agencies. The results would be reports on the specific recreation implications of the Devil Canyon, Denali, Vee, and Watana proposals. Special studies, of historic and prehistoric values that might be lost through flooding of proposed reservoir areas or other project features, would be made. It is believed probable, from preliminary research already accomplished by the National Park Service in cooperation with the University of Alaska, that cultural values in the fields of history and prehistory are significant in the Susitna River Basin.

93. The Bureau of Mines should continue, in cooperation with the Geological Survey, to investigate the mineral resources of the Basin, particularly minerals of construction.

94. The Bureau of Land Management should cooperate with the Alaska Soil Conservation district in performing land classification and land capability surveys in selected portions of the lower Susitna Valley.

95. The Geological Survey has accomplished a large part of the basic mapping program. Topographic maps at the scale of 1:250,000 are now available for the entire Basin and maps at the scale of 1:63,360 have been published or are nearing completion for all of the Basin east of longitude 150° west, which includes the main Susitna River Valley and all areas east of the Alaska Railroad. Construction cost for 11 additional stream-gaging stations to provide a complete program of surface-water investigations would be $204,000. Annual operating cost of the complete stream-gaging and sediment-sampling program would be $44,000. A combined stream-gaging and sediment-sampling station should be installed near Denali dam site as soon as possible.

96. The Alaska Railroad has indicated that its Industrial Development Board will continue to study means of promoting new industry, new processes, and new population in the area to be served by Susitna Power.

97. The Fish and Wildlife Service should prepare a river basin survey report on the fish and wildlife resources. Major interest would be centered on the location of salmon spawning areas and the intensity of utilization. This study should be made concurrently with Bureau of Reclamation investigations of Devil Canyon project.

98. The Agricultural Research Administration and the Alaska Experiment Station should continue to cooperate in determining potential agricultural development of the Basin, with special attention to possible limitations imposed by climate.

99. The Alaska Development Board, a Territorial agency, will continue to study possible industrial development in the Railbelt. With the availability of low-cost energy from Susitna River power plants, the Board will encourage industries to exploit the mineral resources of the Basin. Knowledge that large industries are ready

and eager to locate in the Railbelt will be an important factor in determining the economic feasibility of Devil Canyon project and other future developments.

CONCLUSIONS

100. Development of the water resources and effective use of other natural resources of the Susitna River Basin are essential to continued growth of the Railbelt economy. To this end, a comprehensive development plan is needed to assure full and nonconflicting use of the water resources of the Basin.

101. The substantiating materials to this report present a plan leading to the ultimate development of the hydropower resources of the Susitna River Basin. This outline, however, is not a comprehensive plan for the development of the Basin's water resources. Investigative data are lacking in too many phases to permit formulation of a truly comprehensive plan. Further investigations are needed in all aspects of resource development.

102. Power market studies show that the power requirements of the Railbelt will continue to exceed by ever-increasing amounts the combined capacity of all existing and authorized power plants.

103. The costs of energy from the various power projects throughout this report appear exceedingly high in average rate per kilowatt hour. Based on the present high cost of construction, this can be reasonbly expected. Coupled with the high cost of construction is the fact that all studies conducted were based on reconnaissance information and are of necessity, conservative.

In the future it is reasonable to expect that the economy of Alaska and the States will continue to move into a closer equilibrium, and resulting from this, costs for Alaskan construction will decline. As this trend develops these power projects will continually become more feasible for development. National economic conditions resuming normalcy should enable these public works projects to be constructed at a lower cost than are presently estimated.

RECOMMENDATIONS

104. It is recommended

(a) That the ultimate plan of development of the hydropower resources, as described in this report and the related substantiating materials, be approved as a general guide for further investigations, subject to such modification as may be found necessary by reason of those further investigations.

(b) That the investigations proposed to be undertaken by the Department of the Interior and other Federal and Territorial agencies, as summarized in paragraphs 89 through 99 of this report and presented in more detail in Chapter VI of the substantiating materials, be performed; and that, where necessary, authorizations and appropriations necessary to performance of this work be made by the Congress.

(c) That particular attention be given to the urgency of investigating Devil Canyon power project; and that appropriations be made to the Bureau of Reclamation by the Congress at such time and in such amounts that the envestigation will not be delayed for lack of funds.

Joseph M. Morgan.

SUBSTANTIATING

MATERIALS

CHAPTER I

CHARACTER AND PURPOSE OF THE REPORT

This report describes the Susitna River Basin, its resources and potentialities. As more than 99 percent of the Basin area is public domain under the jurisdiction of the Department of the Interior, it is especially proper that this is a departmental report. In the Department some agencies are responsible for inventory of resources, while others are primarily concerned with management problems or development and utilization. Outside the Department, additional Federal agencies as well as Territorial Government agencies also have specialized knowledge of, and interests in, the Basin.

This departmental report was sponsored by and prepared under the general supervision of the Bureau of Reclamation.

Herein for the first time pertinent basic data on the Susitna River Basin from many agencies are assembled in one report so that development and utilization problems may be more clearly defined, examined, and resolved. Only by such critical and coordinated analysis will a comprehensive plan of basin development evolve that will result in the most good for the greatest number.

Would water-resource development in the Basin conflict with conservation of recreational resources or fish and wildlife resources? Would reservoirs inundate land more valuable for its timber resources, mineral deposits, or agricultural potentialities?

To what extent would the well-being of native tribes be adversely affected by a more extensive use of the resources? These and many other problems must be studied and investigated to arrive at a fully integrated and mutually acceptable program for conservation, development, and utilization of resources.

When proof was established for a higher priority use of the water resources at several dam sites the Bureau accepted those findings. Even though a plan of ultimate development is suggested herein, proof of priority is lacking in many instances and must be determined before any ultimate plan can be mutually accepted. Years of further study may be required.

However, the plan for initial development is believed to be noncontroversial and should receive immediate attention and action.

Finally, the report points to further studies and investigations that should be initiated by various departmental agencies to coordinate and integrate the Department's activities in the Basin.

CHAPTER II

S U S I T N A   R I V E R   B A S I N

GENERAL DESCRIPTION

The Susitna River Basin, referred to in this report as the Basin, is located in South Central Alaska. It is a vast, rugged, virtually uninhabited, irregular oval 250 miles from east to west and 100 miles from north to south. In its 19,900 square miles, more than 60 rivers flow into the Susitna to give the area great potentialities for hydroelectric development.

In area it is larger than New Hampshire and Vermont combined. The north and west rims of the oval are walled in by the highest peaks of the Alaska Range, including the highest mountain on the North American Continent. Mount McKinley looks down on this wilderness of lakes, rivers, mountains, canyons, and meadows that make up the Susitna Basin.

Virtually the only concession to civilization is a ribbon of steel--the Alaska Railroad--that bisects the Basin in a north-south direction.

From the windows of the Diesel streamliner train that runs between Anchorage and Fairbanks, the north and west rims of the watershed are a panorama of 1-, 2-, and 3-mile high snow-clad peaks with ponderous glaciers spilling down their sides.

The mountain walls to the north and west are forbidding, and the area to the east of the Alaska Railroad is a wilderness that is legendary in the Territory. Many a trapper, lured by the prospects of a virgin fur country, has found the region "too tough" for a second season in its hills.

The Susitna Basin east of the Alaska Railroad is as rugged a locale for travel and exploration as can be found anywhere in the North Country. At least 35 rivers and streams fan into the Susitna from the high plateau country to the east and southeast.

This high plateau country is completely without access roads. Virtually the only trails in the area are game trails. Even the Indians who lived in the Interior rarely visited the region.

The Susitna River Basin is separated from the Yukon Plateau area by the lofty Alaska Range which forms a great arc roughly paralleling the shore line of the Gulf of Alaska. (On the south the dome-like Talkeetna Mountains separate the Basin from the Matanuska River Basin.) The eastern part of the Susitna River Basin is not as clearly defined, the drainage divide being in the marshy muskeg and lake-dotted Copper River Plateau.

With a total relief of 20,269 feet from the mouth of the Susitna River to the summit of Mount McKinley, it is readily conceived that topography of the Basin is rugged and spectacular. The snow- and ice-capped Alaska Range is a practically unbroken western and northern boundary to the Basin. The lowest pass through the range is Broad Pass on the railroad near elevation 2400.

The main stem of the Susitna River rises in the glaciers on the south side of Mount Deborah, Mount Hess, and Mount Hayes. These three peaks are all between 2 and 3 miles high. Mount hess was scaled for the first time in the summer of 1951.

The large plateau lakes on the east rim of the Basin and the countless small lakes and ponds of the area drain into the Susitna. From the point where the glacier-fed streams from the north and the lake-fed streams from the east and south join, the Susitna River flows westerly for about 80 miles through deep canyons. It then turns sharply southward for 120 miles and is joined by a multitude of mountain streams as it flows out over a wide plain, finally emptying into Cook Inlet--a salt-water body with the second highest tides in the world.

However, in the 80 miles of westerly flow, where the Susitna carves its bed in a succession of canyons, is the region of hydroelectric potential of immediate importance.

CLIMATE

Even though Susitna River Basin is bounded on the south by an arm of the ocean, the climate of the Basin exhibits the general characteristics of a subhumid continental climate. The main body of the Basin is separated from the moderating effects of the Pacific Ocean by the Chugach Mountains on the southeast and by Kenai Peninsula on the south. Records of temperature, precipitation, and other weather data are entirely lacking for the portion of the Basin east of the Alaska Railroad and are scanty for the portion west of the railroad; most of the records are from stations along the railroad. Most of the following general description is based on these records and applies primarily to the lower valley area below Gold Creek.

The July daily maximum temperatures in the Susitna Valley average about 70°; the highest temperature was 90°, which was recorded at Caswell, Skwentna, and Talkeetna. The daily minimums in the valley during July average about 47°, with a mean July temperature of about 58°. The mean January temperature averages about 8°. The lowest temperatures recorded in the Susitna Valley were -50° at Skwentna and -48° at Talkeetna and Susitna.

Maximum summer temperatures are rather warm, but the daily range is great, resulting in a comparatively short growing season. The frost-free period averages about 74 days between June 12 and August 25. In occasional years frost occurs every month.

Meager data indicate that the freeze-up of Susitna River usually occurs about the middle of December and the break-up about May 1. Smaller rivers and lakes have a slightly shorter period of open water.

The Susitna Valley receives almost twice as much precipitation as does the Matanuska Valley. The comparatively large amount is due primarily to the location of the valley in a direct line with Cook Inlet. No mountain barrier obstructs the flow of moisture brought into the valley by southwesterly winds, the direction prevailing in most storm situations. Progressing northward, normal annual precipitation increases from 28 inches at Susitna to 44 inches at Curry, then decreases to 21 inches at Summit, on the northern border of the Basin. Puntilla, at the western edge of the Basin, receives about 14 inches annually. Except for Summit and Puntilla, all weather stations in the Basin are below 600-foot elevation. It is therefore difficult to estimate precipitation in the mountain areas. Based on a short record of runoff of Susitna River at Gold Creek, average precipitation on the drainage area above this station is estimated at about 40 inches annually, with probable extremes of about 15 and 70 inches. About 55 percent of the total annual precipitation occurs from July through October, whereas only 20 percent falls from March through June.

The highest and most widespread storm rainfall in Susitna Valley occurs when a low-pressure area is centered in the vicinity of Bristol Bay or the lower Kuskokwim River Valley. Storms may move into this area from the Bering Sea or from the North Pacific Ocean. They may even move into the Gulf of Alaska and then curve, moving west over the lower Susitna Valley and into the Kuskokwim Valley. Storms located in the Gulf of Alaska and Cook Inlet generally produce cloudy conditions over the Susitna Valley and occasionally rain occurs, depending upon the exact position, strength, and movement of the storm.

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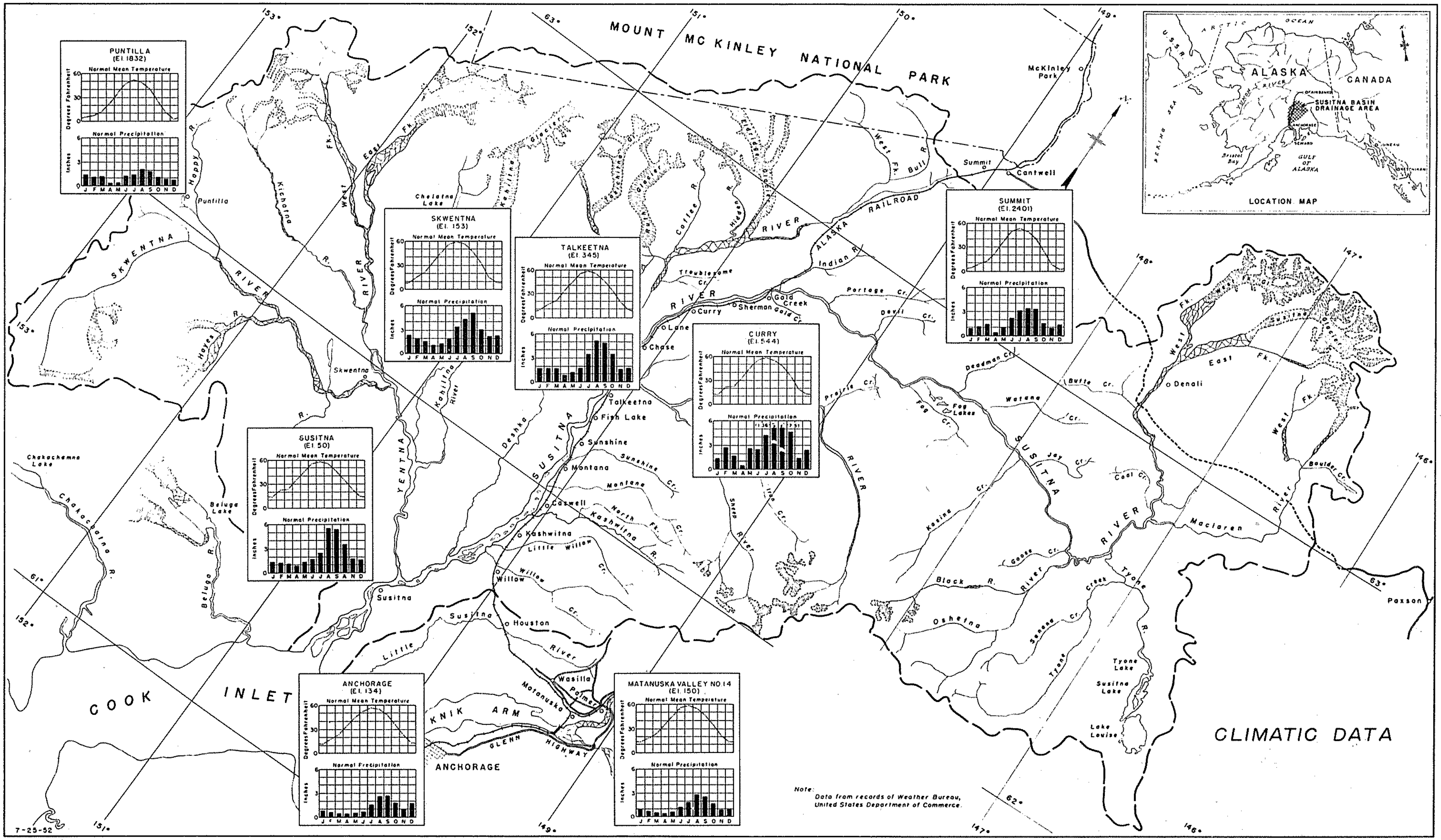


CLIMATIC DATA

About one-half of the total precipitation in the Susitna River Basin falls as snow. This results in natural storage of winter precipitation, with accumulation generally lasting through March. At Talkeetna, snow is usually about 5 feet deep at that time. The greatest recorded depth of snow on the ground at Talkeetna was 104 inches; the total snowfall during the same season was 167 inches.

Measurable precipitation occurs about 130 days a year at Susitna Valley stations. It can be expected on more than half the days in August and September, but on about 5 days during April.

Surface winds, although modified by local terrain, are generally northerly in all but the three summer months, when the prevailing wind is from the south.

The accompanying table summarizes some of the more important climatological data recorded at stations in the Susitna River Basin. Data from Anchorage and a Matanuska Valley station are also shown for comparison.

Climatological Data

Station	Elev. (feet)	Yrs. of record	Mean temperature (degrees F.) Jan.	July	Annual	Average annual precip. (inches)	Average annual snowfall (inches)	Average frost-free period Length (days)	Last temp. of 32° in spring	First temp. of 32° in fall
Anchorage 1/	134	29	12.9	57.3	35.2	14.54	60	115	May 19	Sept. 11
Caswell	290	3	1.5	58.5	31.0	26.05	(3/)	(3/)	(3/)	(3/)
Curry 2/	544	6	12.2	58.7	34.9	43.66	149	95	May 30	Sept. 2
Matanuska Valley No. 14 1/	150	32	13.1	57.4	35.1	15.50	45	105	May 27	Sept. 9
Puntilla	1,832	9	5.1	51.6	26.0	13.50	100	34	July 12	Aug. 15
Skwentna	153	11	7.0	58.3	32.7	30.62	120	94	May 29	Aug. 31
Summit	2,401	10	4.5	52.1	25.9	20.86	124	4/ 74	4/ June 11	4/ Aug. 24
Susitna 2/	50	15	12.6	58.2	35.1	27.97	64	4/ 74	4/ June 14	4/ Aug. 27
Talkeetna	345	32	8.7	57.9	33.4	30.01	127	4/ 69	4/ June 13	4/ Aug. 21

1/ Not in Susitna River Basin; shown for comparison.

2/ Stations not now in operation.

3/ Insufficient data.

4/ Freezing temperatures have been recorded in every month in occasional years.

HISTORY AND SETTLEMENT

Captain James Cook, on his third voyage of discovery in 1778, was the first white man to visit the body of water in South Central Alaska that now bears his name. "On June 1, 1778, Captain Cook anchored the RESOLUTION and the DISCOVERY in waters he called 'Turnagain River,' a tributary of the much larger 'Cook River.' At Possession Point, about 25 miles from the site of Anchorage, the Captain planted the English flag, claiming possession of all the land for his British monarch."

The early Russians did some exploring in the Cook Inlet country. Other than their trade with the Indians, there is little known of their occasional travels in the hinterland.

The Russians realized that the Susitna Basin was a vast area. Far to the northwest they could see a tremendous mountain surpassing any other peak in size. This mass of ice and snow they named Bulshaia Gora, or "Big Mountain." The Indians called it Denali, the "Home of the Sun."

The first American of record to see this lofty peak was a prospector named Frank Densmore. He saw the peak in the early 1890's. W. A. Dickey, another prospector, saw the peak in 1896. He wrote about the mountain in the New York Sun, January 24, 1897, calling it Denali; but upon hearing that McKinley had been nominated for the presidency, he renamed the mountain McKinley. The name became official at once.

The Susitna area was only vaguely known when the Eleventh Census (1890) took first official cognizance of the region. A trading post and native village were located at Knik outside the Basin's southern rim, and an Indian trail led off to the Copper River country. Once or twice a year natives from the Interior came to the coast to trade copper and furs for guns, ammunition, whiskey, and other products of the white man's civilization.

The first known prospectors to search for gold in the Susitna Basin started inland from Cook Inlet in the late 1880's with a year's outfit and supplies. They attempted the upstream navigation of the Susitna River. They returned in 3 weeks completely discouraged, having lost their supplies and nearly their lives. They stated that "the most beautiful scenery and the richest mines in the world might be in the Susitna Basin, but that the mosquitoes obscured their vision and occupied their attention to the exclusion of everything else."

With the discovery of gold in the Klondike, the spotlight of the world was directed on Alaska. In 1898, the United States Geological Survey sent G. H. Eldridge and a party to explore the Susitna. While making a reconnaissance of the geology and mineral deposits of the Susitna country, the party was to map a trail to the Interior and determine whether a wagon road or railroad could be built to the gold fields. The party traveled up the Susitna River with Indian guides. They reached what today is Broad Pass, the divide between the Susitna and the Yukon drainage basins. Here the guides deserted, fearing for their lives from the Interior Tena Indians. Eldridge and party continued into the Tanana Valley and the Yukon watershed.

The Susitna route to the Interior, once established, described, and mapped, was never popular with gold seekers as it was a far more difficult route than that through Skagway, the White Pass, and down the Yukon, or via the Valdez trail.

Although the Susitna Basin was "tough country," a few gold seekers, who found the Klondike and the more recently discovered Fairbanks fields overcrowded, roamed the hills and valleys of the Susitna Basin. By 1908, two placer areas, Valdez Creek and the bed of the Yentna River, plus the lode prospects in the Willow Creek region, were producing about a quarter-million dollars annually; but operations grew slowly due to high transportation costs and difficult terrain.

The Susitna Basin received its breath of life when President Wilson signed into law on March 14, 1914, a bill to build a railroad from the coast of Alaska to Fairbanks in the Interior. The route approved by President Woodrow Wilson was up the Susitna River. A large construction camp was established in 1914 on the shore of Knik Arm, a branch of Cook Inlet, and on July 10, 1915, business lots and home sites were sold in a brand new town called Anchorage.

The Alaska Railroad, built by equipment that was used in constructing the Panama Canal, was finally pushed through to completion after 9 years' work. The golden spike was driven by President Harding on July 15, 1923. Passenger service to the Interior has grown from one train a week to one streamliner a day. Today the Alaska Railroad is a smooth-running efficient operation with new Diesel-driven equipment.

Except for a small settlement of traders, trappers, prospectors, and natives at the junction of the Susitna and Talkeetna

Rivers about halfway up the north-south axis of the Basin, and a village near the mouth of the Susitna River, there was no permanent population of record prior to the advent of the Alaska Railroad. Even today there are only about 400 persons in the entire Basin.

Although there are 17 stations on the Alaska Railroad within the Basin, most of them are merely section houses with summer crews of a dozen men dwindling in winter to a straw boss and four or five trackwalkers. The division point of Curry on the railroad has a permanent population of 160. The village of Talkeetna, according to the last census, had 106. Some 20 of these are Civil Aeronautics Administration personnel and their families at the airfield adjacent to the town.

The only other nearby village of importance to the Susitna Basin is 10 miles beyond the north boundary of the Basin. Cantwell is about 4 miles outside the southeast corner of Mount McKinley National Park. Cantwell is connected with Mount McKinley National Park by a gravel road. A highway now under construction from Cantwell will run eastward 131 miles, cross the upper Susitna River Basin and end at the Richardson Highway. This will enable tourists to drive from the States right to Mount McKinley--the highest peak in North America.

THE LAND

Except for about 5,000 acres, the United States Government owns the Susitna River Basin. The Basin area is 12,700,000 acres. The custodial agent of this public domain is the Bureau of Land Management of the Department of the Interior.

Of the 19,900 square miles in the Basin, only 252 square miles are surveyed land.

H. H. Bennett and Thomas B. Rice made a reconnaissance soil survey of the Cook Inlet region for the United States Department of Agriculture in 1914. Even today, after 38 years have elapsed, no significant additional data are available on the Basin's soils. However, in the past several years, technicians of Alaska Agricultural Experiment Station, Department of Agriculture, Bureau of Land Management, and Territorial Department of Agriculture, traveling across the Basin have had limited opportunity to generally confirm the Bennett and Rice report on soils. It is believed, but not wholly confirmed, that there are over one million acres of potential agricultural land in Susitna River Basin. Of this area 600,000 acres are considered potential farm land and over 400,000, grazing land.

For more detailed data in this report, a complete tabulation of soil classification compiled by Bennett and Rice is shown in the final chapter "Reports of Other Agencies" under the heading "Bureau of Land Management." In the same chapter is a soil classification map accompanying the Territorial Department of Agriculture report.

Climatological data are available from only a few isolated stations in the Basin and not adequate to form a positive limited judgment on whether this land could be successfully farmed. Very limited meteorological studies show the growing season to be only 74 days as compared with the more accurately determined 108 days in adjoining Matanuska Valley and 117 days in the nearby Anchorage area.

TIMBER RESOURCES

Everyone agrees that the Basin contains extensive and valuable timber. Nowhere in the States west of the Mississippi River are there comparable stands of commercial birch timber. In Susitna Basin there are more than 150,000 acres of birch timber.

In addition to birch there are stands of merchantable cottonwood and white spruce.

No timber stand in the Basin is being commercially utilized at the present time. The Bureau of Land Management is the agency responsible for timber surveys, fire protection, and management, including timber sales contracts. Further details regarding timber resources of the Basin are in the Bureau of Land Management contributing statement in the final chapter "Reports of Other Agencies."

MINERAL RESOURCES

Little is known of the Basin's mineral resource potentialities. The more accessible areas along the railroad or the principal streams are likely to have been reasonably well prospected in past years, while the more inaccessible canyons and hinterlands probably received but little attention.

Gold has been the only mineral production of any importance. The three principal gold mining districts are the lode deposits at Willow Creek and placer deposits at Yentna-Cache Creek and at Valdez Creek. Past production has been over $23,000,000 including minor amounts of silver.

Copper has been found on Iron Creek and on the West Fork of Chulitna River.

Coal has been found at many places in the lower Susitna River Basin.

In the last several years, a few mines have been occasionally operated, but none on a continuous basis over a long period of years.

WATER RESOURCES

The Susitna is a big river. Long-term flow at its mouth is roughly estimated at 22,500,000 acre-feet in an average year. This is more water than the Colorado River flow at Hoover Dam.

Although there is no information on occurrence of the Basin's underground water supplies, the general geology would indicate large quantities, especially in the southern half of the Basin.

The only utilization of the water resources, at present, is for domestic use and for Alaska Railroad locomotives.

FISH AND WILDLIFE RESOURCES

The fish and wildlife resources are extensive and very important.

The Susitna River salmon run annually accounts for about $2,000,000 in the Cook Inlet fisheries industry. It is known that salmon run up the main stem of the river as far as the mouth of Portage Creek a few miles below Devil Canyon. The utilization of spawning areas above Devil Canyon needs further investigation. Streams above Devil Canyon abound with grayling and other nonmigratory fish.

There are many valuable fur animals. In the upper Basin are large numbers of caribou. The largest moose herd in Alaska is in the Basin.

RECREATION

The Alaska Railroad runs fishermen's specials over summer weekends to certain well-known trout and grayling streams along the tracks. But in the Railbelt no one needs to go more than a mile from the tracks to fill his creel.

At Curry, division point on the Alaska Railroad, there is a good hotel. A ski tow operates on winter weekends and the hotel gets some patronage from the Anchorage outdoor fans. A military rest camp at Lake Louise in the extreme southeast corner of the Basin is in a wilderness area, where ducks and geese abound and caribou and moose are plentiful.

To the west of Talkeetna, on the trail to Peters Creek, is a favored vantage point from which to view Mount McKinley. Perhaps a visitor center could be established here to enable people to enjoy the mountain on clear days. Trains go back and forth each day and stops could be arranged between them. Planes stop at Talkeetna regularly.

CHAPTER III

R A I L B E L T   E C O N O M I C   A C T I V I T I E S

The importance of the Susitna River Basin's natural resources, their development and utilization, is not confined to the Basin itself. The area affected by the development of the Basin extends along the entire Railbelt from Seward to Fairbanks, a distance of 473 miles, and is closely associated with the strengthening of the defenses of the nation against over-the-top attack by a foreign power. Moreover, development of Susitna River hydroelectric projects is basic to the economic awakening and physical development of the natural resources of the heartland of Alaska.

KENAI PENINSULA

Town of Seward

Seward is the gateway city and civilian port of entry to the heartland of Alaska. Its official population in 1950 was 2,053, an increase of more than 100 percent in the past decade. Estimates of its present population vary from 3,000 to 3,500.

Seward was established in 1903 as a port of entry for Central Alaska, and in 1904 construction of a privately owned railroad began from Seward northward to Fairbanks. During all of Seward's 50 years of existence it has varied little from this original economic pattern. This ice-free, year-round harbor of Seward on Kenai Peninsula is now the southern terminal of the Government-owned Alaska Railroad and the northernmost port of the regular steamship lines operating between the States and Alaska. A paved highway, nearing completion, connects Seward with Anchorage, Fairbanks, and the Alaska Highway.

Local resources, including fish and other sea foods, and small ore deposits of gold and other metals, have never provided a livelihood for any substantial number of Seward's inhabitants. A major part of its income is derived not from the production of goods, but the rendering of transportation services to other portions of Alaska—especially Anchorage, Fairbanks, and their respective military installations. In 1950 the port of Seward handled 428,953 tons of freight.

Seldovia

Seldovia is the commercial fishing center of Kenai Peninsula. The four small canneries there process salmon, halibut, and various kinds of shell fish for the Anchorage market and export trade. Cold storage plants and a boat harbor are among other facilities serving the needs of the fishing industry.

A small sawmill in the community, utilizing local timber stands, provides cut lumber for local needs.

Among the most promising future industrial developments are two large chrome deposits near Seldovia. These deposits have been worked in the recent past and the ore stock piled in the harbor. Recently renewed interest has been expressed in working the deposit again.

Homer

Located across Kachemak Bay from Seldovia, the town of Homer, holds promise of being a favorite resort center for hunters and sports fishermen who come in large numbers to enjoy the excellent hunting and fishing around Kachemak Bay. A large lodge to accommodate sportsmen and tourists is scheduled for construction this coming season.

Homer has grown in activity and importance since the Sterling Highway, terminating at Homer, was connected with the road around Turnagain Arm to Anchorage in the fall of 1951. Numerous farms and homesteads have been started recently in the surrounding area. Potatoes and hardy truck crops, particularly cabbage and cauliflower, are grown in commercial quantities and trucked to the Anchorage market. The area is particularly well adapted to dairy farming but at present the dairy industry is small and serves only the local market. Cattle and sheep grazing are both promising agricultural developments.

Homer also contains a small hand cannery, a small sawmill and a growing business in the processing of berry products.

Between Homer and Anchor Point are large coal deposits. Considerable interest has been expressed in these coal deposits in recent months which may lead to an early mining operation there.

Kenai

Kenai is the fastest growing community on the Peninsula due to extensive military construction in the surrounding area representing expenditure of about $6,500,000. If proposed plans are carried out, military expenditures for large-scale development in the area may exceed $100,000,000. The region is currently experiencing a land boom and the area adjacent to the village of Kenai and adjacent to military installations is being subdivided. Land speculators and proprietors of local businesses are picking up substantial acreage in anticipation of larger and more important military expansion.

A large land area around Kenai has been withdrawn and set aside as the Kenai National Moose Range, protecting the largest remaining moose herd in Alaska.

The Kenai River, which empties into Cook Inlet near Kenai, is one of the most important spawning streams for sockeye salmon in the Territory.

Whittier

The Port of Whittier, at the northeast corner of Kenai Peninsula, has been taken over by the Military and closed to movements of civilian cargo and passengers. This port is one of the military supply lines that must be maintained for the defense of the Territory.

One of the four largest sawmills in Alaska, producing about 11-1/2 million board feet of lumber a year, is located at Whittier.

Prospects for the Future

Prospects are bright for the continued economic development of the Kenai Peninsula. The reopening of chrome mining operations near Seldovia and the large-scale mining of coal deposits near Anchor Point are both likely possibilities in the near future and would go far in contributing income and employment in the region.

With continued construction of new roads and improvement of existing roads within the Peninsula and between the Peninsula and the Anchorage area, substantial increases in the tourist and resort business and in agricultural activity are certain to occur.

If proposed plans for military installation near Kenai are carried out, large-scale construction will continue there for several years, and contribute substantially to the income of the area.

ANCHORAGE AREA

Anchorage, Alaska's largest community and fastest-growing city, boasts of more than 50,000 population within a 10-mile radius of its post office. Only 20 years ago Anchorage was a quiet little town of about 3,000. The main source of employment was the Alaska Railroad, a little farming, some gold mining, and two small coal mines in the Matanuska field.

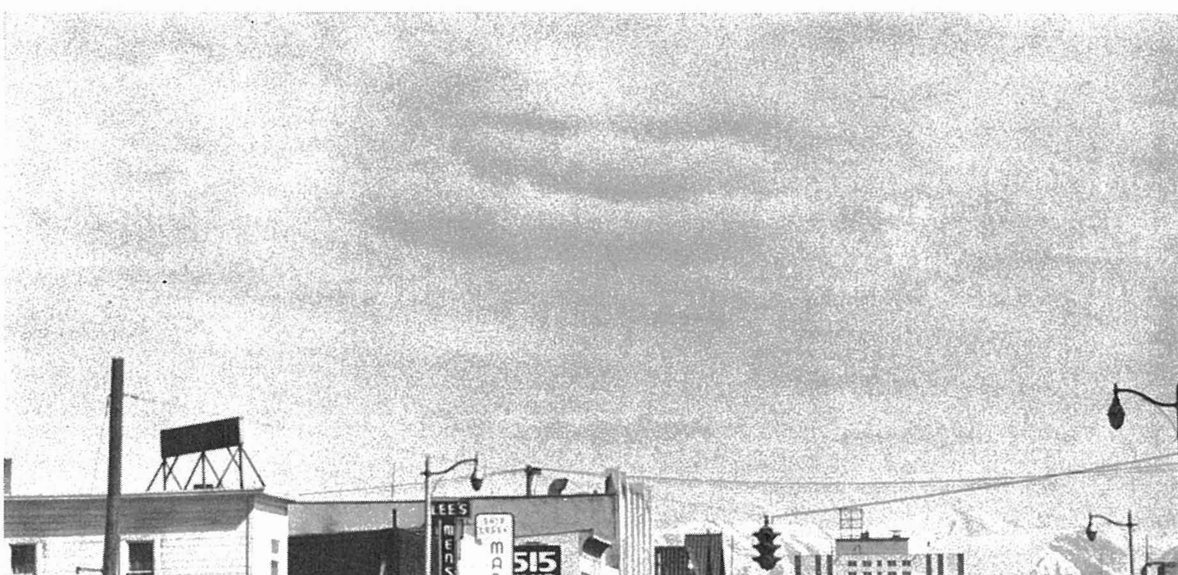
Then came the Matanuska Colony in 1935. Two hundred families were sent from Minnesota, Wisconsin, and Michigan by the Federal Government to farm in the fertile valley just 50 miles from Anchorage. This transplanting of 200 families, supported by "Uncle Sam" until they got on their feet, was an economic boon to the town of Anchorage.

The aviation industry, spreading its wings from Anchorage to Fairbanks, to the Kuskokwim country, to Bristol Bay, to Kodiak, to Seward, and down the coast to Juneau, brought new families and new incomes to the community of Anchorage.

In 1939, the darkening clouds of war spread over Alaska. The Military arrived, set up tents, then built barracks and set out guns on promontories along the coast.

Soon after Pearl Harbor Day, a quarter-million soldiers, sailors, and marines were in Alaska. Anchorage had become a military encampment and a gigantic war program was underway on three sides of the town. Fort Richardson was established at an initial cost of $85,000,000, and here the unified command of Army-Navy-Marine Corps was located. The war in the Aleutians was directed from the Anchorage headquarters.

Aerial view of Anchorage business district reveals well-planned modern city with wide streets.



Street scene in heart of downtown Anchorage.

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The community of Anchorage was totally unprepared for the influx of the United States Military. It was unprepared for the expansion that such a tremendous increase in personnel entailed. The city experienced growing pains of every variety and expanded without much order and planning.

When the war retreated from Alaskan shores, everyone expected that Anchorage would lose a large part of its 10,000 population. But that did not happen.

The Federal Government realized that Alaska was the strategic keystone for the defense of the continent, and has, since the close of World War II, poured well over a half-billion dollars into Alaskan projects.

The location of Anchorage, which made it the hub of Military activity in the Territory, contributed to the skyrocketing growth of the city and the surrounding community.

The pressing need for homes, for wholesale and retail businesses, for service industries, and for professional services of all kinds gripped Anchorage with unprecedented suddeness. Tarpaper shacks went up overnight. Jerry-built flats, trailer courts, improvised homes, and false-front stores were put together.

But through all the welter of rapid growth, a sense of permanence took over. Office buildings of steel and concrete were erected in the downtown area. Hotels, apartments, huge permanent housing projects started to dot the Anchorage landscape. Subdivisions and new suburban communities blossomed. Trunk sewers were laid. A water system for a large community was installed. Utilities and a dial telephone system became a part of the municipal government.

As a civilian community of permanence, Anchorage offers as much as most cities of the same size in the States--this surprises practically all visitors on their first trip.

Schools, churches, clubs, and residences--just like those of any American community--are in evidence here. The financial institutions of Anchorage contain half of the deposits of all Alaska. About half of all the distribution business of Alaska centers in Anchorage.

The construction industry is the leading industry of the Anchorage area and will probably continue to be for the next 10 years. More than 70 local Alaskan concerns and Stateside contracting firms are engaged in the field. The foreseeable construction contracts for the years immediately ahead exceed $100,000,000 yearly and the annual pay roll is in excess of $40,000,000. It is estimated that slightly more than 50 percent of the entire construction program is in the immediate Anchorage area.

Is there a solid future to the Anchorage area? Is there direct evidence that this region is not in for a big recession, should international relations take a turn for the better?

The best answer available is the conclusion drawn by the Alaska Development Board after a year-long study of the Anchorage area.

> "Military construction will remain a leading industry in the Anchorage area--barring the outbreak of hostilities--for at least the next decade, and probably longer.
>
> * * * * * * * * *
>
> "The House Committee on Appropriations in approving the second supplemental appropriation bill for fiscal year 1952, also endorsed for Elmendorf Air Force base a 25-year construction program, termed 'necessary to provide for the proposed mission' of the installation. No projection was made for the Fort Richardson construction program. The Fort, however, which has been described as one of the nation's leading military installations, was reported only 20-percent complete as of October 1950.
>
> "Not mentioned previously is another source of income registering an impact upon the city's economy: defense and civilian construction projects located in regions tributary to Anchorage. Activities connected with the port development at Whittier, communications station at Kenai, the naval station at Kodiak, radar installations along the Bering Sea and even Aleutian Island developments are felt on the Anchorage scene. The huge defense projects in the Fairbanks area also bring new dollars to Anchorage business firms. Construction programs of nondefense agencies such as The Alaska Railroad, Alaska Road Commission, Bureau of

Reclamation, Civil Aeronautics Administration, Alaska Public Works Agency, and others constitute another source of income. While there is no way of measuring actual amounts these projects contribute to the economy, they are believed to be substantial. Many of the projects are serviced and supplied, in whole or in part, by Anchorage firms."

A recent editorial in the Anchorage Daily Times sums up economic activity as follows:

"ANCHORAGE HAS EVERYTHING. It has grown 52 per cent in population since the official census of 1950. Today it is continuing the same rapid growth. The Alaska Development Board predicts it will have a population of 81,000 by 1956.

"What will all those people do here?

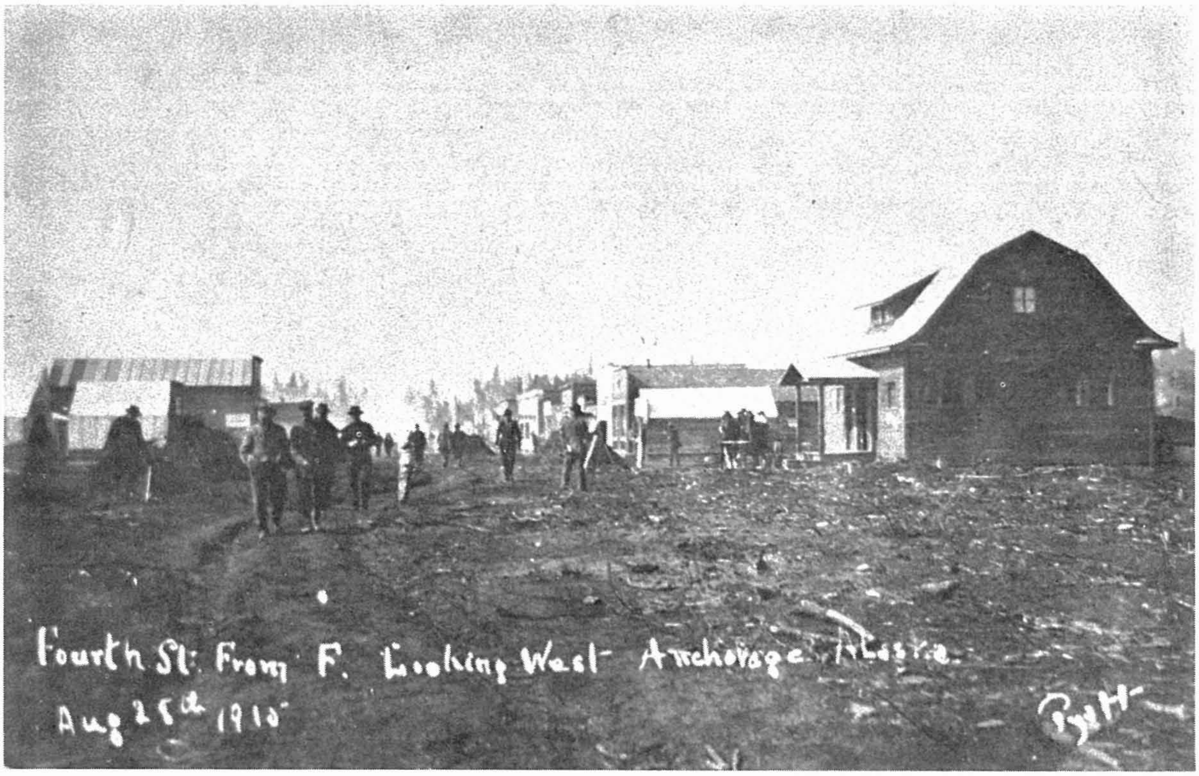
"The puzzle is more complicated with the discovery that the predicted growth makes no allowance for new activities that would offer new sources of employment.

"Should any one of the dozens of potential industries become a reality, the population forecasts would be made obsolete: The growth, instead of being merely astronomical, would become supercollosal or something else.

