DRAFT ENVIRONMENTAL IMPACT STATEMENT

HYDROELECTRIC POWER DEVELOPMENT

UPPER SUSITNA RIVER BASIN
SOUTHCENTRAL RAILBELT AREA, ALASKA

ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA

SEPTEMBER, 1975

SUMMARY

Hydroelectric Power Development, Upper Susitna River Basin
(Southcentral Railbelt Area, Alaska)

(X) Draft Environmental Statement ( ) Final Environmental Statement

Responsible Office: Alaska District, Corps of Engineers
Colonel Charles A. Debelius, District Engineer
P.O. Box 7002, Anchorage, Alaska 99510
Telephone (907) 753-3128

1. Name of Action: ( ) Administrative (X) Legislative

2. Description of Action: The recommended plan is to construct dams on the upper Susitna River at Watana and Devil Canyon, powerplants, electric transmission facilities to the Railbelt load centers, access roads, and permanent operating and recreational facilities.

Since the current study is in the feasibility stage, impacts are not exhaustively evaluated. If the project is authorized and funded for detailed studies, environmental, social, economic, and engineering aspects of the project will be studied at length prior to a recommendation to Congress for advancement to final project design and construction.

3 a. Environmental Impacts: The two-dam system would inundate some 50,500 acres extending 84 miles upstream from Devil Canyon Dam. Nine miles of a total 11-mile reach of white water would be inundated in Devil Canyon. Transmission lines would total 364 miles in length, average 125-140 feet in width, and require about 5,300 acres of right-of-way, over half of which would require vegetative clearing. The project would utilize a renewable resource to produce projected power needs of the Railbelt area equivalent to the annual consumption of 14.8 million barrels of oil. Heat and noise and air pollution problems associated with most alternative energy production sources would be prevented. Stream flows for some distance below Devil Canyon would carry significantly reduced sediment loads during the summer months. Recreational opportunity would be increased by access roads and creation of project-related recreational facilities.

b. Adverse Environmental Effects: The following adverse impacts would result from project implementation: impairment of visual quality resulting from access roads, dams, and transmission lines; loss of vegetation and habitat due to inundation and road construction; creation of public access resulting in increased pressure on wildlife and need for intensified game management and fire prevention practices;

increased turbidity of Susitna River downstream from Devil Canyon Dam during winter months; foreclosure of future mineral extraction from inundated land and limitations of options for uses of lands affected by the transmission corridors; direct impact on moose through some reduction of already limited habitat; possible inhibition of movement and increased mortality of caribou which cross reservoirs between calving and summer ranges; temporary degradation of air, water, and vegetation as a result of slash and debris disposal; inundation of one historical site and any archaeological sites which might be discovered within the reservoir pools; social impacts related to seasonality of construction work and demands upon services of small communities located in the vicinity of construction activity.

4. Alternatives: Construct no additional electrical generating facilities, construct other Susitna hydroelectric alternatives, construct other Southcentral Railbelt hydroelectric facilities, develop other alternative energy generating facilities using resources such as coal, oil, and natural gas, nuclear power, geothermal, solar, or other alternative power generating resources.

5. Comments Requested (Departmental Review):

U.S. Department of the Interior
U.S. Department of Agriculture
U.S. Department of Commerce
U.S. Environmental Protection Agency
Federal Energy Administration
U.S. Department of Transportation
Federal Power Commission
U.S. Department of Health, Education, and Welfare
U.S. Department of Housing and Urban Development

The Honorable Ted Stevens - U.S. Senate
The Honorable Mike Gravel - U.S. Senate
The Honorable Don Young - U.S. House of Representatives

Office of the Governor of Alaska - State Clearinghouse

Joint Federal-State Land Use Planning Commission for Alaska

City Mayors:

City of Anchorage
City of Fairbanks

Borough Mayors:

Matanuska-Susitna
Fairbanks North Star
Kenai Peninsula

University of Alaska

<u>Native Corporations</u>:

- Doyon Limited
- Cook Inlet Regional Corporation
- Ahtna, Incorporated
- Alaska Federation of Natives

Sierra Club
Friends of the Earth
Alaskan Conservation Society
Alaska Center for the Environment
Izaak Walton League of America
Alaska Wildlife Federation and Sportsmen's Council, Inc.

Matanuska Electric Association, Inc.
Central Alaska Utilities
Golden Valley Electric Association
Chugach Electric Association

Administrative Management Society
Alaska Methodist University
Association of the Army
Bankers Alaska Association
Anchorage Bar Association
Anchorage Businessmen's Association
Mt. View Businessmen's Association
American Business Women Association
Anchorage Business and Professional Women
Spenard Business and Professional Women
Susitna Business and Professional Women
Employees Association of Alaska Public
Alaska Society of Professional Engineers
Alaska Society American Institute of Mining, Metallurgical and Petroleum Engineers
American Society of Civil Engineers
Society of American Military Engineers
Society of Petroleum Engineers of AIME
Anchorage Jaycees
Gold Rush Jaycees
League of Women Voters
American Society for Public Administration
Captain Cook Jaycees
International Jaycees
Anchorage League of Women Voters
Fairbanks Industrial Development

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HYDROELECTRIC POWER DEVELOPMENT
UPPER SUSITNA RIVER BASIN

Table of Contents

Table of Contents (Cont'd)

Table of Contents (Cont'd)

Table of Contents (Cont'd)