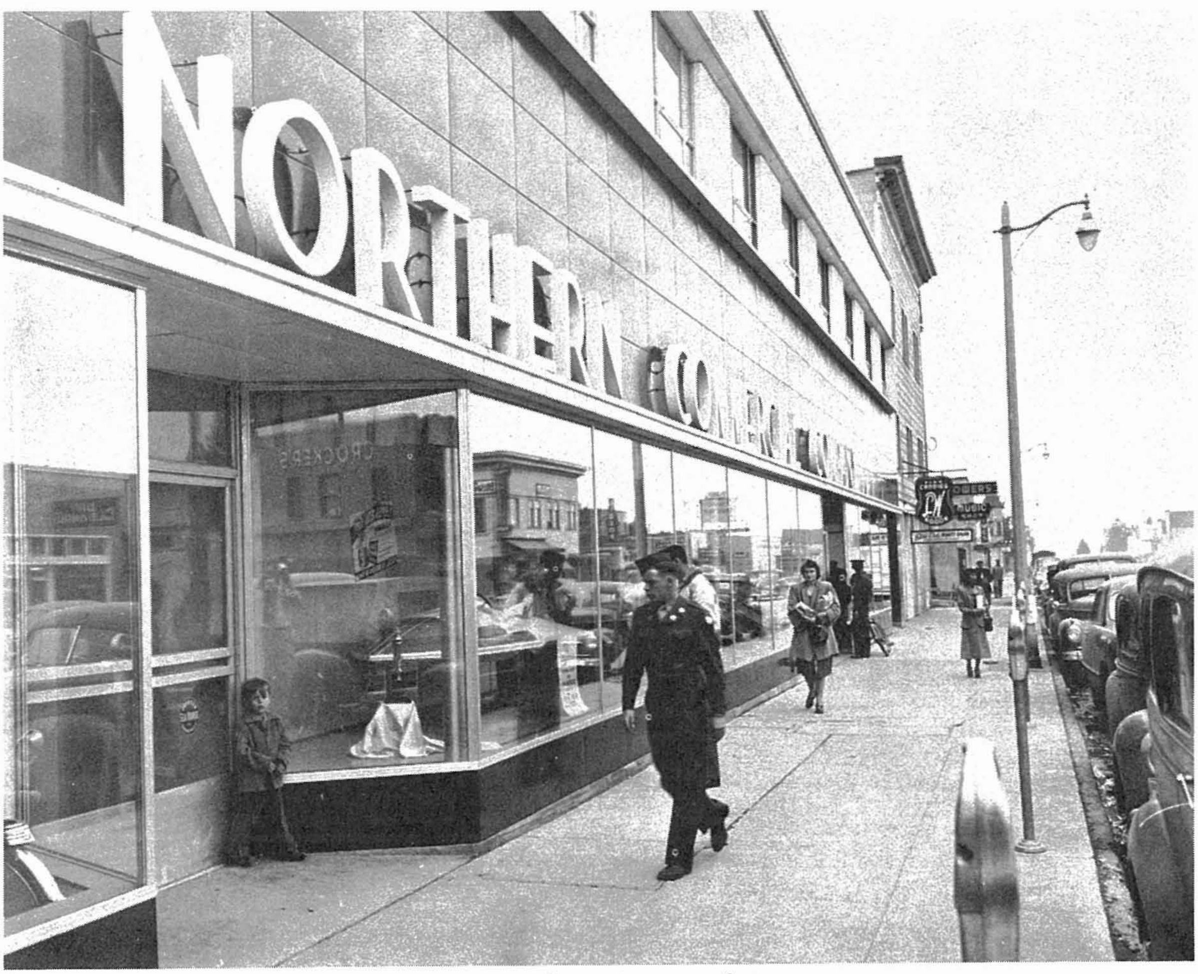
"All this is happening while local residents still have fresh memories of the sleepy little village that was Anchorage only a decade ago. The city was officially 2,277 persons in 1930 and 3,488 in 1940. It was growing at the healthy rate of about 10 per cent a year.

"Then came the 1940's and the establishment of the military next door. Nobody knows exactly what happened but by 1944 estimators said there were 9,000 here. The city council thought it had problems.

"Forecasters said the city would shrink to 6,000 when the war ended. The city planning commission started laying out projects for a city of 15,000 on the theory that the plans would allow for some 20 years of growth.



Anchorage, 49 days after Government town site land sale held July 10, 1915. Highest price paid for a lot was $1,150.



Same location 36 years later.

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"While many local residents, including some members of the commission, thought plans for such a huge city were silly, the population started to swell.

"Those who said in 1944 that 15,000 could never live here were saying in 1950 that 50,000 could never live here. Today the Alaska Development Board says more than 50,000 are here and the scoffers are saying 81,000 could never live here.

"The record shows that the scoffers have been consistently wrong. The Chamber of Commerce has been repeatedly embarrassed with the discovery that its estimates of population were smaller than those coming from official quarters. For a time, the Chamber was in the unusual predicament of having new projects launched and brought into being faster than its committees could dream them up.

"Where but in Alaska could such unprecedented situations and developments take place?

"Anchorage has actually blossomed out as a large city while a segment of the population was 'waiting for the bubble to burst' and predicting economic collapse.

* * * * * * * *

"Greater Anchorage is destined to become a San Francisco with the opening of her waterfront to ocean shipping and the construction of a bridge across Knik Arm. The city will become a Spokane as the seat of the Inland Empire with the development of Alaska's first Grand Coulee in the Susitna River.

* * * * * * * *

"A description of this community can be almost anything, depending on which facets of its variegated background and economy are given emphasis.

"But one thing is certain. It all spells opportunity. There is opportunity for every sort of new enterprise that can be conceived. The expanding economy is a big invitation to men of vision."

THE MATANUSKA VALLEY

The Matanuska Valley, north and adjoining the Anchorage area, is about the size of the state of Rhode Island.

The valley averages 20 miles in width and 60 miles in length, and the valley floor varies from 36 to 400 feet above sea level. It is bounded by the Talkeetna Mountains on the north and the Chugach Mountains on the south. The Matanuska River is laden heavily with silt, which evidently had something to do with the naming of the valley, as Matanuska is derived from two Indian words meaning "muddy water."

The three valley towns are Palmer, Wasilla, and Matanuska. Although the population of the Matanuska Valley has not increased as spectacularly as the neighboring Anchorage area, the population gains are substantial and are expected to continue at a steady pace. The population of the valley was recorded as 1,989 in 1939 and by 1950 had increased to 3,087--an increase of over 50 percent, which is particularly impressive in the light of the area's principal dependence on farming and coal mining. Palmer, the busy hub of the valley farm life, has been the main contributor to the increased population.

The most reliable estimates are that the valley's population will continue to increase at an even more rapid rate and will reach around 10,000 in 1965. The prospect of low-cost electric power for industrial development could easily increase the population potential much beyond the 10,000 estimate.

Highway signboards on the outskirts of Palmer indicate that local citizens believe "Palmer is the Future Capital of Alaska." In fact, land has been donated to the city and reserved for that purpose. The possibility of moving the capital has been spiritedly debated by the Territorial Legislature in Juneau.

The Matanuska Valley coal field is one of the largest known in the Territory; and of the several operating mines, the Evans-Jones is the largest. Matanuska coal is the principal source of supply for the Anchorage area, including the Alaska Railroad and military installations. Many coal miners are part-time farmers.

Matanuska Electric Cooperative Association serves the valley, including the City of Palmer, the coal mines, and the farms.

Roads form a network in the valley and connect with blacktop highways to Anchorage (50 miles from Palmer), to the Richardson Highway and the Alaska Highway to the States, and to various mountain roads. Nearly every farm has access, within a quarter of a mile or less, to a graveled road. Railroad transportation is available at Palmer, Matanuska, and Wasilla. There are airports at Palmer and Wasilla.

Tourist attractions in the valley are many, and there are four lodges already established in the valley. On nearly every Sunday and holiday throughout the year, people may be seen picnicking, fishing, boating, hiking, picture taking, hunting, berry picking, or mountain climbing. The tourist trade is a profitable business for the residents of the valley.

Farm Lands

The Matanuska Valley adjoins the Susitna Basin; and, therefore, it is pertinent to discuss the agricultural development of the valley in detail. From a standpoint of future settlement and agricultural development of the lower Susitna River Basin, the experience of the Matanuska Valley can be most valuable.

The farming area of the Matanuska Valley is about 28,000 acres, or approximately 44 square miles. However, less than one-half is cleared and in agricultural production.

The Matanuska Valley lies practically as near the Arctic Circle as does Oslo in Norway and Leningrad in Russia. Practically all Finland and most of Norway and Sweden lie farther north. The winters of the valley are not as severe as those of the northern midwestern states, and not much longer.

Farmers in the valley practice diversified farming, growing a wide variety of field crops, pasture plants, vegetables, and berries.

Environmental conditions in the valley are exceptionally well suited to the growth of canning peas. The quality of the canned product is excellent, and yields compare favorably with those of the best pea-canning district in the States.

As far as other vegetables are concerned, there are many which thrive in the valley climate: radishes, leaf and head lettuce, both early and late cabbage, cauliflower, parsnips, celery, rutabagas, turnips, carrots, beets, chard, spinach, peas, rhubarb, and onions. High yields per acre of all vegetables are the rule.

A few acres typical of the 13,000 acres now under cultivation in Alaska.

Long days of almost constant sunlight result in premium produce.

In the past 12 years, a number of varieties of seed and fiber flax have been grown experimentally. Yields have been high. The oil content of the seed varies from about 30 to 43 percent.

Fall rye is one of the surest cereal crops which can be grown. Oats and barleys of any variety mature readily, produce good yields and the grain is plump and well-filled. The average yield of oats is 45 bushels per acre; hulless barley, 23 bushels; barley, 30 bushels; and winter rye, 20 bushels.

Potatoes are one of the main crops of the valley. Average yield per acre of marketable potatoes is approximately 5 tons, but yields as high as 18 tons per acre have been grown when irrigated.

Livestock and Dairying

The livestock population has been gradually increasing in the valley--both in quantity and quality. All classes of poultry, meat, and dairy animals are represented.

Dairying is one of the chief types of farming in the Matanuska Valley. Opportunities for considerable expansion in dairy farming are indicated by the following reported shipments of dairy products from the States into Alaska last year:

Milk--condensed, dried	$1,100,000
Butter and cheese	$1,500,000

There are a number of flocks of sheep on valley farms, most of them crossed Romney-Marsh with a few flocks of Hampshires.

Hogs grow rapidly and produce excellent quality pork, bacon, and ham. Although corn cannot be produced in the valley, the use of barley for finishing meat animals and poultry produces a firm, well-marbled product that compares favorably with the quality of meat imported from the States.

Although there is a thriving poultry industry in the valley, the supply of dressed poultry and fresh eggs cannot begin to meet the demand.

Agricultural Experiment Station

An Agricultural Experiment Station of the University of Alaska, located in the valley, has done considerable research on various crops, livestock raising, and fertilization. It has grown experimentally approximately 150 varieties and crosses of potatoes.

Matanuska Valley Farmers Co-operating Association

Most of the farm products are marketed through the Matanuska Valley Farmers Co-operating Association under their trade mark "Matanuska Maid." The Co-op does an annual business of $3,000,000. The organization is owned and controlled by farmers.

The Association operates a garage, machine shop, power plant, woodworking shop, slaughterhouse, warehouses, creamery, trading post, and cold-storage and vegetable-storage houses.

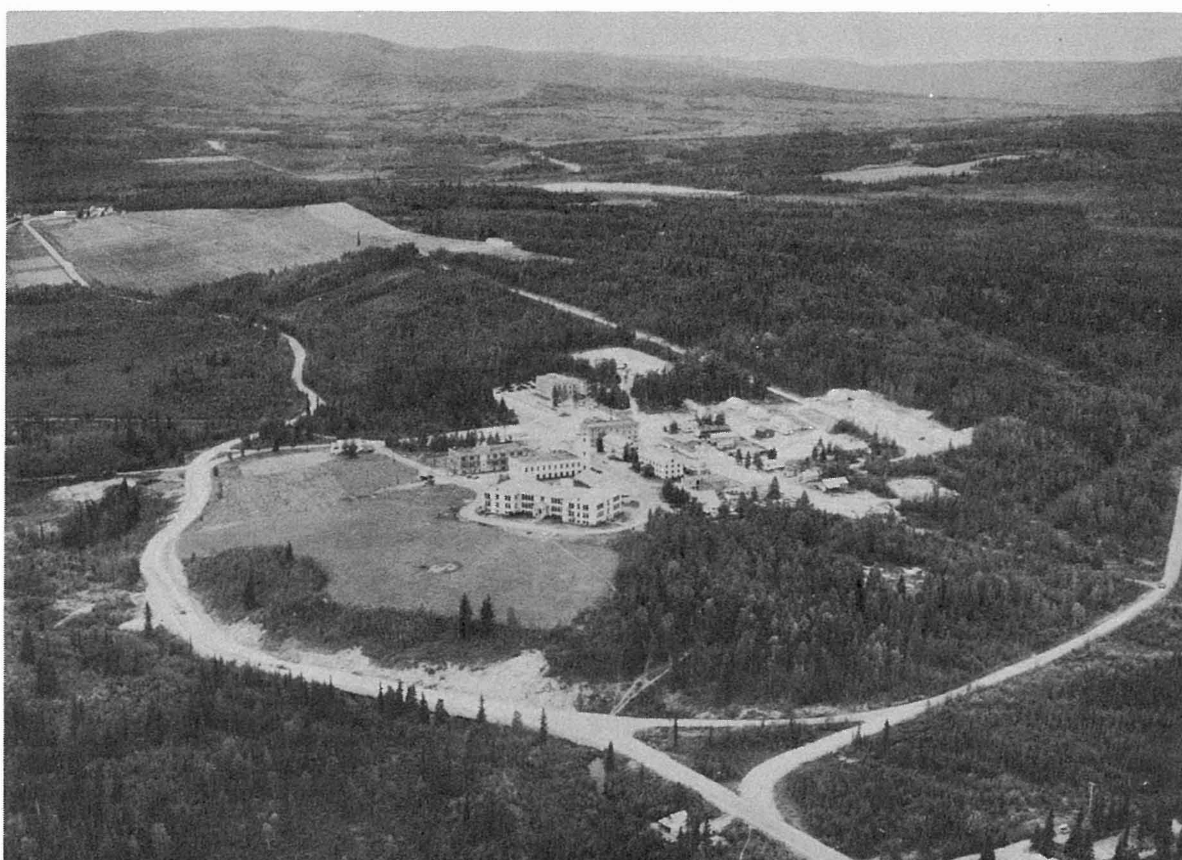
Farms and dairy products from the valley are sold to the Army and through commercial channels in Anchorage. The supply is inadequate to meet the demand.

FAIRBANKS AREA

Fairbanks is the largest community in Alaska north of the City of Anchorage. The "Golden Heart of Alaska," as it is known, is the northern terminus of the railroad, the end of the Alaska Highway, and the beginning of air transportation to the back country. It is the economic center of a 227,000 square-mile trade area. Population of Fairbanks and surrounding area is unknown and even very difficult to estimate. In 1950, Bureau of Census counted 5,626 people within the city limits of Fairbanks, but the official city limits are many blocks inside the densely populated area. Officials of the Town of Fairbanks say, "The present population of Fairbanks and its suburban area can be safely estimated at 21,000 persons." The local Chamber of Commerce estimated in October 1951 that the population of the Town of Fairbanks, its suburban area, and military bases was 34,300.

Until the beginning of World War II, Fairbanks was principally a mining town. In 1902 Felix Pedro struck gold on Pedro Creek, just outside the present Town of Fairbanks. The gold rush brought thousands of people into the area. In the decade 1910-20, exhaustion of the best high-grade "pay streaks" resulted in a loss of one-third of the Fairbanks population. However, the United States Smelting, Refining, and Mining Company brought large dredges into the gold fields in 1924, which revitalized the economic activities in the Fairbanks area. Now there are eight mammoth dredges in the Fairbanks mining district and several more in nearby areas. There are many additional operating gold mines throughout northern Alaska served by Fairbanks.

Downtown Fairbanks. In center is multimillion-dollar eight story, block square, Northward Building.



University of Alaska in suburban Fairbanks. One of world's foremost geophysical institutes, dealing with research in high latitudes.

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In recent years, the area's mining activities have been extended to include other metallic minerals, such as antimony and tungsten.

The mining of coal at Healy on the Alaska Railroad south of Fairbanks is a very important industry. Healy River coal deposits are among the largest in the Territory. These mines supply coal to the Fairbanks area, including large military installations and the Alaska Railroad. The Federal Government is investigating the possibility of using Healy River coal for the production of synthetic liquid fuels. Recently, the President's Materials Policy Commission recommended as a national policy "* * * a continuing study of the economic aspects of producing synthetic liquid fuels from shale and coal in relation to security needs and the outlook for future potential supplies."

The Navy has discovered very significant oil and gas fields about 400 miles north of Fairbanks. Fairbanks residents believe that eventually the Federal Government will either construct a synthetic liquid fuel plant at Healy River, or pipe gas and oil from the Arctic slope to a potential refinery at Fairbanks.

Fairbanks is a very modern city. It is the financial center of northern Alaska, with bank deposits of over $25,000,000. There are two newspapers, one a daily and the other a weekly publication. Civil Aeronautics Administration has recently completed a new $5,000,000 commercial airport.

Tourist trade has increased each year since World War II, and is now an important business. Regular sightseeing trips are available to the gold fields, University of Alaska, Tanana River, across the Arctic Circle to the Yukon, to McKinley National Park on the railroad, Circle Hot Springs, Yukon River, Kotzebue (the largest Eskimo community in Alaska), Nome, and other points of interest.

Mount McKinley National Park is very popular, not only with tourists, but with Alaskans. Located south of Fairbanks, it is accessible by railroad, but completion of the highway now under construction will make it even more easily reached. Hotel facilities are very modern, and the meals are excellent. The mountain scenery is superlative. The trip to the Park is a never-forgotten event.

Near the city of Fairbanks are two of the Military's strongest bases for defense of the continent. A third base is 100 miles away.

Over $150,000,000 has been invested in these bases in the Fairbanks area in the past 5 years. Another $150,000,000 is proposed for military construction in this area in the next few years.

Fairbanks is in an anomalous position. The combined impact of military growth and civilian expansion has hit this frontier mining community so hard that municipal problems have piled up and pyramided to an unprecedented degree. The city government and civic organizations are faced with the problems of an almost overnight expansion from a quiet Alaskan village into a modern, hustling, bustling city.

Located in the sub-Arctic, with attendant problems of continental climate and permafrost ground conditions, Fairbanks has far more acute growing problems and growing pains than any other modern city under the American flag.

In spite of all its problems, including the difficulties of building a modern city in the sub-Arctic, Fairbanks is destined to be a great and growing city. At present, it is drawing people from the States in unprecedented numbers. Even in the month of January 1952, with the temperature at times hitting 50° below zero, more than 2,000 persons arrived in Fairbanks---over the Alaska Highway in their own cars, via the Alaska Railroad, and by airplane from the States.

"The rush is on" is the expression one hears in Fairbanks. Building of permanent housing projects, apartment houses, and business structures, paving of streets and roads, opening up of a dozen real estate subdivisions---all are outward evidences of permanent growth.

Rural electrification is giving the spark of life to farm and suburban living. The demand for power extends a hundred miles down the Alaska Highway from Fairbanks. It fans out in a veritable spider web from the city. As fast as electrical energy can be furnished, the rural areas are being populated.

Civic organizations declare that Fairbanks will be a community of 50,000 in the next decade. The military installations around Fairbanks will be the permanent "outer defenses" of the continent from attack across or over the top of the Arctic Ice Cap.

Fairbanks will be the hub of a road system that will reach the extremities of the Territory within a few years. These roads will be very important as they will be the means of bringing minerals and metals out of the hinterland.

New Alaska Railroad freight yard in Fairbanks.

Fairbanks industrial area. Fairbanks Exploration Company's 9,000-kilowatt steam power plant in center.

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Fairbanks has numerous attributes for permanent growth. Not the least of them is the University of Alaska. Hardly 30 years old, this land-grant institution has an outstanding school of mines; a progressive school of agriculture, with jurisdiction over three agricultural experiment stations; and an internationally famous geophysical institute. The Arctic Institute of Health, planned for the immediate future, will add to the prestige and renown of the University. The Cooperative Wildlife Research Unit is headquartered at the University and the first two graduate degrees granted at the University were in Wildlife Management.

The Tanana Valley near Fairbanks is the northernmost region of agricultural development in Alaska, at the present time. The growing season for tender plants, such as potatoes, averages 105 days. For plants such as grains and grasses, planted on south slopes, the average is 123 days. Rainfall is only about 7 inches in the months of May, June, July, August, and September, with the highest amount in August. Irrigation is badly needed.

Although the farming is diversified, potatoes, hay, and grain are the most important crops. Up to $150 per ton is made on commercial grades of potatoes, and some acres yield from 8 to 12 tons. Practically all the vegetables which can be grown in the Northern States--cabbage, cauliflower, brussels sprouts, beets, radishes, carrots, turnips, rutabagas, lettuce, peas, broccoli, parsnips, and rhubarb--produce a good yield and quality in the Tanana Valley. Cabbage grows especially large, some up to 30 pounds.

There is just one commercial dairy in the Tanana Valley, although some farmers have a few cows for their own use.

Thousands of day-old chicks are shipped in by airplane during the spring and summer months, and later sold as fryers in the local markets.

The principal markets for the crops grown in the Tanana Valley are: the town of Fairbanks, the two air bases near Fairbanks, and another air base 100 miles away. Produce is also shipped to communities down river, delivered by airplane to outlying small towns and to mining communities, and sent out by trucks to various construction and mining camps in the vicinity.

SUMMARY

This chapter has outlined the historical and present economic development of the major centers of activity in the Railbelt. Initial cause of activity was gold mining, primarily in the Fairbanks area. This resulted in construction of transportation facilities to serve the gold-producing areas. Coal mining has also become an important industry.

Fishing, farming, and lumbering are other activities which expanded from small beginnings to their present important status. Construction of military and civilian facilities and buildings probably employs more people than any other existing industry in the Railbelt. With increase in population resulting from other economic development, recreation and tourist trade have also become important sources of income.

These activities are only a suggestion of the potential future development which may take place in the Railbelt if large quantities of low-cost power are made available. The next chapter briefly discusses the extent of this potential activity with particular emphasis on future requirements for power from Susitna River plants.

CHAPTER IV

POWER SUPPLY AND MARKETS

An abundant supply of low-cost electric energy from the Susitna River Basin projects could go far in improving the area's economy and promoting higher standards of living. Hydroelectric energy will constitute a particularly important incentive to the growth of manufacturing industries utilizing the Railbelt's varied mineral resources and increased output of agricultural products. The hydroelectric projects of the Basin are also expected to contribute electric power for irrigation and farming purposes and to serve the Railbelt's homes and commercial establishments.

An estimate of the combined electric power requirements for all these uses is essential in order to determine the electric facilities to be installed at the river projects in the Basin. This report therefore gives thorough consideration to the subject of future electric power requirements in a region which includes virtually all of the Susitna River Basin and the densely populated adjacent areas. For simplification, the region covered by this survey will be referred to as the Railbelt, or, simply, the power market area.

POWER MARKET AREA

The drainage basin of the Susitna River system contains approximately 400 people. The power supply problem has been relatively small, as this commodity has been but one of many considered difficult to provide in this sparsely settled area. On the other hand, Fairbanks to the north and Anchorage to the south have become fast-growing population centers. Before World War II these cities were important points on the Alaska Railroad from the port of Seward to the rich gold-mining district around Fairbanks. These centers, swelled by post-war defense construction, have become extremely short of power. These critically power-short adjacent areas are included in the power market area because the Susitna River plants are a logical source of hydroelectric power for them.

The Railbelt is generally thought of as the area adjacent to the railroad from Seward to Fairbanks. It is possible to transmit power from the Susitna River to every point on the railroad and to many points at considerable distance from the railroad, depending on the individual economies of the local service. For the purpose of this report most potential loads up to 100 miles on either side of the railroad will be considered within the power market area. The area is approximately one-tenth the total area of the Territory or about 50,000 square miles. Within this area is concentrated nearly one-half of the Territorial population, exclusive of military personnel.

EXISTING POWER PLANTS AND TRANSMISSION LINES

The abundant potential water-power resources of Alaska total more than 8,000,000 kilowatts of installed hydroelectric capacity. Of this amount approximately 1,500,000 kilowatts are in the Susitna River Basin. In all of Alaska the installed hydroelectric capacity is 27,758 kilowatts. Only 3,380 kilowatts of this capacity are located in the power market area contiguous to the Susitna River Basin.

The principal existing hydroelectric plant is the 2,000-kilowatt Eklutna plant of the Anchorage Public Utilities. Annual generation from the plant is about 16,000,000 kilowatt-hours. This plant will be acquired by the Bureau of Reclamation and its firm water supply diverted through the new Eklutna plant of the Bureau of Reclamation.

Fuel electric plants in the market area in 1951 totaled 49,636 kilowatts of installed capacity. Of this amount 14,500 kilowatts of steam and 11,700 kilowatts of internal combustion served military needs; and 13,850 kilowatts of steam and 9,586 kilowatts of internal combustion were for public supply. The total fuel generation for 1951, exclusive of military production, is estimated at more than 15,000,000 kilowatt-hours. Diesel fuel for internal-combustion engines and fuel oil for steam electric generation is transported from California by tanker and then by rail. Coal is supplied by rail from the Matanuska and Healy coal fields located adjacent to the railroad.

The sole transmission line in the area consists of 27 miles of 33,000-volt line which delivers power from the existing Eklutna plant to the City of Anchorage. This line and plant will be acquired by the Bureau of Reclamation. The line will later be salvaged as it will not be needed after the new Eklutna plant, including a 115,000-volt transmission line, is in operation.

Two private power enterprises of importance operate in the power market area. The Fairbanks Exploration Company operates a 9,500-kilowatt steam generating plant in Fairbanks for supplying power to its summer gold dredging operations. The Golden Valley Electric Association is negotiating to purchase this plant to provide a firm power supply for its members in the association's service areas around Fairbanks. The association would continue to supply power to the mining company for its dredging operations.

The other private utility, the Inlet Power and Light Company, operates about 2,800 kilowatts of miscellaneous Diesel generating equipment near Anchorage. The distribution system of the company may be purchased by the city of Anchorage or the Chugach Electric Association.

A third private utility may become a reality if plans materialize at Kenai to utilize equipment which is now idle in the Northern Commercial steam plant in Fairbanks. This utility would furnish power for nonmilitary use near the new military communication center.

The Fairbanks Municipal Utilities System commenced operating its new 3,500-kilowatt steam power and heating plant early in 1952. Electrical energy and heat are furnished to customers within the city of Fairbanks.

In addition to the 2,000-kilowatt Eklutna hydroelectric plant, the Anchorage Public Utilities operates the stern half of the tanker "Sackett's Harbor" with a capacity, limited by its beach location, of about 3,500 kilowatts, and a number of Diesel generating units. In all probability, none of the generating equipment now operated by the city of Anchorage will be used as firm power sources after adequate amounts of hydropower are available.

The city of Seward operates Diesel generating equipment to furnish all power needs for that seaport area.

A number of small power systems are in operation along the Railbelt on which specific data are not available. Among the more important ones are those at Nenana, Curry, Talkeetna, Moose Pass, and Homer.

POWER FACILITIES UNDER CONSTRUCTION

The first major plant for supplying power for public consumption in the area is the Bureau of Reclamation's 30,000-kilowatt Eklutna hydroelectric project under construction near Anchorage. It is scheduled for initial operation in the spring of 1954 with an annual firm production of 143,000,000 kilowatt-hours.

The Alaska Railroad and the Chugach Electric Association are jointly constructing the 9,500-kilowatt Knik Arm steam heat and power plant, scheduled for completion in the late fall of 1952. Already completed in conjunction with the steam plant is a 1,700-kilowatt Diesel plant. The Diesel plant was placed in service early in 1951. The Knik Arm plant will be operated by the Bureau of Reclamation and will later be integrated with the Eklutna project. Firm generation from this plant will be approximately 42,000,000 kilowatt-hours annually. Heat will be furnished for the buildings and shops of the Alaska Railroad and the large Alaska Native Service hospital.

POWER UTILIZATION

In 1950 approximately 100,000,000 kilowatt-hours of electrical energy were utilized within the market area exclusive of military needs. The majority of this energy was consumed by residential and commercial customers, while a relatively small amount went to medium and small industrial customers. The total use of power grew rapidly with the post-war military construction boom. In 1940 the estimated area use was less than 10,000,000 kilowatt-hours.

Lack of generating capacity has been the predominant factor restricting more widespread use of electrical energy by individual customers. In recent years many customers in suburban areas have encountered long delays in obtaining service. Frequent brownouts are imposed due to inability to meet winter peaks. Daily reminders to conserve electricity are carried in all papers serving the area. In addition the power rates have remained very high. In spite of these deterrents, many homes and apartments are equipped with major electrical appliances. The amount of power per residential customer used in 1950 in Fairbanks and Anchorage was approximately 2,400 kilowatt-hours annually as compared to 1,830 kilowatt-hours, the national average.

In commercial and industrial fields electrical power is utilized in labor saving devices. The cost of power is low compared with labor. Large amounts of power are being used in military and civilian construction activities. This is a high summertime load which helps to raise the load factor. Most industrial applications are, at present, relatively small.

WHOLESALE POWER RATES

Rates for wholesale power are high, being restrictive in nature rather than promotional. All production is sold as firm power without reserve capacity and, at times, without sufficient capacity to meet peaks. Existing wholesale rates of 6 cents per kilowatt-hour in Fairbanks and 2-1/2 cents per kilowatt-hour in Anchorage are for energy when and if available, and reflect approximately the actual cost of production by fuel generating plants in those terminal cities.

FUTURE LOAD DEVELOPMENT

An accurate forecast of the markets for energy from potential power developments of the Basin is extremely difficult. The two factors, an adequate source of dependable power and low electric rates, will permit increased use in all fields; but it is uncertain to what degree consumption will increase.

Large blocks of low-cost electric power in the area will undoubtedly attract industries to develop the natural resources of the Railbelt. The importance of low-cost power to commercial life, mining, and industrial and agricultural development, is a proven fact not requiring further demonstration.

The very large defense construction activity all along the railroad is the present impetus behind the rapid growth of all populated areas in the Railbelt. By chain reaction a very large civilian building program is under way. Substantial private financing from within the Territory and the States has provided the capital to build large apartment buildings and mass housing developments. Still more capital is ready for exploration and development of local natural resources into industries that will provide permanent, year-round employment to a large number of workers.

The more likely early industries are those which would supply products needed for local consumption at a lower cost than for imported goods. Many small industries are already supplying building materials and food products. It is believed that many others will be ready to replace military construction activities as those permanent installations are completed.

The scope of this report permits only a tentative estimate of future power loads, based on a combination of the projection of current trends in population and the components of potential future loads. These preliminary estimates indicate that the power loads will grow rapidly and suggest the proportions that these can be expected to attain in 20 to 30 years. Careful consideration of many factors points out a need for at least 3 billion kilowatt-hours by 1970.

It is anticipated that detailed studies of power markets, to be conducted in the future as each individual power project is investigated, will further justify anticipation of a load of this proportion.

Residential

The gold rush days of Alaska are over and homes are as modern as those found in the States. Because of the extreme winter climate many requirements of modern Alaskan homes are even more rigid. Regardless of the isolation and high cost of transportation, Alaskan homes are being equipped with all modern electrical appliances.

For the fully electrified home of the future, the estimated power requirements would approach 30,000 kilowatt-hours annually. The largest use, at present, in Alaska is at Ketchikan, which is outside the power market area, where the average residential consumption in 1950 was 5,450 kilowatt-hours. This high consumption, involving some house heating, is stimulated by low electric rates which averaged 1.86 cents per kilowatt-hour.

With an abundance of power available at low rates it is expected that house heating saturation will reach 50 percent in all of the Railbelt by 1970, resulting in an average residential use of at least 10,000 kilowatt-hours annually. Applied to the 260,000 estimated population in the market area by 1970, use of this amount would yield a total of 635,000,000 kilowatt-hours per year.

Rural

A good many successful farms have been in operation in Alaska for many years. The operators of these farms have learned the potentialities and understand most of the limitations imposed by the climate and soil. In the principal farming areas--Matanuska Valley around Palmer, Tanana Valley around Fairbanks, and scattered coastal areas along the Kenai Peninsula--agriculture consists chiefly of dairying and the production of potatoes and vegetables on a small scale.

Although a limited export trade in a few agricultural specialties may develop, farmers will need to depend primarily on local markets. This means they will need to produce the variety of products required by the people living in Alaska who are engaged in mining, fishing, forestry, hunting, transportation, communications, and future large industries. The rapidly expanding tourist trade will also be an important factor when facilities become available. An auxiliary type of agriculture will probably develop to service these industries and activities. The primary cash crop, potatoes, was expanded sufficiently to take care of most of Alaska's post-war civilian needs. Mixed livestock farming with dairy cattle, hogs, poultry, sheep, goats, and beef cattle is important in the Matanuska Valley. If Alaskan agriculture is to continue and expand, livestock must occupy a greater part in farming operations in the future. A steady expansion in the acreage of cleared land is essential for the production of feed and for soil-improving crops.

A rough estimate by the United States Department of Agriculture of the acreage urgently needing detailed soil study and mapping is as follows: Matanuska Valley, 90,000 acres; Tanana Valley, 60,000 acres; western Kenai, 35,000 acres; and near Anchorage, 7,000 acres. In addition, some schematic soil classification and mapping will be necessary on which to base preliminary judgment as to the suitability of other areas and to guide future detailed surveys.

Most present farms in the Tanana and Matanuska Valleys are electrified. Many new farms will be created by land clearing and drainage and sprinkler irrigation. To help meet the growing demands for agricultural products it is conservatively estimated that the farms in the Railbelt will number between 3,800 and 4,000 by 1970. Part of the prospective market for power will be due to more users, although the larger part lies in a greater average demand. Total requirement for all farms in 1970 would approximate 66,000,000 kilowatt-hours.

Commercial

Wholesale establishments, retail stores, office buildings, and small industries are increasing in number and size with population. A large per-capita increase in power used for these purposes seems in prospect. At the estimated rate of population growth, with a reasonable increased use per capita, the total requirement in 1970 would be 254,000,000 kilowatt-hours.

Municipal

Fairbanks and Anchorage are already as modern as most communities of comparable size in the States. Civic improvement plans include the most progressive programs of street lighting. It is conservatively estimated that over 2,000,000 kilowatt-hours will be needed for such purposes by 1970, including pumping of municipal water supplies.

Large Industrial

All modern industry depends entirely on transportation for movement of raw materials, labor, and finished products. The Alaska Railroad was the lifeline to early development of the Territory and will continue to be a major implement to industrialization of the Railbelt.

For many years officials of the Railroad have discussed the need for electrification of their system. The nature of the mountain terrain that has to be negotiated by the freight and passenger trains, plus the amount of rolling stock that needs to be allocated to transporting their own fuel, plus the increasing costs of that fuel, should lead to serious consideration of the potentially abundant hydroelectric power midway along the Railbelt.

Lower operating expenses might assist in recouping the investment in new rolling stock and facilities; and conservation of fuel would also be a desirable aspect. Such electrification should be completed on the major portion of the approximately 540 miles of rail line by 1970.

Within Anchorage and Fairbanks and their suburbs extensive systems of electrically operated trolley coaches may be expected to replace the present motor coaches. Such systems would grow in proportion with the population and would be substantial users of energy.

Much of the future electrical energy is necessary for the sound and diversified growth of industry in the area. Great new industries will be based on the broad range of mineral resources of the Railbelt. These minerals fall into categories of fuels, chemicals, building materials and aggregates, precious metals and metals of industrial utility.

Gold has been the principal metal mined in Alaska and will continue to require significant amounts of electrical energy.

A potential industry which might be a major claimant for power is the production of synthetic fuels from coal, requiring between 75,000 and 140,000 kilowatts of power at high load factor. Refining of petroleum products to be piped from the Naval Petroleum Reserve appears to be an alternative solution to the problem of furnishing much-needed fuel products from local resources. Here again large amounts of power would be consumed.

Due to the remote location of Alaska from the source of virtually all supplies and equipment used in the Territory, there is a wide field of opportunities which can be developed for private enterprise, for wide employment, and for the beneficial and profitable uses of power and resources. New industries will stimulate still other opportunities.

The volume of industry needed for the Railbelt by 1970, if it is to continue to progress and prosper as a semi-independent region, will require no less than 1,732,000,000 kilowatt-hours annually.

Replacement of Fuel-Electric Generation

Fuel heating and generating plants now existing, under construction and planned for operation by 1955 for military needs, will produce an estimated 320,000,000 kilowatt-hours annually. Measures to conserve fuel will encourage displacement of a greater and greater part of fuel-generated power. Such displacement should ultimately increase the hydroelectric power load by at least 169,000,000 kilowatt-hours annually.

Losses

Power from Susitna River plants would have to be transmitted long distances to distribution centers, since very little of the power would be used in the Basin proper. Total distribution and transmission losses would total approximately 297,000,000 kilowatt-hours on the loads of 1970.

Summary

The total annual power requirements of 3 billion kilowatt-hours are summarized by the component elements in the tabulation below.

Type of load	Million kilowatt-hours
Residential	635
Farm	66
Commercial	254
Municipal	2
Large industrial	1,732
Military	169
Losses	297
Total	3,155

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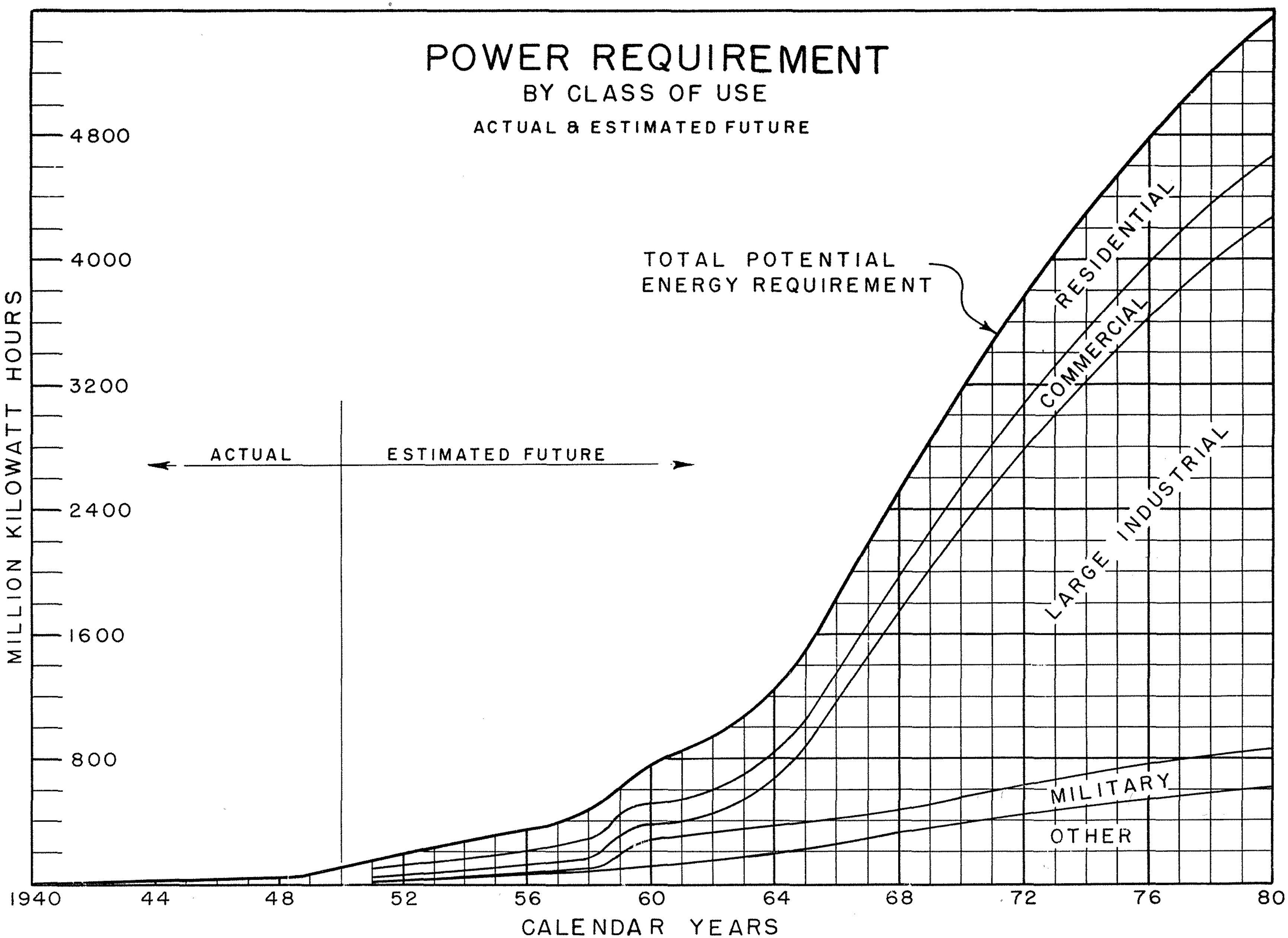
POWER REQUIREMENT
BY CLASS OF USE
ACTUAL & ESTIMATED FUTURE
MILLION KILOWATT HOURS
4800
4000
3200
2400
1600
800
TOTAL POTENTIAL ENERGY REQUIREMENT
RESIDENTIAL
COMMERCIAL
LARGE INDUSTRIAL
MILITARY
OTHER
ACTUAL
ESTIMATED FUTURE
1940
44
48
52
56
60
64
68
72
76
80
CALENDAR YEARS

The accompanying chart, "Power Requirement by Class of Use," shows the projection of historical loads from 1940 to 1980.

POWER PLANTS

Potential power development described in this report, together with those existing and under construction, have adequate capacity to meet the load requirement of 3 billion kilowatt-hours by 1970. Existing plants, excluding the miscellaneous hydro, Diesel, and steam generating capacity which will be later removed from service, can produce 57,000,000 kilowatt-hours annually. Plants under construction primarily to furnish power for civilian needs will generate about 185,000,000 kilowatt-hours, and total aggregate potential of the Susitna River Basin is 6,180,000,000 kilowatt-hours. The total annual production available would be 6,422,000,000 kilowatt-hours. The potential installations, it is assumed, would be made only as required by load growth.

The Devil Canyon project, with an ultimate installed capacity of 390,000 kilowatts, is the most logical initial development. This plant should be ready for operation by 1958 to 1960, with an initial capacity of 195,000 kilowatts. With construction of Denali Reservoir to provide additional storage regulation and with periodic installation of generators, the plant would be adequate to handle load growth of the Railbelt until about 1967. This is illustrated in the chart, "Generator Nameplate Capacity."

TRANSMISSION LINES

High-capacity transmission lines will be required in order to deliver power from plants of the Susitna River to load centers. The power to be generated at Devil Canyon will require a minimum of one 230-kilovolt line north to Fairbanks, a distance of about 185 miles, and one 230-kilovolt line south to Anchorage, a distance of about 160 miles. The latter distance might be shortened by 30 miles by selection of a shorter route to a point across Knik Arm north of Anchorage. Submarine cables would be used across the Arm. The precise pattern which the backbone transmission system ultimately takes and the capacities of its lines and substations will depend on the trend of industrial development following the current defense construction program.

The accompanying map indicates the approximate location of the 230-kilovolt line and a network of feeder transmission lines and substations to represent the manner in which the system must be developed to deliver power to potential wholesale customers.

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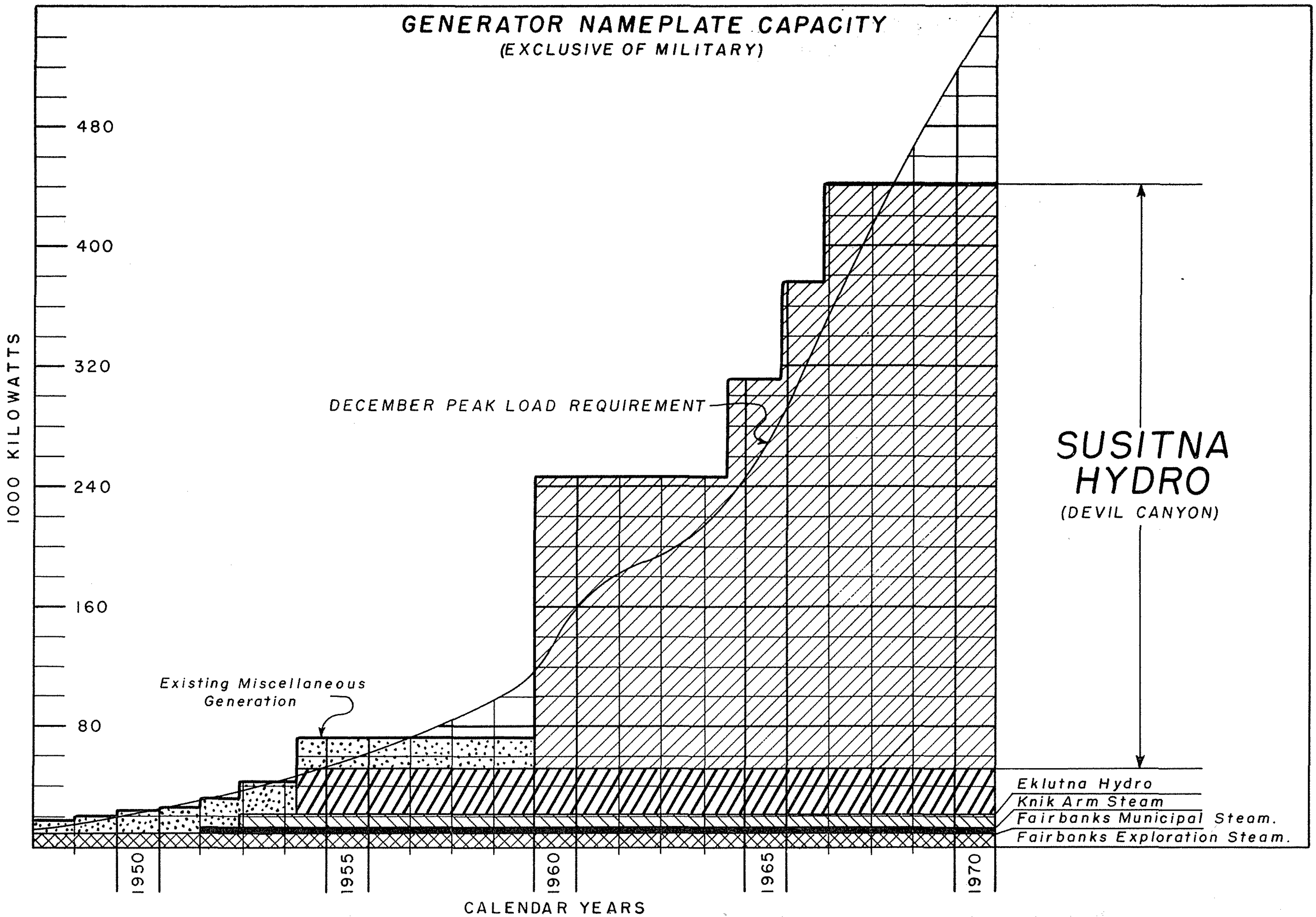
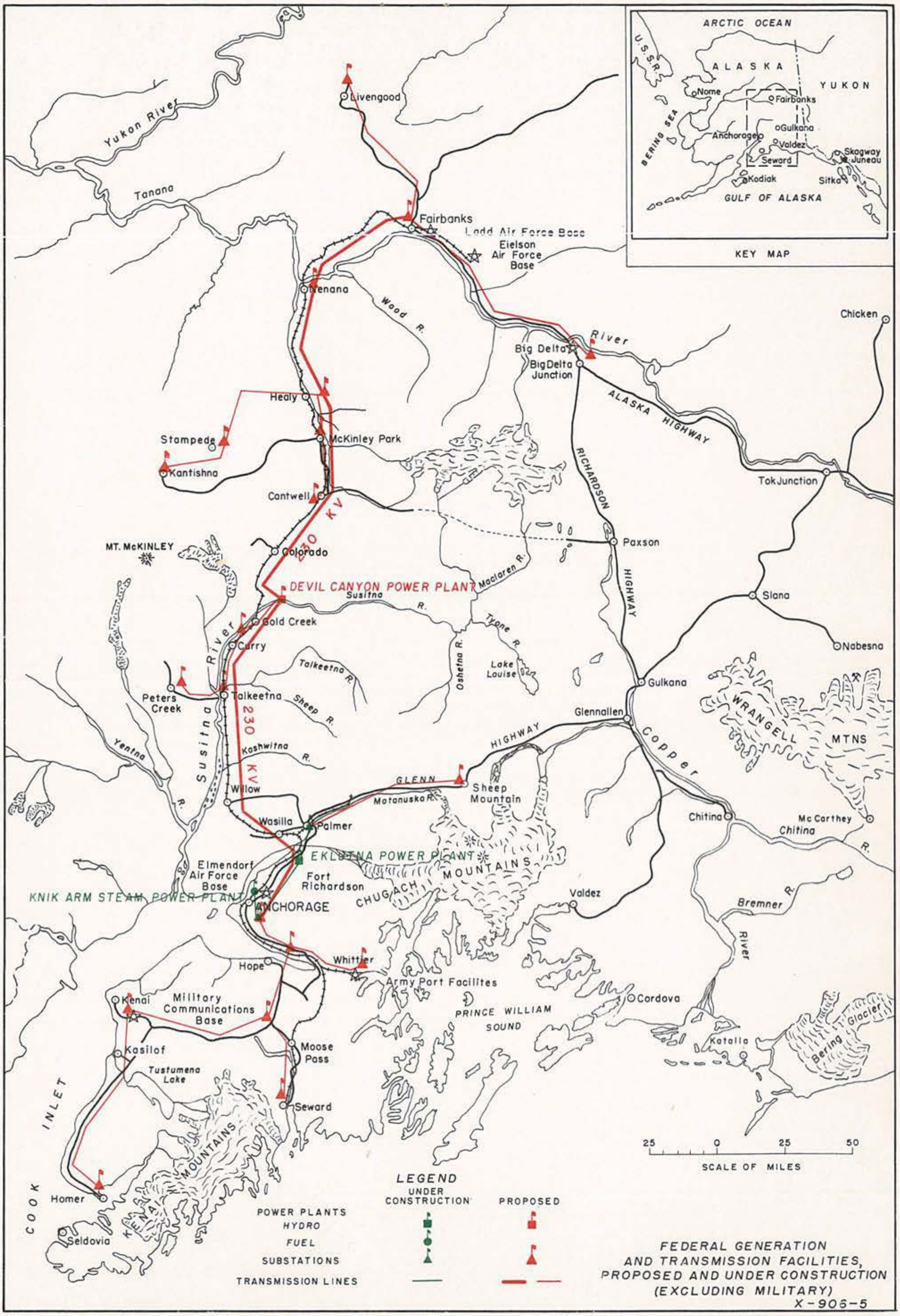


GENERATOR NAMEPLATE CAPACITY
(EXCLUSIVE OF MILITARY)
1000 KILOWATTS
480
400
320
240
160
80
DECEMBER PEAK LOAD REQUIREMENT
Existing Miscellaneous Generation
SUSITNA HYDRO
(DEVIL CANYON)
Eklutna Hydro
Knik Arm Steam
Fairbanks Municipal Steam.
Fairbanks Exploration Steam.
1950
1955
1960
1965
1970
CALENDAR YEARS



FEDERAL GENERATION AND TRANSMISSION FACILITIES, PROPOSED AND UNDER CONSTRUCTION (EXCLUDING MILITARY)

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Location, voltage and capacity of these, including the system on the Kenai Peninsula, will depend on the location and character of loads and other considerations. The marketing of power on a low-cost basis is dependent upon some such network of lines being made available at least coincident with the demands for power.

Requests for power have already motivated two Rural Electrification Administration cooperatives to prepare justification for transmission lines into newly developed areas. The Golden Valley Electric Association plans to extend service to Big Delta, nearly 100 miles southeast of Fairbanks; and the Chugach Electric Association has surveyed for a line to furnish power to the Girdwood-Portage-Whittier area approximately 50 miles southeast of Anchorage.

LOAD FACTOR

Electric rates in common use on Bureau projects are closely related to load factor--the ratio of average load to maximum demand. A lower unit cost of power results where the customer maintains a higher load factor. This is appropriate because the installed capacity required to furnish high load-factor service is less than is required for low load factor.

The load factor for the Anchorage Public Utilities, the largest operating system in the power market area, averages about 53 percent. With the tremendous increase in industrial loads in the future, many with very high load factor, it is estimated that a steady improvement will result in a 55-percent factor by 1960 and 65 percent by 1970.

CHAPTER V

POTENTIAL WATER-RESOURCE DEVELOPMENT

It is obvious that some effort must be made to provide generating equipment which will supply the future power requirements discussed in Chapter IV. The portion of the total load shown as "Large industrial" would develop only if large amounts of relatively low-cost energy were available. Provision of low-cost power would be a strong inducement to attract large industrial plants to the Railbelt. Much of the total power market, however, will be expanding and in urgent need of an adequate power supply.

Susitna River Basin is ideally located to supply energy to the entire Railbelt. Gold Creek station on the Alaska Railroad is about equi-distant from the ends of the railroad at Seward and Eielson. Devil Canyon project, on the main stem of the Susitna River 12 miles above Gold Creek, is a logical site for initial development to supply the major load centers of Anchorage and Fairbanks.

This chapter briefly describes the field investigations of the Susitna River Basin, basic water supply data and studies, and the potential development of the water-power resources of the Basin. A short discussion of other possible water-resource developments is also included. Alternative sources of electric power are also examined.

FIELD INVESTIGATIONS

Field investigations of Susitna River Basin have been made during several summers. Each site discussed has been visited on the ground. Topography of each site was examined, and at most sites a profile was taken of the best apparent dam axis. The surface geology at each dam site was studied to determine the adequacy of the foundation and abutments for various types of dams. Possible seepage from the reservoir and around the dam was also studied as far as possible from observation of ground surfaces. Reconnaissance was made for sources of suitable construction materials.

A few available large-scale maps were used to augment the meager engineering data. General reports on the geology of the Basin supplemented the field examination.

Engineering and geological data were the basis for rough estimates of construction costs at most of the sites. With the exception of Devil Canyon and Denali, these cost estimated are not included in the report. They were used to estimate energy cost.

Until more accurate data are available, elevations, stream widths, dam heights, crest lengths, and reservoir capacities for most sites should be considered as only reasonable approximations. Data for sites on the main stem of the Susitna River, from and including Devil Canyon site to the headwaters, are much more comprehensive than for other sites in the Basin.

WATER SUPPLY STUDIES

Water Resources

The source of all runoff of Susitna River and its tributaries is precipitation which falls, or has fallen in the past, within the drainage Basin. Recorded precipitation varies from an annual average of 14 inches at Puntilla to 44 inches at Curry. All climatological stations are at relatively low elevations. Average annual precipitation over the entire Basin is estimated at 45 inches. Annual variation of precipitation is not large; minimum annual precipitation at Talkeetna is about 45 percent of maximum.

Three major factors affect the monthly distribution of runoff in the Basin: (1) monthly distribution of precipitation; (2) proportion of total precipitation which falls as snow; and (3) large areas of glaciers in the Basin. This combination of factors tends to produce a relatively high, uniform discharge from May through September and low runoff during the winter. About one-half the total precipitation falls as snow from October through April. In late April, snow at lower elevations begins to melt. High discharge from snow melt continues through July, when all but the very highest snow has disappeared.

By this time, however, warm summer temperatures have begun to have their effect on the many glaciers in the Basin. Little is known about the characteristics of glacier melt. Maximum runoff from these ice masses probably occurs during July and August, when temperatures are highest. Runoff from glacier melt is augmented and sustained by the increase in precipitation from July through October, with a maximum in September. Runoff begins to decrease in October, when precipitation falls as snow at the higher elevations. From November through April, little surface runoff occurs, and the small stream flow consists primarily of outflow from ground water.

Summer temperatures influence the amount of annual runoff as well as the monthly distribution. An unusually warm summer could cause glacier melt far in excess of the increase in volume of glaciers and ice fields resulting from precipitation which fell during the preceding winter. Conversely, during an unusually cool summer glacier melt could be less than the addition to ice volume caused by precipitation. The correlation between annual precipitation and corresponding annual runoff is therefore unfavorably affected.

The above brief description of runoff characteristics of the Susitna River and its tributaries is based on analysis of only 2 years of runoff record at one stream-gaging station in the Basin. The Geological Survey has measured the runoff of the Susitna River at Gold Creek since August 1949. Provisional records through September 1951 were made available for these studies. These records are summarized in the following table:

Runoff of Susitna River at Gold Creek
In 1,000 acre-feet (by water years)
(Drainage area: 6,240 square miles)

	1949	1950	1951
October	---	385	227
November	---	154	77
December	---	88	68
January	---	63	59
February	---	44	46
March	---	45	44
April	---	52	96
May	---	707	865
June	---	1,172	1,243
July	---	1,390	1,376
August	1,505	1,219	1,207
September	932	494	1,286
Total	2,437	5,814	6,576

All estimates of runoff of the various streams in the Basin were derived from this short record. Runoff records of streams in nearby basins are too short to extend the record at Gold Creek by correlation. Several comparisons were made between runoff at Gold Creek and precipitation at several stations in the Susitna River Basin and in nearby basins. No entirely satisfactory correlation was obtained, owing to the many factors other than total precipitation which affect and control the amount of runoff. The best comparison was with precipitation at Talkeetna. Annual

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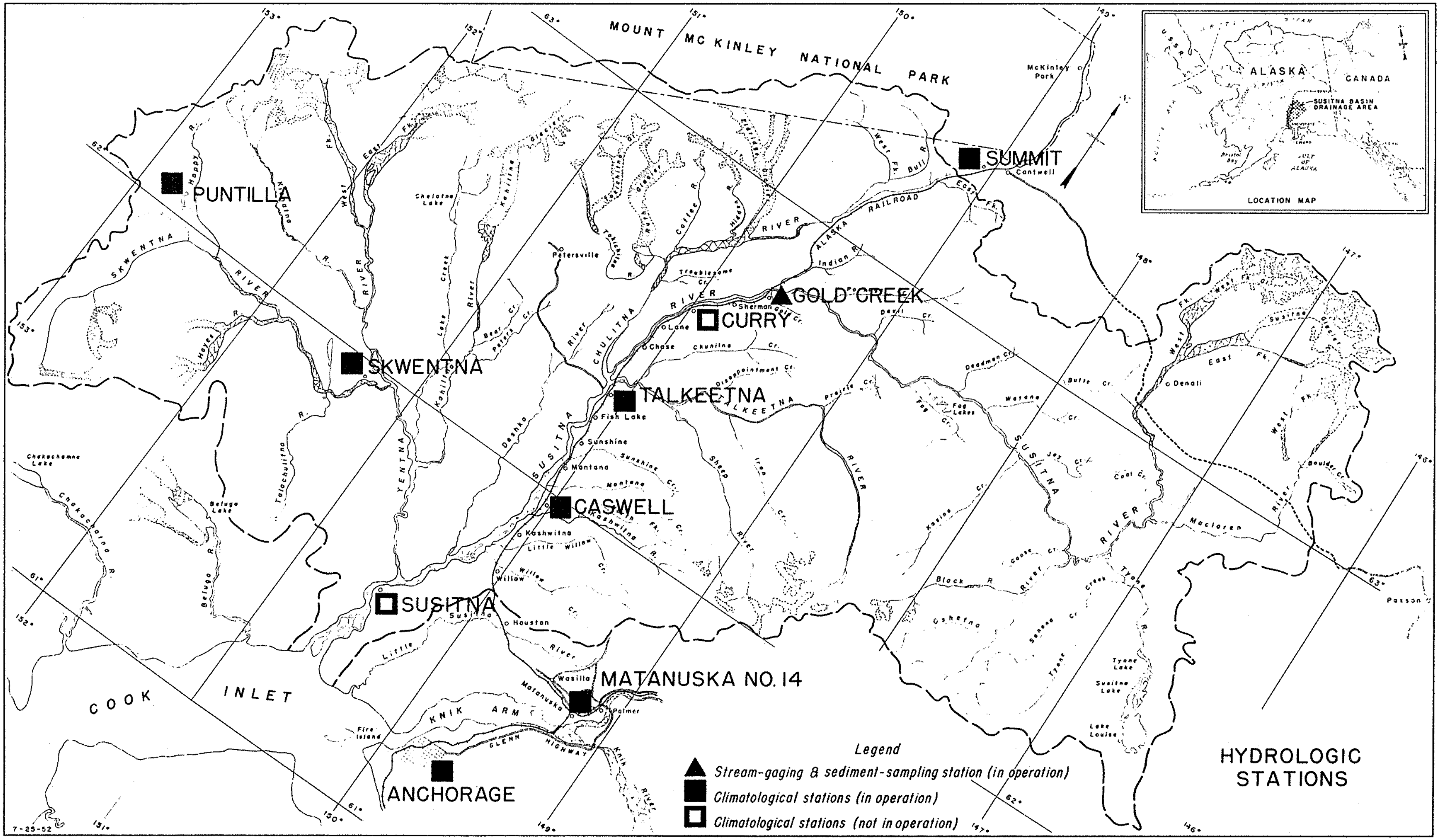


MOUNT MC KINLEY NATIONAL PARK
SUMMIT
Cantwell
McKinley Park
PUNTILLA
SKWENTNA
GOLD CREEK
CURRY
TALKEETNA
CASWELL
SUSITNA
MATANUSKA NO. 14
ANCHORAGE
COOK INLET
KNIK ARM
GLENN HIGHWAY
ALASKA RAILROAD
SKWENTNA RIVER
YENTNA
SUSITNA RIVER
CHULITNA RIVER
TALKEETNA RIVER
Petersville
Sherman
Lane
Chase
Fish Lake
Sunshine
Montana
Kashwitna
Willow
Houston
Wasilla
Palmer
Denali
Paxson
Tyone Lake
Susitna Lake
Lake Louise
Chakachamna Lake
Beluga Lake
Chelatna Lake
Fire Island
ALASKA
CANADA
SUSITNA BASIN DRAINAGE AREA
LOCATION MAP
Legend
Stream-gaging & sediment-sampling station (in operation)
Climatological stations (in operation)
Climatological stations (not in operation)
HYDROLOGIC STATIONS
7-25-52

runoff of the Susitna River at Gold Creek was extended back to 1922, the beginning of precipitation record at Talkeetna. Because of the Basin topography and the normal storm pattern, annual runoff at Gold Creek and at all dam sites in the Basin above that point was adjusted to slightly increase the departure from average. Maximum annual runoff was increased from 136 percent of average to 150 percent; minimum was decreased from 66 to 50 percent. Unadjusted figures were used for all other stations.

Average annual runoff at the various dam sites in the Basin was estimated from the 30-year average at Gold Creek, using unit runoff in acre-feet per square mile as the comparison. In adjusting unit runoff at Gold Creek to the other locations, consideration was given to normal precipitation at the nearest Weather Bureau stations, storm paths, and average altitude. Unit runoff was estimated for relatively homogeneous subareas, and total runoff for the subareas was combined to give total average annual runoff at the dam sites. This average runoff was then reduced 15 percent to adjust for the scantiness of the hydrologic data on which the estimate was based. Percentages of average annual runoff were applied to obtain estimated annual runoff for each year at each dam site.

Monthly distribution of annual runoff was estimated from the short records at Gold Creek and of streams in nearby basins. Trends were established for glacial and nonglacial streams, and the estimates reflected the observed differences. The same distribution was used for all years at any one site.

The critical period for reservoir and power plant operation depends primarily on annual variation in runoff at the site. It also depends on the amount of active reservoir capacity at the site and at upstream sites. The critical period is, therefore, not the same for all sites. For a single project with a small reservoir and no upstream storage, the critical period may be only the 1 year of minimum runoff. For a project with a large reservoir and substantial upstream regulation, the critical period would be about 17 years long.

Estimated runoff at any site for any individual year may be far from the actual runoff which occurred in that year, owing to the lack of basic hydrologic and meteorologic data. Runoff during a critical period shows with reasonable accuracy what runoff might be expected during a conservative, typical, dry cycle. Many more records, both in length of time and in location, are very much needed to provide accurate basic data for hydrologic studies of surface-water resources.

Extent of the ground-water resources of the Basin is unknown. Because of the large amount of unpermeable glacial till in the Basin above Gold Creek, there is little possibility of developing and using ground water in this area. In the rest of the Basin there is greater probability of ground-water storage reservoirs. Extensive investigation will be required to evaluate the potentialities of ground-water development. This study should be made when use of ground water in the Basin appears desirable.

Water Rights

Man has made very little use of the water resources of the Basin. The only known consumptive uses are: domestic use at the few places of habitation, and use by the steam locomotives and shops of the Alaska Railroad. Most of these diversions are from small, relatively clear tributaries. Nonconsumptive uses include fish wheels and diversions for placer mining. Most mining diversions have been abandoned. Present major use is for hydraulic monitors in the Peters Creek area.

No Federal or Territorial laws govern appropriation of water in Alaska. Common law, as expressed in court decisions, recognizes principles of priority, beneficial use, highest use, and negotiability. None of the present uses has been established as rights by court decree. However, because of the small amount of water involved, such recognition would have little adverse effect on any development discussed in this report. Water rights required for future projects, when they are proposed for development, should be evidenced by filing with the United States Commissioner of the appropriate recording district.

Reservoir Evaporation and Seepage

No allowance was made for evaporation from reservoir surfaces. Fragmentary records of evaporation in the Matanuska Valley and near Fairbanks indicate that evaporation losses from reservoirs would be about 1 percent of average annual runoff. Because inaccuracies in runoff are expected to far exceed this proportion, evaporation losses were not evaluated in the reservoir operation studies.

No allowance was made for seepage from reservoirs. Seepage from a reservoir would be unavailable for power generation at that site but could be used for generation at downstream sites, subject to seepage from those downstream reservoirs. Character of material at the dam-site foundations and in the reservoir basins indicates seepage losses are expected to be small at most of the sites. One exception is Susitna Station site, near the mouth of the river, where seepage might be large and difficult to control. Study of seepage losses will be a necessary part of each site investigation.

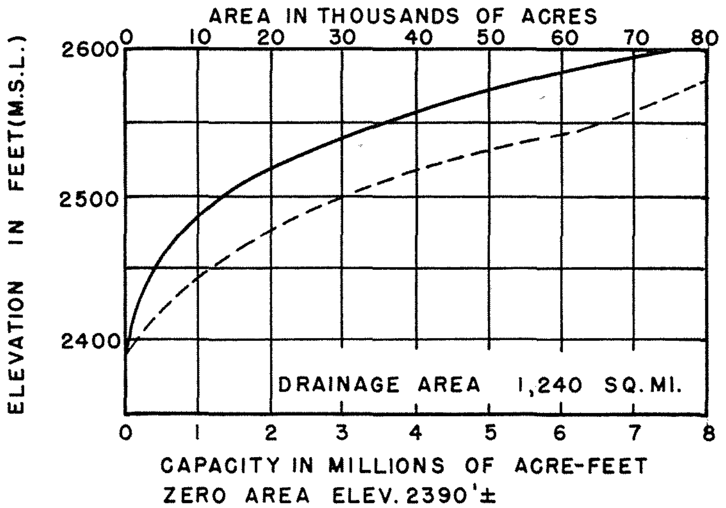
Reservoir Sedimentation

Deposition of sediment in reservoirs is expected to be a problem which could be solved. Records of suspended sediment load carried by Susitna River past the Gold Creek gaging station are now being obtained by the Geological Survey. Records for 1 year show a total suspended load of 5,600,000 tons. This figure was the basis for estimating total loads, including suspended load and bed load.

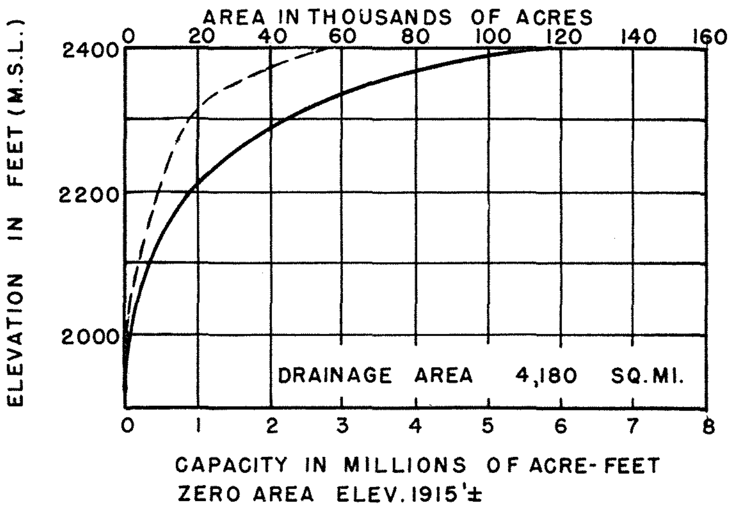
The greater portion of the sediment load probably consists of outwash from the many glaciers in the Basin. Other sediment load was assumed to be negligible by comparison. In the absence of other data, sediment outflow from glaciers was assumed to be proportional to estimated contributing glacier area. The recorded sediment load passing Gold Creek was adjusted by adding estimated deposition in the stream bed between the glaciers and the measuring station. The resulting total was used to estimate sediment outflow from other glaciers in the Basin. From these figures, estimates were made of sediment deposition in the various reservoirs during a 100-year period. Adjustment was made for estimated deposition between glacier and reservoir, either in the stream channel or in upstream reservoirs. Space reserved for sediment deposition was distributed throughout the depth of the reservoir in general accordance with data obtained from reservoir sedimentation surveys in the Western States. Additional field data and office study will be required to make a final determination of the space which should be reserved for sediment deposition at each reservoir site.

Water Utilization

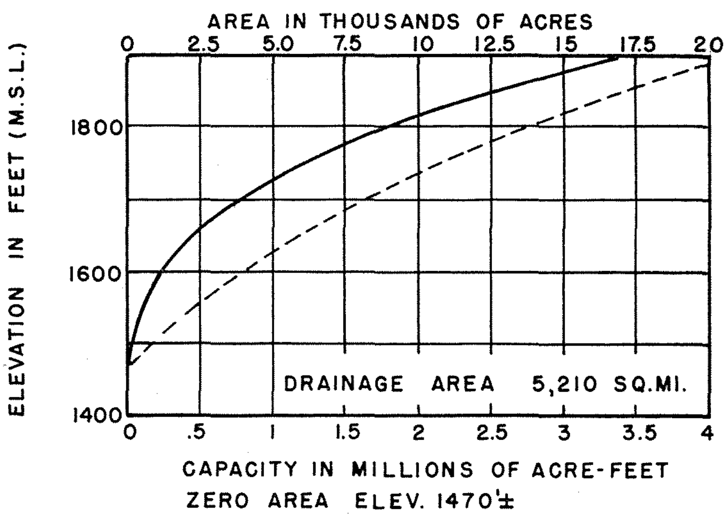
Theoretical reservoir and power plant operation studies were made for most individual sites included in the plan of ultimate development, as well as for many of those which were rejected. Stream runoff previously estimated was used in these studies. Reservoir capacity curves were based on the best topographic maps available, which in most cases were inadequate. Reservoir releases were made only for power production. These releases would not only be sufficient to maintain the existing fishery development, but would



DENALI



VEE



WATANA

AREA & CAPACITY CURVES

CAPACITY ————

AREA - - - - - - - -

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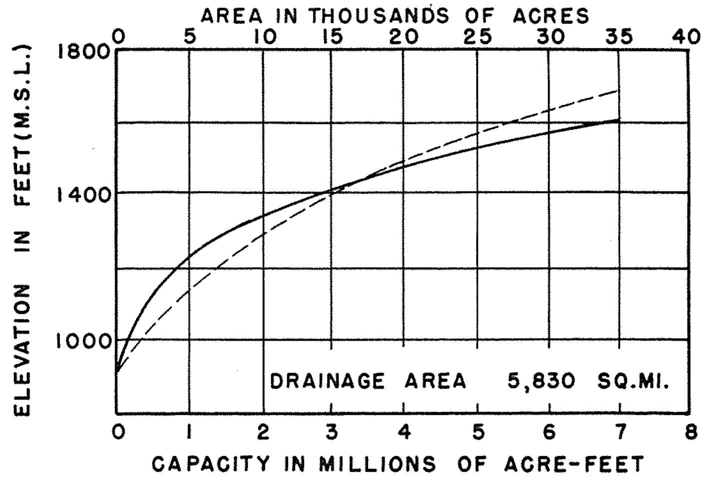
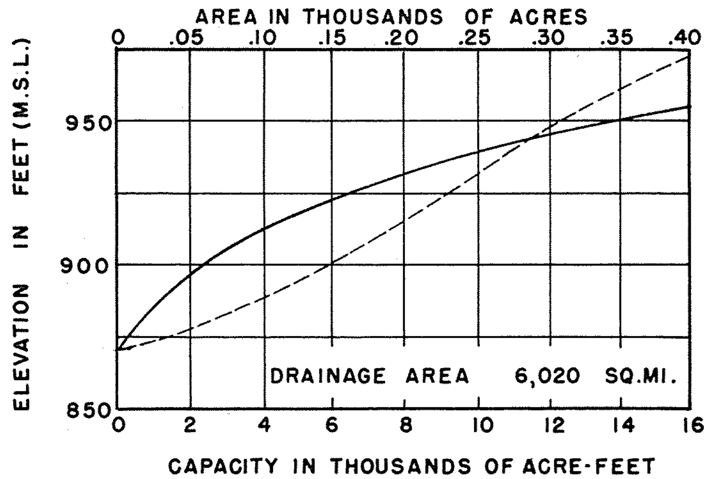


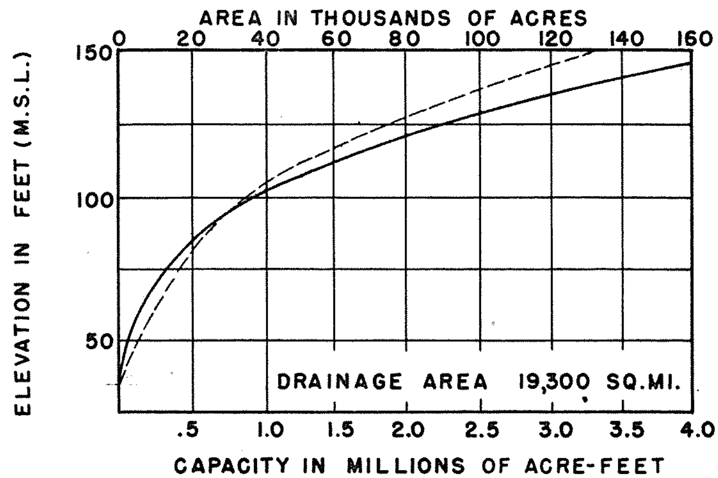
ZERO AREA ELEV. 925'±

DEVIL CANYON



ZERO AREA ELEV. 870'±

OLSON



ZERO AREA ELEV. 40'±

SUSITNA STATION

AREA & CAPACITY CURVES

CAPACITY————

AREA - - - - - - - - - -

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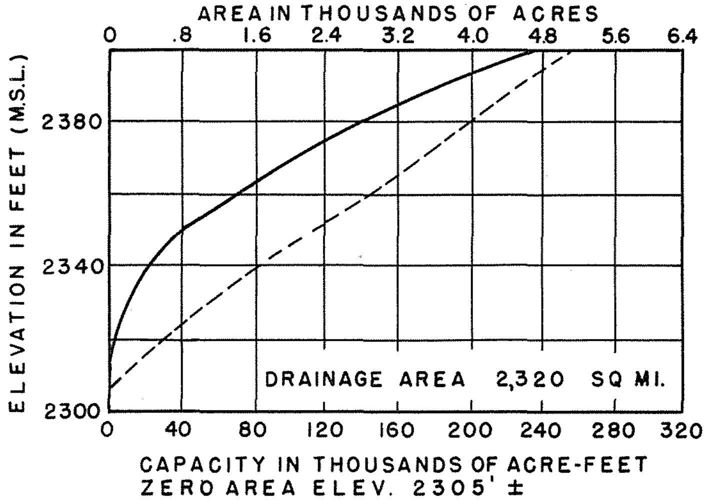
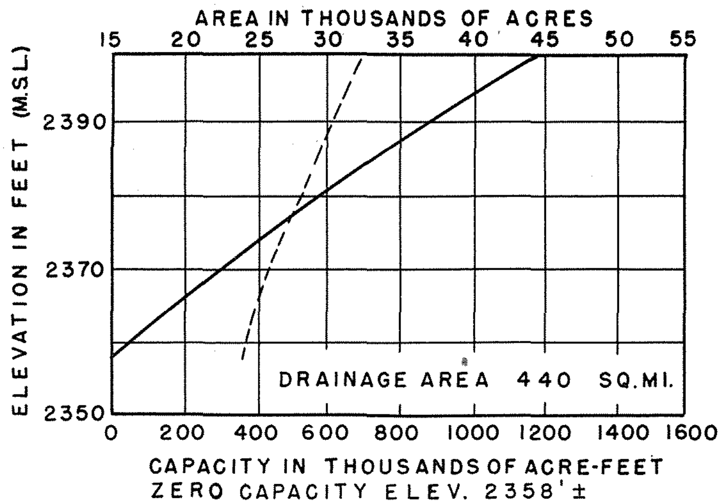
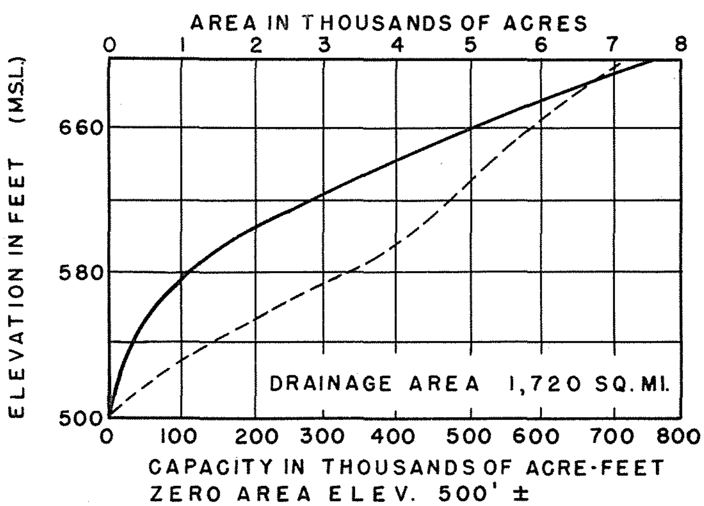


MACLAREN



TYONE



TALKEETNA

AREA & CAPACITY CURVES

CAPACITY ————

AREA - - - - - - - - -

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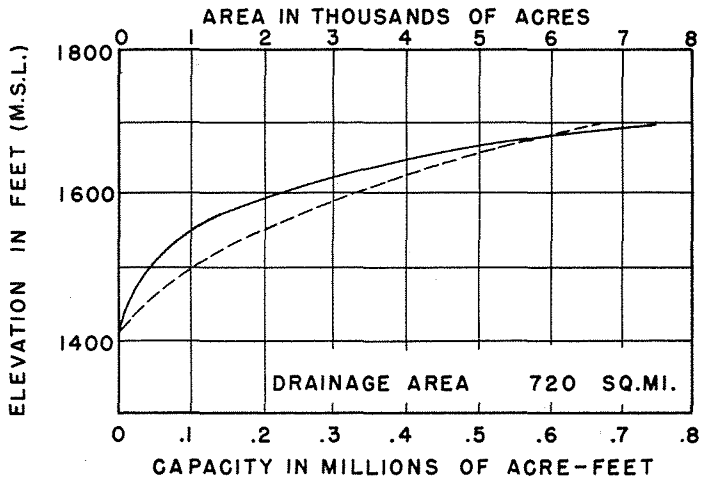
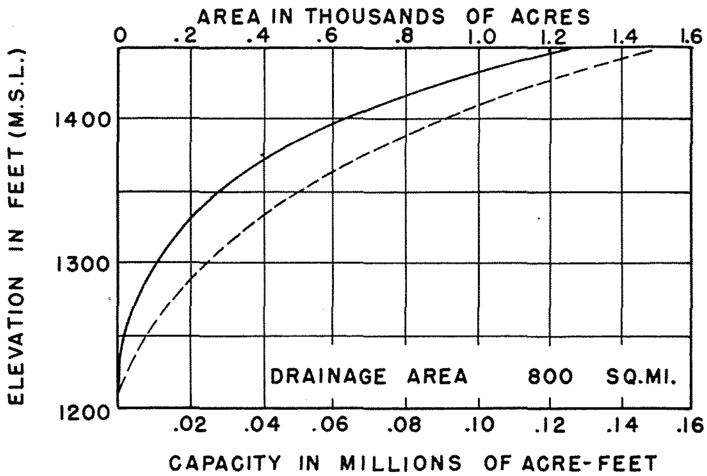


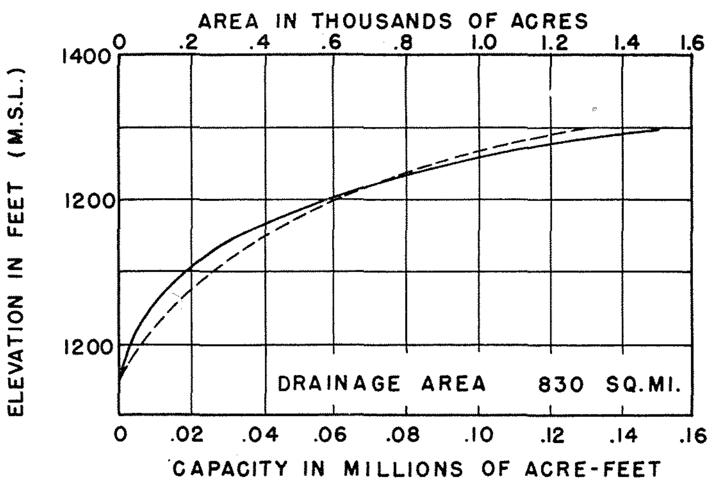
ZERO AREA ELEV. 1410'±

TRAPPER



ZERO AREA ELEV. 1210'±

GREENSTONE



ZERO AREA ELEV. 940'±

GRANITE GORGE

AREA & CAPACITY CURVES

CAPACITY ————

AREA - - - - - - - -

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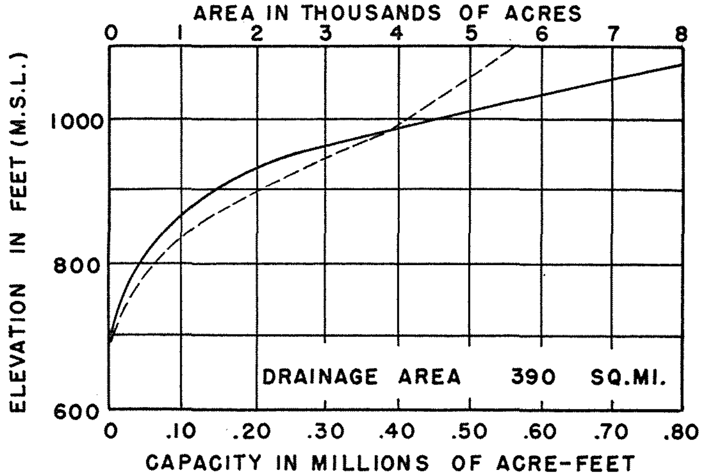
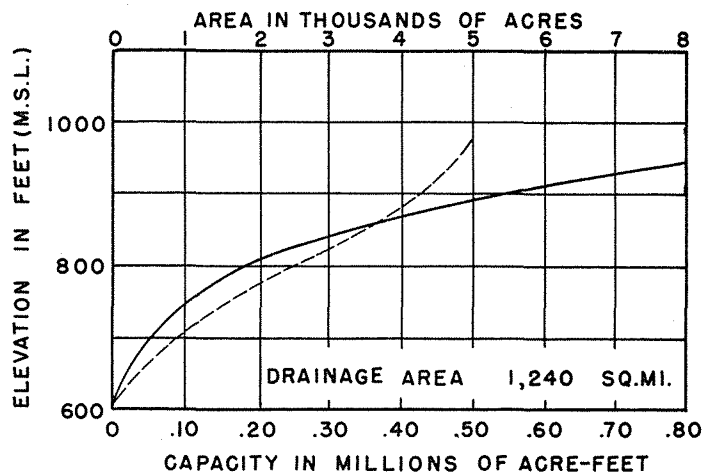