LIST OF FIGURES

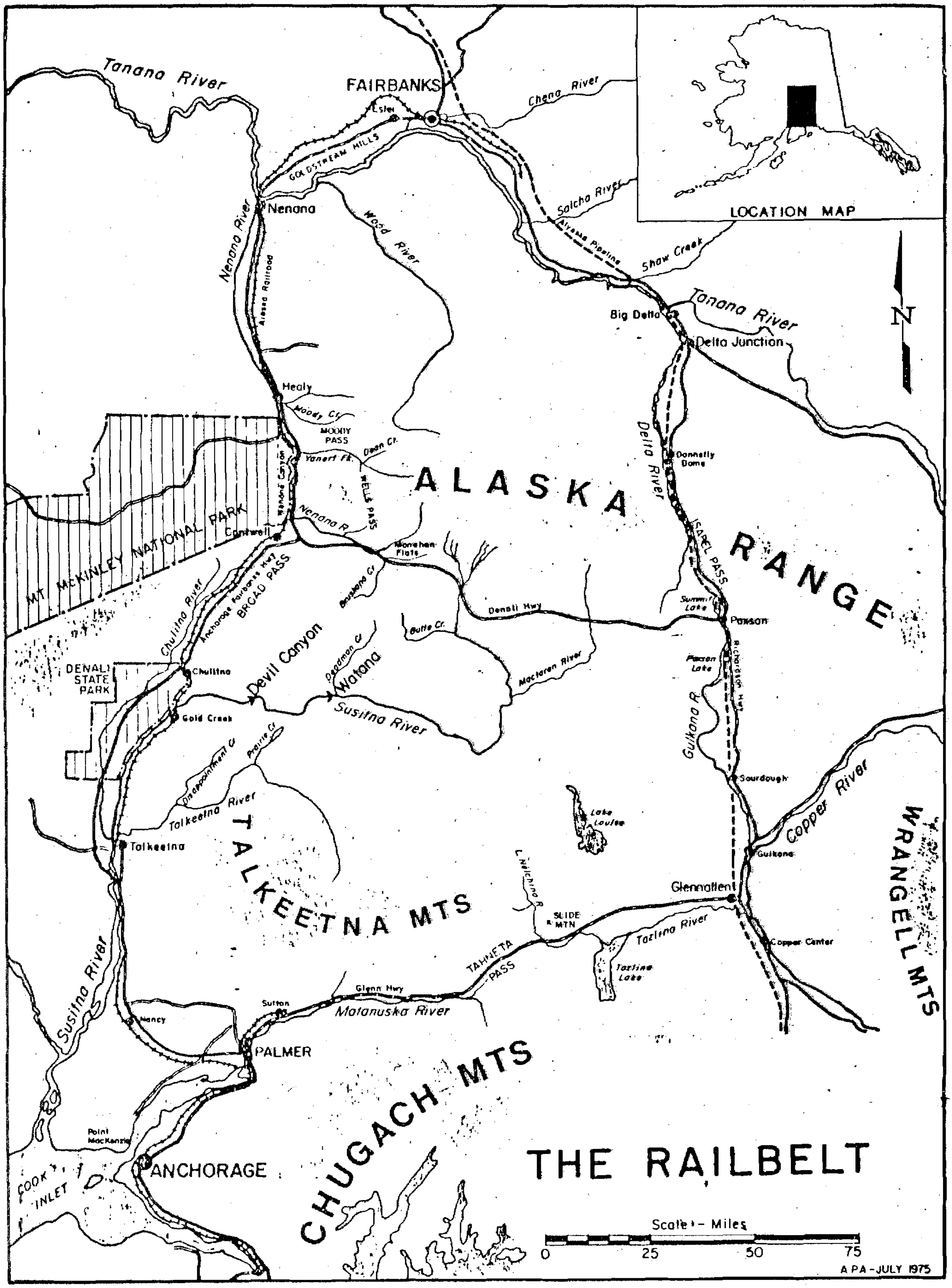
1.0 PROJECT DESCRIPTION

1.01 Purpose and Authority. The utilization of renewable resources to produce electrical energy for domestic and industrial uses has become a primary concern in today's energy crisis. The consumption of non-renewable sources of energy such as petroleum and natural gas has now reached a critical point where conservation of domestic sources must be considered. With the forecast increase in development for Alaska and corresponding increase in demand for electric power, the Committee on Public Works of the U.S. Senate, at the request of local interests made through Senator Ted Stevens, adopted a resolution on 18 January 1972, requesting a study for the provision of power to the Southcentral Railbelt area of Alaska. The resolution is quoted as follows:

> That the Board of Engineers for Rivers and Harbors created under the provisions of Section 3 of the River and Harbor Act approved June 13, 1902, be, and is hereby, requested to review the reports of the Chief of Engineers on: Cook Inlet and Tributaries, Alaska, published as House Document Numbered 34, Eighty-fifth Congress; Copper River and Gulf Coast, Alaska, published as House Document Numbered 182, Eighty-third Congress; Tanana River Basin, Alaska, published as House Document Numbered 137, Eighty-fourth Congress; Yukon and Kuskokwim River Basins, Alaska, published as House Document Numbered 218, Eighty-eighth Congress; and, other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to the Susitna River hydroelectric power development system, including the Devil Canyon Project and any competitive alternatives thereto, for the provision of power to the Southcentral Railbelt area of Alaska.

1.02 Scope of the Study. The investigation is being conducted in two stages. Stage 1 is an interim report, to be completed by 1 December 1975, on the feasibility of hydroelectric development on the upper Susitna River. Stage 2 is a comprehensive report, anticipated to be completed in 1978, to determine the feasibility of developing other hydroelectric sites in the Southcentral Railbelt area.

The Southcentral Railbelt area is that portion of the Yukon and southcentral subregions which extends from Cook Inlet and the Gulf of Alaska on the south to the southern slopes of the Brooks Range on the north, a distance of about 500 miles. This area, containing about 75 percent of Alaska's population, is served by the Alaska Railroad and is commonly referred to as the "Railbelt." (See Figure 1.) Major power resources, both hydroelectric and fossil fuels, and the greatest power demands are in this region.