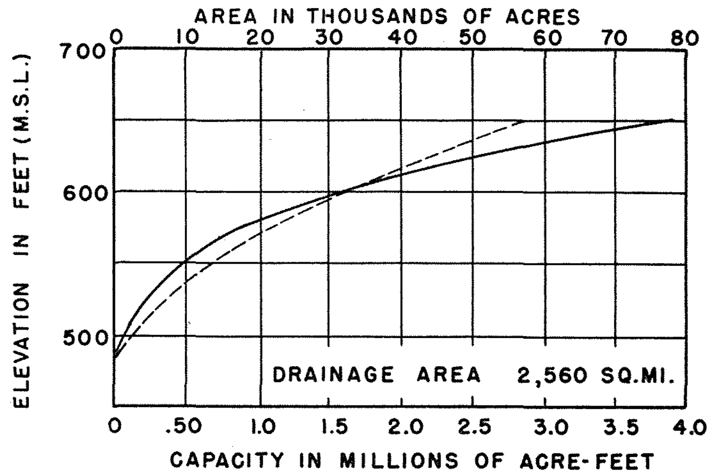
ZERO AREA ELEV. 690'±

SHEEP RIVER



ZERO AREA ELEV. 605'±

KEETNA



ZERO AREA ELEV. 485'±

TOKICHITNA

AREA & CAPACITY CURVES

CAPACITY ————

AREA - - - - - - - -

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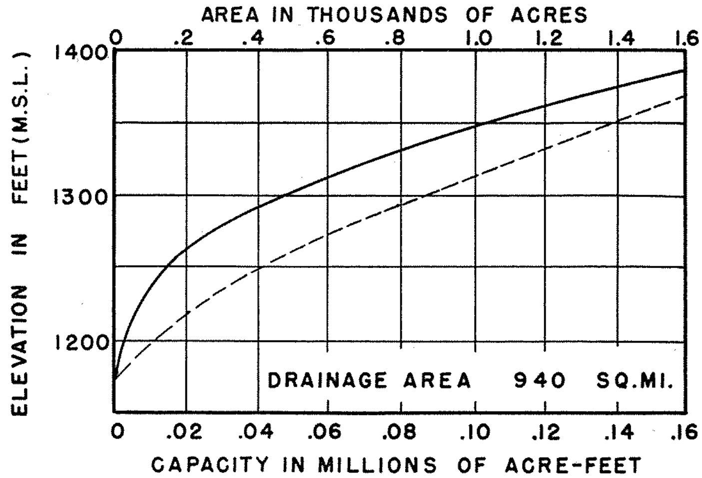
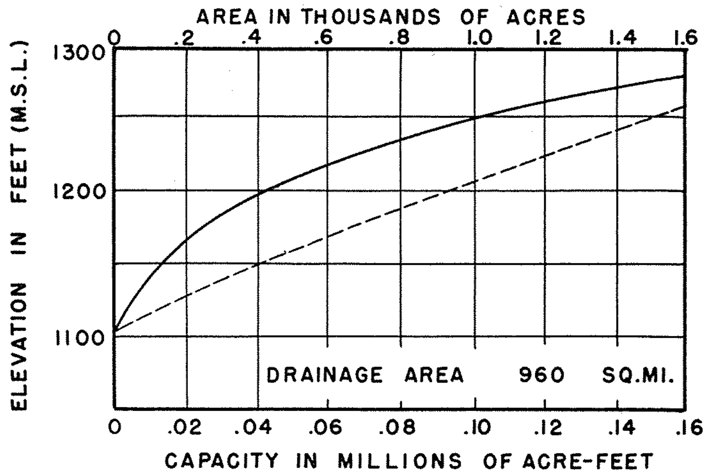


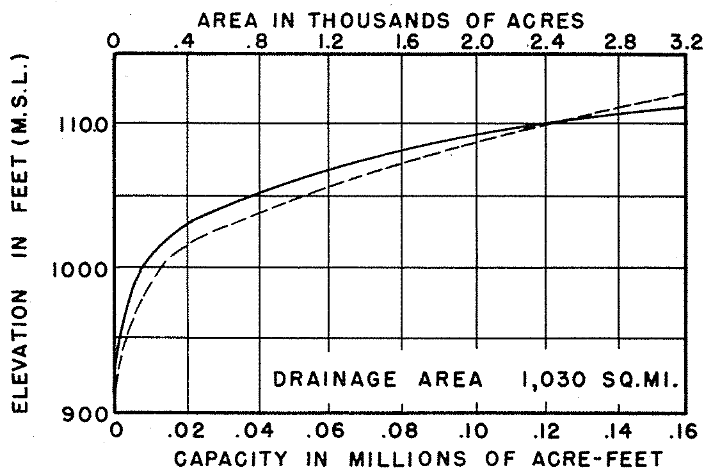
ZERO AREA ELEV. 1175'±

CHULITNA



ZERO AREA ELEV. 1105'±

PARTIN



ZERO AREA ELEV. 915'±

LUCY

AREA & CAPACITY CURVES

CAPACITY ————————

AREA - - - - - - - - - -

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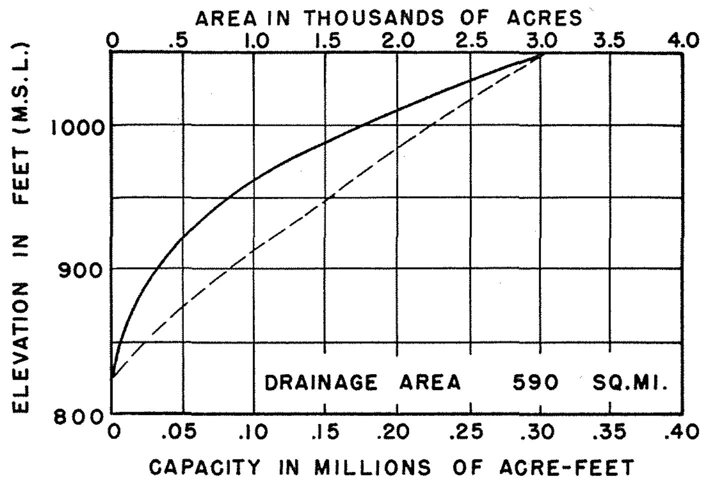
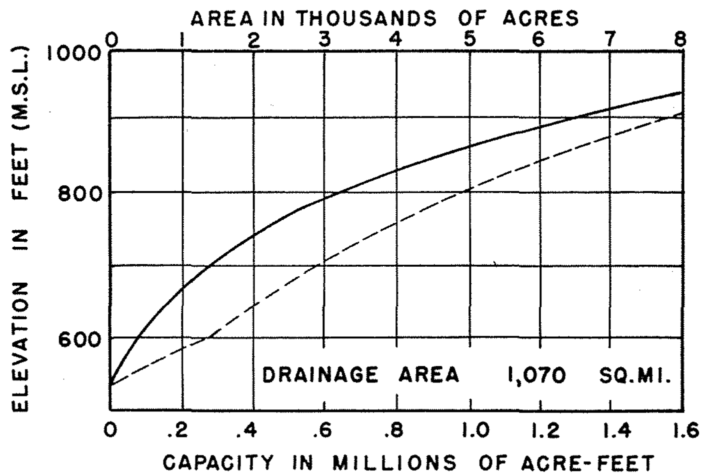


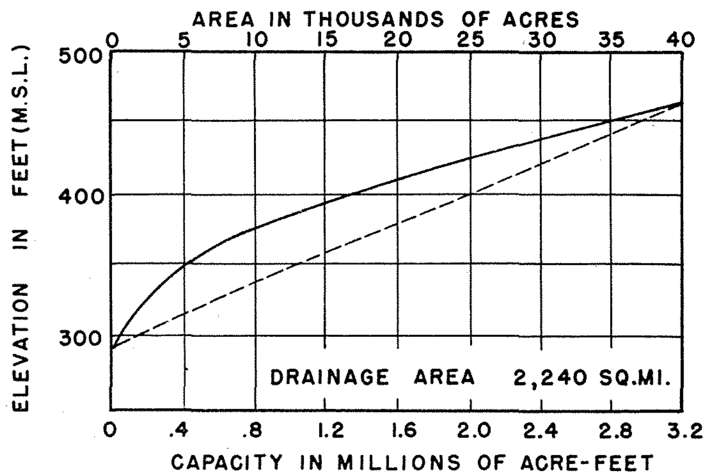
ZERO AREA ELEV. 825'±

SKWENTNA NO.1



ZERO AREA ELEV. 535'±

SKWENTNA NO.2



ZERO AREA ELEV. 290'±

TALACHULITNA

AREA & CAPACITY CURVES

CAPACITY ————

AREA - - - - - - -

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probably benefit fish life. Potential multiple-purpose operation has not been studied in sufficient detail to determine the conditions under which releases should be made for other uses.

Annual firm energy output was distributed equally to each month. Energy output calculated in operation studies was reduced 5 percent to allow for possible inaccuracies in reservoir capacity, sediment deposition, runoff forecasts, and plan of operation. Unadjusted energy output and a plant factor of 60 percent were used to determine power plant capacities.

Theoretical operation studies were first made for each reservoir and power plant separately, assuming there was no upstream use or regulation. Each study covered the critical period of operation, considering reservoir inflow and active storage capacity. For most sites, several operation studies were performed with various active reservoir capacities. At each site, cost of energy calculated for various dam heights, together with evaluation of other data, resulted in an approximate economic dam height. These preliminary studies indicated that some sites should be excluded from the plan of ultimate development at least for the present time, because of high cost of energy.

Coordinated operation studies were then made for the remaining reservoirs and power plants, where two or more potential projects were on one stream, or an independent section of a stream. Combinations of reservoirs were varied to obtain maximum output for minimum cost. One of these coordinated studies was of the proposed initial development of Devil Canyon Reservoir and power plant with the upstream supplemental storage of Denali Reservoir. These coordinated operation studies may not have resulted in the maximum possible feasible output for the various combinations of reservoirs. Other criteria or plans of operation might increase the energy output of the system. However, the results are reasonably accurate, and potential output should equal or exceed the figures which are shown.

Design Flood Studies

Envelope curves were prepared for use in estimating spillway design floods and diversion requirements during construction. Maximum recorded peak discharges of all Interior Alaska streams were used to define the basic curve. The period of record on all of these streams, except one, is 5 years or less. This period is too short to provide a satisfactory estimate of peak floods. Therefore, results of the inflow design flood study for

Eklutna project, Alaska, were used to adjust the basic curve to obtain conservative estimates of inflow design floods and diversion requirements during construction at each dam site. Spillway design floods were assumed equal to inflow design floods read from the curve. No attempt was made to route floods through reservoirs or to correct for flood regulation which might be available at previously constructed upstream reservoirs.

POTENTIAL POWER DEVELOPMENT

The first portion of this section includes a discussion of potential development at each site with no upstream development or regulation. The geology and engineering features of each site are described, and the potential energy output and approximate energy cost are listed where applicable. Some sites were eliminated from further consideration solely on the basis of the field examination. These sites are mentioned and the reason for their rejection is discussed. A complete discussion is included for those sites which were rejected from the plan of ultimate development on the basis of detailed studies.

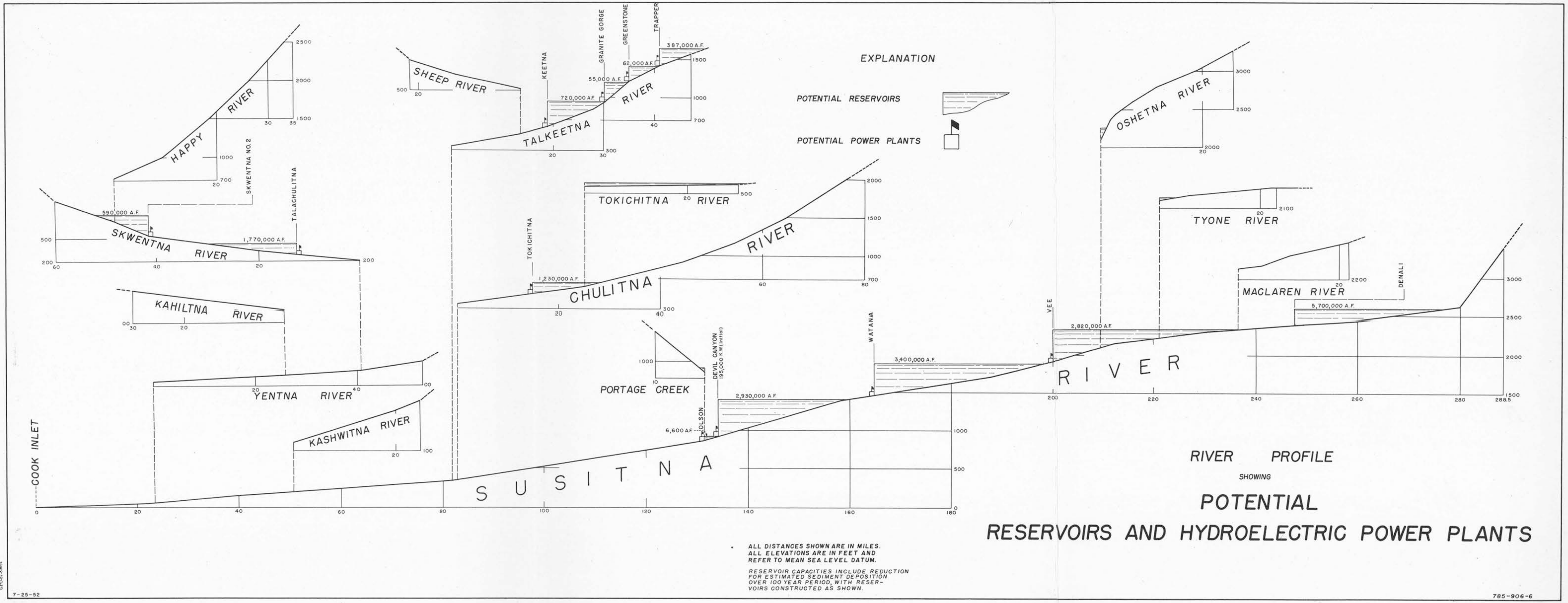
The second portion of this section discusses the plan of ultimate development. Included is the combination of projects on each stream or independent section of a stream which should produce the largest output for the least cost. Many possible combinations of projects were not studied in detail. As power needs expand in the Railbelt, much more study can be given to programing the expansion of generating facilities.

The Basin contains many sites where hydropower installations of about 5,000 kilowatts or less would be possible. These are so numerous that no attempt was made to examine or list them. The projects which have been studied include all the major power sites in the Basin.

Independent Site Development

The main stem of the Susitna River heads in two large glaciers on the south slope of the Alaska Range, 284 miles from its mouth at Cook Inlet. The river flows south for several miles in a broad, braided channel with a low gradient.

Butte Creek Site.--At river mile 262, above the mouth of Butte Creek, this site offers the first favorable topography for a dam. The stream bed narrows to 300 feet and the banks rise 100 feet above the water. However, glacial silts on the right



RIVER PROFILE

SHOWING

POTENTIAL RESERVOIRS AND HYDROELECTRIC POWER PLANTS

- ALL DISTANCES SHOWN ARE IN MILES. ALL ELEVATIONS ARE IN FEET AND REFER TO MEAN SEA LEVEL DATUM.

RESERVOIR CAPACITIES INCLUDE REDUCTION FOR ESTIMATED SEDIMENT DEPOSITION OVER 100 YEAR PERIOD, WITH RESERVOIRS CONSTRUCTED AS SHOWN.

abutment are very fluid and are unsuitable for a dam foundation. This removal would be very expensive. This site was rejected in favor of the Denali site, which has a better foundation for a dam and a larger reservoir capacity. Denali Reservoir would inundate Butte Creek site.

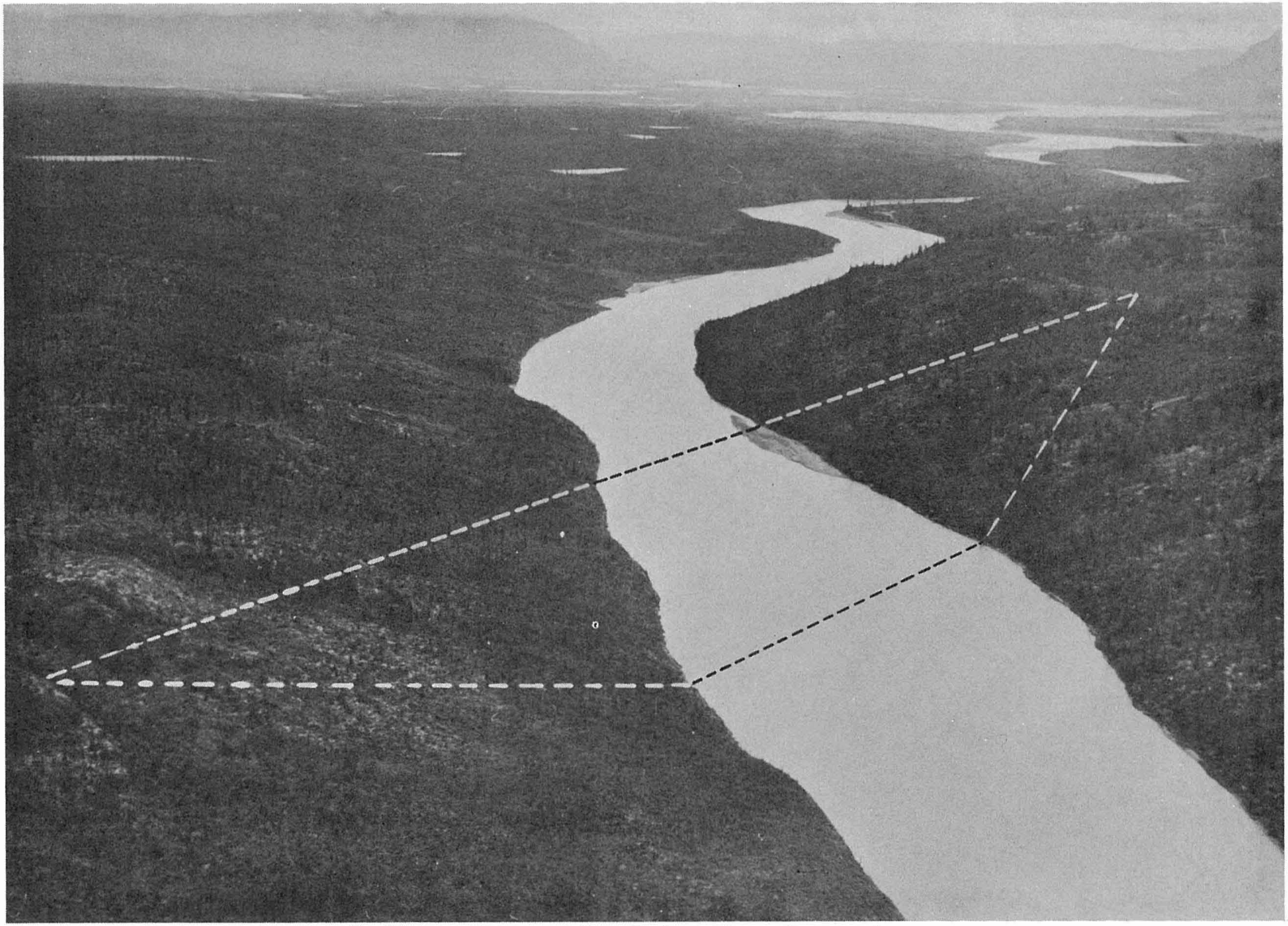
Denali Site.--Below Butte Creek the river returns to its broad, low-gradient channel, which it maintains to river mile 251. Here the stream bed narrows and the abutments become more pronounced. Denali dam site, named for an abandoned gold town formerly situated in the reservoir basin, is located at mile 248.

The abutments at this site are made up primarily of glacial till, a heterogeneous mixture of clay, silt, sand, and gravel. The site may afford a good foundation for an earth dam. The topography of the site is such that water seeping around the abutments would follow a rather long path of percolation to reach the channel downstream. An extensive geologic investigation program, including extensive sampling of undisturbed materials and adequate percolation tests, would be necessary to prove that there are no extremely soft clays or silts nor pervious layers of sand or gravel in the abutments. Permafrost conditions, if present in the foundation, will cause some construction difficulties.

Earth materials for the dam would probably be borrowed selectively, and processed from glacial till adjacent to the site. An extensive investigation program to locate suitable materials would be necessary prior to construction. Riprap for the faces of the dam could be obtained from Denali Peak, 15 miles northeast. A veneer of clean gravel appears to be located on the left bank from the stream bed to a height of 300 feet. This deposit, though probably not deep, would provide satisfactory aggregate for concrete structures, as well as additional pervious material for the dam.

Denali Dam would be limited to a height of about 205 feet by the topography of the left abutment. A gated spillway channel would be constructed several hundred feet west of the dam. Water passing over the spillway would enter existing lakes and return through natural drainage to the main stream a few miles below the dam.

The main function of Denali Reservoir would be to provide regulated releases as required for power generation at downstream plants. A large active reservoir capacity would be needed for hold-over storage as well as for annual regulation. Preliminary reservoir operation studies indicate that there might be periods



Looking upstream at Denali dam site and reservoir area.

GPO-87-8046

of several month during which there would be no releases, or reservoir heads would be low. Therefore, no power plant has been considered at this site. More detailed studies might indicate that a small power plant would be desirable. Outlet works would be constructed to release water for downstream use.

The reservoir formed by Denali Dam would be 29 miles long, extending almost to the headwater glaciers. Total reservoir capacity would be 6,700,000 acre-feet. A large portion of the glacial outwash, which is now deposited in the flat stream channel below the glaciers, would settle in the upper end of the reservoir. One million acre-feet of reservoir space should be reserved for estimated sediment deposition over a 100-year period.

Data for Denali site are as follows:

Type of dam: Earth
Height above stream bed: 205 ft.
Crest length: 1,900 ft.
Stream bed elevation: 2,390 ft.
Minimum reservoir elevation: 2,390 ft.
Maximum reservoir elevation: 2,590 ft.
Power storage capacity: 5,700,000 ac.-ft.
Average annual runoff; 1,650,000 ac.-ft.
Estimated dam cost: $80,000,000
(Power plant installation not anticipated.)

Maclaren Site.—Maclaren River, which heads at Maclaren Glacier, joins Susitna River 12 miles below Denali dam site. Six miles below the confluence, at river mile 230, bedrock outcrops are seen in the stream channel for the first time. The very resistant granitic rock would be an excellent foundation for a dam. The rock bluffs are about 15 feet high and are covered with glacial till and a veneer of fluvial-glacial sands and gravels. The abutments extend out from the stream on a rather flat slope.

A dam at the Maclaren site would be an earth and concrete structure not more than 100 feet high. The concrete river section would be used for an overflow spillway.

Total reservoir capacity would be 210,000 acre-feet, of which at least 52,000 acre-feet should be reserved for sediment deposition. The net storage capacity would provide only slight regulation of inflow below Denali Dam. Using releases from Danali Reservoir, output of a power plant might be coordinated with other Susitna River power operations. However, present plans consider flooding his dam site with water impounded by a high dam at a downstream site. Should plans for this high dam be abandoned in favor of a lower structure, further consideration should be given to possible development of the Maclaren site.

Pertinent data for this site are as follows:

Type of dam: Combination earth and concrete
Height above stream bed: 100 ft.
Crest length: 2,300 ft.
Stream bed elevation: 2,305 ft.
Maximum reservoir elevation: 2,395 ft.
Average annual runoff: 2,910,000 ac.-ft.

This site was not included in plan of ultimate development.

Vee Site.--Below Maclaren dam site, the river valley is U-shaped, with low banks composed of glacial till. The stream gradient increases below the mouth of Tyone River, and rock outcrops appear. About 9 miles below the mouth of Oshetna River, the river enters a 2-mile rock canyon.

Vee dam site, which takes its name from the V-shaped cross section of the canyon, is located about midway in this canyon at river mile 200. The hard granite walls extend 500 feet above the stream bed and would provide a sound foundation for any type of dam. A rather large fault located upstream is not expected to cross the dam site. The rock next to this fault is very complex, being folded, extensively metamorphosed, and intruded by dark-colored dikes.

The major investigation and construction problems at this site would be connected with a saddle along the extension of the left abutment. Low point in the saddle is 350 feet above the river bed. Depth of the sand which appears on the surface and depth to bedrock are unknown. Extensive geologic investigation would be necessary to determine depth to bedrock, character of the bedrock, and rates of percolation through the overburden material under various reservoir heads. For a high dam in the canyon section, a large earth dam would probably be required in the saddle, with a positive cut-off to bedrock. For a main dam less than 350 feet high, possibly no construction work would be necessary at the saddle.

Hard, dense, and durable natural concrete aggregate is readily accessible 1 mile downstream from the dam site. Suitable earth materials for construction of an earth dike in the saddle could

Looking upstream at Vee dam site and reservoir area.

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likely be found both upstream and downstream from the saddle. Impervious material could be obtained by selective borrowing from the glacial till just south of the saddle.

Preliminary studies, assuming conservative geological conditions in the saddle, indicate that the economical height of a dam at the Vee site would be about 425 feet. Canyon topography is favorable for a much higher dam, but the cost of the saddle dike might become a larger portion of the total when conditions at the saddle become known, the economic height should be reanalyzed. The height is limited to about 480 feet by the divide between Susitna River Basin and Copper River Basin in the Lake Louise area at the head of Tyone River. The dam would be a concrete arch-gravity structure with the power plant located at the toe. An overflow spillway could terminate in a ski-jump bucket on top of the powerhouse.

The reservoir would extend to the mouth of Maclaren River, a distance of 36 miles. Total capacity would be 2,820,000 acre-feet. Reservoir operation studies of Vee Reservoir were made only with upstream regulation at Denali Reservoir. Sediment deposition in Vee Reservoir would be small under this condition. If the project were constructed without upstream regulation, an estimated 400,000 acre-feet of space should be reserved for sedimentation.

Data for the Vee site are listed below. No data are given for the dike, as too little is known of the subsurface conditions.

Type of dam: Concrete, arch-gravity
Height above stream bed: 425 ft.
Crest length: 1,400 ft.
Stream bed elevation: 1,915 ft.
Minimum reservoir elevation: 2,175 ft.
Maximum reservoir elevation: 2,330 ft.
Power storage capacity: 2,150,000 ac.-ft. (with no reservation for sediment deposition)
Average annual runoff: 4,420,000 ac.-ft.

Development for coordinated operation with other Susitna River power plants is discussed later in this chapter.

Watana Site.--Downstream from Vee dam site the river channel changes from a narrow, steep-walled canyon to a generally


Looking upstream at Watana dam site and reservoir area.

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broad, U-shape. This topography continues for about 35 miles, with a slight narrowing at Watana dam site at river mile 165.

The rock at this site is sound, hard, coarse-grained granite. The site appears excellent from a geologic standpoint, and no foundation deficiencies were observed. Hard, dense, and durable concrete aggregate is available in the form of stream gravels both upstream and downstream from the site.

The steep, rugged canyon is not considered suitable for construction of an earth dam, although one could possibly be built. If Watana site were considered for an earth dam, extensive exploration for embankment materials would be necessary. Impervious materials might be found in the reworked glacial till on the slopes above the abutments. Pervious and semipervious materials could probably be found in gravel bars in the stream channel.

Watana site is suitable for either a straight-gravity or an arch-gravity dam. A dam of either type would have a gated overflow spillway. The power plant would be located at the toe of the dam near the right abutment. The river could be diverted through the dam during construction, as the canyon is more than 400 feet wide at the bottom.

Total reservoir capacity would be 3,400,000 acre-feet. The reservoir would extend upstream 33 miles almost to Vee site. Reservoir operation studies of Watana Reservoir were made only with upstream regulation. If the project were constructed without upstream regulation, an estimated 400,000 acre-feet of space should be reserved for sediment deposition.

Pertinent data for the Watana site are summarized below:

Type of dam: Concrete, straight-gravity or arch-gravity
Height above stream bed: 440 ft.
Crest length: 1,650 ft.
Stream bed elevation: 1,470 ft.
Minimum reservoir elevation: 1,740 ft.
Maximum reservoir elevation: 1,900 ft.
Power storage capacity: 2,340,000 ac.-ft. (with no reservation for sediment deposition)
Average annual runoff: 5,410,000 ac.-ft.

Development for coordinated operation with other Susitna River power plants is discussed later in this chapter.

Devil Creek Site.--Downstream from Watana dam site the canyon presents many possible sites. Devil Creek site, at river mile 143 just below the mouth of Devil Creek, has a minimum width at river level. This site is favorable for a low dam but becomes very wide as the height increases. The right abutment would restrict the height of a dam to about 350 feet, which would back water up to Watana site. The canyon walls are sound, granitic rock and are suitable for a concrete dam.

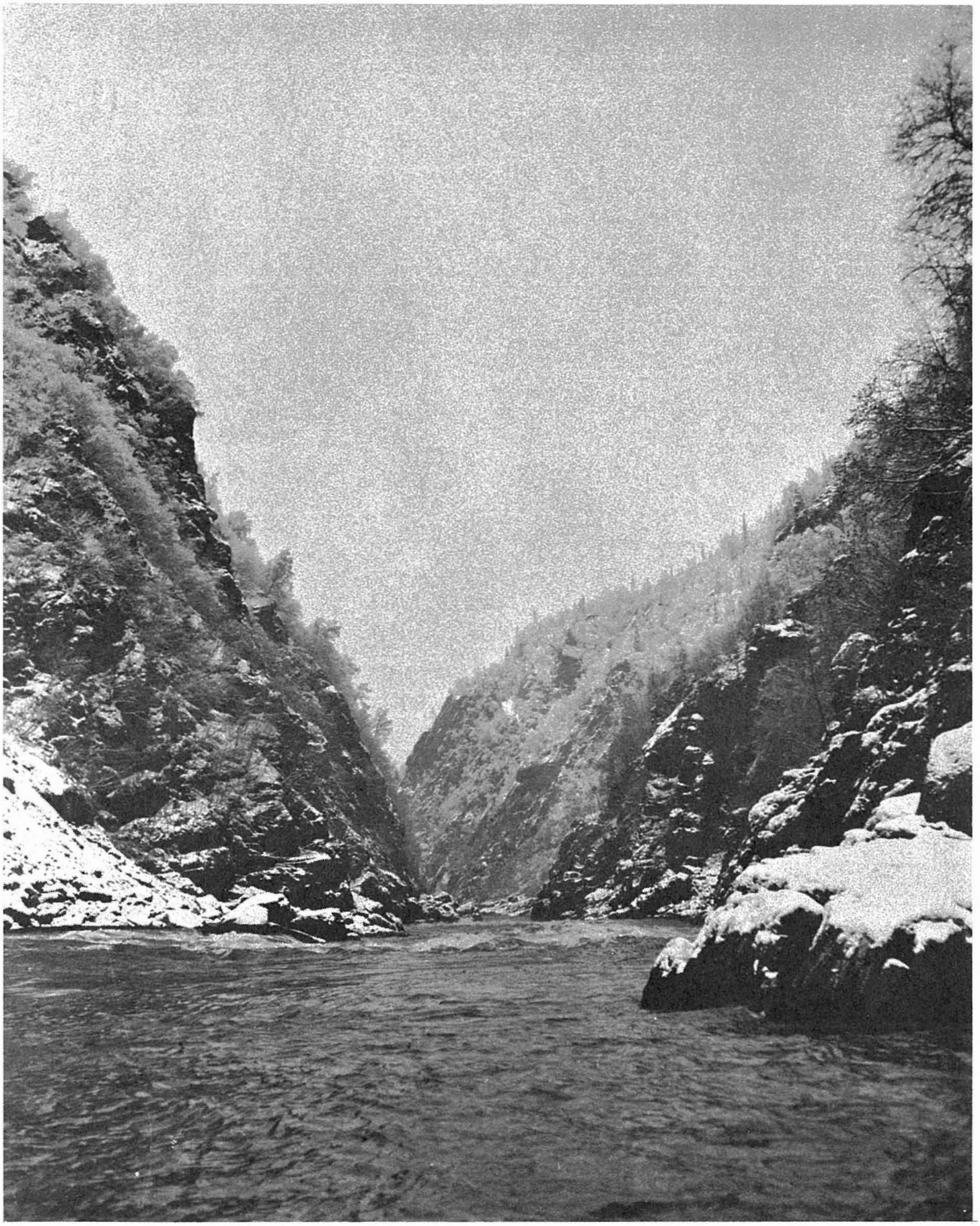
Construction of a dam at this site would eliminate a high dam at the Devil Canyon site 9 miles downstream, as the difference in elevation is only 150 feet. Preliminary studies show that the site further downstream is better for development than either the upper site or a combination of the two. Therefore, Devil Creek site has been excluded from the plan of ultimate development.

Devil Canyon Site.--Several miles below Devil Creek site, the Susitna River enters a narrow, steep-walled section known as Devil Canyon. Located at river mile 134, this site has been selected for initial development in the Susitna River Basin.

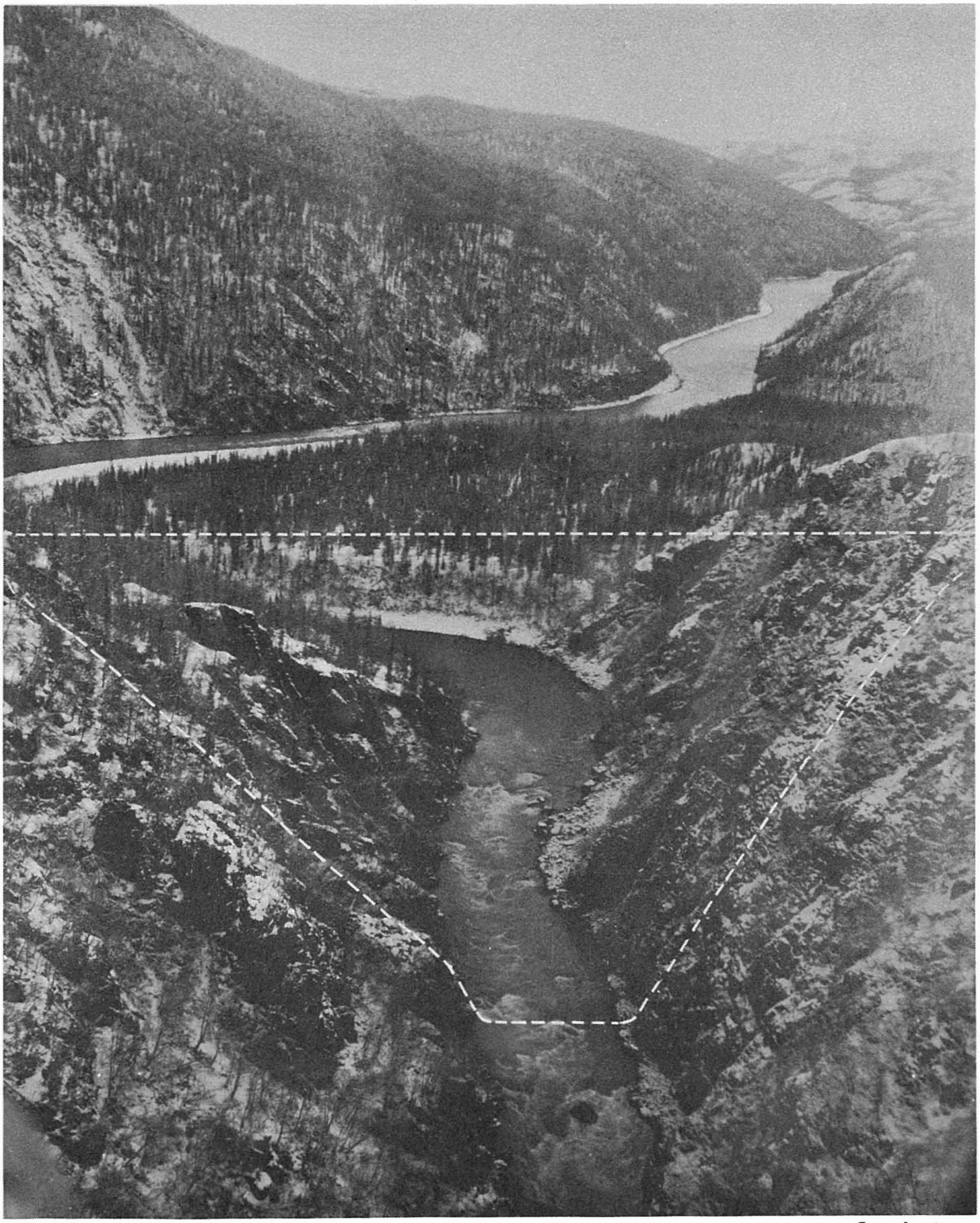
The Canyon walls rise more than 500 feet above river level. The rock at this site consists of a very hard, tough, metamorphosed, argillitic rock, which has been intruded by granitic dikes. The dam site appears to be excellent from a geologic standpoint. A fault zone one-half mile upstream does not directly cross the dam site. Investigation must determine whether or not there are offshoots of this fault. Special care would be required at the intake of the diversion tunnel, which will be close to the fault. Considerable exploration would be required to determine foundation conditions at the spillway site in a small saddle on the left abutment. Suitable natural concrete aggregate is located in sufficient quantity just upstream from the dam site.

Devil Canyon Dam would be a concrete, arch-gravity structure. Economic studies indicate that the dam should be about 500 feet high. The crest would be about 1,100 feet long. The stream channel is 150 feet wide.

The spillway would be located in a slight depression in the extension of the left abutment. It would be a concrete,



Looking downstream toward Devil Canyon dam site.



Looking upstream toward Devil Canyon dam site. Concrete aggregate on flat just upstream of site.

straight-gravity, overflow section with control gates. Spills would discharge into a downstream side canyon, which would return the water to Susitna River.

The powerhouse would extend along the right bank of the river, starting at the toe of the dam. A temporary diversion tunnel would be driven through the right abutment. The penstock intake would be above the diversion tunnel and connected to it through an inclined shaft. The shaft would be concrete-lined and have an inner metal liner which would continue through the diversion tunnel, terminating with feeder lines into the power plant. The diversion tunnel would be plugged with concrete above its connection with the inclined shaft. A gatehouse structure located downstream from the penstock intake would regulate inflow to the penstock.

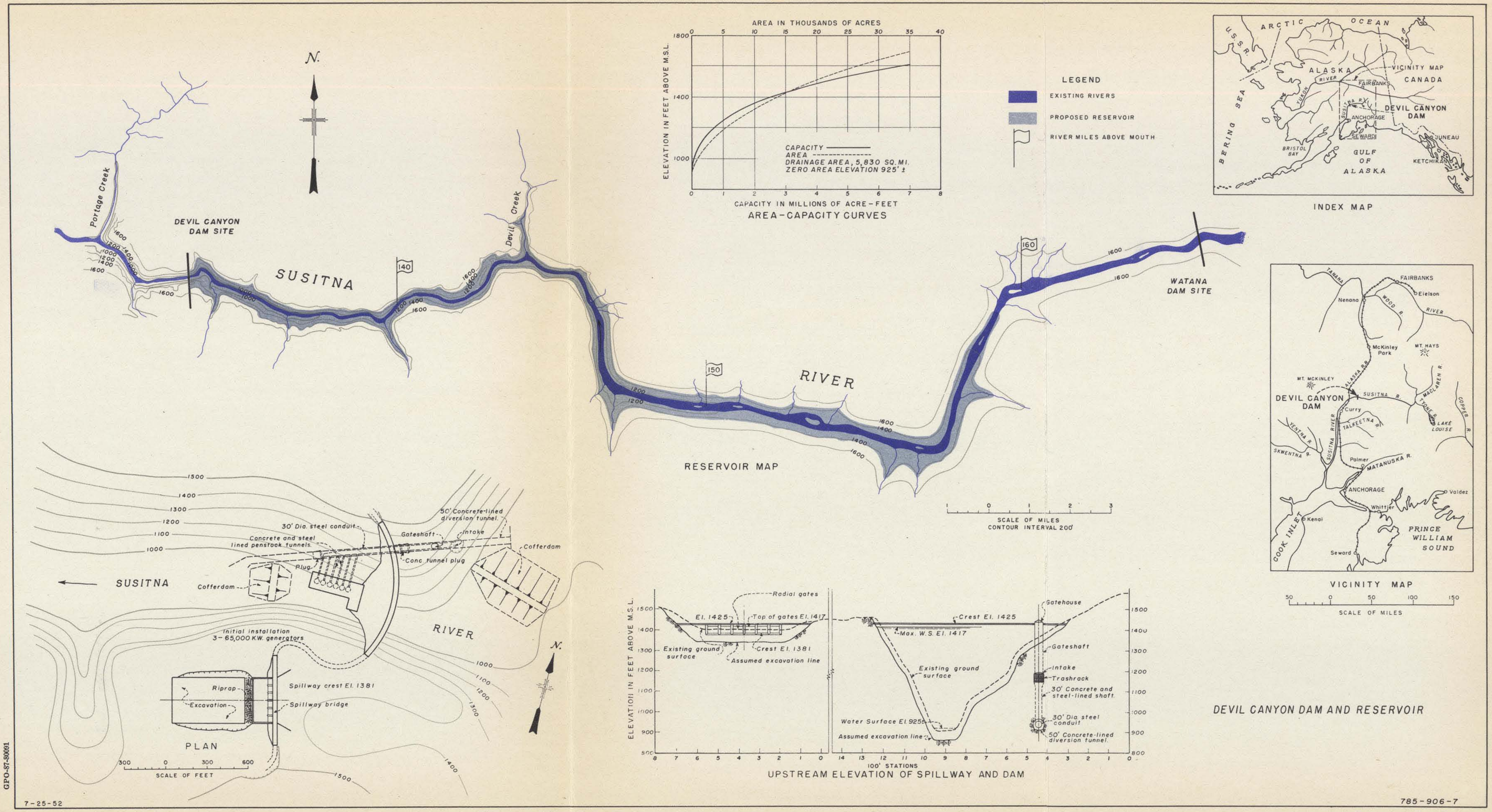
Devil Canyon Reservoir would be 25 miles long, extending almost to Watana dam site. Total capacity would be 2,930,000 acre-feet. With no upstream regulation, 400,000 acre-feet of space should be reserved for sediment deposition.

Data for Devil Canyon site, without benefit of any storage at upstream reservoirs, are as follows:

Type of dam: Concrete, arch-gravity
Height above stream bed: 500 ft.
Crest length: 1,100 ft.
Stream bed elevation: 925 ft.
Minimum reservoir elevation: 1,205 ft.
Maximum reservoir elevation: 1,417 ft.
Power storage capacity: 1,950,000 ac.-ft.
Average annual runoff: 6,080,000 ac.-ft.
Power Plant capacity: 232,000 kw.
Annual energy output:
    Firm: 1,150,000,000 kw.-hr.
    Average nonfirm: 180,000,000 kw.-hr.
Approximate energy cost at site:
    Less than 10 mills per kw.-hr.

A larger development for coordinated operation with other Susitna River power plants is discussed later in this chapter.

Olson Site.--In the next 3 miles below Devil Canyon dam site, the Susitna River falls about 55 feet. At river mile 131, just below the mouth of Portage Creek, Olson dam site is the last



DEVIL CANYON DAM AND RESERVOIR

constricted canyon on the main stream. The rounded abutments are hard, sound graywacke, which would provide a good foundation for a low, concrete dam.

The dam would be a straight-gravity structure and would raise the water surface 50 feet. The water depth is limited to this amount because of Devil Canyon site upstream, which is a more desirable site for a high dam. The spillway would be a gated overflow section and would occupy most of the crest length. The power plant would be located on the right bank adjacent to the toe of the dam. The penstock would be installed in the temporary diversion tunnel.

The dam would impound only 6,600 acre-feet of water. Backwater would extend nearly to Devil Canyon dam site. Because of the lack of storage capacity, no independent study was made for this power plant.

Data pertinent to the Olson site are as follows:

Type of dam: Concrete, straight-gravity
Height above stream bed: 60 ft.
Crest length: 400 ft.
Stream bed elevation: 870 ft.
Minimum reservoir elevation: 920 ft.
Maximum reservoir elevation: 920 ft.
Power storage capacity: ---
Average annual runoff: 6,310,000 ac.-ft.

Development for coordinated operation with other Susitna River power plants is discussed later in this chapter.

Gold Creek Site.--Gold Creek dam site is at river mile 123 in a broad section comparable to many sites in the Missouri River Basin. The abutments are rock. Depth to bedrock below the stream bed is unknown; borings for the Gold Creek bridge 3 miles downstream, indicate that it is more than 70 feet. Foundation exploration and preparation would be a major problem in constructing an earth dam at this site. A cut-off to bedrock might be very deep. An earth filter might obviate extending the dam or a cut-off to bedrock. Suitable embankment materials might be difficult to obtain. Pervious and semipervious materials could be obtained in the river bed. Selective borrow from the glacial till on the plateaus above the river would provide impervious material for the core of a dam.

An earth dam 135 feet high at the Gold Creek site would back water up to Olson dam site. The dam would be almost 4,900 feet long at the crest. A spillway and a power plant could be constructed below the dam along either abutment.

Future investigation of this site should include a study of possible power development by diversion from Chulitna River, which is more than 300 feet above Susitna River at the Gold Creek site. Water could be diverted through a 5.4-mile tunnel into Indian River and thence through a 1.9-mile tunnel into Gold Creek Reservoir. This plan would be complicated by lack of adequate reservoir capacity on Chulitna River after allowances for silt deposition.

Gold Creek site was not included in the plan of ultimate development because of the uncertain foundation conditions and probable excessive cost of an adequate structure.

Tyone Site.--Tyone River is the uppermost tributary of the Susitna River which contains a dam and reservoir site. The stream drains part of the plateau between the Susitna and Copper Rivers, which is made up largely of glacial till and outwash materials. The dam site is located at the outlet of a series of three large lakes. The glacial till at the dam site should be adequate to support a low, earth dam, although subsurface investigations would be required to determine the character of the overburden on the abutments. Suitable material for earth embankment could be found within the glacial deposits.

An earth dam only 35 feet high has been considered because available topography is inadequate to establish the exact elevation of the divide to Copper River drainage. The dam would have gated, concrete outlet works and would impound 700,000 acre-feet. There are no glaciers above the dam site, and the sedimentation problem would be minor.

The purpose of Tyone Reservoir would be to regulate release of water to downstream power plants. There would be no power plant at the dam. However, Denali Reservoir would provide enough regulation to eliminate the need for Tyone Reservoir. This site was considered as an alternate to Denali. The following table summarizes data for Tyone site:

Type of dam: Combination earth and concrete
Height above stream bed: 35 ft.
Crest length: 500 ft.

Stream bed elevation: 2,358 ft.
Minimum reservoir elevation: 2,358 ft.
Maximum reservoir elevation: 2,385 ft.
Power storage capacity: 700,000 ac.-ft.
Average annual runoff: 222,000 ac.-ft.

This site was not included in plan of ultimate development.

Chulitna Site.--Chulitna River drains the southern slope of the Alaska Range in Mount McKinley National Park and flows south to join Susitna River near the town of Talkeetna. The Basin contains 2,620 square miles, of which an estimated 330 square miles are covered by glaciers.

Chulitna dam site is the farthest upstream site, located 54 miles above the mouth of Chulitna River. Foundation conditions are definitely inferior. The foundation rock is primarily a soft, weak argillite, with an intrusion of greenstone. The site would probably be adequate for an earth dam, but suitable embankment materials might be hard to locate near the site.

Topography is adapted to construction of an earth dam 190 feet high. Such a dam would have a gated spillway along the left abutment. The 108,000 acre-feet of active reservoir capacity would be almost filled with sediment over a 100-year period. This site was not included in the plan of ultimate development, owing to this lack of power storage capacity, the poor foundation conditions, and the scarcity of suitable earth materials.

Partin Site.--Partin dam site is located 51 miles upstream from the mouth of Chulitna River. The rock is relatively sound argillite. A subsurface exploration program should prove the foundation conditions adequate for a concrete gravity dam or for an earth dam. It might be difficult to locate suitable earth materials, especially impervious embankment material.

A concrete dam 140 feet high could be built at this site. A dam this high would inundate the Chulitna site. The total reservoir capacity would be only 85,000 acre-feet, which would be entirely filled with sediment before the expiration of 100 years. This site was, therefore, not included in the plan of ultimate development.

Partin site would be the point of possible diversion from Chulitna River to Susitna River as discussed under Gold Creek Site.

Lucy Site.--Lucy dam site, on the Chulitna River 44 miles above its mouth, is in sound granite which would be adequate for any type of concrete dam. Sufficient concrete aggregate is available in the gravel bars adjacent to the site.

A dam built to maximum canyon height would be 200 feet high. Total reservoir capacity would be 131,000 acre-feet, of which 100,000 acre-feet should be reserved for estimated sediment deposition. The small remaining active storage capacity would permit operation of only a 6,500-kilowatt power plant. This small plant would not justify construction of a dam 200 feet high with a length of 700 feet and was, therefore, not included in the plan of ultimate development.

Tokichitna Site.--Tokichitna dam site is on Chulitna River 15 miles above its mouth. The site was named for Tokichitna River, the first major tributary above the dam site. It is the only site on Chulitna River included in the plan of ultimate development.

The foundation rock is primarily graywacke, interbedded with lesser amounts of argillite. The rock is hard and appears to be sound. The foundation would probably be adequate for either an earth or concrete dam. Large quantities of suitable concrete aggregate are available in the river gravels just upstream from the dam site.

The dam would be limited by the right abutment to a height of 150 feet. It would be a straight-gravity concrete structure, with a spillway located high on the left abutment. The power plant would be centrally located along the toe of the dam. A temporary tunnel to divert water during construction could best be located through the right abutment.

Total capacity of the reservoir would be 2,530,000 acre-feet. The extensive area of glaciers above the dam site would necessitate a large reservation for sediment deposition, estimated at 1,300,000 acre-feet. The reservoir would extend 13 miles up the Chulitna River and 32 miles above the mouth of the Tokichitna River.

Data pertaining to the Tokichitna site are listed below:

Type of dam: Concrete, straight-gravity
Height above stream bed: 150 ft.
Crest length: 650 ft.

Stream bed elevation: 485 ft.
Minimum reservoir elevation: 565 ft.
Maximum reservoir elevation: 625 ft.
Power storage capacity: 1,060,000 ac.-ft.
Average annual runoff: 3,670,000 ac.-ft.
Power plant capacity: 45,000 kw.
Annual energy output:
  Firm: 220,000,000 kw.-hr.
  Average nonfirm: 36,000,000 kw.-hr.
Approximate energy cost at site: Less than 10 mills per kw.-hr.

Trapper Site.--The Talkeetna River heads in the Talkeetna Mountains and flows westerly to the Susitna River, which it joins near the town of Talkeetna, a short distance below the mouth of Chulitna River. There are several small glaciers at the headwaters.

Trapper dam site, the uppermost site on Talkeetna River, is 41 miles above its mouth. The rock is extremely shattered, soft greenstone; even the best rock observed could be scratched by a knife blade. The site has undoubtedly been affected by a fault which crosses the left abutment and the river section. This fault is evidenced upstream by an iron-stained, extremely contorted schist in an extensively metamorphosed zone. This zone would affect the design and construction of a dam at this site. An extensive, as well as intensive, subsurface exploration program would be necessary to determine the relation of the metamorphosed zone to the river section. The foundation is believed adequate only for an earth or rock-fill dam. Considerable difficulty might be encountered in locating impervious materials for an earth dam. Suitable rock was not found, although further investigation might prove its presence within an economic distance.

The dam would be 250 feet high, with a concrete spillway located along the right abutment. A temporary diversion tunnel through the right abutment would be finally used for the penstock tunnel. The power plant would be located on the right bank below the dam; it would probably require a piling foundation.

The reservoir would be about 9 miles long. Total capacity would be 427,000 acre-feet, of which 40,000 acre-feet should be reserved for sediment deposition.

Data for the Trapper site are summarized as follows:

Type of dam: Earth or rock-fill.
Height above stream bed: 250 ft.
Crest length: 2,500 ft.
Stream bed elevation: 1,410 ft.
Minimum reservoir elevation: 1,550 ft.
Maximum reservoir elevation: 1,650 ft.
Power storage capacity: 305,000 ac.-ft.
Average annual runoff: 900,000 ac.-ft.
Power plant capacity: 20,000 kw.
Annual energy output:
    Firm: 97,000,000 kw.-hr.
    Average nonfirm: 16,000,000 kw.-hr.
Approximate energy cost at site: 20 to 25 mills per kw.-hr.

Development for coordinated operation with other Talkeetna River power plants is discussed later in this chapter.

Greenstone Site.--Greenstone dam site is 35 miles above the mouth of Talkeetna River. As the name implies, the rock is hard, sound greenstone, with granitic intrusions. The foundation would be adequate for a concrete dam. Suitable natural aggregate in sufficient quantities could be found in the gravel bars one-half mile upstream from the dam site.

A 200-foot dam at this site would back water almost to Trapper dam site. The dam would be of concrete, either arch or gravity, with a power plant located on the downstream toe. A spillway tunnel would be located in the right abutment.

The reservoir would have a total capacity of only 62,000 acre-feet. If Trapper Reservoir were not in operation, 40,000 acre-feet of space should be reserved for sediment deposition. This would leave such a small power storage capacity that no individually operated power plant would be feasible.

Data for Greenstone site are as follows:

Type of dam: Concrete, arch or gravity
Height above stream bed: 200 ft.
Crest length: 700 ft.
Stream bed elevation: 1,210 ft.
Minimum reservoir elevation: 1,330 ft.
Maximum reservoir elevation: 1,400 ft.

Power storage capacity: 43,000 ac.-ft.
(with no reservation for sediment deposition.)

Average annual runoff: 1,000,000 ac.-ft.

Development for coordinated operation with other Talkeetna River power plants is discussed later in his chapter.

Granite Gorge Site.--This site is on Talkeetna River 30 miles above its mouth. The name is descriptive of the dam site. The rock is hard, massive granite and the foundation would be excellent for a concrete dam. Suitable aggregate in the form of stream gravels is located in sufficient quantity within 1 mile upstream from the dam site.

The dam would be a concrete structure, either arch or gravity, 270 feet high. The spillway would be located in the right abutment and would discharge into an existing lake, from which it would flow through natural channels to the river downstream from the dam. The power plant would be located on the downstream toe of the dam.

The river gradient in this section is very steep and the reservoir would be only 5 miles long, extending to Greenstone dam site. Total storage capacity would be 55,000 acre-feet. An estimated 40,000 acre-feet should be reserved for sediment deposition if no upstream reservoirs were built. The net power storage capacity would be too small to warrant independent development of this site.

Summarized data for Granite Gorge site follow:

Type of dam: Concrete, arch or gravity
Height above stream bed: 270 ft.
Crest length: 550 ft.
Stream bed elevation: 940 ft.
Minimum reservoir elevation: 1,105 ft.
Maximum reservoir elevation: 1,200 ft.
Power storage capacity: 38,000 ac.-ft.
(with no reservation for sediment deposition.)
Average annual runoff: 1,030,000 ac.-ft.

Development for coordinated operation with other Talkeetna River power plants is discussed later in this chapter.

Sentinel Rock Site.--Just upstream from Iron Creek and 28 miles above its mouth, Talkeetna River is constricted by vertical cliffs to a width of 100 feet. These abutments rise to a height of 80 feet and then flatten out in a broad section. The rock is hard, massive granite, which is more resistant to erosion than is the surrounding greenstone which it has intruded. The foundation is excellent for a dam.

Economic dam height studies indicated that Keetna Dam, 9 miles downstream, should be built to such a height that it would back water above this site. Therefore, Sentinel Rock site was not included in the plan of ultimate development.

Keetna Site.--Keetna dam site is about 2 miles below the confluence of Talkeetna River and Disappointment Creek. The rock is hard, sound graywacke, and the foundation appears adequate toe a concrete dam. Suitable concrete aggregate is readily available from the gravel bars adjacent to the site.

If Keetna site were developed with no other reservoirs upstream, the economic dam height would be about 445 feet. The dam would be a straight-gravity, concrete structure, with a spillway along the right abutment. The power plant would be located on the downstream toe.

The reservoir formed by a 445-foot dam would inundate not only Sentinel Rock site but also Granite Gorge site. It would extend 13 miles upstream and would store a total of 1,290,000 acre-feet. About 90,000 acre-feet of this space should be reserved for sediment deposition.

Data pertaining to Keetna site for independent development are summarized below:

Type of dam: Concrete, straight-gravity
Height above stream bed: 445 ft.
Crest length: 1,690 ft.
Stream bed elevation: 605 ft.
Minimum reservoir elevation: 855 ft.
Maximum reservoir elevation: 1,040 ft.
Power storage capacity: 880,000 ac.-ft.
Average annual runoff: 1,550,000 ac.-ft.
Power plant capacity: 71,000 kw.
Annual energy output:
    Firm: 350,000,000 kw.-hr.
    Average nonfirm: 40,000,000 kw.-hr.
Approximate energy cost at site: 15 to 20 mills per kw.-hr.

Development for coordinated operation with other Talkeetna River power plants is discussed later in this chapter.

Talkeetna Site.--Talkeetna site is located at the confluence of Talkeetna and Sheep Rivers, where a dam would back water up both streams. The valley is 3,800 feet wide at this site. One abutment is hard, sound granite and the other is hard graywacke. The relationship of the contact under the river section would have to be determined in connection with possible reservoir leakage. Depth to bedrock is very great. An extensive subsurface geologic investigation program with water testing would be necessary to determine the depth and character of the alluvial material in the river bed. An extensive earth-materials investigation program would also be required to locate sufficient suitable earth embankment for a large dam. Natural concrete aggregate for appurtenant structures is readily available in the immediate vicinity.

The site is adapted to an earth dam 200 feet high. The reservoir would have a total capacity of 680,000 acre-feet, of which 80,000 acre-feet should be reserved for sediment deposition if no reservoirs are in operation upstream.

Data pertaining to independent development of Talkeetna site are listed below. Coordinated operation with upstream reservoirs is discussed under Ultimate Development.

Type of dam: Earth
Height above stream bed: 200 ft.
Crest length: 4,850 ft.
Stream bed elevation: 500 ft.
Minimum reservoir elevation: 610 ft.
Maximum reservoir elevation: 690 ft.
Power storage capacity: 400,000 ac.-ft.
Average annual runoff: 2,200,000 ac.-ft.
Power plant capacity: 25,000 kw.
Annual energy output:
- Firm: 125,000,000 kw.-hr.
- Average nonfirm: 25,000,000 kw.-hr.

Approximate energy cost at site: more than 30 mills per kw.-hr.

This site was not included in the plan of ultimate development because of the high estimated cost of energy.

Sheep River Site.--This dam site is on Sheep River 13 miles above its confluence with Talkeetna River. The river cuts through a narrow, vertical-walled canyon section about 100 feet deep. Above the canyon, the abutment slopes are rather flat, and the section becomes large. The site is sound, massive granite and should prove excellent in all geologic respects. Sufficient quantities of suitable concrete aggregate are available from gravel bars within 1 mile of the site.

The dam would be a gravity concrete structure 300 feet high with a power plant at the toe. Total reservoir capacity would be 348,000 acre-feet, but 20,000 acre-feet of this space should be reserved for sediment deposition.

Sheep River site was not included in the plan of ultimate development because of the high estimated cost of energy.

Skwentna No. 1 Site.--The Yentna River, largest tributary of the Susitna, joins the latter stream 24 miles above its mouth. The two main tributaries of the Yentna are Kahiltna River from the north and Skwentna River from the west. The only potential power sites were found on the Skwentna River.

Skwentna No. 1 dam site is located 53 miles above the mouth of Skwentna River. The foundation rock is a relatively hard, fine-grained graywacke within an area made geologically complex by contorted shales and associated intrusions. A geologic investigation should determine what problems might be caused by the relationship of the rock at the dam site to the surrounding inferior rock. Natural concrete aggregate is readily available in large quantities. Earth embankment material could probably be located within an economic distance.

A dam at this site would be limited to a height of 185 feet. Total reservoir capacity would be 172,000 acre-feet. An estimated 70,000 acre-feet of this space could be reserved for sediment deposition. Power Plant capacity would be about 5,500 kilowatts. Energy output would be so small and energy cost so high that the project was not included in the plan of ultimate development.

Pertinent data for Skwentna No. 1 site are listed below:

Type of dam: Earth or concrete
Height above stream bed: 185 ft.
Crest length: 600 ft.

Stream bed elevation: 825 ft.
Minimum reservoir elevation: 930 ft.
Maximum reservoir elevation: 1,000 ft.
Power storage capacity: 75,000 ac.-ft.
Average annual runoff: 730,000 ac.-ft.
Power plant capacity: 5,500 kw.
Annual energy output:
Firm: 27,000,000 kw.-hr.
Average nonfirm: 9,000,000 kw.-hr.
Approximate energy cost at site: More than 30 mills per kw.-hr.

This site was not included in plan of ultimate development.

Skwentna No. 2 Site.-- This site is 42 miles above the mouth of the Skwentna River. The foundation consists of relatively hard, sound graywacke with some associated argillites. This rock is suitable for an earth dam and is believed adequate for certain types of concrete dams. Considerable investigation might be necessary to locate fine material for the core of an earth dam. Natural concrete aggregate is readily available in the river bottom.

The dam would be a concrete structure, 285 feet high, with a gated overflow spillway adjacent to the left abutment. The power plant would be located on the downstream toe at the right bank. The reservoir would extend 11 miles upstream and would have a total capacity of 670,000 acre-feet. With no upstream reservoirs, 80,000 acre-feet of space should be reserved for sediment deposition.

Future studies might prove the desirability of an earth dam at this site, provided suitable materials could be located nearby. However, fluid silts within the channel are very unstable and would hamper the use of heavy equipment needed to construct an earth dam.

Data for this site are as follows:

Type of dam: Concrete, straight-gravity
Height above stream bed: 285 ft.
Crest length: 950 ft.
Stream bed elevation: 535 ft.
Minimum reservoir elevation: 690 ft.
Maximum reservoir elevation: 810 ft.
Power storage capacity: 390,000 ac.-ft.
Average annual runoff: 1,300,000 ac.-ft.

Power plant capacity: 30,000 kw.
Annual energy output:
  Firm: 150,000,000 kw.-hr.
  Average nonfirm: 25,000,000 kw.-hr.
Approximate energy cost at site: 25 to 30 mills per kw.-hr.

Talachulitna Site.-- Talachulitna dam site is a constriction in the Skwentna River 13 miles above its confluence with Yentna River. The Talachulitna River joins the Skwentna about 2 miles above the site. The river has cut a channel through a resistant, dense, hard greenstone. The foundation is suitable for construction of a low concrete or earth dam, or a combination of both. Geologic investigations would be required to determine the location and character of bedrock on the extensions of each abutment. Adequate quantities of natural concrete aggregate are available within a mile of the site. Suitable impervious material would be difficult to locate. An earth materials exploration program should be started early in the geologic investigation.

The dam would be a combination earth and concrete structure 155 feet high. The concrete section would be placed in the main river channel and would have a gated overflow spillway adjacent to the left abutment. The power plant would be located at the downstream toe on the right abutment. The total crest length would be about 2,000 feet. The concrete section would be 300 feet long at the base and 500 feet long at the crest.

The reservoir would be 17 miles long and would store 2,370,000 acre-feet. Reservation for sediment deposition should be at least 600,000 acre-feet, if no reservoirs are built upstream.

Data for Talachulitna site are as follows:

Type of dam: Combination earth and concrete
Height above stream bed: 155 ft.
Crest length: 2,000 ft.
Stream bed elevation: 290 ft.
Minimum reservoir elevation: 375 ft.
Maximum reservoir elevation: 437 ft.
Power storage capacity: 1,250,000 ac.-ft.
Average annual runoff: 2,470,000 ac.-ft.
Power plant capacity: 38,000 kw.
Annual energy output:
  Firm: 190,000,000 kw.-hr.
  Average nonfirm: 20,000,000 kw.-hr.
Approximate energy cost at site: 10 to 15 mills per kw.-hr.

Susitna Station Site.--The stream channel and valley of the Susitna River from Gold Creek to the mouth are very wide. At river mile 22, about 2 miles below the mouth of Yentna River, the river banks converge and steepen slightly. The topography here is suitable for an earth dam 100-feet high. The site is named for the nearby village of Susitna, a station for the river boats which formerly plied the river.

This site would require a great deal of geologic investigation before a dam should be designed or constructed. The major problem would be possible seepage from the reservoir. Depth to bedrock in the stream channel is probably more than 500 feet. This great depth would preclude a cut-off to bedrock. The fluvial-glacial sediments might so reduce the rate of percolation that seepage loss from the reservoir would not be excessive. Extensive percolation testing of the substrata upstream and downstream from the dam site and in the reservoir rim would be necessary to determine whether or not piping might take place under potential reservoir heads. The abutments would require special investigation as they appear to be very inferior. An extensive investigation program would be necessary to prove the geologic feasibility of the Susitna Station site.

The river is about 1,900 feet wide at this site. A 100-foot dam would have a crest length of about 5,600 feet. A saddle some distance from the left bank either would require a low dike or could be used for a spillway. The reservoir would have a total capacity of 2,600,000 acre-feet and would extend about 30 miles up both the Susitna and Yentna Rivers. If there were no upstream reservoirs, all this capacity would probably be filled with sediment in less than 100 years.

The major problem at this site would be the possible impairment of the important salmon run up the Susitna River. The Susitna produces about 30 percent of the Cook Inlet salmon pack. If a dam were built at the Susitna Station site, adequate provision would have to be made to permit the adult salmon to pass upstream to spawn and to permit the fingerlings to return to the ocean. Although this might not be an insurmountable problem, further consideration of this site is definitely inadvisable at the present time. It is not included in the plan of ultimate development.

Potential output at the site with upstream reservoirs in operation is discussed under Ultimate Development.

Other Potential Sites.--Thorough aerial reconnaissance of the entire Susitna River Basin was made to locate all major power sites. All those which were found are discussed in this report. Two of the necessary three elements were found at many other locations. An adequate water supply and a large reservoir capacity were found at many sites, particularly on the Yentna River and its tributaries; however, no dam sites were found at these locations. Suitable dam sites can be found on some smaller tributaries; but these streams are too steep to have good reservoir basins, and the water supply is deficient.

Ultimate Development

Construction and coordinated operation of several power plants on one stream or independent section of a stream would result in a greater energy output than the sum of the output of the individual plants. This would be possible for two reasons: (1) upstream storage would increase the regulated flow at downstream plants; and (2) if runoff is not as fully regulated at some plants as at others, output of the plants can be adjusted in accordance with the partially regulated flow. Coordinated operation would result in the plan of ultimate development discussed in the following paragraphs.

Susitna River above Gold Creek.--Ultimate development of the Susitna River above Gold Creek would probably include the following major features:

Denali Dam and Reservoir
Vee Dam, Reservoir, and power plant
Watana Dam, Reservoir, and power plant
Devil Canyon, Dam, Reservoir, and power plant
Olson Dam and power plant

The dams would have the same dimensions as those described under Independent Site Development. Power storage capacities in the reservoir would also be the same, except for Devil Canyon Reservoir. Under ultimate operation with upstream reservoirs, no space would be reserved in Devil Canyon Reservoir for sediment deposition. Power storage capacity would be increased to 2,100,000 acre-feet.

Results of coordinated operation of these five projects are as follows:

Power plant capacity:
- Vee: 260,000 kw.
- Watana: 310,000 kw.
- Devil Canyon: 390,000 kw.
- Olson: 50,000 kw.

Annual system energy output:
Firm: 5,000,000,000 kw.-hr.
Average nonfirm: 200,000,000 kw.-hr.
Approximate system energy cost at sites: 7.5 to 10 mills per kw.-hr.

Chulitna River.--Tokichitna Dam, Reservoir, and power plant constitute the only project on Chulitna River which is included in the plan of ultimate development. No coordinated operation is possible on this stream.

Talkeetna River.--Potential projects on Talkeetna River are well-suited to coordinated operation. Ultimate development on this stream would probably comprise the following major features:

Trapper Dam, Reservoir, and power plant
Greenstone Dam, Reservoir, and power plant
Granite Gorge Dam, Reservoir, and power plant
Keetna Dam, Reservoir, and power plant

Size of dams and power storage capacity at the three upper sites would be the same as for independent development. Keetna Dam, however, would be reduced to a height of 345 feet, so that Granite Gorge site would not be inundated. Crest length would be 1,250 feet and minimum reservoir elevation 805. The reservoir would have a net power storage capacity of 510,000 acre-feet.

Results of the coordinated operation are as follows:

Power plant capacity:
Trapper: 19,000 kw.
Greenstone: 20,000 kw.
Granite Gorge: 27,000 kw.
Keetna: 56,000 kw.
Annual system energy output:
Firm: 600,000,000 kw.-hr.
Average nonfirm: 60,000,000 kw.-hr.
Approximate system energy cost at sites:
15 to 20 mills per kw.-hr.

Other combinations of plants on Talkeetna River were also considered. An operation study was made of Talkeetna project, with only a 100-foot dam, using regulated discharge from Keetna Reservoir in the coordinated study. The small increase in system energy output would not justify the cost of such a large structure. A coordinated operation study was also made eliminating Granite Gorge project and leaving Keetna Dam at the 445-foot height used in the independent study. This study indicated a firm system output of 590,000,000 kilowatt-hours, only slightly less than was obtained in the four-plant operation. Unit cost of energy was higher, so the combination was rejected.

Skwentna River.--Operation of the two potential projects on Skwentna River could be coordinated to increase slightly the firm energy output. The size of the dams and the power storage capacity of the reservoirs would be the same as for independent site development. Results of the coordinated operation study are as follows:

Power plant capacity:
    Skwentna No. 2: 30,000 kw.
    Talachulitna: 42,000 kw.
Annual system energy output:
    Firm: 360,000,000 kw.-hr.
    Average nonfirm: 40,000,000 kw.-hr.
Approximate system energy cost at sites:
    15 to 20 mills per kw.-hr.

Susitna Station Site.--With the ultimate development of upstream reservoirs to trap most of the silt discharged by headwater glaciers, production of power would be possible at the Susitna Station site. Yentna River and its northern tributary, the Kahiltna, would be the only major glacial streams with no storage regulation. An estimated 640,000 acre-feet of space should be reserved for sediment deposition.

The problem of salmon runs at this site is discussed under Independent Site Development. This problem would be as important at Susitna Station with other reservoirs upstream as without them. For this reason, the site was not included in the plan of ultimate development. However, the following data summarize potential development with a 100-foot dam.

Type of dam: Earth
Height above stream bed: 100 ft.
Crest length: 5,600 ft.
Stream bed elevation: 40 ft.
Minimum reservoir elevation: 100 ft.
Maximum reservoir elevation: 130 ft.
Power storage capacity: 1,500,000 ac.-ft.
Average annual runoff: 22,500,000 ac.-ft.

Power plant capacity: 190,000 kw.
Annual energy output:
Firm: 950,000,000 kw.-hr.
Average nonfirm: 300,000,000 kw.-hr.
Approximate energy cost at site:
Less than 10 mills per kw.-hr.

This site is not included in plan of ultimate development.

Initial Development

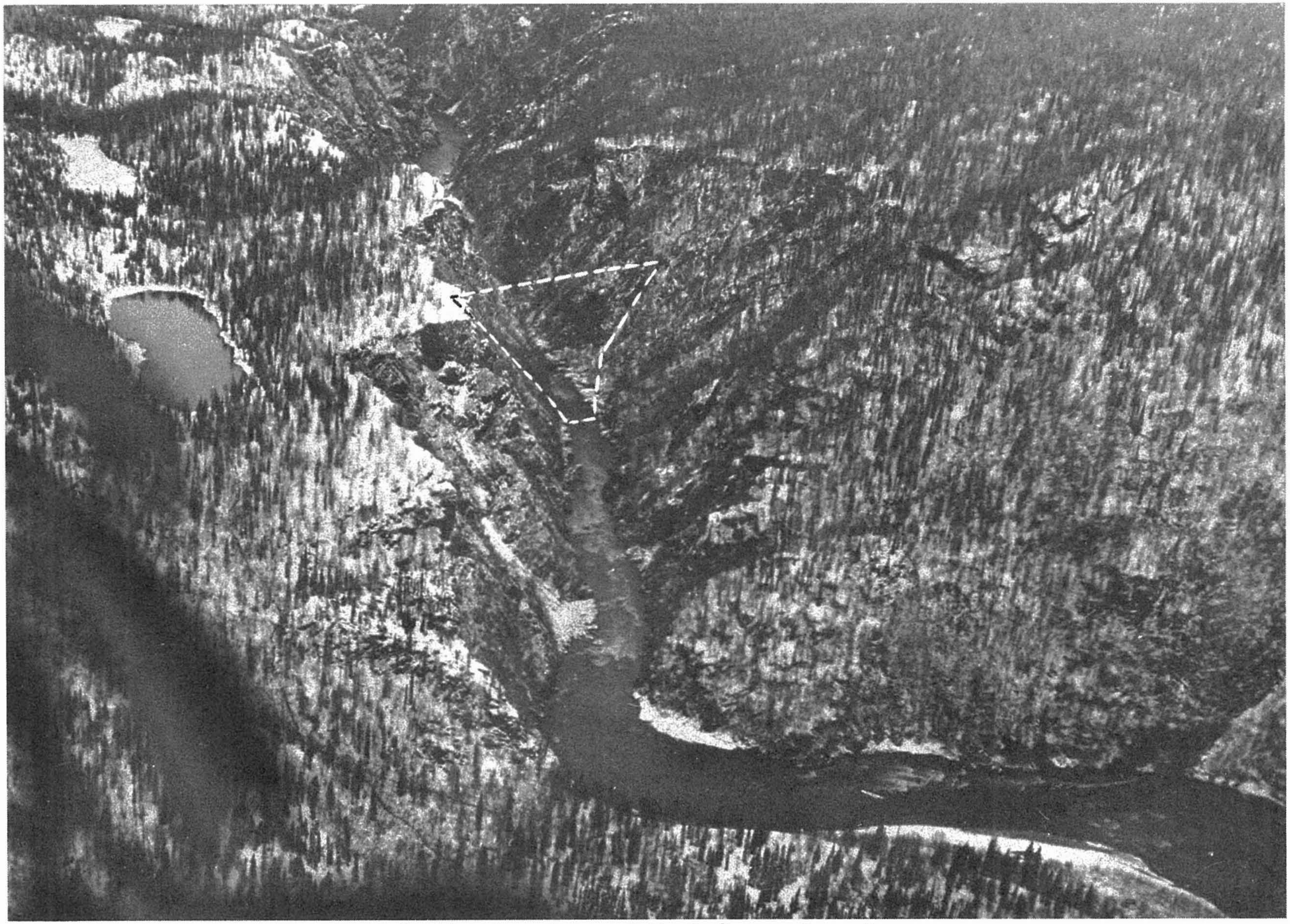
The initial development considered for Susitna River Basin would be the Devil Canyon project. The dam and reservoir would be the same as were described under Independent Site Development. The maximum potential capacity of the power plant as a separate development would be 232,000 kilowatts. Ultimate capacity with upstream regulation would be 390,000 kilowatts. The powerhouse would be initially constructed with space for six units to allow for expansion to the ultimate capacity of the power plant. Initial installation would consist of three 65,000-kilowatt units, for a total capacity of 195,000 kilowatts. This initial capacity was determined by the power market requirements derived in chapter IV. As the power load requires additional generation, a fourth 65,000-kilowatt unit could be installed, although the water supply is adequate for only 232,000 kilowatts of firm output.

Construction of Denali Reservoir could be considered as stage B of the initial development. The additional storage regulation would make it possible to almost double the capacity and output of Devil Canyon power plant. Even if construction of Denali Dam was deferred for decades, there would be sufficient storage in Devil Canyon for sediment accumulation. After construction of Denali Dam no additional storage space would need to be reserved in Devil Canyon Reservoir, as almost all the sediment would be trapped in Denali Reservoir. Water supply at Devil Canyon would support a 370,000-kilowatt plant at a 60-percent plant factor. However, the installation would probably consist of the ultimate capacity of 390,000 kilowatts, comprising six 65,000-kilowatt units.

Variable data for Devil Canyon site for the two stages of initial development are listed below:

Stage A, Devil Canyon

Power storage capacity: 1,950,000 ac.-ft.
Power plant capacity: 195,000 kw.



Looking downstream at Devil Canyon dam site.

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Annual Energy output:
Firm: 970,000,000 kw.-hr.
Average nonfirm: 240,000,000 kw.-hr.

The estimated cost for stage A development is approximately $250,000,000. This cost includes a power house structure of sufficient size to allow installation of additional generators under the phase B development.

Approximate energy cost at the site including all annual cost would be about 9.0 mills per kw.-hr.

Stage B. Devil Canyon with Denali

Power storage capacity: 2,100,000 ac.-ft.
Power plant capacity: 390,000 kw.
Annual energy output:
Firm: 1,850,000,000 kw.-hr.
Average nonfirm: 200,000,000 kw.-hr.

The total estimated cost to complete stage B is approximately $378,000,000. Energy cost at the site, including all annual expense for both the Denali and Devil Canyon Projects would be about 8.0 mills per kw.-hr.

All mill costs are based on a repayment period of 50 years with interest and amortization at 2-½ percent.

OTHER POTENTIAL DEVELOPMENT

The previous discussion has been concerned solely with the development of the hydroelectric power potential. This feature appears to be the best development for utilizing the water resources of the Basin, particulary in the near future. Hydroelectric development, however, does not preclude other uses of the same water resources.

Much thought, but little detailed study, has been given to potential development other than for power and one flood control project. Other problems and possibilities are discussed below.

Irrigation

Existing commercial agricultural development in the Basin is negligible. Primary causes of this are the very recent rise of a large market in the Anchorage area and the closer proximity to this market of the producing lands of Matanuska Valley. The land in the Susitna River Basin, which might be suitable for agriculture, lies in the lower portion of the southern end of the valley. Much work must be done to determine the suitability of the soils and climate of this area for agricultural production. The department of Agriculture is now actively engaged in making these studies.

None of these potential agricultural lands may be classified as arid on the basis of total annual precipitation, which averages between 25 and 30 inches per year. However, the monthly distribution of this precipitation is not conducive to optimum production. Rainfall from the first of May to the middle of July is usually not sufficient to meet plant requirements. The growing season is short and it would be desirable that seed germination and early season plant growth not be retarded because of lack of water. Soil moisture content would normally be high in the spring as a result of snow melt. However, this amount plus the meager rainfall could not be counted on to meet the requirements for early season plant growth. After the middle of July rainfall gradually increases and would normally be sufficient to mature crops. In occasional years deficiencies occur even during this portion of the season.

Any indicated need for irrigation water will be entirely on a theoretical basis until further studies and experiments are made. It may be found that certain crops and some types of soil would benefit and produce more abundantly if furnished supplemental water by irrigation. If irrigation is found to be economically desirable to increase yields or improve quality of crops, the water resources of the Basin can provide a plentiful supply. The major problem would be the best method of application.

Sprinkler irrigation has been tried with outstanding success at a few farms in the Matanuska Valley. There are undoubtedly many places in the Basin where the advantages of this type of irrigation would make its use desirable. Where irrigable land is in small isolated tracts, interspersed with streams and lakes, sprinkler irrigation would probably be indicated, using the nearby water supply and avoiding long distribution laterals. This would be especially true if the land were rolling and could not or should not be leveled for surface irrigation.

Future field investigation may disclose that there are large areas within the Basin, or to which water could be diverted from the Basin, which would require irrigation and would be adaptable to surface distribution through canals and laterals. Sprinklers supplied from the distribution system might also be used.

Studies of the need for irrigation and of the benefit to be obtained from it are currently being made by the Department of Agriculture. If the results of these studies are favorable, the Bureau of Reclamation should begin studies and field investigations to determine the engineering and economic feasibility of a definite irrigation plan.

Flood Control

The Alaska District, Corps of Engineers, has prepared an interim report entitled "Cook Inlet and Tributaries," dated January 20, 1950. The report is a survey of the rivers and harbors of the Cook Inlet area and includes a discussion of water-resource development of the Susitna River Basin. Flood control is one of the problems described. The following paragraphs are selected quotations from this report.

> "Inundation of portions of the town of Talkeetna occurs periodically as a result of high flows in Susitna and Talkeetna Rivers. The area which is flooded is located on the left bank of the Talkeetna River, just upstream from its confluence with Susitna River. In June 1942, overbank flow from the Talkeetna inundated part of the town east of the railroad and extended to the lower end of the airfield.
>
> "Additional damage is caused by erosion of the left bank of the Talkeetna River on the northwest side of the town. The flow is diverted against the approaches of the railroad bridge and the left bank of the river immediately downstream by an island which has been formed upstream from the bridge. The railroad prevents destruction of the bridge approaches by periodically dumping riprap. The bank below the bridge has receded nearly 400 feet since 1917, and during the 1949 flood was cut back as much as 100 feet in places. Several small cabins have been destroyed. Some cutting also has taken place along the left bank of the Susitna River about one-half mile below the town."

Since the completion of its report, the Corps of Engineers constructed a dike of poles bound together by cables to prevent further erosion by Talkeetna River. This dike was so placed to encourage deposition of sediment behind the dike. The results are very satisfactory.

Complete protection of the town against inundation, either from flood flows in the Talkeetna River or from backwater from the Susitna River, would require a levee on three sides of the town and pumping facilities to avoid ponding. The cost of such protection was found to be many times the possible benefits. As further development of the area occurs, additional flood protection may become warranted and economically justified.

The report by the Corps of Engineers further states, regarding the flood problem in the Susitna River Basin:

> "The lack of development in the flood plains obviates the necessity for flood protection at the present time. However, the potential hazards arising from floods are present in many locations. Proper planning of developments can prevent the necessity for expensive flood protection works in the future. Every effort should be made to inform the persons responsible for improvements of the dangers of inundation from infrequent floods as well as from bank erosion."

Drainage

The Susitna River Basin contains extensive areas of poorly drained land. This is caused by lack of well-defined system of surface drainage or unusually tight soils which do not permit subsurface drainage.