FAIRBANKS
Tanana River
Chena River
Ester
GOLDSTREAM HILLS
Nenana
Nenana River
Alaska Railroad
Wood River
Salcha River
Alyeska Pipeline
Shaw Creek
Big Delta
Delta Junction
Healy
Moody Cr.
MOODY PASS
Dean Cr.
Yanert Fk.
WELLS PASS
Nenana Canyon
Nenana R.
ALASKA RANGE
Delta River
Donnelly Dome
ISABEL PASS
MT. McKINLEY NATIONAL PARK
Cantwell
Monahan Flats
Anchorage Fairbanks Hwy
BROAD PASS
Chulitna River
Brushkana Cr.
Denali Hwy
Butte Cr.
Summit Lake
Paxson
DENALI STATE PARK
Chulitna
Devil Canyon
Deadman Cr.
Watana
Maclaren River
Paxson Lake
Richardson Hwy
Gold Creek
Susitna River
Gulkana R.
Sourdough
Disappointment Cr.
Prairie Cr.
Talkeetna River
Copper River
Lake Louise
Talkeetna
L. Nelchina R.
Gulkana
WRANGELL MTS
TALKEETNA MTS
Glennallen
SLIDE MTN
Tazlina River
TAHNETA PASS
Tazlina Lake
Copper Center
Glenn Hwy
Sutton
Matanuska River
Susitna River
Nancy
PALMER
CHUGACH MTS
Point MacKenzie
ANCHORAGE
COOK INLET
THE RAILBELT
LOCATION MAP
N
Scale - Miles
0
25
50
75
APA-JULY 1975

FIGURE 1

The proposed action discussed in this draft environmental impact statement is a two-dam system located in the Upper Susitna River Basin which will provide hydroelectric power to the Southcentral Railbelt region in Alaska. (See Literature Cited.)

1.03 Description of Action. The recommended plan consists of construction of dams and powerplants on the upper Susitna River at Watana and Devil Canyon, and electric transmission facilities to the Railbelt load centers, access roads, permanent operating facilities, and other project-related features.

A subsidiary purpose in the construction of the electric transmission line will be the interconnection of the two largest electrical power distribution grids in the State of Alaska, which will result in increased reliability of service and lower cost of power generation.

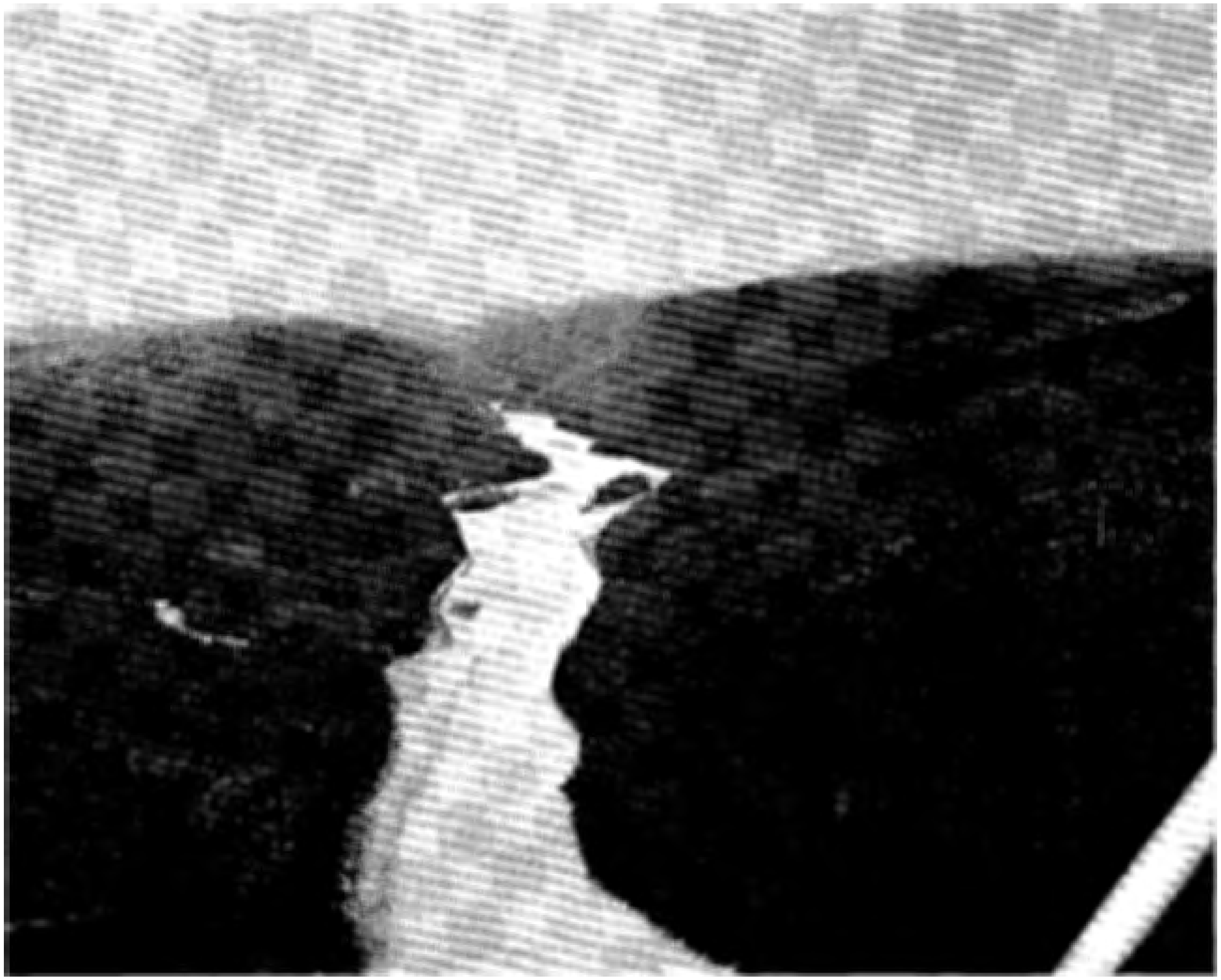
The proposed plan for the Watana site (figure 2) would include the construction of an earthfill dam with a structural height of 810 feet at river mile 165 on the Susitna River. The reservoir at normal full pool would have an elevation of 2,200 feet and a crest elevation of 2,210 feet, have a surface area of approximately 43,000 acres, and would extend about 54 river miles upstream from the damsite to about 4 miles above the confluence of the Oshetna River with the Susitna.

The generating facilities would include three Francis reaction turbines with a nameplate capacity of 250 MW per unit, and a flow of about 5,300 cfs per unit at nameplate capacity. The firm annual production of electrical power at Watana would be 3.1 billion kilowatt-hours.

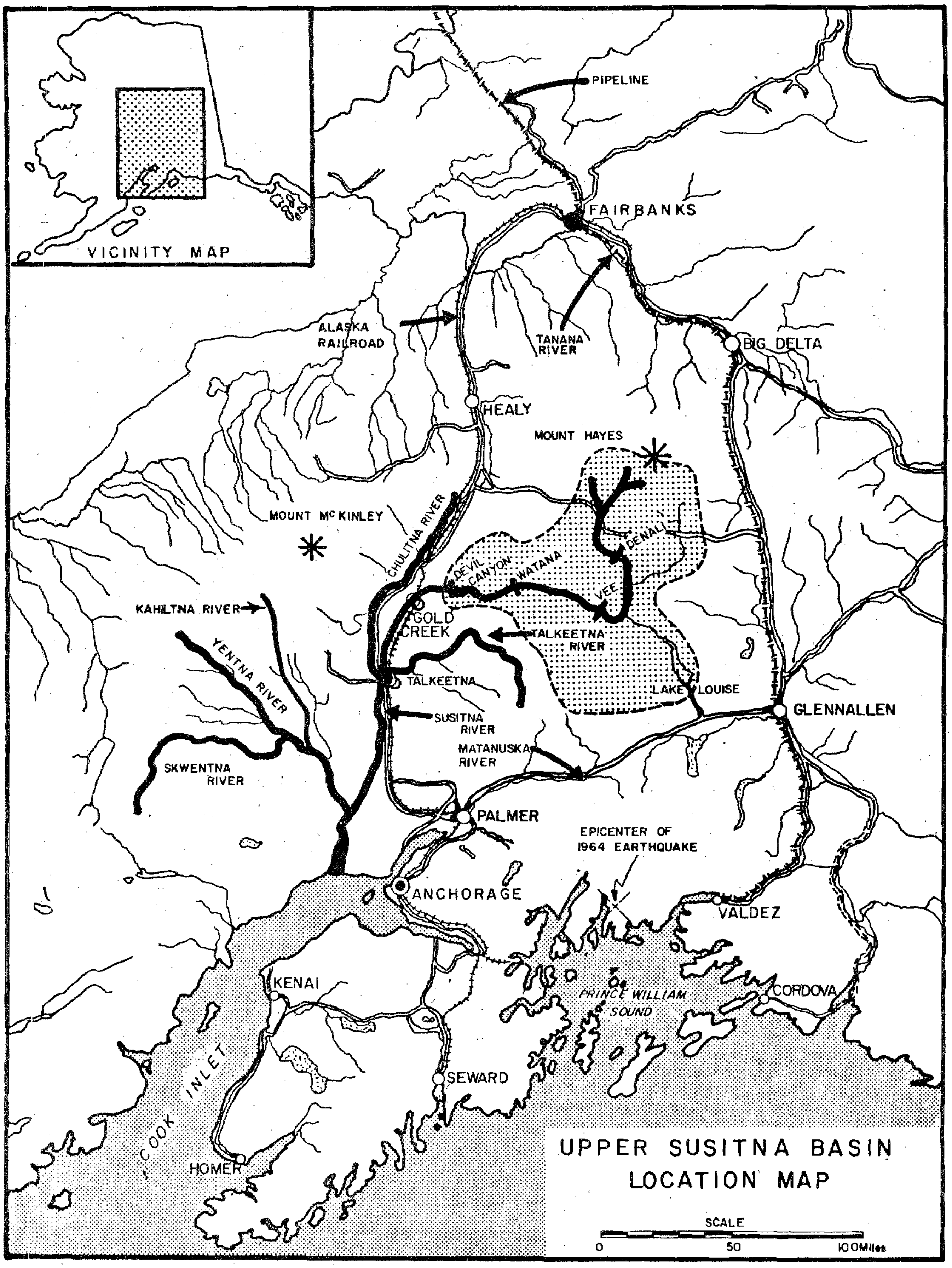
Development of the Devil Canyon site includes the construction of a concrete, thin-arch dam with a maximum structural height of 635 feet and with a crest elevation of 1,455 feet. The dam would be located at river mile 134 on the Susitna River. Devil Canyon reservoir would have a water surface area of about 7,550 acres at the normal full pool elevation of 1,450 feet. The reservoir would extend about 28 river miles upstream to a point near the Watana damsite, and would be confined within the narrow Susitna River canyon.

The generating facilities would include four Francis reaction turbines with a nameplate capacity of 180 MW (megawatts) per unit. The flow at nameplate capacity would be about 4,400 cfs (cubic feet per second) per unit. The firm annual energy provided at Devil Canyon would be increased to 3.0 billion kilowatt-hours.