The largest poorly drained area is the broad lower valley of the Susitna River below Talkeetna. Others are: (1) the area between the mouth of Butte Creek and the mouth of Maclaren River; and (2) the largest part of the Tyone River Basin, which drains part of the plateau between Copper River and Susitna River. However, the last two areas are of little importance, as the climate is not suitable to agriculture even if the land were drained and soils were otherwise satisfactory.

The poorly drained land in the lower valley lies in large tracts interspersed with large areas of better-drained land. Much of this area is probably adaptable to economical drainage, and the drained land would undoubtedly be suitable for crop production. As long as there is sufficient well-drained potential agricultural land which could be developed at less cost than could the poorly drained land, construction of drainage facilities would not be necessary. Detailed investigation of drainage problems will probably not be needed for many years.

Recreation

Recreation is a major factor in the economy of the Railbelt. The many lakes and streams of the Susitna River Basin are important in satisfying the recreational needs of both residents and tourists. Recreational facilities at potential reservoirs would be isolated and difficult of access, but no more so than some of the lakes which are used now. Reservoirs operated for power purposes would normally be at minimum stage for each year at the end of April, with water-surface elevations increasing to maximum at the end of August or September. Construction of recreational facilities should be considered during the investigation of potential projects. However, recreation is not now considered to be a major aspect of water-resource development in the Basin.

Fish and Wildlife

The fisheries resource of the Susitna River Basin is of such economic importance that it must be protected and, if possible, expanded. It must be given full consideration in connection with all plans for development of the water resources.

Field investigation has not been sufficient to accurately locate the spawning grounds of salmon, the most important fish in the Basin. However, major salmon runs are unknown on the Susitna River above Gold Creek. Power releases from these reservoirs would be adequate to maintain life of nonmigrating fish, and will be regulated to prevent damage to salmon spawn.

If dams are considered for construction on streams which are used by migratory fish, full consideration must be given to the fisheries resource. Satisfactory fish ladders or other means of bypass should be provided so that there will be no appreciable interference with salmon runs. Extensive investigation will be necessary to discover the location of all salmon spawning areas and to determine the most successful means of assuring their continued propagation.

Consideration should be given to stocking the potential reservoirs with game fish. The dead storage reserved for power head and the operation of the reservoirs for power generation might be favorable for a good game fish resource. If game fish were to be placed in a reservoir with no power plant, an adequate dead storage pool for maintenance of fish life would be required. This would be a positive development of water resources for the benefit of fisheries.

The Susitna River Basin abounds with many forms of wildlife. The Fish and Wildlife Service states that some of the reservoirs considered as part of the plan of ultimate development might act as barriers to seasonal migrations of caribou. They would also inundate the habitat of some fur-bearing animals. However, there are vast caribou grounds in addition to those which would be flooded. The reservoirs would create additional shore line suitable for aquatic, fur-bearing mammals. The net effect of these reservoirs on the wildlife of the Basin would probably be very small.

ALTERNATIVE POWER DEVELOPMENT

Other means of supplying electric power to the Railbelt are available in addition to the development of the hydropower resources of the Susitna River Basin. These other possibilities include generation of electric power at Diesel plants, steam plants, and hydro plants in nearby river basins. None of these are considered competitive with Susitna River Basin hydropower in supplying the needs of the Railbelt.

Diesel

Electric energy generated by Diesel engines is comparatively expensive, costing about 30 mills per kilowatt-hour in the Fairbanks area. For this reason Diesel-electric plants normally are used where the loads are small and the larger and cheaper steam or hydro plants are not adaptable. Because of the excessive cost and the small size of units, Diesel plants would not be suitable to supply the large requirements for low-cost power in the Railbelt.

Steam

Several steam electric plants are now supplying a major portion of the power used, both civilian and military, in the Railbelt. Plants of much larger capacity would be required to supply the future load. Studies of the cost of constructing and operating a plant of 100,000-kilowatt capacity indicate that the cost of generation, including fixed charges, would be about 1.5 cents per kilowatt-hour. Such plants could be built near the load centers and thus eliminate a long transmission system. Even this saving, however, would not enable a steam plant to compete on a cost basis with hydropower generated at plants on the main stem of the Susitna River.

Another important reason for not using thermal-electric plants is a desire to conserve nonrenewable oil, coal, and natural gas resources. Generation of power by water is a nonconsumptive process, which uses no fuel. Although larger fuel supplies are being made available through new discoveries and new methods of extraction, there is an ever-increasing need for fuel conservation. Larger quantities of fuel are needed than ever before. New and different uses are being found for coal, oil, and gas--the most common fuels for steam plants. There is no limit to the nonfuel uses which may be found. It is therefore desirable to conserve these resources as much as possible through the use of hydropower, particularly where the cost is not prohibitive. For this reason, several hydro plants are included in the plan of ultimate development for the Susitna River Basin, even though they indicate a cost per kilowatt-hour of energy which would exceed that of steam plants.

Hydro

There are many potential projects in nearby basins which could generate hydroelectric power to supply the requirements of the Railbelt. Some of these projects are large enough and are so situated that they could possibly serve the entire Railbelt. Others are so small or are so located that they could serve only a portion of the power market area. The most important of these alternative projects are described below.

Rampart Project.--Rampart dam site is located on the Yukon River about 100 air line miles northwest of Fairbanks. The foundation rock is sound, hard granite, and the site is suitable for a straight-gravity concrete dam up to 450 feet high. However, the vast storage provided by the extensive Yukon Flats upstream from the site would limit the height of the dam. A dam 290 feet high would have a crest length of 2,500 feet. Active storage capacity would be about 130,000,000 acre-feet. Estimated installed capacity of a power plant would be 1,500,000 kilowatts.

Power from the Rampart site could not be supplied to areas south of the Yukon-Tanana Valley because of the long transmission distance. The capacity and output are much larger than would be needed for loads at Fairbanks in the foreseeable future. Because of these factors and the barrier to navigation on the Yukon, the project was not considered.

Cathedral Bluffs Site.--Cathedral Bluffs dam site is located on the Tanana River, 179 miles southeast of Fairbanks via the Alaska Highway. The site is suitable for an earth dam 185 feet high. The reservoir would inundate the villages of Tanacross and Mansfield and several miles of the Alaska Highway. A power plant at this site would have an estimated installed capacity of at least 100,000 kilowatts.

The major unknown factor at this site is the depth of cut-off necessary in the river bed to prevent percolation from the reservoir. Using conservative assumptions for this item, the estimated cost of energy would be between 10 and 15 mills per kilowatt-hour. Because this cost would be more than for Devil Canyon power, and because of excessive transmission distance to Anchorage, the site was eliminated. Cathedral Bluffs project, however, is a good potential site for future development.

Wood Canyon Site.--Wood Canyon dam site is on Copper River below the mouth of Chitina River, about 260 highway miles east of Anchorage. At this point Copper River flows for several miles through a narrow, steep-walled canyon. A concrete dam 600 feet high would have a crest length of about 1,700 feet. The regulated flow provided by the reservoir would operate a power plant with an estimated installed capacity of 1,200,000 kilowatts.

Large blocks of low-cost energy could be generated at this site, which might attract an electrochemical or electrometallurgical industry. Transmission distances to Anchorage and Fairbanks would be great. Furthermore, the site is not suited to stage construction. A large portion of the investment in the dam would bring in no returns until the Railbelt load would require the full power plant capacity.

The most serious drawback to this development, however, would be interference with the important Copper River salmon run. Careful study would have to be made of means to assure continued salmon propagation before any definite plans were made.

Chakachamna Site.--Chakachamna Lake, 85 air line miles due west of Anchorage, is 15 miles long and averages 2 miles wide. The lake, dammed by Barrier Glacier and its terminal moraine, would provide the reservoir storage for any development on Chakachatna River.

Two alternative developments are possible. The first would require three dams, with appurtenant power plants, on Chakachatna River. The first dam would be about 6½ miles below the lake outlet and would back water into Chakachamna Lake. The second dam would be 12 miles and the third 14½ miles below the lake outlet. Total installed capacity of the three power plants would be about 370,000 kilowatts. An alternative scheme to use the present storage capacity of Chakachamna Lake would require a draw-down tunnel, diverting to a downstream power plant. By using an 11.2-mile tunnel and 1.8 miles of penstock, about 870 feet of total power head could be obtained. Installed power plant capacity would be about 160,000 kilowatts.

Transmission distance to Anchorage would be about 100 miles over extensive areas of muskeg and swampy terrain. The transmission system would be a major item of cost. Fairbanks is too far away to be served by Chakachamna project. Power could be supplied only to the Anchorage area and to Kenai Peninsula.

Energy would cost about 15 to 20 mills per kilowatt-hour. The project was rejected because of the high energy cost and because of its inability to serve the entire Railbelt. It should be considered only as a possible future power source.

Kenai Peninsula Sites.—Several potential power projects on Kenai Peninsula have been investigated in considerable detail by the Corps of Engineers and discussed in its report entitled "Cook Inlet and Tributaries." Two of these projects, Cooper Lake and Crescent Lake, showed an estimated energy cost of less than 1 cent per kilowatt-hour. These two projects, however, could not supply the ultimate power load of Kenai Peninsula. Low-cost power from the Susitna River Basin would be preferable to enable the supply to keep pace with the demand. However, it might be desirable to build one small plant on Kenai Peninsula to supply the initial local power demand and to provide line regulation which would be necessary with the ultimate use of Susitna River power.

ULTIMATE POWER GRID

As the Territory continues to grow in population and economic development, increasing amounts of energy will be required. The geographic pattern of this load growth is difficult to predict. It is probable, however, that a large portion of the increased power demand will be supplied by some or all of the hydro plants outside Susitna River Basin which have just been described.

Power plants on the Susitna River would be centrally located with respect to this ultimate development. The transmission lines required to serve the Railbelt with power from Devil Canyon project could easily be expanded into a transmission system interconnecting all these projects to serve interior Alaska. Devil Canyon project is an ideal beginning for the ultimate power grid.

CHAPTER VI

FUTURE INVESTIGATIONS

The Susitna River Basin is an area which possesses great potential wealth in its water, mineral, land, and wildlife resources. Some data have been obtained about the mineral resources in localized areas. There is a dearth of information regarding the water, land, and wildlife resources of the Basin. Most of the known facts about the hydropower, agriculture, recreation, and wildlife potentialities are summarized or mentioned in this report.

Minerals and fisheries are the only resources of the Basin which have been exploited to any great extent. However, even the fishing has been carried on in Cook Inlet with no accurate knowledge of the part played by the Susitna River and its tributaries. It would be possible for future independent development of one resource or one aspect of a single resource to irrevocably prevent adequate development of another resource. It is of utmost importance, therefore, that all resource development in the Basin be coordinated to produce the maximum benefit.

In order to attain this end, coordination must begin with and carry through the planning stage. A beginning has been made with this cooperative basin survey report. The following paragraphs outline certain work which should constitute the next phase of investigations or study for the various agencies. Continued coordination of these studies will ensure optimum benefits from development of the Basin.

BUREAU OF RECLAMATION

The next item of study by the Bureau of Reclamation will be a detailed investigation of Devil Canyon project. This work is now in progress with the construction of an access road during the summer and early fall of 1952. This road will extend from Gold Creek station on the Alaska Railroad to Devil Canyon dam site. It will facilitate transportation of men, equipment, and supplies to the site.

Actual investigation of the project will begin in July 1953. The field investigations, office studies, and preparation of the report will take about 3 years and will cost about $900,000. This work will include the following features: topographic surveys; foundation exploration, including extensive diamond drilling; search for suitable construction materials; water supply studies, including theoretical operations of reservoir and power plant; estimate of maximum probable flood; preliminary design and cost estimates of all project features; studies of transmission line requirements; power market surveys; and economic studies. The project report will discuss all these items, will state conclusions regarding the feasibility of the project, and will make recommendations regarding its construction.

The next project to be investigated by the Bureau of Reclamation will probably be Denali Dam and Reservoir. Estimates of future power requirements indicate that additional generating capacity will be needed soon after Devil Canyon project is completed. Denali project will provide supplemental storage for Devil Canyon project and thus double the output of the power plant. Investigations of Denali project will include the same items as listed for Devil Canyon project. The field and office studies will cost about $200,000. They will begin in July 1955 and the report will be completed within 2 years.

Power market studies outlined in this report indicate a further increase in energy requirements, which must be supplied by more generating facilities. Investigation of Vee and Watana projects will follow soon after the study of Devil Canyon and Denali projects. Preliminary planning will take 3 years for each project. Work will begin on Vee project in July 1956 and on Watana project in July 1957. Investigations costs will be about $900,000 and $600,000, respectively.

Investigations of other projects in the Basin have not been definitely programed. Output of Devil Canyon, Vee, and Watana power plants will supply the energy demand of the Railbelt for many years. As the load continues to increase and the location of maximum use becomes more apparent, other projects can be investigated which will most adequately fulfill the needs. These may include other projects in Susitna River Basin or some of those projects outside the Basin which were not considered for initial or proximate development.

Other investigative work will probably be done by the Bureau of Reclamation in the field of irrigation and drainage. Studies now in progress and proposed by the Bureau of Land Management and by agencies of the United States Department of Agriculture are expected to reveal the suitability for crop production of large areas of land in the Susitna River Basin. Some of this land will probably require irrigation or drainage. In this event, the Bureau of Reclamation should undertake field investigations and other necessary studies to determine the engineering and economic feasibility of definite plans for irrigation or drainage.

OTHER AGENCIES

Investigative studies by other agencies should be carried on concurrently with those of the Bureau of Reclamation. This is especially true of those aspects which are directly concerned with use or development of water resources, so that maximum benefits can be obtained through coordinated planning.

Department of the Interior

The National Park Service has formulated a program of river basin studies and special archeological work in Alaska for the 6-year period 1954-59. Total cost for this period is estimated at $440,000. At least $50,000 should be spent for the first year of work in the Susitna River Basin. A total of about $100,000 should be spent over a 3-year period to produce an adequate report on recreational possibilities of the Basin. The recreational interests of the National Park Service and the wildlife interests of the Fish and Wildlife Service are closely allied in this Basin. These aspects should be studied cooperatively.

The Bureau of Mines should continue, in cooperation with the Geological Survey, to investigate the mineral resources of the Basin, particularly minerals of construction. Most of these are now imported at high cost. If they were to be made available locally, building costs could be reduced, to the benefit of the entire Railbelt. This will be a continuing investigation and no specific cost has been estimated.

The Bureau of Land Management plans to perform land classification and land capability surveys in selected portions of the lower Susitna River Basin during the period 1955-57. This work will be done in cooperation with the Alaska Soil Conservation district. The Bureau of Land Management will also study the possibilities creating a substantial wood product industry to utilize the extensive commerical stands of birch timber in the Basin. The Bureau should also cooperate with the National Park Service and the Fish and Wildlife Service in planning the best use of public lands for recreational purposes.

The Geological Survey has completed most of the field work for topographic mapping of the Basin. The work remaining is largely compilation of maps. The Survey had planned a river survey of the Susitna River, starting in 1953, at an estimated cost of $161,000. However, it now proposes to postpone this work until after completion of the quadrangles on a scale of 1:63,360. Completion scale of these quadrangles will be 1:20,000. With a small amount of additional work, these maps will probably supply adequate information for preliminary estimates of reservoir capacity and for classification of lands having power-site value.

The Survey will continue to investigate the mineral resources of the Basin in cooperation with the Bureau of Mines.

Stream gaging and sediment sampling are two very important aspects of future planning which are the responsibility of the Geological Survey. A complete program of surface-water investigation would involve the installation of at least 11 additional stream-gaging stations and some additional construction at the existing station at Gold Creek. Total estimated construction cost is $204,000, and estimated annual operating cost for the 12 stations is $24,000. Cost of the ultimate program to determine sediment loads of the Susitna River and its major tributaries is expected to be about $20,000 annually.

A combined stream-gaging and sediment-sampling station should be installed on Susitna River in the vicinity of Denali dam site as soon as construction of the Paxson-McKinley Park highway has progressed far enough to facilitate access. Data gathered at this site should cover as long a period as possible to increase the accuracy of the hydrologic studies of Denali project. Estimated installation cost of this station is $15,000 and annual operation cost would be about $4,000.

The Alaska Railroad has indicated that its Industrial Development Board will continue to study means of promoting new industry, new processes, and new population in the area to be served by Susitna power.

The Fish and Wildlife Service will play an important part in the investigation and development of the Susitna River Basin. It is now expanding the small program which has been carried on the past few years to determine the location of salmon spawning areas and the intensity of utilization. The Bureau of Reclamation is bearing a small portion of this cost, with a transfer of $5,000 for fiscal year 1953. Increased appropriations should be made directly to the Fish and Wildlife Service in order that it may complete an adequate river basin survey within the next few years. This study should be made concurrently with Bureau of Reclamation investigations of Devil Canyon project.

Department of Agriculture

The Agricultural Research Administration and the Alaska Experiment Station should continue to cooperate with the Alaska Soil Conservation district and the Bureau of Land Management in determining potential agricultural development of the Basin. A study of possible limitations imposed by climate should be an important aspect of this work.

Territory of Alaska

The Alaska Development Board has recently made an extensive study of the Anchorage area, which will be published in the near future. In addition to this comprehensive work, they have made continuing investigations of the potentialities for industrial development throughout the Territory. These studies and investigations clearly indicate that certain types of industrial processes could be started and continued profitably in the Railbelt as well as other parts of the Territory if other high costs of production could be compensated for by low-cost power.

The Board is actively promoting the various opportunities which the Railbelt offers and encouraging industrial development. Future activities of the Board should include a more detailed investigation of the specific industries which could profitably compete with Stateside interests if low-cost power were made available. Insofar as possible, definite commitments should be secured from those companies which have evinced interest in locating in the area.

CHAPTER VII

R E P O R T S

O F

O T H E R   A G E N C I E S

DEPARTMENT OF THE INTERIOR AGENCIES

NATIONAL PARK SERVICE
REGION IV
SAN FRANCISCO, CALIFORNIA

A PRELIMINARY STATEMENT REGARDING RECREATION RESOURCES OF THE SUSITNA RIVER BASIN

The knowledge of the National Park Service regarding the Susitna basin is in generalities. It must be improved by specific field investigations before opinion can be expressed as to the basin's recreation resources.

A comprehensive river basin recreation reconnaissance should be made with special reference to the water-control proposals, but at this time there are no funds whatever in sight for such an undertaking.

In the Alaska Field Committee Six-Year Program Report for 1952 a total of $265,000 is estimated for river basin studies during the period 1954 to 1959, inclusive. Also, for special archeological work in river basins, a sum of $175,000 is estimated for the same period.

If, pursuant to these estimates, the Congress provides funds for the work contemplated, it is probable that the National Park Service would desire to enlist the aid of the University of Alaska and other highly qualified institutions for assistance with special field studies of the history, archeology, biology, and other cultural resources of the basin. Lay-out plans for physical improvements that might be justifiable on recreation grounds (if any) such as roads or trails, air strips, lookout points, camps, docks, vacation home sites, museums or observatories, and other interpretive aids, would be prepared by the Service. These would show graphically what could or should be done in the basin to conserve all of its cultural resources.

If a program of the magnitude outlined above is not undertaken, the results will be piecemeal, inadequate, and lacking in comprehension or consistency.

Of the total amount estimated, as explained above, for river basin studies and special archeological work ($440,000 over a 6-year period for all Alaska) at least $50,000 should be set up for the first year of work in the Susitna basin alone. Varying amounts would be needed thereafter, totaling probably $100,000 over a 3-year period, in order to produce a satisfactory report commensurate with the scope and scale of the Bureau of Reclamation concept.

However, the Susitna basin is of such growing importance that even without specific factual information as called for above, the obvious or circumstantial evidence of the basin's value is highly convincing, and it can be discussed accordingly with some degree of realism.

Bisected by the Alaska Railroad, the basin contains a Railbelt division offering a dozen small rail-side communities which are well known to recreationists. People travel by train to whatever station or place along the railroad they want to reach, and work back from there on foot on their hunting and fishing and sightseeing trips. The large number of landing strips, lakes, and rivers providing access by land or float plane make the most remote and inaccessible parts of the basin relatively well known to thousands of local residents, and many visitors from outside. Hunting and fishing are the main pursuits. Reservoirs, in addition to the natural landing places, would mean more plane traffic.

Curry, an attractive railroad village half way to Mount McKinley National Park, is an appealing recreation center. One of the finest distant views of Mount McKinley and the Alaska Range is obtained from the vicinity of this station. There are fishing and hunting opportunities in the Curry region. Winter activities are growing in popularity near the station. The comfortable railroad hotel at Curry is a major attraction.

In the upper reaches of the basin, the alpine scenery is superlative even by Alaska standards. The National Park Service should have a more than usual interest in the basin since a portion of Mount McKinley National Park lies within it. Much of the park setting, including some of the most dramatic park approaches, is within the Susitna basin.

The route of the Denali Highway, from Paxson to Cantwell and McKinley Park, crosses the upper Susitna Valley. The Denali Reservoir, as indicated at this time in planning data, occupies a location over which the highway is planned to cross. Obviously an adjustment will have to be made in this situation. Since the highway location was made with the park in mind, close attention to the best scenic routing was exercised, as well as to good drainage, permafrost, and other factors. If it should not be easy to obtain satisfactory alternate locations to accommodate both the highway and the reservoir, confliction of desires may result.

The upper Susitna region, along this Denali Highway route, provides good fishing and hunting, and the high mountain and glacier scenery is magnificent. When the highway is completed a large area will become accessible to motorists and, unless strong wildlife conservation enforcement measures are provided, the game and fish will disappear.

Natural lakes in this upper portion, which are easily reached from the Denali Highway route or by float plane, obviate justification for the Denali Reservoir on ground that in itself it would contribute to recreation. This viewpoint holds generally with respect to all of the proposed reservoirs throughout the basin. In short, they are not needed for recreation. This is not meant as an argument by the Park Service against the water controls proposed. The Service is aware that industrialization in the mining, agriculture, building materials, and perhaps other fields is expanding in the Railbelt, and that the Susitna hydroelectric proposals are further evidence of growth which apparently is bound to occur. The need is to provide funds from recreation, including wildlife conservation, so that recreation can keep pace with other objectives. All of the recreation or cultural values of the basin are more or less perishable.

The Railbelt already is an industrial corridor linking Interior Alaska with the coastal regions. It is one of the richest natural resource securities we have in inland Alaska. With an electric power potential as great as is indicated in the Susitna basin (exceeding 2 billion kilowatt-hours annually, from the potential plant at Devil Canyon, 15 miles east of Gold Creek, alone), the continued modernization of facilities of all kinds, including the cities, the railroad, and others, appears to be a wise objective for recreation as well as other enterprises. At this time there is no knowledge of the amount of power recreation will use in the areas to be served by Susitna basin power. Obviously it will be substantial.

In conclusion, insofar as the National Park Service would be concerned, there appears to be no objection in principle to the reclamation scheme. Final judgment is reserved, however, subject to the gathering of information by the Service, and the working out of further details by all concerned. The interests of the Park Service, and the Fish and Wildlife Service, are closely alined in this basin, and should be explored cooperatively if that could be arranged.

B U R E A U   O F   M I N E S
REGION I
JUNEAU, ALASKA

MINING INDUSTRY in the SUSITNA RIVER BASIN and ALASKA RAILBELT

INTRODUCTION

Hydroelectric power generated from the Susitna River basin development will be available for distribution to mineral industries in the so-called Railbelt, which includes areas adjacent to the Alaska Railroad between Anchorage and Fairbanks. Long-range plans include transmission lines to outlying districts such as the Seward Peninsula and Prince William Sound areas when demand justifies construction of the additional facilities.

Mineral wealth, especially gold, is locally abundant in the Railbelt and adjacent areas; it has played a major role in the economy of the region since the discovery of the gold placers near Fairbanks in 1902. The Alaska Railroad was built to connect the thriving mining camps of the Fairbanks and Yukon River regions with ocean transportation at Seward. Completed in 1923, the railroad has greatly assisted the mining industry through dependable service and a reduction of freight rates. The development of a dependable supply of low-cost power will have a similar beneficial effect on present and potential mineral industries.

The current (1949-52) military construction program in the Railbelt has resulted in an artificial change in economic conditions which has displaced the mining industry from the paramount position it formerly held. Construction of military plant and housing facilities, a large influx of both military and civilian personnel, and the rapid growth of connected service industries have economically outranked mineral production.

However, mining still employs many men and is the principal support of numerous communities throughout the entire region. Although much of the Territory is wholly unexplored or inadequately developed, the indicated and potential reserves of commercially and strategically important minerals are known to be large. These reserves are increasing in importance in direct ratio to the rate of exhaustion of more accessible deposits.

Because of the nature of the country, mineral resources have always been and will continue to be the basis of a stable economy in the inland regions; they are the principal inland natural resource. Normal conditions and the orderly, long-range development of transportation, power, and processing facilities will result in greatly increased activity in mining and related industries.

MINERAL PRODUCTION

Gold Production

Although now in decline, gold (largely from placers) has been the principal mineral product of the Railbelt. The total production of placer gold from the Railbelt and adjacent areas is given by region in table 1; location of the placer districts is shown on figure 1, "Mineral Deposits in the Railbelt Area."

Total Mineral Production

Gold still is the most valuable mineral product; but coal, antimony, tungsten, and nonmetallic minerals used as building materials are becoming increasingly important. Total mineral production for the area is given in table 2, "Mineral production from the area served by the Alaska Railroad up to and including 1949."

MINING

Gold

All significant lode-gold mining operations in the Railbelt have been suspended because of unfavorable economic conditions. Several mines in the Willow Creek district are maintaining facilities and/or are doing development on a small scale. In the major gold placer fields, only the lower cost operations are still in production. During 1951, five dredges were operating in the Fairbanks area and one at Livengood. Several small hydraulic placer mines continued to work at reduced scale. All of the operations use steam or oil-generated power.

Known placer reserves are extensive and the potential production of both placer and lode gold from undeveloped areas in the Railbelt can be expected to support a large gold mining industry under favorable economic conditions.

Coal

The fuel requirements of the rapidly increasing number of military and civilian heat installations are currently exceeding coal production capacity; additional mines, processing plants, and transportation facilities must be provided to maintain military efficiency. As an indication of this increase, production since 1940 is given as follows:

Year	Production Short tons
1940	173,970
1945	297,644
1950	395,000
1951	475,000

Coal-bearing formations are widely distributed throughout the Railbelt, (figure 1) and coal reserves are known to be large. The coal, all of which is Tertiary in age, ranges in rank from lignite to high volatile C bituminous--depending on the degree of deformation of the enclosing formations.

Two principal coal fields, Healy and Matanuska, have been mapped by the Geological Survey and partly investigated by the Bureau of Mines. This work is being continued by both agencies.

The Matanuska field is the principal source of coal for the Anchorage area. This coal is classified as high volatile B and C bituminous. Although of the same age as the lower-rank coals of the Railbelt, the quality of the Matanuska deposits has been enhanced by pressure and movement. While improving the coal, these forces have introduced mining and treatment problems which require additional processing equipment.

At present, (March 1952) the Evan Jones Coal Company has the only large underground operation in the Matanuska field. A stripping operation at Houston supplies some coal of sub-bituminous C rank to the Anchorage market, but the reserves available for this type of mining are limited. Active preparations to reopen the Buffalo mine are in progress; other inactive leases are being considered as possible producers if the demand for coal continues to increase as presently indicated.

The coal requirements of the extensive military and civilian installations in the Fairbanks area are currently supplied by two strip mines and one underground operation in the Healy field. The coals from this field are mainly sub-bituminous B in rank, although some beds are sub-bituminous C; reserves are known to be large. Comparatively low heat content and poor storage qualities are characteristic of all Healy field coal beds presently being mined. Investigations by the Bureau of Mines indicate that the coals can be upgraded and their storage qualities improved by low

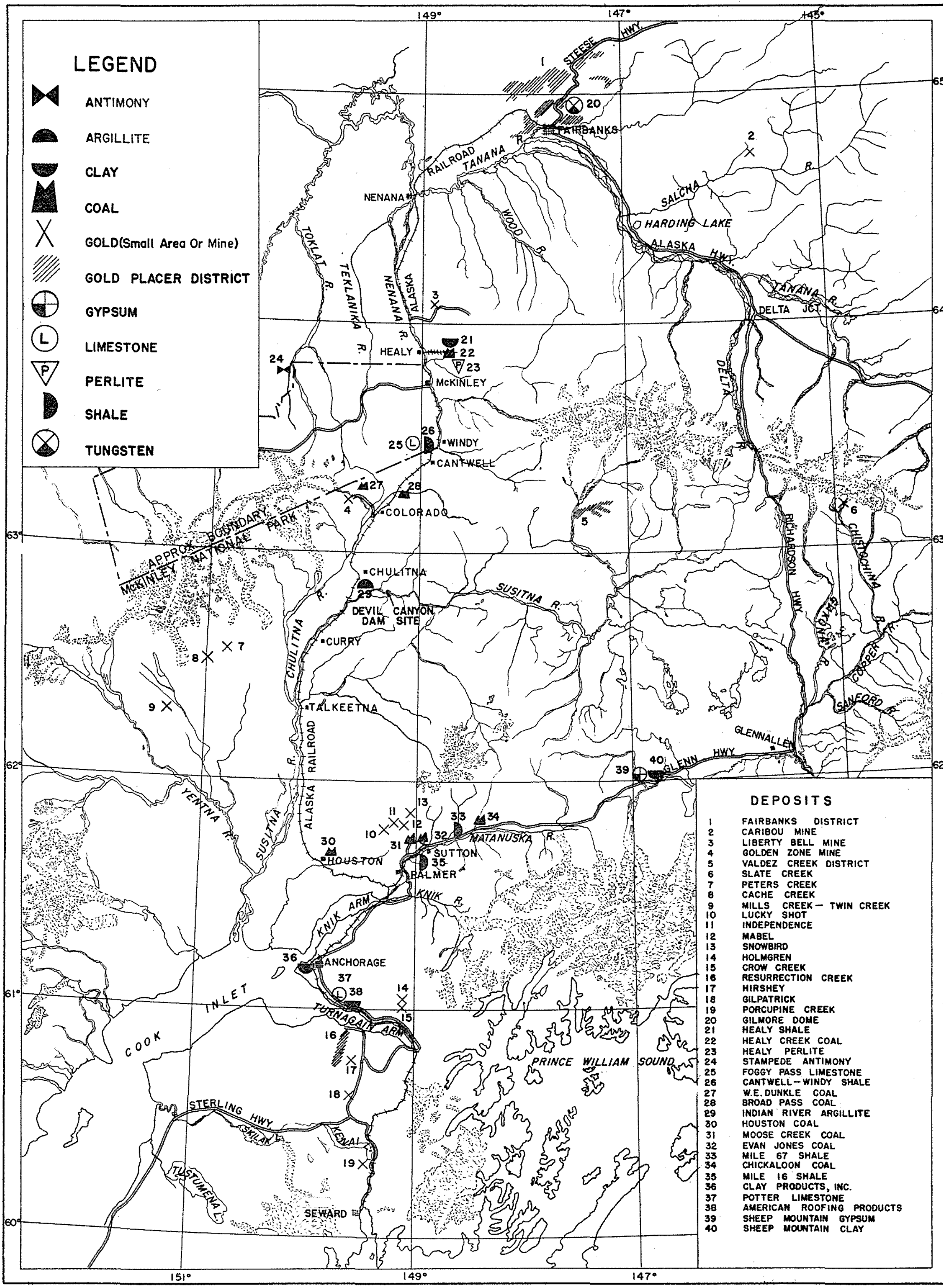


FIG. I MINERAL DEPOSITS IN THE RAIL BELT AREA

GPO-87-80091

temperature carbonization and briqueting. Utilization of these processes would require additional equipment and a corresponding increase in power requirements.

Investigations by the Bureau of Mines also have indicated that the low-rank coals of the Railbelt can be used for production of synthetic gasoline and oils by the process of hydrogenation. Preliminary cost estimates indicate that the process cannot compete with imported liquid fuels under present conditions. A 10,000-barrel-per-day hydrogenation plant (smallest efficient unit) is estimated to require 70,000 kilowatts 1/ of electric power.

Antimony

High-grade antimony ore is being produced from the Stampede mine which is situated on the Stampede River, west of Healy, Alaska. This mine and another prospect on Slate Creek (in the same area) were investigated by the Bureau of Mines and the Geological Survey in 1942. Both deposits contain indicated and inferred reserves of considerable importance. High mining and transportation costs have handicapped mining and retarded exploration and development of the deposits.

Tungsten

Tungsten deposits in the Gilmore Dome and adjacent areas near Fairbanks were investigated by the Bureau of Mines 2/ and Geological Survey during World War II. The Stepovich mine on Gilmore Dome was operated during the war and delivered 2,184 units of WO_3 to the Metals Reserve stock pile at Fairbanks. Operations were suspended when metal prices declined. As the result of a substantial Defense Minerals Exploration Administration loan, the Stepovich deposits will be extensively explored during the 1952-53 field seasons. A long-term mining and milling operation and an important production of highly critical tungsten is expected to result from this work.

The granitic-metamorphic contact zone, in which the Gilmore Dome deposits occur, extends over a considerable area which has not been thoroughly prospected. Indications of tungsten have been found at numerous places, but have not been explored or developed.

1/Ford, Bacon, and Davis, The Synthetic Liquid Fuel Potential of Alaska Survey Area: Corps of Engineers, Department of the Army, October 31, 1950.

2/Thorne, Robert L. and others, Tungsten Deposits in Alaska: United States Bureau of Mines Report of Investigations 4174, 1948.

Successful operation of the Gilmore Dome deposits will stimulate additional prospecting which may well develop a new major tungsten producing district.

Copper

Although Alaska has produced a large amount of copper, principally from the fabulous Kennicott mines, production of this metal from the Railbelt proper has been negligible. There are no copper mines operating in Alaska at the present time.

The Prince William Sound district would be under the remote influence of the proposed power development when and if distribution facilities were extended to the Seward Peninsula.

This district contains numerous copper deposits 3/ some of which have supported profitable operations in the past. The known larger deposits are comparatively low in copper content, but the metal occurs associated with sulfide minerals which contain up to 50-percent sulfur.

The rapid increase in sulfur consumption and the exhaustion of readily available deposits of native sulfur have resulted in a world shortage of vital concern. The deficiency is being made up partly by recovering sulfur or sulfur products from fumes resulting from the smelting of sulfide minerals. Smelter facilities for such recovery are being constantly increased.

Investigations by the Bureau of Mines and the Geological Survey have proven several deposits which are presently marginal in copper value but which contain large tonnages of recoverable sulfur. Opportunities are favorable for the development of additional large reserves; this work will be continued by the Bureau of Mines as conditions permit.

The deposits so far examined are suitable for large-scale mining operations in which a high degree of mechanization would be prerequisite for economical recovery. Under favorable economic conditions, local smelting and sulfur recovery might be possible. Cheap, dependable power would be an important cost factor in mining, milling, and smelting operations.

3/Moffit, Fred H. and Fellows, Robert F., Copper Deposits of the Prince William Sound District, Alaska: Geological Survey Bulletin 963-B, 1950.

Minerals of Construction

With the exception of sand and gravel, the use of native nonmetallic minerals for construction purposes has been negligible. Natural aggregates are plentiful throughout most of the Railbelt area and usually are available locally for construction and road building programs. Other nonmetallic materials such as cement, clay products, and mineral insulating materials are imported at high cost. Because of the greatly expanded military and civilian construction programs, the establishment of a local construction materials industry should reduce building costs and benefit both the stability and economy of the Railbelt.

To investigate this possibility, the Bureau of Mines in cooperation with the Geological Survey has conducted an extensive survey of numerous deposits which might be suitable for the manufacture of construction materials. The survey has included examination, mapping and sampling of the deposits and laboratory test work to determine the physical properties and suitability of the various materials.

Specific investigations have included the raw materials and products as follows:

Raw Material	Product
Clay Shale	Brick and clay products
Clay (Haydite) Shale (Haydite) Argillite (Haydite) Perlite	Lightweight concrete aggregate
Clay, shale, limestone, argillite, and conglomerate	Mineral wool
Limestone, shale, and gypsum	Cement

Location of deposits which preliminary tests have shown to be favorable for use is shown in figure 1.

The survey has indicated that raw materials suitable for the manufacture of cement, lightweight aggregate (Haydite), and clay products are available in quantity at various locations throughout the Railbelt. Laboratory and field investigations of these materials are continuing and will be expanded to include mineral wool and perlite.

Table I.—Placer gold production from the area served by the Alaska Railroad up to and including 1949

Districts	Region	Up to and Including 1936 (U.S.G.S. Bull. 907)	1937–1949 (incl.)	Up to and Including 1949
Valdez Creek, Willow Creek, and Yentna-Cache Creek	Cook Inlet-Susitna	$ 3,730,600	1/$ 1,860,000	1/$ 5,590,600
Moose Pass-Hope and Turnagain Arm-Girdwood	Kenai Peninsula	2,213,200	1/ 56,000	1/ 2,269,200
Bonnifield-Nenana, Fairbanks, Hot Springs, Kantishna, Rampart, and Tolovana	Yukon River Basin	120,244,200	1/ 58,500,000	1/ 178,744,200
Total		$126,188,000	$60,416,000	$186,604,000

1/Placer silver included.

Table 2.—Mineral production from the area served by the Alaska Railroad up to and including 1949

Commodity	Up to and Including 1936 (U.S.G.S. Bull.907)	1937-1949 (incl.)	Up to and Including 1949
Gold:			
Placers	$126,188,000	1/$60,416,000	1/$186,604,000
Lodes 2/	12,517,300	3/ 13,925,000	3/ 26,442,300
Subtotal	138,705,300	1/3/ 74,341,000	1/3/ 213,046,300
Silver (mainly from alloys with gold)	845,000	(4/)	845,000
Coal	9,835,000	21,651,000	31,486,000
Miscellaneous, including lead, antimony, tungsten, copper 5/, and other products	225,000	6/ 468,000	693,000
Total	$149,610,300	$96,460,000	$246,070,300

1/Includes placer silver.
2/Does not include production from Prince William Sound and Nuka Bay districts.
3/Includes lode silver, copper, lead, and zinc.
4/Included with gold.
5/Does not include production from Prince William Sound district.
6/Antimony only; all other miscellaneous included with lode gold.

A L A S K A   R O A D   C O M M I S S I O N
JUNEAU, ALASKA

RELATION OF PROPOSED SUSITNA RIVER BASIN TO FUTURE HIGHWAY PLANNING

None of our existing roads will be affected by the construction of any of the 20 dams shown in the Bureau of Reclamation preliminary over-all plan for development of the Susitna River basin for hydroelectric power. However, the location planned for the Paxson-McKinley Park road now under construction will need to be materially revised in the vicinity of the Susitna River, if the proposed Denali Dam is constructed at the site shown on the Bureau of Reclamation plan. The 200-foot dam proposed for the Denali site would create a reservoir extending from the dam site at about 2 miles below the 63° parallel upstream, a distance of approximately 40 miles, to within a short distance of the face of the two glaciers at the headwaters of the Susitna River. The United States Geological Survey map of this area, 1951 edition, drawn with 200-foot contour intervals, indicates that the minimum width of this reservoir would be about 2 miles. The line as planned for the Paxson-McKinley Park road crosses the Susitna approximately 20 miles upstream from the proposed Denali dam site.

If the Susitna River basin project is approved and adopted, the Bureau of Reclamation's tentative plans call for the Denali Dam to be the second one constructed. The storage created by this dam is needed to provide uninterrupted production of power at the hydroelectric plant at the Devil Canyon Dam, which is the first one planned for construction.

From a study of the United States Geological Survey maps of the upper Susitna area; it is estimated that a route for the Paxson-McKinley Park road, which would cross the Susitna at the site of the proposed Denali Dam, would be from 15 to 20 miles longer than the route originally chosen. The survey line for this latter route has been completed from the west to the Susitna River, and aerial survey is now being made from the Susitna eastward. There is an investment of approximately $40,000 in these surveys for the section of road which would be abandoned if it becomes necessary to revise the location of this route.

With not even a reconnaissance as a guide, it is not possible to obtain a very accurate comparison of the cost per mile for the route by way of the proposed dam with that for the line which is now in the planning stage; but the United States Geological Survey maps indicate that for the former there would be many miles of canyon location with probable sidehill construction that would be very costly to build and maintain. The contour interval on the United States Geological Survey map is 200 feet. With only this as a basis for an estimate of the increased cost of the road, if we were forced to relocate our proposed line to cross at the Denali dam site, the estimate is only a little better than a guess. However, on the basis of $50,000 a mile for 37 miles on the proposed line, as against $60,000 a mile for 55 miles for the relocated line, the increased cost is $1,450,000. This assumes the bridge cost at each location to be the same. When the dam is completed, the bridge can be salvaged for another location and the road can cross on top of the dam.

With the construction of the Paxson-McKinley Park road ready to be pushed eastward from the Brushkana Creek, which stream is only between 3 and 4 miles from the point where the relocated line would quite probably depart from the surveyed line, the Alaska Road Commission will soon be in the position of being forced to decide whether the prospect of the development of the Susitna River basin receiving Congressional approval is enough in the realm of probability to warrant revising the location of the road to the much more costly but poorer line. It is believed that construction on this road should be concentrated on the Paxson end and on the Cantwell to McKinley Park section until the power development plan for this basin is somewhat more crystalized than at the present time. However, the dam which affects the location of Paxson-McKinley Park road is reputed to be the second one in the scheme, so it might become a reality in the not-too-distant future. The storage capacity of the reservoir is enormous. If less capacity would suffice for the estimated future power needs of Alaska, it is suggested that a dam site near the proposed bridge site on the originally planned line for the road be considered by the Bureau of Reclamation. It is reported that this latter site had been rejected because the reconnaissance indicated poor foundation material on the west bank. It is suggested that before this location is definitely rejected for this reason, some drilling be done to determine the depth of the quicksand visible at the surface. If the poor material extends no great depth, it can probably be excavated for far less money than is involved in relocation of the line for the road. The increased cost resulting from this road line relocation does not end with the cost of construction, but continues to increase with the added expense each motorist has to make for the added 15 or 20 miles of distance to travel and with the extra length of road which will have to be maintained.