A total of 6.1 billion kilowatt-hours of firm annual energy would be produced by the combined Devil Canyon-Watana system. Secondary annual average energy production from this two-dam system includes an



Looking upstream toward Watana damsite. Tsuena Creek in left center of photo.
Damsite just beyond the visible section of river.



VICINITY MAP
PIPELINE
FAIRBANKS
ALASKA RAILROAD
TANANA RIVER
BIG DELTA
HEALY
MOUNT HAYES
MOUNT McKINLEY
CHULITNA RIVER
DEVIL CANYON
WATANA
DENALI
VEE
KAHILTNA RIVER
GOLD CREEK
TALKEETNA RIVER
YENTNA RIVER
TALKEETNA
LAKE LOUISE
GLENNALLEN
SUSITNA RIVER
MATANUSKA RIVER
SKWENTNA RIVER
PALMER
EPICENTER OF 1964 EARTHQUAKE
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
COOK INLET
SEWARD
HOMER
UPPER SUSITNA BASIN LOCATION MAP
SCALE
0
50
100 Miles

FIGURE 2

additional 0.7 billion kilowatt-hours per year. The 6.8 billion kilowatts of firm and secondary annual energy would be the energy equivalent of about 14.8 million barrels of oil per year, or about 100 billion cubic feet of natural gas per year, or about 1.5 billion barrels of oil over a 100-year project-life period.

Most of the generated electrical power would be utilized in the Fairbanks-Tanana Valley and the Anchorage-Kenai Peninsula areas. The proposed transmission system would consist of a 184-mile, 230 kv double circuit line from Gold Creek to Fairbanks (called the Nenana corridor), and a 136-mile, 345 kv double circuit line from Gold Creek to the Anchorage area (called the Susitna corridor). Both lines would generally parallel the Alaska Railroad. Power would be carried from Watana and Devil Canyon to Gold Creek via a common transmission line, a distance of 44 miles. Total length of the transmission lines would be 364 miles. The general locations of the transmission lines are shown on Figure 3. Transmission line corridors would require a cleared right-of-way approximately 125-140 feet in width totaling slightly more than 5,300 acres. Towers would be either steel or aluminum and of free-standing or guyed type, depending upon final design and local conditions.

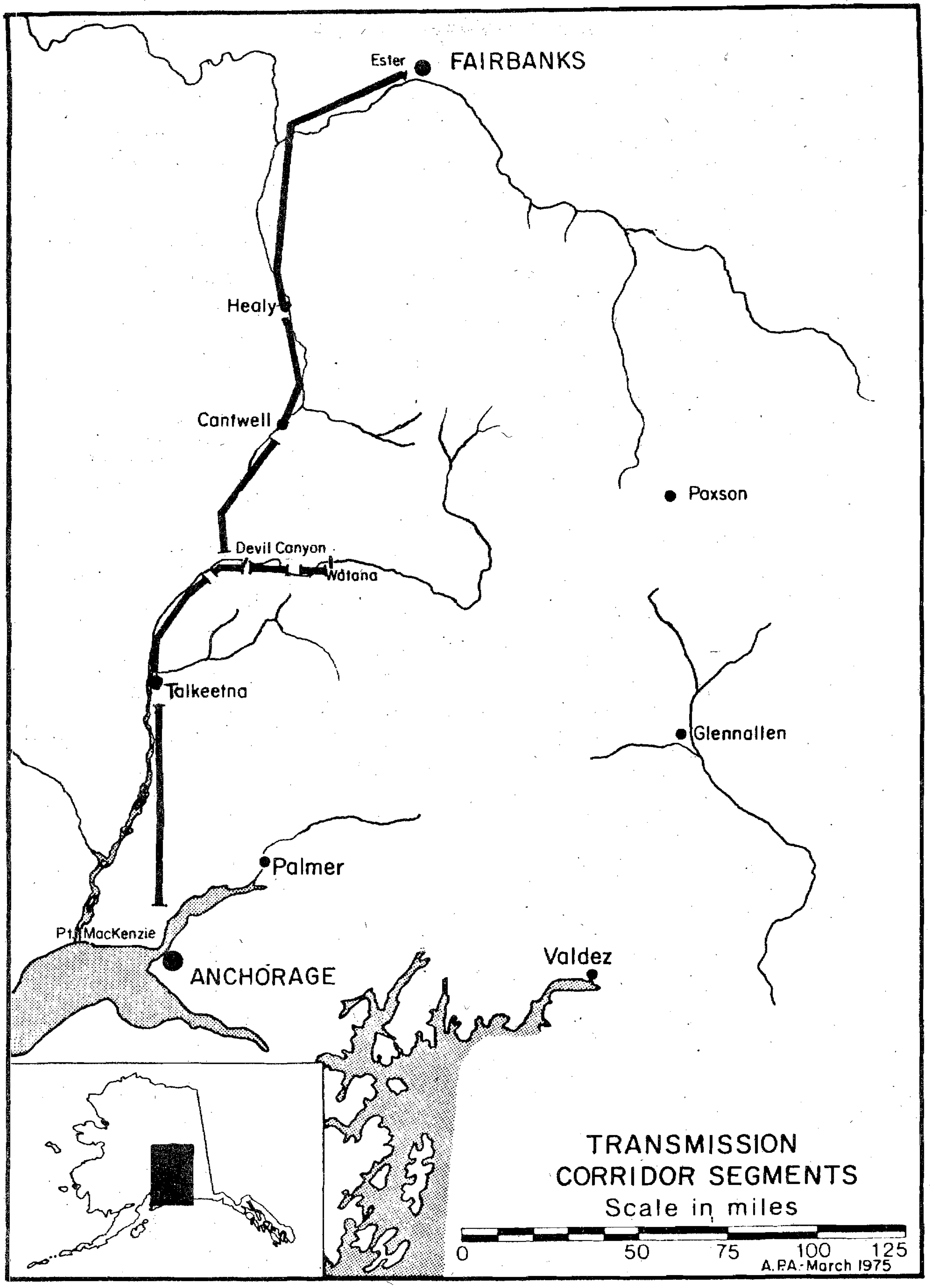
Access to the Devil Canyon and Watana sites would be determined by siting studies that would include consideration of the environmental impacts for roads and transmission lines. Preliminary studies indicate an access road approximately 64 miles in length would connect the Watana site with the Parks Highway via Devil Canyon. A factor considered in location and design of access roads would be their subsequent use for public recreational purposes.

Project-oriented recreational facilities would include visitor centers at the dams, boat launching ramps, campgrounds, picnic areas, and trail systems.

The total first costs of the proposed hydroelectric project based on January 1975 prices are estimated at $1.343 billion, including the transmission system. Overall, Devil Canyon costs are estimated at $432,000,000, and Watana at $911,000,000. Watana Dam would be constructed first.

The benefit-to-cost ratio compared to the coal alternative at 6-1/8 percent interest rate and 100-year project life is 1.4 using Federal financing.

Detailed power and economics, hydrology, project description and costs, foundation and materials, transmission line, and recreational information are available at the Alaska District, Corps of Engineers office in Anchorage, Alaska.



Ester
FAIRBANKS
Healy
Cantwell
Paxson
Devil Canyon
Watana
Talkeetna
Glennallen
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
TRANSMISSION
CORRIDOR SEGMENTS
Scale in miles
0
50
75
100
125
A.P.A. March 1975

FIGURE 3

This environmental impact statement discusses the known and suspected impacts of the proposed project. Since the study is currently in the feasibility stage, the EIS does not include a detailed and exhaustive evaluation of project impacts, many of which cannot be ascertained prior to congressional consideration for project authorization and funding of detailed environmental and engineering studies. The Water Resources Development Act of 1974, Public Law 93-251, sets forth a two-stage authorization process prior to project construction. If the project is authorized, the process requires congressional approval before advancing to final project design and construction. During this period, additional studies will be undertaken to assess environmental impacts of the project. The EIS will be updated and refined during this phase to reflect the changed conditions which normally prevail several years later when design studies are undertaken, and to more fully address impacts on those resources for which detailed information is presently limited. Since the updated and revised EIS will again be fully coordinated with all reviewing entities, Congress will be fully apprised of the latest thinking and the fullest possible consideration of environmental impacts prior to authorizing advancement to final project design and construction stages.

Meanwhile, general environmental studies are continuing. Inventory and evaluation studies of fish and wildlife resources affected by the project are being conducted by the Alaska Department of Fish and Game, U.S. Fish and Wildlife Service, and National Marine Fisheries Service. As these ongoing studies identify specific areas of concern, they will be selected for more intensive investigation during detailed design studies, should Congress authorize advancement to that stage. Examples of problems expected to be addressed during the detailed design study phase include identification of significant adverse impacts to important fish and wildlife species, and specific actions which should be taken to prevent, ameliorate, or mitigate these impacts.

Susitna Glacier on Susitna River drainage. Glacier melt in summer months contributes to high sediment in the river.

2.0 ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.01 Physical Characteristics

2.01.1 Description of the Area. The Susitna River, with an overall drainage area of about 19,400 square miles, is the largest stream discharging into Cook Inlet. The Susitna River basin is bordered on the south by the waters of Cook Inlet and the Talkeetna Mountains, on the east by the Copper River plateau and the Talkeetna Mountains, and on the west and north by the towering mountains of the Alaska Range. The upper Susitna River upstream from the proposed Devil Canyon damsite drains an area of approximately 5,810 square miles (see Figure 4).

Three glaciers flow down the southern flanks of the Alaska Range near 13,832-foot Mount Hayes to form the three forks of the upper Susitna River. These forks join to flow southward for about 50 miles through a network of channels over a wide gravel flood plain composed of the coarse debris discharged by the retreating glaciers. The cold, swift, silt-laden river then curves toward the west where it winds through a single deep channel, some 130 miles through uninhabited country, until it reaches the Alaska Railroad at the small settlement of Gold Creek.

After the Susitna escapes the confinement of Devil Canyon, the river's gradient flattens. The river then turns south past Gold Creek, where it flows for about 120 miles through a broad silt and gravel-filled valley into Cook Inlet near Anchorage, almost 300 miles from its source.

Principal tributaries of the lower Susitna basin also originate in the glaciers of the surrounding mountain ranges. These streams are generally turbulent in the upper reaches and slower flowing in the lower regions. Most of the larger tributaries carry heavy loads of glacial silt during the warmer summer months.

The Yentna River, one of the Susitna's largest tributaries, begins in the high glaciers of the Alaska Range, flows in a general southeasterly direction for approximately 95 miles and enters the Susitna 24 miles upstream from its mouth.

The Talkeetna River originates in the Talkeetna Mountains on the southeastern part of the basin, flows in a westerly direction, and discharges into the Susitna River 80 miles upstream from Cook Inlet and just north of the community of Talkeetna.

The Chulitna River heads on the southern slopes of Mount McKinley, the highest point in North America, with an elevation of 20,320 feet. The river flows in a southerly direction, joining the Susitna River near Talkeetna.