Any other dam sites shown on the Susitna River basin hydroelectric power development plan will have no direct effect on any of the proposed roads on the Alaska Road Commission plans for development of new roads during the next 6 years. It is very unlikely that development of this river basin for power will have any appreciable indirect bearing on the highway program in Alaska before the end of the 6-year planning period. However, looking further into the future, production of cheap hydroelectric power should reflect in the increased development of the economy of Alaska and in its growth in population, provided there are natural resources awaiting cheap power for economical development. Extension and improvement of the highway system of Alaska will go hand-in-hand with its growth and economic development. If the Susitna River basin is a feasible one, its adoption should indirectly have a profound effect on the future highway program for Alaska.

B U R E A U   O F   L A N D   M A N A G E M E N T
REGION VII
ANCHORAGE, ALASKA

COMMENTS OF THE BUREAU OF LAND MANAGEMENT ON BUREAU OF RECLAMATION'S PROPOSED PLAN FOR WATER RESOURCES DEVELOPMENT IN THE SUSITNA BASIN

It is axiomatic that land and water are inseparable in their use. In the Susitna basin the Bureau of Reclamation has pioneered a way to bring them into a relationship in which each makes the other more useful. The general plan of water-resources development recommended in the report provides mainly for the construction of hydroelectric projects, and should render substantial benefits to agricultural and industrial interests and also lead the over-all development of South Central Alaska.

Nearly all of the land in the Susitna basin is vacant, unappropriated, and unreserved. Of the total land area of 12,700,000 acres, approximately 6,580 acres are reserved for public use purposes and barely 5,000 acres are patented or entered land. There are a few settlement claims scattered throughout the area which may eventually be surveyed and patented. None of the land is presently embraced in grazing leases or timber sale contracts. Only 155,255 acres in the whole basin are surveyed land. In the area there is an undetermined number of mining claims, the validity of most of which has not been tested.

The agricultural Research Administration has estimated that there are about 600,000 acres of potential farm land and over 422,000 acres of grazing land in the Susitna basin on its high and low benches and inadequately drained plains below an elevation of 500 feet, if climatic conditions do not prohibit its use (table 1).

As seen from the table, there is a large acreage physically capable of being tilled or grazed from the standpoint of soils alone. The limiting physical factor in any agricultural development of portions of the Susitna basin is anticipated to be deficiencies in climate. Limited meteorological studies show the growing season to be comparatively short--generally about 70 days as compared with 100 days in the Matanuska Valley, 115 days in the Anchorage area, and 70 to 100 days on the Kenai Peninsula.

Possibly the very large lake created at the confluence of the Yentna and Susitna Rivers by the dam projected at Susitna will have a significant affect on lengthening the growing season on agricultural lands in the lower portion of the basin. Fortunately, most of the potential farm land in the basin lies in close proximity to the proposed reservoir. If not, important agricultural development in the Susitna basin even under greater population pressure and more favorable economic conditions is unlikely.

With further development of the Matanuska Valley and Kenai Peninsula agricultural areas in the immediate future, there would clearly be no call to increase the presently very small amount of land in agricultural use in the Susitna basin. There are very definite limits to the agricultural market in Alaska and hence to the possibility of expanding farm land use, unless new uses providing industrial outlets are developed. It is predicted, based upon factors now apparent, that there will be no economic demand that warrants extension of agriculture to new lands in the Susitna basin unless population in South Central Alaska reaches over 500,000 people.

At present, the development of new areas would be generally successful only to the extent such areas possess advantages over others already in agricultural use and could take markets away from older areas when the present market deficit is adequately supplied. Where existing demands could be adequately supplied from areas already being developed, of comparable or superior productivity, additional land in new areas should be put to use only if there is a large new demand which cannot be supplied from them.

At the present time, there are only about 12,500 acres under cultivation in Alaska producing primarily vegetable and forage crops. Based on an estimated 115,000 civilian and military population in Alaska, exclusive of the panhandle and the native population who normally use only small quantities of farm products, about 31,000 acres could be in production of products adapted to Alaskan climatic conditions if this market were fully supplied from South Central Alaska--except for beef and cheese products, for which there is considered to be an economic feasibility limitation at present. If the latter products could be produced economically also, a total of 75,900 acres could be in production. Several times this quantity of agricultural land, as shown by Soil Conservation Service land capability surveys and Bureau of Land Management reconnaissance land classification surveys in Western Kenai Peninsula, the Matanuska Valley, and the Fairbanks area, is available, including lands both within and outside of present farm and homestead areas, to provide for this food deficit. In the future, however, as the economy of this part of the Territory continues to develop, population greatly increases, and the better lands in these areas are developed, further expansion in the cultivated acreage might best take place in the southern Railbelt areas of the Susitna basin and on lands adjacent thereto in the agriculturally promising Pittman to Houston area where concentric farm development around the present agricultural development in the Matanuska Valley is expected to eventually occur.

Very little of the land to be inundated by the projected dam reservoirs has any value for agricultural or other forms of settlement and development. From the standpoint of a future agricultural land utilization program in the basin it is important that any settlement be restricted as far as possible to the most suitable lands and that on such lands settlement conditions be made as favorable as possible to the success of various forms of enterprise.

The Bureau of Land Management in cooperation with the Alaska Soil Conservation district plans during the period 1955 to 1957 to conduct land classification and land capability surveys for various purposes in selected portions of the Railbelt in the lower Susitna basin and adjacent Houston to Pittman areas in advance of settlement. These surveys will assist to program and guide settlement onto lands suitable for various forms of development. Unfortunately, however, experience has shown that only a very small percent of the homesteads in Alaska is developed into permanent farms.

The need for the development of Susitna water resources for power is considered to be urgent and pressing while the need for conversion of land resources into farms and ranches in the Susitna basin is still in the future. The stimulus to commercial and industrial developments in South Central Alaska given by abundant and cheap power and the almost certain attendant growth of urban population will, however, increase the requirements for agricultural products and hasten the time when some of the lands should be brought into production.

It may be possible to build up part-time farming in parts of the basin by creating regular forest employment. At the present time, work in harvesting wood crops is insignificant, but there are possibilities of utilizing the Talkeetna and possibly other birch stands as they become accessible by transportation developments for birch veneer, flooring, and other wood product industries.

The Susitna River basin sustains the largest stand of commercial birch timber west of the Mississippi River. Large stands of merchantable cottonwood and aspen also occur in relatively pure stands. Merchantable white spruce is found intermingled with the birch as well as in small areas of pure stands. Today, the birch and cottonwood have not been exploited because high freight rates and labor costs have prohibited competition with the States. Someday, however, the timber situated in the Susitna Valley will afford a thriving, permanent, year-long industry. When, depends upon the demand for birch lumber, the supply of which is becoming scarce as the birch stands in the United States are being depleted faster than they are growing.

There are large stands of mature and overmature birch ready for exploitation, but there are also found large areas of young even-age birch. There have been so many burns in past years that all-age stands have been created. This will assure a constant supply of timber in the future. The age and geographic distribution of the birch stands are favorable for the beginning of sustained-yield management units.

Most of the birch timber is found on the benches and ridges above the streams where it would be safe from the water impounded by dam construction; this is not true of some of the cottonwood stands.

The timber is found in large stands which can be generally defined by geographical locations.

1. Knik Birch Stand.--This timber is known locally as the Knik Birch Stand: It is located on the northwest side of Knik Arm. It embraces 68,000 acres of mature merchantable birch timber with a gross volume of 89,000,000 board feet. In addition to this, there is a birch-spruce type area of over 6,000 acres which carries about 29,000,000 board feet. Some cottonwood occurs in this area, but the total volume is less than 3,000,000 board feet.

2. Talkeetna Birch Stand.--This stand of timber is situated about 6 miles east of the Alaska Railroad and roughly 90 miles north of Anchorage. It parallels the railroad for many miles. It covers an area of approximately 80,000 acres which supports an estimated 100,000,000 board feet of merchantable birch timber. Many millions of board feet are found in smaller adjoining stands which are inaccessible today and about which little is known as to quality and volume.

3. Shell Hills Stand.--This little-known birch stand is about 75 miles northwest of Anchorage on the low hills between the forks of the Yentna and Skwentna Rivers. Only a general aerial reconnaissance has been made of the area thus far. It is known that the area supports a good body of timber which is today inaccessible.

4. Peter Hills Stand.--This, too, is a little-known birch stand. It is situated at the foot of the Peter Hills 20 to 30 miles west of Talkeetna. It is now thought of as a potential birch supply after the other more accessible stands have been exploited.

5. Susitna Cottonwood Stands.--Very good stands of cottonwood are to be found along the Susitna River from close to its mouth to Talkeetna. Some of these stands are quite extensive. The tributaries of the lower Susitna Valley also afford quite extensive stands. The volume and acreage is not definitely known, but it is certain that it runs into many millions of feet and thousands of acres.

6. General Spruce Stands.--There are thousands of acres of white spruce scattered over the Susitna basin which will furnish a substantial amount of lumber when harvested in conjunction with the birch and cottonwood stands.

Outdoor recreation is rapidly winning a place as an important form of land use in the Territory. With new road construction the Alaskan, too, has acquired mobility and frequently answers the "call of the wild." Tourist business promises to become one of Alaska's major industries. The use of the land for this purpose is not only a distinct social benefit, but it is also important economically. The Susitna basin, tributary to an area of comparatively dense population and high per capita wealth, is in a favorable position to benefit from the demands of a rather huge recreational market.

The Department of the Interior has large responsibilities for conserving natural recreational attraction and providing some facilities for the enjoyment of them. Mount McKinley National Park, which lies partly within the northern portion of the basin, was established by an act of Congress in 1917. Nancy Lake, which lies on the southeast margin of the basin, is already a prime recreational center. The Bureau of Land Management has 96 cabin sites under lease there under the Small Tract Act and has set aside sizeable area for public recreational purposes. This is only a good beginning. The shore line of other attractive lakes and on some of the clear-water streams along the railroad will be classified and surveyed into cabin tracts and reserved in part for public use as demand develops.

The forests which serve as a background to almost all recreational activity--to many it is the direct attraction--must be properly managed and saved from further devastation by adequate fire-control measures, because of its enhancement of scenic values, wildlife population, and stream and lake enjoyment. If properly protected there is no doubt that large areas of wilderness in the Susitna basin, unsuitable for more intensive use, will become increasingly valuable as a recreational resource. It is in the interest of the majority of the people that adequate provisions be made soon for public recreation areas. Such areas are of several types--wilderness preserves, natural areas, roadside areas along the Paxson to Cantwell road, camp sites, community parks, and game preserves. In a large measure, the final determination of the necessary number, size, and distribution of all types of recreation areas must await a more complete analysis of public demand for various types of recreation and the lands available.

Some of the small communities along the railroad may be suddenly faced, upon completion of high priority power projects, with urgent problems of growth deriving from new industrial establishments attracted by cheap power and undeveloped mineral and forest resources. The Bureau of Land Management intends within a few years to inventory and classify lands for present and future use, and disposal in and about these communities, and if there be need, design and survey adequate town sites for them.

Public lands in the Susitna basin will no doubt continue to supply gold; and other mineral deposits may come into more significant use with Government subsidization of mining, improved transportation, and power development. The Bureau of Land Management, charged as it is with the disposal of all mineral deposits, has a large responsibility in expediting the development of the mineral lands.

Table 1.--Estimate of potential agricultural land in Susitna basin below 500 feet, but without regard to the limitations of climate

(Source: Alaska Agricultural Experiment Station)

Land Category	Percent of Total	Potential Farm Land (a) Extensive Use (b)	Intensive Use (c)	GRAZING LAND (d)	TOTAL
		Thousands of acres			
High benches 1/	21	82	94	48	408
Low benches 2/	45	348	410	201	872
Undrained plains 3/	34	19	96	173	640
Total	100	449	600	422	1,920 (e)
		Percent of land category			
High benches		20	23	12	
Low benches		32	41	23	
Undrained plains		3	15	27	
Total		23	31	22	

1/High benches and mountain slopes, a large proportion of which are steep, rough, and broken. Small acreages suitable for cultivation are scattered and disconnected. Grazing is the most intensive use to which a large acreage can be put, and even this grazing land will not be used unless winter feed can be grown elsewhere in the basin. Most of the land in this category will be left in the forest.

2/Low benches, rolling glaciated land forms, and elevated terraces and plains. These areas are linear in nature, following the river courses and separating large areas of undrained land.

3/Low undrained plains (tundra, muskeg, marshes, and swamps) make up the largest contiguous areas which occupy the center of the basin. Within this land class are inclusions of rolling hills and elevated land that may be broken and farmed. When population pressures warrant extensive drainage operation, some of the present wet soils will be cultivated.

(a) Land that can be tilled. Climatic limitations may prohibit its use.

(b) Land that can be immediately cleared and tilled without reclamation practices.

(c) Includes acreages listed in the column on the left, plus additional acres that can be cultivated after drainage.

(d) Summer range areas, exclusive of acreages listed in the columns on the left, can be used only if supplementary winter feed is produced within the basin.

(e) Total agricultural area of basin west of 150° and below elevation of 500 feet.

SOURCES:

Bennett and Rice, Reconnaissance soil survey of the Cook Inlet Region; United States Department of Agriculture, 1914.
Several map series: United States Geological Survey, 1920-1945.
Gasser, Information for prospective settlers: Alaska Department of Agriculture, 1948.
Unassembled notes and observations of technicians during Railbelt travel: Alaska, Agricultural Experiment Station, 1948-1952.

NOTE:

There is only a negligible amount of land east of the longitude 150° North in the Susitna basin which lies below an elevation of 500 feet.

B U R E A U   O F   I N D I A N   A F F A I R S
ALASKA NATIVE SERVICE
JUNEAU, ALASKA

REPORT RELATIVE TO DEVELOPMENT OF HYDROELECTRIC POWER, SUSITNA RIVER BASIN, BY BUREAU OF RECLAMATION, INTERIOR DEPARTMENT

In accordance with action taken by the Alaska Field Committee at their meeting held in Anchorage, October 18 and 19, 1951, this office has reviewed the plans of the Bureau of Reclamation for the development of hydroelectric power in Susitna River basin and I would like to report to the Bureau of Reclamation that this investigation disclosed that their proposed hydroelectric power development in that area will not adversely affect any program of the Alaska Native Service. There are no known natives living in the area who will be required to move because of this development. In other words, the proposed development will not flood or in any manner disturb any native village in the Susitna River basin.

On the other hand, the hydroelectric development program's objective is to develop power for use in the Alaska Railbelt which will undoubtedly bring industrial development into that area. A number of natives reside in the Alaska Railbelt area. However, they as a whole gain their livelihood through employment in the labor market and, therefore, it is fair to assume that any development of hydroelectric power would increase their employment possibilities. Therefore, the development should improve rather than hinder their potential employment.

Undoubtedly some of the natives living in that area do gain a portion of their livelihood in trapping and fishing. It is assumed, however, in this report that the development of hydroelectric power in the Susitna River basin will not seriously affect the fishing or fur-bearing industries.

In view of the foregoing, the Alaska Native Service interposes no objection, but on the other hand, endorses the development of hydroelectric power in the Susitna River basin. We believe that such a project will benefit all the people, including the native population residing in that area.

A L A S K A   P U B L I C   W O R K S
JUNEAU, ALASKA

The District Office, Alaska Public Works, Office of Territories, Department of the Interior, has long recognized the need for further and detailed study on hydroelectric possibilities in the Railbelt area of Alaska.

A study of the various electric generating plants now under operation and construction by numerous federal and municipal agencies, and the rapid expansion of distribution systems indicates an urgent need for a coordinated long-range plan and system.

The need for a power-transmission grid, especially in Anchorage and vicinity, has existed for several years and each year the need becomes progressively more acute.

Studies to date by Alaska Public Works have disclosed that deep wells are feasible and consequently a solution to the problem of obtaining ample potable water for water distribution systems in the Railbelt area, all of which will require low-cost electrical energy for pumping purposes.

UNITED STATES GEOLOGICAL SURVEY
WASHINGTON, D. C.

STATEMENT OF GEOLOGICAL SURVEY ACTIVITY IN SUSITNA RIVER BASIN AS REQUESTED BY BUREAU OF RECLAMATION

TOPOGRAPHIC MAPPING

The expanded topographic mapping program of the Geological Survey in Alaska during the past several years has resulted in the publication of complete coverage of the Susitna River Basin at the scale of 1:250,000. Large scale mapping for publication at the scale of one mile to the inch (1:63,360) has been published or is nearing completion for most of the area in the Railbelt. This accelerated mapping program is a major part of the activity of the Geological Survey in the Susitna Basin to date. It has resulted in providing many basic maps which are essential for the use of agencies involved in planning for the development of the resources of the Basin. The areas for which published maps are available and our current operations are shown on the map, "Status of Topographic Mapping."

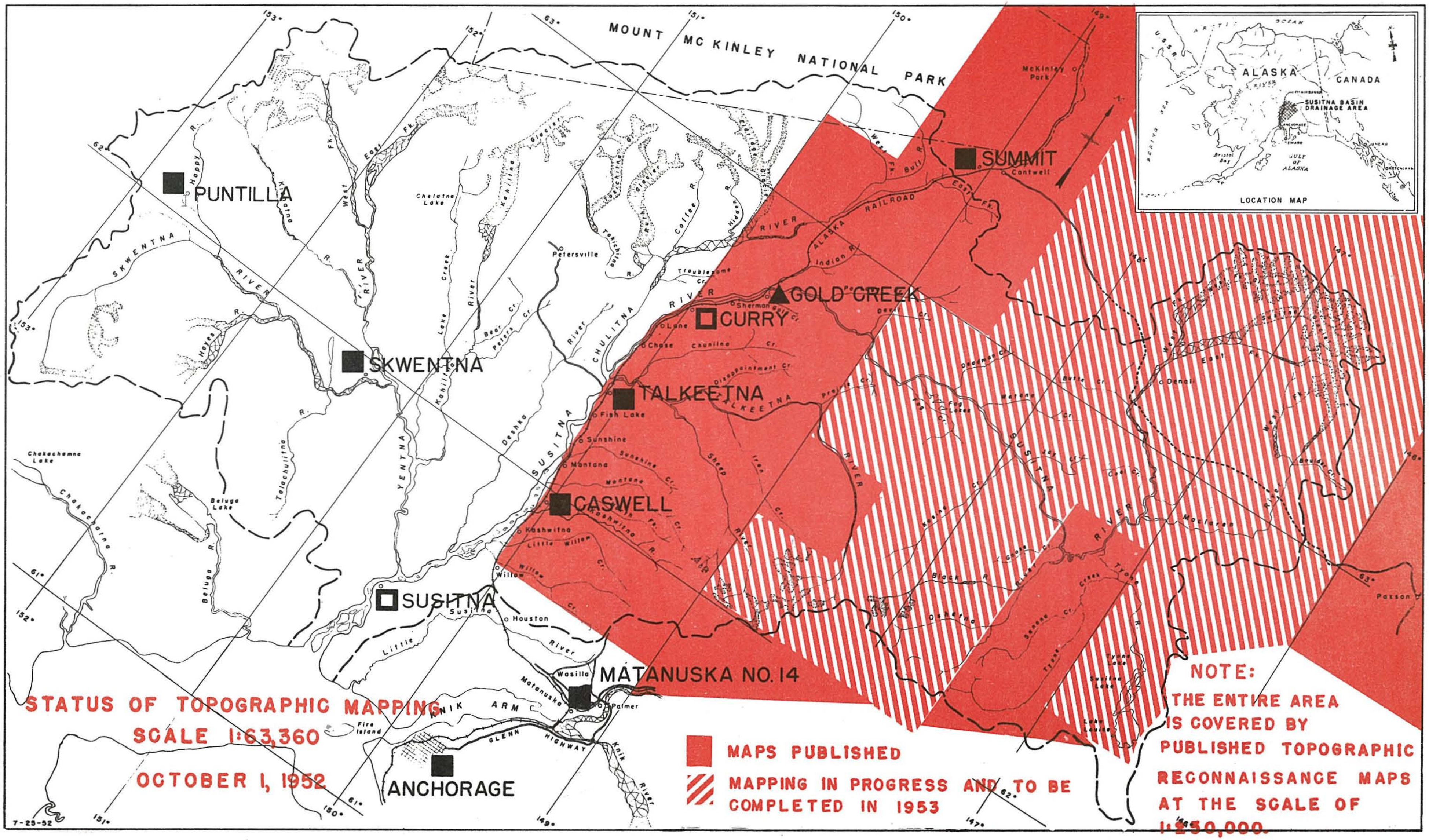
During late 1948 and early 1949, the Geological Survey was apprised of the proposed Bureau of Reclamation studies in the Susitna Basin and of the attending need for topographic maps. The area emphasized at that time was the portion of the Basin above Gold Creek.

Immediate plans were made to obtain vertical, single-lens aerial photography of the area, as required for photogrammetric mapping. Aerial photography in Alaska is a difficult operation because of adverse weather conditions. Fortunately, the photographic project in the summer of 1949 was highly successful and almost complete coverage of the Susitna Basin above Gold Creek was obtained. A small amount of additional Basin coverage was obtained during 1950 and 1951.

With aerial photography available, field survey operations which had begun on the transportation routes fringing the Susitna Basin were extended during the 1950 and 1951 summer seasons to cover the entire Basin area above Gold Creek. Operations were successfully facilitated by the use of all possible rapid and advanced methods of surveying, including the establishment of vertical control by vertical angles, precise barometric altimetry, and air-borne radar altimetry, shoran control of photography and air transportation. Helicopters were a special boon and allowed substantial savings in time by providing a means of transporting men and equipment from base camps to mountain crests and other isolated areas difficult of access by any other means.

The field work described above and results of subsequent map compilation, and field and photographic plans for 1952 and later years, are outlined below as related to the indicated tentative reservoir areas in the Susitna Basin.

GPO-87-80667


MOUNT MC KINLEY NATIONAL PARK
PUNTILLA
SKWENTNA
SUMMIT
GOLD CREEK
CURRY
TALKEETNA
CASWELL
SUSITNA
MATANUSKA NO. 14
ANCHORAGE
STATUS OF TOPOGRAPHIC MAPPING
SCALE 1:63,360
OCTOBER 1, 1952
MAPS PUBLISHED
MAPPING IN PROGRESS AND TO BE COMPLETED IN 1953
NOTE:
THE ENTIRE AREA IS COVERED BY PUBLISHED TOPOGRAPHIC RECONNAISSANCE MAPS AT THE SCALE OF 1:250,000.
ALASKA
CANADA
SUSITNA BASIN DRAINAGE AREA
LOCATION MAP
7-25-52

1. Mapping at 1:63,360 Scale (covers entire Basin east of the Alaska Railroad which is practically all of the area east of longitude 150° West)

Chulitna River at Coal Creek and Copeland Creek
Talkeetna and Sheep Rivers

Maps of these areas have already been compiled. Most have been published and publication of the remainder is expected in the near future.

Susitna River above Gold Creek, including the headwaters.

All maps have been controlled and are ready for compilation. Compilation is scheduled for completion by January 1953.

Chulitna River at Coffee River	Yentna River
Susitna River at Deshka River	Skwentna River

All quadrangle mapping in the area west of longitude 150° West, comprising about 8,000 square miles, is dependent upon the securing of aerial photography.

2. Mapping at 1:250,000 Scale

The entire Susitna River Basin is covered by published maps of the 1:250,000 scale series. Quadrangle names are as follows:

Mount Hayes	Talkeetna Mountains	Mount McKinley
Gulkana	Tyonek	Anchorage
Healy	Talkeetna	

The mapping in the Susitna River Basin has been entirely financed from funds directly appropriated to the Geological Survey for topographic mapping. The magnitude of future operations will depend upon the availability of funds.

GEOLOGY AND MINERAL RESOURCES

Topography

The drainage basin of the Susitna River comprises three topographic divisions; from west to east, the southeastern slope of the Alaska Range from Mount Spurr on the south to Mount Hayes on the northeast; the Susitna Lowland, and most of the Talkeetna Mountains. This area, about 180 miles long and 150 miles wide, is drained by the Susitna River and its tributaries.

Throughout that part of the Alaska Range that forms the western, northwestern, and northern wall of the Susitna drainage basin, the range is extremely rugged and deeply glaciated. Most of this part of the range is 7,000 feet to 9,000 feet in elevation. Seen from the south, the crestline presents an uneven aspect, with the range low on the whole, dominated by three high mountain masses. These are the Mount Spurr-Mount Gerdine group in the extreme south and culminating in Mount Gerdine (12,600 feet); the Mount McKinley group at the great bend in the range, culminating in Mount McKinley (20,230 feet) and Foraker (17,280 feet); the Mount Hayes group culminating in Mount Hayes (13,740 feet). Most of the streams rising in higher parts of the range head in glaciers. The mountains around Mount Spurr, Mount McKinley and Mount Hayes support long glaciers, some of which extend 20 to 30 miles from their source to the edge of the plains bordering the range. Glaciers on the south side of the range are much larger than those on the north side as this side receives the most precipitation.

At its widest part, about 50 miles north of the Susitna River, the Susitna lowland is 70 miles wide. It narrows rapidly northward, and beyond the latitude of Curry, the lowland continues as the Broad Pass depression about 10 miles wide. The surface of the Susitna lowland is largely mantled by deposits of glacial and glaciofluvial origin, formed during Pleistocene time when a vast ice sheet covered this area. Its topography, though minor in relief, is diversified. The northern part has a great system of parallel north-south ridges, 10 to 50 feet high, and looks as though it had been furrowed by a great plough. Between the Susitna Valley and the Matanuska Valley is a broad, low, medial moraine, extending southwest from the corner of the Talkeetna Mountains. This is hilly country with relief up to 200 feet and numerous lakes. A few high hills and low mountains, composed of granite, rise in the center of the Susitna lowland just north of Cook Inlet. The most important of these is Mount Susitna, 4,397 feet high.

The Susitna lowland and its extension, the Broad Pass depression, are bordered on the east by the Talkeetna Mountains, a rudely circular, very rugged mountain mass. Most of the area of these mountains drains into the Susitna River and its tributaries. The Talkeetna Mountains are approximately 100 miles across in a north-south direction and 80 to 90 miles across in an east-west direction. They are 7,000 to 8,000 feet in elevation in the southern part just north of the Matanuska Valley, and around the headwaters of the Talkeetna River, but summit elevations are less to the north. North of the Susitna River few elevations exceed 6,000 feet. After the headwater tributaries that rise from glaciers on the south slopes of Mount Deborah and Mount Hayes unite near Denali, the Susitna River flows southward about 40 miles and there abruptly turns westward to cross the Talkeetna Mountains by a deep, narrow, stream-cut gorge, to enter the Susitna lowlands between Curry and Talkeetna.

The Talkeetna Mountains are strongly glaciated and extensive glaciers still exist in the highlands of the southern part of the range.

Geologic Setting

The geology of the area drained by the Susitna River and its tributaries has been known in a general way for many years. A report by S. R. Capps, "Geology of the Alaska Railroad Region" (United States Geological Survey Bulletin 907, 1940), is the most recent and comprehensive summary, although it covers only part of this large drainage basin.

For purposes of discussion of the geographic distribution of rocks, the region can be broken down into four areas: the southern flank of the Alaska Range, the Talkeetna Mountains, the broad lowland of the lower Susitna River, and a flat lake-dotted area in the headwater region of the Susitna River.

The southern flank of the Alaska Range is underlain primarily by a northeasterly trending belt of folded and faulted Mesozoic sedimentary rocks, largely argillite, slate, and argillaceous sandstone, with some interbedded limestone and volcanic material. Locally, older rocks of Paleozoic age are present. This belt of sedimentary rocks also underlies that portion of the Talkeetna Mountains north of the Susitna River. Scattered granitic intrusives of probable late Mesozoic age are widely distributed throughout the sedimentary sequence.

The southern portion of the Talkeetna Mountains is essentially a batholithic mass of quartz diorite and associated intrusive rocks. These rocks are probably related to the intrusive rocks of the southern flank of the Alaska Range. Basic lavas, tuffs, and greenstone of pre-Cretaceous age which cover the northern portion of the batholith are especially well exposed throughout the length of the Talkeetna River. The batholith is flanked on the south by late Mesozoic and Tertiary sedimentary rocks, predominantly sandstone, shale, arkose, and conglomerate, which contain the coal measures of the Matanuska River Valley.

The broad lowland of the lower Susitna, Yentna, and Kahiltna Rivers is largely covered by unconsolidated Quarternary deposits. Along the margins of this broad covered area Tertiary sedimentary rocks occur. These are mainly shales and sandstones with lesser amounts of conglomerate. Locally they are coal bearing. Similar Tertiary rocks probably underlie the greater part of the covered area.

The lake-dotted area in the headwater region of the Susitna River is also largely covered by Quaternary deposits. Scattered outcrops of undifferentiated Paleozoic sedimentary rocks occur within this area. Basic lavas, tuffs, greenstones, and granitic intrusives similar to those of the Talkeetna Mountains farther west crop out on the margins of this covered area.

Mineral Resources

Although parts of the Susitna basin have not been examined geologically, and much of it in only a reconnaissance manner, a variety of minerals are known to occur in the area. Production has come mainly from deposits of gold.

Gold.--Gold has been mined in three main areas in the Susitna basin, Willow Creek district, Yentna district, and Valdez Creek district.

The Willow Creek district is a small but important lode-gold mining district along the southern border of the Talkeetna Mountains. To date, the district has produced about 5 percent of Alaska's lode-gold output. Productive gold quartz veins occupy shear zones in quartz diorite within an area about 8 miles long in a nearly easterly direction and about 4 miles wide. The ore is essentially a free-milling, gold quartz ore containing small amounts of sulfides and tellurides. All mines in the Willow Creek district are small, and most minable veins have been exploited only to shallow depths. Yet the veins in this district are similar mineralogically and structurally to veins of other districts where mining has been carried out for several thousand feet in depth. Larger-scale operations are needed to exploit the Willow Creek type of veins most successfully. The geologic setting of the Willow Creek veins is favorable to successful lode mining but this is temporarily overbalanced by unfavorable economic conditions.

Practically all of the gold mined in the Yentna district has come from placer deposits, mainly within the basins of Cache Creek and Peter's Creek and from the area of Mills Creek and Twin Creek. Mining began in the Cache and Peter's Creek area in 1905 and has continued to the present time. Although gold quartz veins have been found in slate and graywacke, associated with granitic intrusives in the area, little or no lode gold has been produced. The placer deposits so far mined, include present stream gravels, terrace gravels, morainal material, and basal Tertiary conglomerate. Concentration of the gold seems to have occurred through erosion of the Mesozoic sediments with their gold quartz veins and deposition as basal Tertiary sediments. These in turn have been eroded and the gold in large part transferred to more recent gravels. Whereas, most of the production has come from present stream gravels and low terraces, all of the above occurrences have yielded gold concentrates.

The Valdez Creek mining district near the headwaters of the Susitna River is primarily a placer area, essentially all of its production being from this source. Lodes have been prospected in the area, chiefly for gold; but little or no gold has been produced from them. Placer mining began in recent stream gravels but soon revealed the main source of gold was an old buried stream channel, the Tammany Channel, which was being eroded by Valdez Creek. Although most of the production has come from Tammany Channel near Denali, other old gold-bearing channels are known. The district has never been a large producer and there has been little activity of late. It is likely that interest in the district will increase when it becomes more accessible after completion of the McKinley-Paxson road which will make the district more accessible from the railroad and accessible from the Richardson Highway.

Placer and lode gold have been produced at a few other places in the Susitna basin, but production has been small.

<u>Copper</u>.--Occurrences of copper in the Susitna basin are known principally in two areas--Iron Creek and near the West Fork of the Chulitna River.

Iron Creek is a tributary of the Talkeetna River in the western part of the Talkeetna Mountains. The copper prospects all occur in a belt of andesite greenstones, some of which are amygdular lava flows and some are coarser-grained rocks that are probably intrusives. Many of the copper prospects show abundant copper carbonates and bornite near the surface as oxidation products; but beneath a shallow zone only a few feet thick the original minerals are pyrite, arsenopyrite, chalcopyrite, specular hematite, and quartz. The ores occur as vein fillings along shear zones or replacement deposits in the sheared greenstone. Development work was carried out mainly between 1910 and 1917 and consisted of trenches and open cuts. Locally there are bodies of nearly pure copper sulfides, but no large ore bodies of this type have been developed. Most of the ore is of moderate richness. No active prospecting or development work has been done in the Iron Creek district in recent years, and most of the claims have been abandoned.

About 8 miles west of Colorado on the Alaska Railroad, carboniferous rocks are mineralized to some degree within a belt about 8 miles wide and 2 miles long that crosses the West Fork of the Chulitna River. The rocks are intruded by small stocks and dikes of dioritic composition. The lodes are related to the intrusions and are of three kinds: (1) disseminated deposits mainly in the intrusive rocks; (2) replacement deposits along bedding in calcareous rocks; (3) tabular and lenticular lodes with conspicuous vein quartz along fissures and shear zones. The area contains numerous prospects but no productive mines, except for some past production at the Golden Zone mine. Most of the lodes are valued mainly for their gold and silver content, although they contain also notable quantities of arsenic and several carry copper, lead, and zinc. One is valued solely for its copper, another for its silver and lead. Gold occurs in the gravel of several of the creeks, but no valuable deposits have been found.

Coal.--Tertiary rocks of terrestrial origin are believed to underlie the mantle of stream and glacial deposits over most of the Susitna lowland. Parts of the sequence where exposed along the borders of the lowland are known to contain beds of sub-bituminous coal and lignite. Coal beds may be present under a considerable part of the lowland.

From time to time a small amount of sub-bituminous coal has been mined from beds a few feet thick near Houston. Currently, strip mining is practiced.

Near Costello Creek, about 11 miles by road northwest of Colorado on the Alaska Railroad, a local basin of Tertiary rocks of about 7 square miles contains several beds of sub-bituminous coal; the thickest is 9 feet. Mining has been carried on intermittently, on a small scale, for a number of years.

At the time the railroad was constructed through the area a small amount of lignite was mined at Broad Pass and sold to the Alaska Railroad. Here the coal-bearing formation contains at least two, probably several, lignite beds. The thickest known bed is 10 feet thick.

Most of the coal produced in the Railbelt has long been mined from two fields outside of the Susitna basin, the Nenana coal field on the north flank of the Alaska Range and the Wishbone Hill coal field near Palmer just east of the southern part of the Susitna River basin. In the Nenana field, large reserves of coal are known, some of which can be produced by strip mining. In the valley of Healy Creek, the number of coal beds ranges from 30 to 32 and the beds range in thickness from less than a foot to more than 55 feet.

The coal in the Wishbone Hill coal field is distinctive from the known coal in the Susitna lowland and from the coal in the Nenana in that it is bituminous in rank. Coal occurs in numerous beds, some of which are as much as 6 feet thick.

In summary of the mineral resources, it can be stated that the Susitna basin contains probable large reserves of sub-bituminous coal in the Susitna lowland, an important lode-gold area; the Willow Creek district; and significant placer gold deposits in the Yentna and Valdez Creek districts. Prospects of other metals such as copper, zinc, and lead are known, but, based on development work to date, are not particularly promising. The area is promising for construction materials, gravel, shale for Haydite, clay for Haydite, and brick. Present information indicates that the known and potential mineral resources of the Susitna basin are mainly of gold, coal, and construction materials. It should be kept in mind, however, that parts of the Susitna basin have not been examined geologically; large areas have been examined in a reconnaissance fashion only; and parts of it are difficult of access, particularly with respect to commercial production.

The more important references on the geology and mineral resources of the Susitna basin are listed below.

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WATER RESOURCES INVESTIGATION

The Geological Survey is currently furnishing available stream-flow information to the Bureau of Reclamation. This consists essentially of data for Susitna River at Gold Creek and data on streams in adjacent basins. Data on the sediment load of the Susitna River at Gold Creek is also being supplied.

A large amount of additional water-resources investigation is prerequisite to a more detailed study of water utilization in the Susitna River basin. This work should include the establishment of additional stream-gaging and sediment-sampling stations. It is possible that some study will eventually be necessary of the ground-water resources of the basin. The magnitude of this ground-water investigation is unknown at present, and no estimate has been made of its cost.

Surface-Water Investigations

Investigation of the initial development of the main stem of the Susitna River would require the installation of two more gaging stations and some additional construction at the existing station. The estimated total cost of this work is $34,000. Annual operation cost of these three stations, including office computations and administrative overhead, would be about $6,000.

A minimum of nine additional stream-gaging stations should be established ultimately to provide an inventory of the surface-water resources which would be adequate for a water utilization study of the main stem of the Susitna River and its major tributaries. No program is suggested for this work, as it should be coordinated with future investigations of the water-resource developments. The individual stations should be established well in advance of each project investigation to insure a sufficient length of run-off record. The estimated cost of constructing these nine stations is $170,000, over half of which is for a station near the mouth of the Susitna River. Estimated annual operating cost of these stations is $18,000.

The above estimates are rough and tentative. Only a detailed examination of the site of each gaging station would make possible a reasonably accurate estimate of cost. Operation of gaging stations at some sites may be too expensive to be practicable, owing primarily to difficult access and transportation.

Sediment Investigations

A minimum program of sediment sampling is proposed in order to determine the magnitude of the sediment problem in the

Susitna River basin. This minimum program is based on the operation of three index stations located at the sites of three stream-gaging stations. One of these sediment-sampling stations is now in operation at Gold Creek. Miscellaneous measurements of sediment discharge should be made at each of the other proposed stream-gaging stations.

The cost of the sediment-sampling program depends to a large extent on the frequency of the miscellaneous measurements. The initial program should include, in addition to the index station now in operation, miscellaneous observations at two sites. Cost of the initial program is estimated to range from $4,000 to $5,000 annually. The ultimate program to determine sediment loads of the main stem and its major tributaries is expected to cost from $15,000 to $22,000, depending on the number of miscellaneous measurements made at each site. The cost of equipping the two additional index stations is estimated at $3,500.

RIVER SURVEY

The Geological Survey had planned a survey of the Susitna River starting in 1953. This, however, is a very difficult, expensive undertaking. Such a survey in an inaccessible region would require the use of helicopters, a very expensive procedure. The cost is estimated at $161,000.

During the past summer the Survey completed field work for topographic mapping of this area. The publication scale will be 1:63,360 with 100-foot contour interval. The compilation scale will be roughly, 1:20,000. It is believed that with a small amount of additional work this map will supply information for a preliminary estimate of storage available and will furnish a sufficiently accurate map for the classification of the lands having power-site value.

A fairly accurate determination of the water-surface elevation at dam sites, dam-site surveys, and geologic examinations is needed. A study of the completed maps may indicate other information will be desirable. This work will require the use of helicopters. An attempt will be made to obtain a rough check on the water-surface elevations at dam sites during the next field season unless this information is obtained by the Bureau of Reclamation which has greater resources. It is doubted that dam-site surveys will be made until helicopters become available at a lower rental.

The river surveys could not be undertaken before the 1953 field season because of the need for advance planning. The Geological Survey could not finance any such project from its present appropriation. If funds were provided by transfer from the Bureau of Reclamation or by direct appropriation, the work would be carried out in conjunction with the topographic mapping program. The principal cost would be for vertical control. The estimated cost does not include any special dam-site surveys, but one or two of these could probably be made using our regular appropriation. The cost could probably be cut considerably if the 5-foot contour crossings on the river surface were eliminated.

It is proposed that this river survey be postponed until the mile-to-the-inch quadrangles now being made are completed for this area. Supplemental contours in selected areas and one or two dam-site surveys can then be added.

THE ALASKA RAILROAD
ANCHORAGE, ALASKA

The Alaska Railroad looks upon the proposed Susitna hydroelectric development as one of the potentially important factors in the Territory of Alaska. Its completion can be the beginning of a new cycle of population growth in the Railbelt region.

Developments particularly noteworthy during the past two decades clearly point to the commanding position of electrical energy in the growth of industry and population. The rules that apply to the economies of living in the Union, and particularly so the Pacific Northwest, also apply to Alaska.

Just as low-cost, dependable transportation to the Interior, as supplied by the Alaska Railroad, has made possible rapid progress in the Tanana and Yukon Valleys, so will an abundance of low-cost, large-volume electrical energy carry forward progress through the next stage of growth and development in the Northland.

It is virtually an impossibility for the Alaska Railroad to predict in exact figures what will happen to industry, to communities, to population, to homesteading and farming, to mineral development---in short, to every phase associated with the term "opening up the country." But we do know that wherever dependable transportation is associated with an important supply of energy, growth and development take place on an ever-expanding scale.

It is said there are mineral occurrences along the Alaska Railroad which will have their first opportunity for profitable exploitation with the advent of abundant, cheap power. We know of industrial possibilities in the Railbelt that await electrical energy and population. Agricultural development, possibly on a vast scale, may be in the immediate offing if abundant, cheap power makes irrigation and economical farm administration possible.

We have talked of a cement plant for a number of years. The development of the Susitna hydro project may have an important bearing on the realization of that cement plant.

All Alaskans are aware that the tourist industry is a major potential of the Territory. A prerequisite to catering to the public on a satisfactory and profitable scale is the existence of an abundance of cheap electrical energy.

The direct benefit to the Alaska Railroad of building the Susitna hydro project would come in two stages. First would be the transportation of a large tonnage of construction material for the dam, power plant, transmission lines, and ancillary materials. Second would be the tonnage that would develop as a result of hydroelectric power bringing the adjacent Railbelt into a secondary stage of development.

We again must turn to the history of the Pacific Northwest to appreciate what can happen in the Railbelt as a result of an occurrence of large-scale, inexpensive energy. Industrial growth is certain to start and to expand. Population will be attracted both by the presence of electrical energy and by budding industry. Each will be a reactor on the other, tending to heighten the cycle of growth and productivity until they reach their economic limits.

You may be sure the Alaska Railroad will give every assistance possible to the realization of the Susitna hydroelectric project, and the efficient transportation of material and personnel. The Alaska Railroad will assist through its Industrial Development Board in the study and promotion of new industry, new processes, and new population in the area served by Susitna power. We will make it a part of our management plan of operation to assign certain key employees to a continuing study of ways of industrial and physical growth in the Railbelt in close association with Susitna hydro power.

F I S H A N D W I L D L I F E S E R V I C E
JUNEAU, ALASKA

SUSITNA RIVER BASIN REPORT

In accordance with the procedure outlined at the January 1952 meeting of the Alaska Field Committee, the Fish and Wildlife Service submits the following statement as its preliminary report on the proposed plan of the Bureau of Reclamation for hydroelectric development of the Susitna River basin. This report is based on engineering information made available to this Service prior to June 1, 1952.

The Susitna drains approximately 19,300 square miles of virtually uninhabited land lying in South Central Alaska. This area is bordered on the south by the waters of Cook Inlet, on the east by the Chugach and Talkeetna Mountains, and on the west and north by the Alaska Mountain Range. Principal tributaries to the Susitna head in high mountain glaciers and are fast-flowing streams, extremely turbulent in the rugged headwater reaches. The Alaska Railroad, which bisects the Susitna basin, provides the only overland means of transportation and has effected a concentration of the meager population in a belt along the railroad. Economic activities, primarily related to the commercial salmon fishery, are centered in the Cook Inlet area. Placer gold, lode gold, tungsten, and coal are mined in the basin but only in small quantities, while other minerals present have received little attention. Portions of the lower basin suited for agriculture have not been developed.

Climatic and geographic conditions determine to a large degree the distribution of vegetation in the basin. Forests interspersed with low muskeg vegetation cover the lower parts of the basin while the higher benches are covered by timber interspersed with occasional glades of redtop grass. Mountain slopes are occupied by a dense growth of trees up to an elevation of approximately 2,500 feet; above this, scattered thickets of alders and willows in widespread meadows of luxuriant redtop grass predominate up to the higher elevations which are practically devoid of vegetation.

The climate of the basin is characterized by long cold winters, and short moderate summers. The upper portion of the basin receives little precipitation while the lower portion being under the influence of the warm waters of the Pacific Ocean experiences frequent cloudy days with gentle rains during the summer and fairly heavy snowfall during the winter. Talkeetna has an annual mean temperature of 33.3° and an average annual precipitation of 30.7 inches.

During the months of May, June, July, August, and September, stream-discharge rates are high as a result of rainfall, snow melt, and, during the latter part of the summer, run-off from the many glaciers. The severe winters, when temperatures seldom rise above freezing, reduce these high, silt-laden flows to low discharges of clear water.

The proposed plan of development presently considers 19 potential dam sites distributed throughout the basin on the main stem of the Susitna River and its major tributaries; power production is the single purpose. Only one project, Devil Canyon, to be located on the Susitna River approximately three miles above the confluence of Portage Creek and the main stem, is under active consideration for construction in the immediate future. In the long-range plan for extending full hydroelectric development to the basin, the Bureau of Reclamation has proposed five dams on the main stem in addition to Devil Canyon, three on the Skwentna River, three on Chulitna River, one on Tyone River, and six in Talkeetna River watershed.

Such an extensive development could have profound affects on the economy of the Territory of Alaska, as well as that of the Susitna River basin. Susitna River contributes substantially to Alaska's primary commercial asset, the fisheries industry. In 1951, Cook Inlet had 21 salmon canneries and 5 fresh-salmon and frozen-Salmon operators and produced well over 10 percent of the total Alaska pack and 60 percent of the Alaska king salmon pack. From 1941 through 1950 Cook Inlet annually produced approximately 6 percent of the total salmon pack of the Territory. The average annual case production was 137,320 cases of reds; 50,394 of pinks; 30,771 of chums; 31,034 of silvers; and 28,772 of kings. This average annual pack is worth about $7,000,000.

Of the Cook Inlet pack, it is estimated that the Susitna River produces about 60 percent of the kings; 20 percent of the reds; 30 percent of the chums; 20 percent of the silvers; and 10 percent of the pinks; having an average annual value of $2,000,000.

During the past four years aerial and ground surveys have been conducted in the basin to determine those waters utilized by spawning salmon and the intensity of this utilization. These studies will be continued. Complete coverage of all lakes and streams of the basin has as yet not been realized. Salmon are presently known, however, to run up the main stem of the Susitna River as far as its confluence with Portage Creek, a short distance downstream from the proposed Devil Creek Dam, and are known to utilize all main tributaries downstream from the mouth of Portage Creek. Whether salmon do or do not run farther up the main stem has not definitely been determined.

Besides being recognized as one of the pre-eminent salmon streams of the Cook Inlet region, the Susitna drainage, like Alaska in general, is noted for its fishing, hunting, and related recreation. The surface of the possible utilization and enjoyment of these natural renewable resources has, however, barely been scratched because of the inaccessibility of the major portion of the watershed. The area along and adjacent to the Railbelt has thus far carried the greatest burden of the ever-increasing fishing and hunting pressure. Recently the use of airplanes has opened up remote areas to recreationists. Daily flights are now made into the basin by commercial air services from Anchorage, Fairbanks, Palmer, and Talkeetna to accommodate the increasing number of anglers. The completion of the McKinley Park-Paxson highway will further increase sportsman utilization by providing easy access by automobile to the upper portion of the basin. It is apparent that recreation in the basin will play an increasingly important role in economy of the Susitna River basin; however, specific information concerning present and potential utilization of fish and wildlife of the area is not available.

In view of the fact that benefits presently being realized from the Susitna basin are derived mainly from its spawning streams, its unusual endowment of fish and wildlife prized by sportsmen, its valuable fur animals, and its recreational potential provided by the intangibles of unspoiled wilderness; any plans for water development within this watershed must proceed with caution if the economy of the basin, as well as the Territory, is not to be disrupted. The inadequacy of the basic knowledge concerning these resources and the uncertainty of the tentative proposal for development, however, preclude an accurate appraisal at this time of the effects on fish and wildlife of all project structures. Available engineering information, while it may indicate the direct and obvious effects of blocking spawning runs of salmon, does not permit an evaluation of the influence of combined operation of two or more features on downstream areas. It is impossible, therefore, for the Fish and Wildlife Service to give even tacit approval to any of the proposed features.

In addition to the threat to the fishery industry, certain reservoirs created will act as barriers to the seasonal migrations of the important Nelchina caribou herd. The herd is restricted to a definite range within the region and does not make long migrations as is typical of the more northern herds. This, together with the fact that the Nelchina area is reasonably close to the center of population within Alaska, makes the caribou accessible to hunters. Hunting restrictions and predator control within the Susitna basin have resulted in a considerable increase in caribou numbers since 1948, with the result that the herd is now a very valuable wildlife resource.

Although detailed analysis cannot be made at this time, it is evident that all dams which would bar known salmon runs should be abandoned. Further, this Service believes that further investigation of project features above known spawning areas should be deferred until additional studies by the Fish and Wildlife Service enable a more satisfactory delineation of the area used by salmon. Should these studies indicate that certain features of the proposed project may be built without great sacrifice to fish and wildlife, or to other interests, which must be considered in any comprehensive plan of development; then planning for these features should be resumed in close cooperation with all interested agencies so that the proposed structures and operations may be modified to provide greatest over-all benefits without significant sacrifice.

In view of increased interest in the development of Alaska's natural resources, the Fish and Wildlife Service recommends that until such time as satisfactory means and measures may be developed that clearly indicate the feasibility of maintaining the salmon industry at its present or greater level concurrently with water-development projects, no further consideration be given to water-development proposals adverse to the welfare of salmon-spawning runs. The development of other sources of potential power, namely coal and natural gas, having less harmful effects on fish and wildlife, should be fully explored before serious consideration is given to hydroelectric production inimical to fish and wildlife resources of the Territory. This Service cannot condone any proposal which might ultimately result in the piecemeal destruction of the fishery resources of Alaska, nor does it believe in the destruction of one naturally renewable resource of known worth to favor the development of another of potentially unknown value.

On the basis of presently available information and in regard to current project plans of the Bureau of Reclamation for the Susitna River basin, the Fish and Wildlife Service recommends that:

1. The following listed potential dams and reservoirs be eliminated from development plans:

Susitna River:	Susitna Station
Talkeetna River:	Keetna Bearpaw Granite Gorge Greenstone Trapper
Chulitna River:	Tokichitna
Skwentna River:	Talachulitna

6 8 8

2. Further investigation of all other project features be deferred pending delineation of salmon spawning areas and a determination of the affects the reservoirs will have on the wildlife habitat and migration of caribou by the Fish and Wildlife.

OFFICE OF THE SECRETARY
ALASKA FIELD COMMITTEE
JUNEAU, ALASKA

COMMENTS OF ALASKA FIELD COMMITTEE CHAIRMAN ON BUREAU OF RECLAMATION'S PROPOSED SUSITNA RIVER BASIN DEVELOPMENT PLAN

The Susitna basin is a virtually uninhabited wilderness area bisected by the Alaska Railroad line and facilities and containing a handful of inoperative gold-mining developments and one small coal operation. The benefits presently being realized from the basin are derived from its spawning streams which provide over one-half of the Cook Inlet king salmon pack and contribute importantly to the pack of other species, the sanctuary and range which protect and perpetuate important varieties and supplies of big game for the hunter and support the fur bearers which contribute to the income of the basin's few human residents, the streams and lakes which lure the sports fisherman, and the intangibles of unspoiled wilderness which form an important part of Alaska's bountiful recreational and cultural wealth. The Susitna basin is also an area of further potentials. Virgin stands of birch and cottonwood of unmeasured commercial value and indications of varied mineral resources are found within the boundaries of the basin. Of greatest interest to the power-hungry Railbelt extending from Anchorage to Fairbanks, however, are the impressive hydroelectric power potentials.

Briefly, this is the picture of the Susitna basin which may be pieced together from the contributions made to this study by the member agencies of the Department's Alaska Field Committee. In addition, the comments indicate need for the immediate collection of further basic data and a carefully coordinated approach to the development of the basin's potentials.

The lack of basic data is painfully evident in the contributors' inability to talk on their subjects in anything but broad generalities. The Alaska Road Commission is unable to discuss adequately its road relocation problems due to the lack of proper maps, for example, and the Fish and Wildlife Service is unable to estimate the affect of dam construction upon salmon runs and of impoundments upon wildlife resources due to a complete lack of basic investigations. Similar evidence can be picked up in other comments. Although all agree that development is desirable, the question of how much and what form of development is warranted constantly arises as a direct result of this lack of a sound indication of the resources of the basin and of the limitations as well as potentials of their development. Only with more basic data than is presently available can final answer be made to such doubting comments as, "production of cheap hydroelectric power should reflect in the increased development of the economy of

Alaska and in its growth in population, provided there are natural resources awaiting cheap power for economical development" and, in another report, "power is essential to development but there must also be the basic resources to develop."

The need for a coordinated approach to the planning of any development of the basin can be deduced readily from the stated and inherent conflicts between present and proposed programs. The basin is important and of value to the Territory's basic economy today because of its fish, wildlife, and recreation resources, all of which are generally in varying degrees incompatible with water-development programs of any magnitude. If we are to avoid the experience of the dog who lost his bone by attempting to take the "bone" from his own reflection, we must candidly and without compromise of the facts examine the nature of the competition between elements of the present pattern of resource utilization and the proposed new pattern for the basin. A coordinated study of these problems will undoubtedly reveal large areas of apparent conflict between the development and conservation phases of present and proposed programs which could be reconciled by compromise and mutual program modification. The Fish and Wildlife Service and the National Park Service have both expressed the hope that we will draw upon Stateside experience and through careful planning be able to industrialize Alaska with a minimum of detriment to the resources upon which the present basic economy rests. There will be areas of conflict, however, which cannot be reconciled and a choice will have to be made as to which element must be sacrificed in the interest of producing the greatest net benefit. This requires a careful and objective evaluation and weighing of the competing elements in order to determine wisely which has the greatest potentials and should have priority of consideration. Again, the essential is a coordinated approach in which all elements will have an equal opportunity to be studied and evaluated without special bias or prejudice.

In summary, there is an urgent need that funds and personnel be made available to provide adequate basic data, maps, economic studies, and resource investigations at a rate in keeping with the progress of the Bureau of Reclamation's proposed engineering planning. The results of these investigations should then serve as the basis for the preparation of a sound and fully integrated plan for the conservation and development of all resources of the basin and its tributary areas. Both the investigations and planning phases call for a complete coordination and integration of effort in order that the maximum net benefits might be derived from the development of the Susitna River basin. Although the situations are not entirely parallel, the Missouri Basin Field Committee's approach to the development of the Wind River basin might well serve as a model for a truly coordinated Department of the Interior attack on the problems of the Susitna River basin.

DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH ADMINISTRATION
WASHINGTON, D. C.

and the
ALASKA AGRICULTURAL EXPERIMENT STATION
OFFICE OF THE DIRECTOR
PALMER, ALASKA

PRESENT USE AND ESTIMATED ELECTRICAL POWER REQUIREMENTS IN THE MATANUSKA, TANANA, AND SUSITNA VALLEYS

The Bureau of Reclamation has made a survey of water flow and possible power sites on the Big Susitna River. Information gathered by their engineers indicates that a number of power sites are available with a total generating capacity of well over 1,000,000 kilowatts of firm power.

The Bureau of Reclamation has let contracts for driving a $4\frac{1}{2}$-mile tunnel through the Chugach Mountains from about 60 feet below the surface of Eklutna Lake to a location near Goat Creek on the Palmer-Anchorage highway. The contracts call for construction of a penstock and power plant with a gross generating capacity of 30,000 kilowatts.

Demands for power now indicate that upon completion of the Eklutna project there will be as great a shortage of power as there is at present.

The Bureau asked for all the information possible on potential uses of power in the Matanuska Valley with estimates on the potential for the Susitna Valley. Since no land capability survey has been made on the Susitna Valley the data has been estimated. The following data, "Estimate of Agricultural Electrical Requirements," for the Matanuska, Tanana, and Susitna Valleys was compiled by Dr. Allan H. Mick, AES, Soils Science Department, and by Mr. C. Ivan Branton, Department of Agriculture Engineer. They have consulted freely with engineers and others and have been conservative in their estimates.

It is the unanimous concensus that if Central Alaska is to develop agriculturally and industrially there must be electric power in adequate amounts and at low rates.

It is planned to construct the first dam in Devil Canyon above Talkeetna. The first power installation would generate approximately 400,000 kilowatts. Other developments would be made as future demand increased. Power lines would at present cover the Matanuska Valley-Anchorage area, the Kenai Peninsula, and would be extended into the Tanana Valley. As settlement developed lines would be extended to the Susitna Valley and possibly along the Glenn Highway to the Copper River country.

ESTIMATE OF AGRICULTURAL ELECTRICAL REQUIREMENTS

The table below summarizes the present electrical usage of the major agricultural areas in Central Alaska and sets forth an estimate of future requirements. Current values are based on annual reports of cooperative distribution companies, adjusted to reflect actual consumption on the farm. Project requirements are calculated from Edison Institute reports on the progress of rural electrification in those parts of the United States where relatively inexpensive electrical power became available in the late 1930's.

Item	Matanuska Valley	Tanana Valley	Susitna Valley[c]
In 1951 (from cooperative records)			
Farms[a]------------Number	463	31	---
Average consumption per month--Kwh	200	125	---
Average price per kilowatt----Cents	6.07	9.00[b]	---
Annual MEA sales--------Million Kwh	4.0	---	---
Estimated total annual farm consumption-----------Million Kwh	0.9	---	---
Projected future requirements[d]			
Farms------------Number	900	100	200
Average consumption per month with adoption of full electrification[e]			
Minimum------------Kwh	300	350	300
Maximum------------Kwh	600	700	650
With adoption of above, plus electrically powered drying equipment and supplemental heating devices[f]-------------Kwh	800	900	850
Projected annual requirements			
Minimum-------------Million Kwh	3.2	0.3	0.7
Maximum-------------Million Kwh	8.6	1.1	2.0
Accompanying annual industrial requirements[g]---------Million Kwh	1.0	0.2	0.5
Total estimated annual agricultural requirements----------Million Kwh	9.6	1.3	2.5
Grand total Million Kwh	13.4		

a Definition vague, but is assumed to reflect present customer status.
b Estimate only.
c No farms at present. Assumed that 200 farms might develop after power and communications become available, with about the same power requirements as in the Matanuska Valley.
d A date cannot be supplied here. With present rate of development stepped up by removal of present restrictions, and supplemented by more readily available capital, this level might be reached within 10 years.
e Edison Institute values used as a base.
f Assuming that transmission and peak load problems can be solved and that power becomes available at a cost comparable to 3/4¢ or 1¢ under the present economic structure.
g Creameries and other food processing and storage plants.

Present use of power on Alaskan farms

The latest report by the Matanuska Electric Association shows the 1951 farm consumption at almost exactly 200 kilowatt-hours per month. It is interesting to note that the monthly use has increased from about 119 kilowatt-hours per month in 1948. This is an increase of 68 percent in a period of 3 years. One might labor under the impression that this increase in the rate of consumption on farms is abnormally high; however, experience in other areas does not prove that this is so. The following data was accumulated by a survey made by the Portland General Electric Company of 50 typical farms in the Willamette Valley, Oregon.

In 1931 the average monthly consumption of electricity was 115 kilowatt-hours. In 1935 it was 265 kilowatt-hours and in 1939 it was 462 kilowatt-hours per month per farm. Farm rates in this area in 1939 were approximately 1 cent per kilowatt-hour on the low step. Probably the average cost per kilowatt-hour was 2 cents or in that neighborhood. In the area just cited, there was approximately a 200-percent increase in the use of electrical power between 1931 and 1935; and there was a 75-percent increase in the use of electrical power between 1935 and 1939. These data are more than 12 years old and at that time the farm use was over 460 kilowatt-hours per month. The following electrical rate schedule was being used by the Portland General Electric Company in the Salem area about 1945:

First 50 kilowatts: 5 cents per kilowatt
Second 50 kilowatts: 3 cents per kilowatt
Next 100 kilowatt-hours: 1 1/2 cents
Next 100 kilowatt-hours: 1 cent
All over 300 kilowatt-hours: 3/4 cent per kilowatt-hour

Data from the magazine "Electricity on the Farm," show the average annual consumption of electricity for Wisconsin and for the United States as a whole. For Wisconsin the farm use of electricity increased from approximately 108 kilowatt-hours per month in 1941 to 290 kilowatt-hours per month in 1950. This is almost 300-percent increase in 9 years. From the chart presented it seems that the national average has only doubled in the same period, going from approximately 100 kilowatt-hours per month to approximately 200 kilowatt-hours per month. Since the chart shown includes the entire nation, it may be well to point out the cost for electricity in the East on an over-all farm use basis was approximately 3.18 cents per kilowatt-hour in 1950; however, in the West the cost per kilowatt-hour was approximately 1.19 cents. In this connection the farm use in the West was approximately 400 kilowatt-hours per month.

Considering the high labor costs in this area it is possible that the farm usage could be boosted to a point where it would average from 500 to 600 kilowatt-hours per month. This might require some effort on the part of the Extension Service in education as to profitable uses of electricity; however, there are several potential uses of electricity which would meet with wider acceptance than they do in the States. As an example: consider the use of electrically heated hotbeds. With the price of such vegetables as tomatoes and cucumbers at high levels, it would be economical to use electrically heated hot-beds for the production of these high-cost vegetables. Electrical heating of greenhouse benches would also be practical. Greenhouse operations would ultimately require some form of soil sterilization. Electrical power is the most convenient for sterilizing soil in greenhouse operations.

Another use which would have great potential value to vegetable producers in Alaska would be in maintaining root cellars at a proper temperature. As an example, a root cellar for the storage of cabbage or carrots should be held at approximately 30°. An underground cellar could be held at this temperature at very little cost using electricity. Potato storages which need to be held in the vicinity of 40° F. would also offer a practical and profitable manner of using electricity. For large heating loads electricity would still probably not be practical even at 3/4 cent per kilowatt-hour. At 3/4 cent per kilowatt-hour it would cost $2.20 per million BTU for electrical energy compared to 34 cents per million BTU for coal at $10 a ton, and $1.30 per million BTU for fuel oil at 20 cents a gallon. Electricity does pay for its higher cost when by the use of it some operation can be made automatic eliminating labor cost or supervision effort.

Power required for domestic heating

It is doubtful in this severe climate whether the price of electricity will ever be low enough to be used as a major source of heat. As an example, it would require approximately 30 to 35 kilowatts of heating equipment for an average house (insulated with 2 inches of commercial insulation).

Power required for drying hay and grain

For the operation of fans in the process of drying hay or grain, a person might estimate a consumption of 3,000 kilowatt-hours over a 3 months' period. As a source of heat for drying the grain, electricity at 3/4 cent per kilowatt-hour would probably be too expensive. A problem which must be faced in the utilization of electricity in large amounts such as heating applications is that the size of the transformer and of the power distribution lines serving the installation must be large. Existing power lines distributing power to farms would not carry such loads. Farmers would probably not be willing to pay the extra cost required to rebuild the existing distribution system in order to make use of these large blocks of power.

The greatest amount of load building can be done by such applications as domestic water heating, electrical cooking, adequate lighting, and the use of an electric motor wherever one can be used.

When Bonneville and Grand Coulee Dams were being planned on the Columbia River, it was the consensus of opinion of many people that the dams were larger than would ever be needed and that it was kind of a waste of Government money to build these facilities. At the present time, in the Northwest there is a power shortage and both of these dams are in operation although not yet to full capacity, as there is a delay in the production of generating equipment. There is no longer any doubt in anyone's mind in the Northwest but that the entire generating capacity of both dams would be utilized almost 100 percent as soon as facilities are available. The entire agricultural economy of Alaska would be greatly benefited by reduced electrical power rates which can come only by increased generating capacity.

SOIL SCIENCE SECTION

An estimate of potential farm land

The Susitna basin is bounded on the west by Mount Susitna, on the east by the Talkeetna Range and meridian 150°. On the south it opens on Cook Inlet. The basin is roughly oval in shape with the long axis extending some 90 miles north and south. Its east-west width averages 30 miles. An arm extends westward from the main basin to a distance of 25 or 30 miles up the Yentna and Skwentna Valleys. The total land area below an elevation of 500 feet is roughly 3,000 square miles.

In any estimate of agricultural potential climate must receive as much consideration as soil characteristics. For the purpose at hand, it is emphasized that limited meteorological studies show the growing season in this area to be relatively short--somewhere within the range of 78 to 90 days. Rainfall is somewhat greater than in the Matanuska region. Comparable climatic regions elsewhere in the world have never supported much more than a bare subsistence for farm populations. Agricultural development of the Susitna basin under existing economic conditions is therefore unlikely. When economic population pressures become great enough to justify expansion of Alaska's agriculture outside of the present focal regions, it still will remain a matter of some conjecture as to the desirability of developing the Susitna basin.

The limiting factor in the development of this region is therefore anticipated to be deficiencies in climate rather than in soils. Map reconnaissance and observations along the Railbelt reveal that considerable areas of good soil may be found in the Susitna basin. A rough classification includes 3 land categories, briefly described as follows:

1. High benches and mountain slopes, a large proportion of which are steep, rough, and broken. Small acreages suitable for cultivation are scattered and disconnected. Grazing is the most intensive use to which a large acreage can be put, and even this grazing land will not be used unless winter feed can be grown elsewhere in the basin. Most of the land in this category will be left in forest.

2. Low benches, rolling glaciated land forms, and elevated terraces and plains. These areas are linear in nature, following the river courses and separating large areas of undrained land. A major part of the cultivable land falls in this category.

3. Low undrained plains (tundra, muskeg, marshes, and swamps) make up the largest contiguous areas which occupy the center of the basin. Within this land class are inclusions of rolling hills and elevated land that may be broken and farmed. When population pressures warrant extensive drainage operations, some of the present wet soils will be cultivated.

Estimate of potential agricultural land without regard to limitations of climate

Land Category (a)	Percent of Total	POTENTIAL FARMLAND(b) Extensive use (c)	Intensive use (d)	GRAZING LAND (e)	TOTAL
		Thousands of acres			
High benches	21	82	94	48	408
Low benches	45	348	410	201	872
Undrained plains	34	19	96	173	640
Total	449	449	600	422	1,920(f)
		Percent of land category			
High benches		20	23	12	
Low benches		32	41	23	
Undrained plains		3	15	27	
Total		23	31	22	

(a) As described on p. 1.
(b) Land that can be tilled. Climate limitations may prohibit its use.
(c) Land that can be immediately cleared and tilled without reclamation practices.
(d) Includes acreages listed in the column on the left plus additional acres that can be cultivated after drainage.
(e) Summer range exclusive of acreages listed in the columns on the left; can be used if supplementary winter feed is produced within the basin.
(f) Total area of basin west of 150° and below elevation of 500 feet.

SOURCES:

Bennett & Rice; Reconnaissance soil survey of the Cook Inlet region, United States Department of Agriculture 1914

Several map series, United States Geological Survey, 1920-1945

Gasser, Information for prospective settlers, Alaska Department of Agriculture, 1948

Unassembled notes and observations of technicians during Railbelt travel, Alaska Agricultural Experiment Station, 1948-1952.

TERRITORY OF ALASKA AGENCIES

ALASKA DEVELOPMENT BOARD
JUNEAU, ALASKA

The Alaska Development Board, an official agency of the Territorial Government, is pleased to learn that the Bureau of Reclamation currently is engaged in studying hydroelectric power production possibilities in the Susitna River basin. Development of large, low-cost hydroelectric potentials of the basin is certain to shape the industrial destiny of the heartland of Alaska.

We now are in the final stages of completing a comprehensive economic study of the Greater Anchorage area. One of the purposes of the study is to determine immediate and future possibilities for the establishment of basic industry which would utilize natural resources occurring in the region. Successful attainment of that objective is a must if this vitally important section of Alaska is to continue to grow and prosper following completion of various defense construction projects.

Our survey demonstrates beyond doubt that the Greater Anchorage area, including its hinterland along the Railbelt from Seward to Fairbanks, has a prosperous future in store if certain incentives are provided. The foremost among those incentives is the availability of an abundant supply of low-cost hydroelectric power. Lack of low-cost power to heat the crucibles and turn the wheels of industry today constitutes the principal obstacle blocking industrialization of the area.

If the great birch stands adjacent to Anchorage and Talkeetna are to be converted into veneer, plywood, flooring, furniture, and other products Alaska and the nation wants, low-cost power must be made available. If other timber stands are to be utilized, low-cost power must be obtainable. If the region's metallic and nonmetallic mineral resources are to be brought into production, low-cost power first must be present. So it is with other natural resources found within the area.

So much emphasis is given the need for large quantities of low-cost electric energy for several reasons. First, the cost of electric power can in large measure offset other operating costs which are higher in Alaska than elsewhere. Second, large quantities of extremely low-cost power are necessary for certain enterprises such as the electrochemical and electrometallurgical industries. It already has been demonstrated that cost and availability of power is an important factor in determining plant location of the latter industries.

Our investigations show the current power shortage in the region will be even more acute in 1955 than it is today--even though your Eklutna project is developed to its full potential by that time. Few kilowatts will be available to encourage establishment of new industry.

The nation's military chieftans repeatedly have asserted that a strong economy is an asset to Alaska's defense. The importance of basic industry in the defense picture has been emphasized again and again. But far beyond the benefits of a sound economy are the contributions this region of Alaska could make to the United States in terms of "have not" materials.

For the preceding reasons, we strongly urge the Bureau of Reclamation to do everything within its means to speed completion of its Susitna basin studies. Moreover, we urge the Bureau to seek authorization for development of one or more of the Susitna hydroelectric power sites immediately upon completion of its investigations, providing engineering studies show construction to be feasible, with costs being comparable to other projects.

ALASKA DEPARTMENT OF AGRICULTURE
FAIRBANKS, ALASKA

PROBLEMS OF LAND RECLAMATION IN THE SUSITNA RIVER VALLEY AREA

Since the year of 1914 when Henry H. Bennett and Thomas D. Rice made their reconnaissance survey of the Susitna River Valley, it has been recognized that the area held great agricultural potentialities. In the Alaska Experimental Station reports as early as 1898 are found accounts of pioneer farmers and gardeners in this area. These records furnish evidence to the fact that the land is very productive and is well adapted to the production of all cool-weather crops.

This valley contains over 100,000 acres of potential farm and grass lands. (Soil map by Bennett and Rice attached.) The ability of this area to produce an abundance of grass is evidenced by the rank growth in the areas not covered with timber. There are several small farms and family gardens in this area which furnish evidence of the productivity of the soil.

Climate of the Susitna Valley

The average temperature recorded from May to October, inclusive, at the Susitna and Talkeetna Stations was 49.68°. This compares very favorably with the Matanuska Valley which has an average summer temperature of 43.86° for the same period. The average rainfall in the Susitna area for May to September, inclusive, is 14.4 inches as compared to 11.6 inches in the Matanuska Valley. The frost-free period of the Susitna Valley weather stations has not been as long as for the other agricultural areas. This, however, is influenced very materially by the fact that only small areas are cleared and many of these areas lack proper air drainage to prevent summer frosts. The average frost-free period of the Susitna Valley Stations is 80 days, while the average for the Matanuska Valley is 108 days, and for the Tanana Valley is 96 days. Most scientists feel that this condition will be alleviated to a great extent by clearing large areas.

Soils

The soils of the lower Susitna Valley are a mixture of silt-loam, fine sands, and peat. The greater part of this area requires clearing prior to cultivation. There are also very large areas of marsh and muskeg lands. This land is swampy in nature; and, if the surface covering is broken so that aerobic bacterial action starts, the peat decomposes. The soil then becomes much warmer and the blanket of ice melts from under the moss insulation. Past experiences have shown that these areas are very productive when properly drained. In most cases, drainage of these areas will be less costly than clearing of timbered land and the soil promises to be more productive.

Crops

It is a well-known fact that all cool-weather crops which grow well in the Matanuska-Tanana Valleys will thrive in the Susitna area and yields on small-scale operations have been equally as high. The inaccessibility to markets in the early years prevented any appreciable agricultural development in this area.

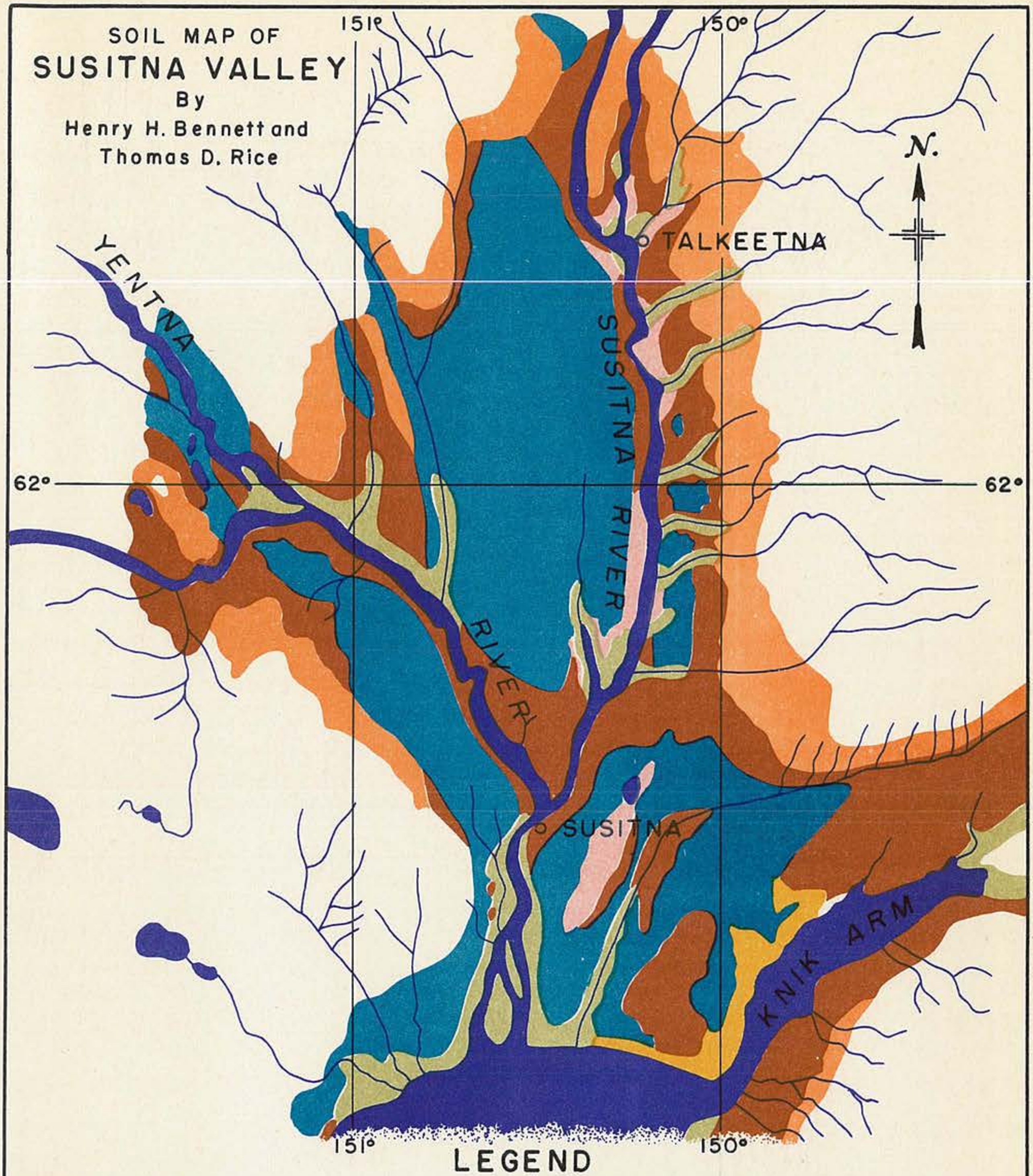
Native Grasses

In the burnt-over areas, several varieties of native red-top grasses (calamogrostis) are most prevalent. These grasses make dense growths from 5 to 6 feet tall in many areas. With the proper clearing of the land, there is every reason to believe that many tame grasses may be successful.

Settlement Problems

In order that any appreciable areas may be developed from a profitable agricultural standpoint, considerable study and research is needed. Research should be conducted to discover economical methods of clearing lands for cultivation, pasture, and meadows. There is also necessity for irrigation studies to be made, especially where the production of vegetable crops will be stressed. Roads should be constructed and trading centers should be laid out. In most instances, assistance will be required in financing farm operations. With the prevailing increase in population in Alaska, very little difficulty in marketing is expected, especially where farmers organize and sell their products through cooperative marketing organizations.

To give the greatest assurance of success, settlers should not be invited or permitted into this area until some of these problems are solved. Considering this area from physiological and climatological standpoints as well as the proximity to existing markets, this area offers as great possibilities for future agricultural development as any other area in Alaska.



LEGEND

- Mainly Knik Loam. Low to moderately high benches, ridges & hillocks. Prevailingly smooth surface, well drained.
- Mainly Knik Loam, high bench phase. High benches, partly rolling. Well drained.
- Mainly Knik Loam, shallow phase. Low benches, mostly flat. Good to excessive drainage.
- Mainly Knik Fine Sandy Loam. Low benches, mostly flat. Good to excessive drainage.
- Mainly Susitna Soils. Flat stream bottoms. Drainage poor to good or excessive, partly overflowed.
- Mainly Muskeg. Low flat, treeless marsh.

UNITED STATES DEPARTMENT OF AGRICULTURE

Reconnaissance Soil Survey Map, 1914

GPO-87-80091

ALASKA DEPARTMENT OF MINES
JUNEAU, ALASKA

Since the mining of construction materials will help create new local power-consuming industries in addition to the mining operations themselves, it seems logical to consider the deposits of industrial minerals first.

A deposit of gypsum that may come into production is at Sheep Mountain, 112 miles from Anchorage on the Glenn Highway. There are approximately 311,000 indicated tons of gypsiferous rock containing 25- to 50-percent gypsum and 348,000 additional tons inferred in this deposit. Also in the near vicinity is a deposit of clay that would be quite suitable for brick making or ceramic work. More clay of a lower grade is at Chickaloon which would probably be satisfactory for brick making.

At mile 67 on the Glenn Highway is a formation of shale that could be used for the production of lightweight aggregate for concrete. Preliminary tests of the material have proved very satisfactory. Another deposit of the same shale exists at mile 16 of the Matanuska branch of the Alaska Railroad.

A deposit of marl exists near Wasilla, which may be mined soon, and it is reported that perlite also exists there.

There are large deposits of pumice and pumicite in the Katmai National Monument that may be within reach of power lines from the Susitna basin. This pumice has been used for lightweight concrete aggregate for a few years now; and as a result of recent legislation by Congress, the production will probably increase. The mineral is also suitable for the making of pozzolan for pozzolan-portland cement.

Other cement materials and clay can be mined in the near vicinity of Anchorage. Limestone and argillite are mined at the Potter quarry, the latter mineral being also suitable for the manufacture of rock wool. Numerous shales and argillites exist that can be used for the making of Haydite, a particular type of lightweight aggregate. Sand and gravel can be obtained almost everywhere in this part of the country. Clay which is suitable for brick making can be obtained from two pits near Anchorage.

Toward the upper end of the Railbelt, the Cantwell-Windy area is the most promising for the future mining of construction materials. There are deposits at Windy Creek and Foggy Pass of limestone which is suitable for cement making, the limestone at Foggy Pass being particularly good. The criterion for cement making is the magnesia content--the limestone may contain no more than 3.3 percent. Shale which will supply the argillaceous component for cement is also plentiful in this area.

Near Healy is a good grade of clay which will probably be quarried in the future, and also a deposit of perlite which would be valuable for the making of a lightweight aggregate.

On the West Fork of the Chulitna River are more deposits of suitable limestone and shale.

Coal mining production in both the Matanuska and Healy River fields will increase with the steadily increasing demand in Anchorage and Fairbanks and nearby military installations. The coal mines will be in the market for cheaper power, of course; but on the other hand if a large amount of cheap power should become available to the above cities and installations, the demand for coal would decrease; and as a result coal mining would decrease rather than expand. So it seems reasonable to assume that potential coal mine power consumption should not be estimated on the basis of expected coal production increase.

In the Fairbanks area, the United States Smelting, Refining, and Mining Company's large-scale gold placer operations are entirely electric, the energy being furnished by their steam generating plant. They have a total of eight electric dredges (five in operation at present), one large electric dragline, and a large number of electrically driven pumps, the total operating load of which is huge. If power were to be made available to this company at a cheaper rate than they can generate it in their plant, they would undoubtedly be happy to purchase it.

There are many small placer operations in the Fairbanks area as well as in the Nenana, Talkeetna, and other districts that could be reached by power lines. They would probably all use power to illuminate their camps, but whether they would immediately go to the expense of turning over their Diesel pumping units for electrically driven units is questionable. New placer operations starting up would probably purchase the electrical equipment, however.

Should lode-gold mining again become profitable in Alaska; the Willow Creek district will most assuredly be back in production, and no doubt a good share of the mines would install electrical equipment rather than Diesel if cheap power were available. The Willow Creek gold deposits are mesothermal veins on the border of a quartz diorite intrusion, and so far have been mined at relatively shallow depths--mostly stopping from above the main adits. It is believed that ore of the above character will be found at greater depths, which would indicate that the ore reserves are good. This district was producing at the rate of about $1,800,000 per year in 1941. Other lode-gold properties that may start producing again when the economic picture changes are located in the Nenana, Talkeetna, and Fairbanks districts.

An interesting silver prospect is located on Portage Creek, 9 miles east of the Chulitna Station of the Alaska Railroad. It is in a brecciated slate formation, and arsenopyrite, chalcopyrite, galena, and pyrite are associated with the pyrargyrite.

The Anchorage and lower Railbelt areas do not have many possibilities for future base metal mining, but most of the remainder of the area within a reasonable distance of the Susitna basin shows good promise. The lower Railbelt possibilities include small copper deposits on Iron Creek, tributary to the Talkeetna River; another on Moose Creek, tributary to the Matanuska River; and others on tributaries to the Susitna River. There is an antimony showing on Antimony Creek, tributary to the east fork of the Chulitna River. In the Lake Illiamna country there are some very promising copper deposits.

Base metal prospects are very favorable in the district around Mount McKinley. An antimony mine is operating on Stampede Creek at present and another good antimony deposit is located on nearby Slate Creek.

A large lead-zinc deposit is located near Mount Eielson, 30 miles east of Mount McKinley, where an intrusion has sent a multitude of dikes and sills into associated sediments and deposited sphalerite, galena, chalcopyrite, and pyrite.

Many antimony deposits of promise and a few good sheelite deposits exist in the Fairbanks area. The best known sheelite deposit in the area is on Gilmore Dome and is scheduled to go into production shortly with the help of Defense Minerals Administration financing.

Last, but certainly not least, to be considered is the possibility of the production of oil. A large anticline extending from the Alaska Peninsula through Cook Inlet and into the Nelchina district is regarded by petroleum geologists as having definite oil-bearing possibilities. The present oil well drilling program at Katalla will probably attract more oil venture capital to the Territory, and the Cook Inlet structure would be the next logical location for oil exploration. Should oil be discovered there, there would be an immediate need for power for more drilling, for pumping and relaying plants, and refineries. Further, a pipe line is contemplated from the Point Barrow oil field to Fairbanks, which, if realized, would call for power for the relaying or booster stations, refineries, et cetera. The changes which would accompany the discovery and actual production of oil in the Territory are many.