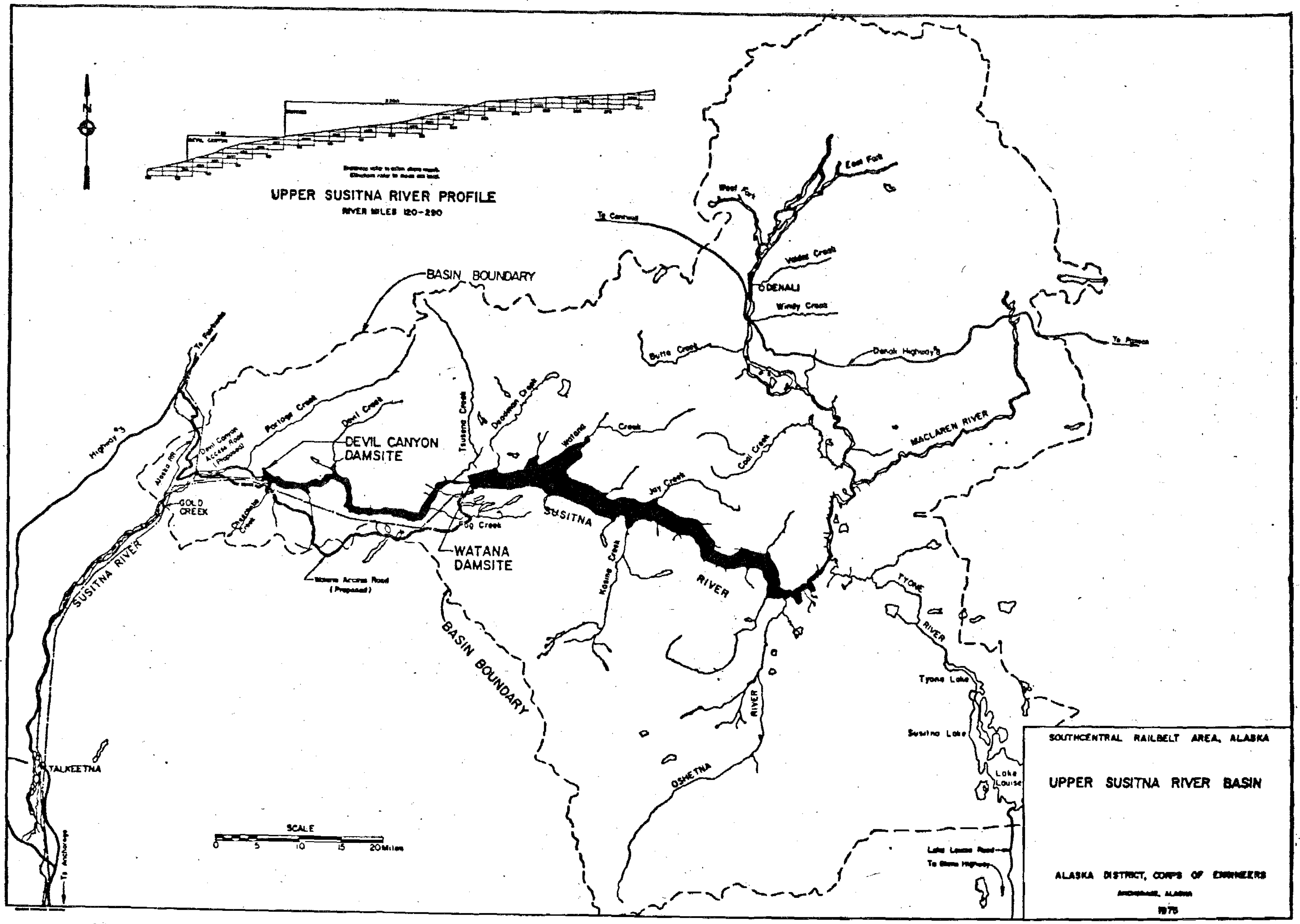

UPPER SUSITNA RIVER PROFILE
RIVER MILES 120-290
BASIN BOUNDARY
DEVIL CANYON DAMSITE
WATANA DAMSITE
GOLD CREEK
TALKEETNA
SUSITNA RIVER
SUSITNA
RIVER
MACLAREN RIVER
TYONE RIVER
OSHETNA
RIVER
DENALI
Portage Creek
Devil Creek
Tsusena Creek
Deadman Creek
Watana Creek
Jay Creek
Coal Creek
Kosina Creek
Fog Creek
Butte Creek
Windy Creek
Valdez Creek
East Fork
West Fork
Denali Highway
To Cantwell
To Paxson
Tyone Lake
Susitna Lake
Lake Louise
Watana Access Road (Proposed)
Devil Canyon Access Road (Proposed)
SCALE
0 5 10 15 20 Miles
SOUTHCENTRAL RAILBELT AREA, ALASKA
UPPER SUSITNA RIVER BASIN
ALASKA DISTRICT, CORPS OF ENGINEERS
1975

FIGURE 4

The principal tributaries of the upper Susitna basin are the silt-laden Maclaren, the less turbid Oshetna, and the clear-flowing Tyone (Figure 4). Numerous other smaller tributaries generally run clear. Streamflow in the Susitna River basin is characterized by a high rate of discharge from May through September and by low flows from October through April.

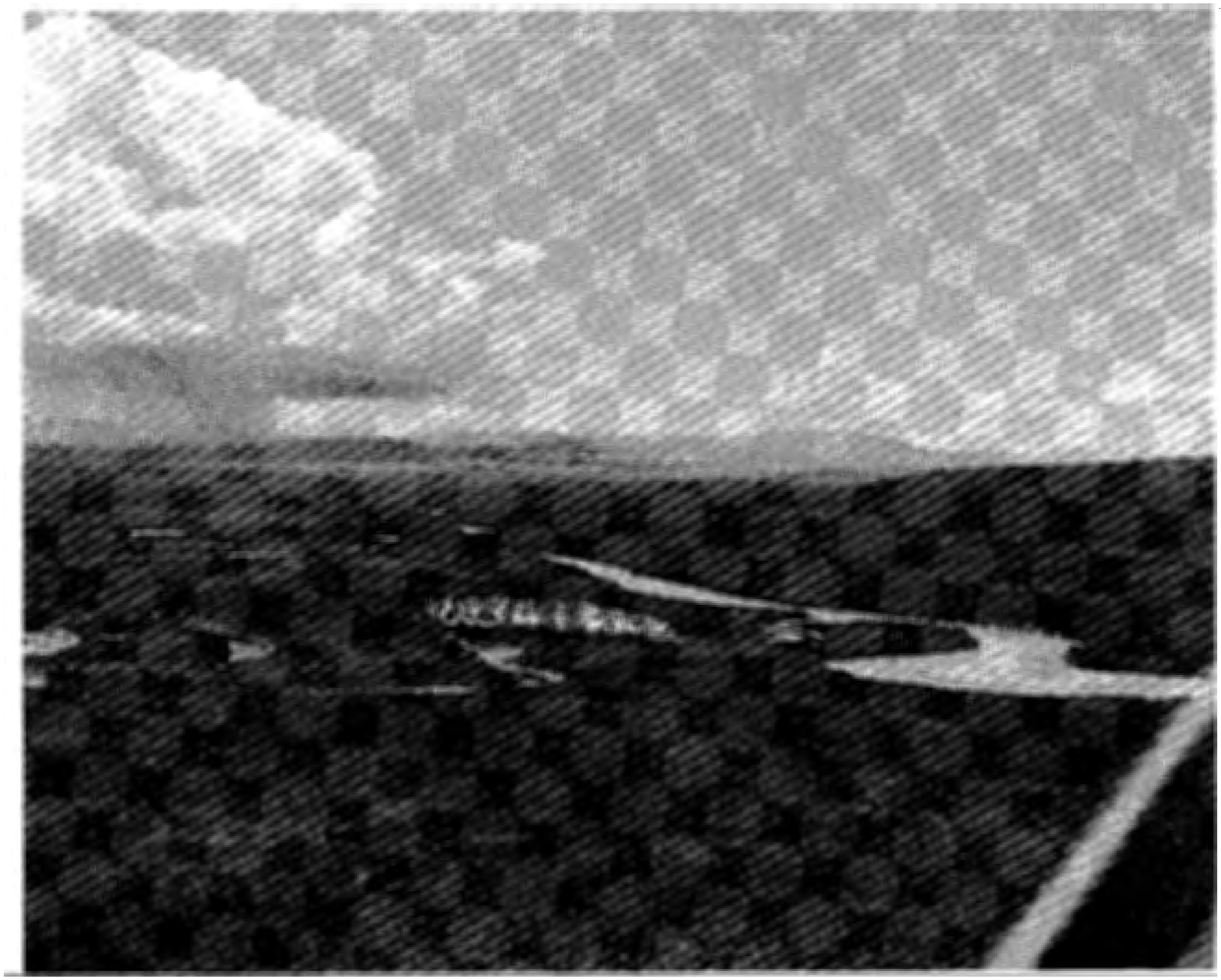
Most of the Upper Susitna River Basin is underlain by discontinuous permafrost. Permafrost is defined as a thickness of soil, or other surficial deposit, or of bedrock beneath the ground surface in which a temperature below 32°F has existed continuously for two years or more. Such permanently frozen ground is found throughout much of Alaska.

The area above and below the Maclaren River junction with the Susitna is generally underlain by thin to moderately thick permafrost. Maximum depth to the base of permafrost in this area is about 600 feet. Around the larger water bodies, such as lakes, permafrost is generally absent. In some areas of the lower section of the upper Susitna basin, permafrost is not a factor, while data are presently lacking in specific sections of the river upstream from Devil Canyon.

Because of the length of the proposed transmission system, and the diversity of terrain and ecosystems bisected by a corridor extending from Anchorage to Fairbanks, the system is divided into six major segments which lend themselves to discussion in terms of generally similar ecological characteristics. The route extending south from Watana Dam to Point MacKenzie is referred to as the Susitna Corridor. The route north from Gold Creek to Ester is called the Nenana Corridor (both corridors share the line from Watana to Gold Creek). The corridor for most of its length generally parallels the Alaska Railroad.

The Susitna Corridor is subdivided into three major segments: (a) Point MacKenzie north to Talkeetna, a distance of 84 miles; (b) Talkeetna to Gold Creek, 38 miles; and (c) Gold Creek to Watana, 44 miles. The Nenana Corridor is also divided into three segments (continuing north): (a) Gold Creek to Cantwell, 62 miles; (b) Cantwell to Healy, 39 miles; and (c) Healy to Ester, 97 miles. These locations are shown on Figure 3. Relevant physical and ecological features of individual transmission-line segments are described in the following paragraphs.

2.01.2 River Characteristics. The upper Susitna River is a scenic, free-flowing river with very few signs of man's presence. The extreme upper and lower reaches of the Susitna occupy broad, glacially scoured valleys. However, the middle section of the river, between the Denali Highway and Gold Creek, occupies a stream-cut valley with spectacular rapids in Devil Canyon that are extremely violent.



Confluence of the Tyone and Susitna Rivers several miles above the upper reaches of the proposed Watana reservoir.

The Susitna, the Bremner in the southcentral region, and the Alsek in the southeast are the three major whitewater rivers in Alaska. All three are Class VI (on a scale of I to VI) boating rivers, at the upper limit of navigability, and cannot be attempted without risk of life. Few kayakers have attempted the dangerous 11-mile run through Devil Canyon.

The Susitna was one of the Alaskan rivers recommended for detailed study as possible additions to the National Wild and Scenic Rivers System in 1973, but was not one of the 20 rivers recommended for inclusion in the system by the Secretary of the Interior in 1974. The Susitna River has not yet been studied as recommended.

About 86 percent of the total annual flow of the upper Susitna occurs from May through September, with the mean daily average flow from late May through late August in the range of 20,000 to 32,000 cubic feet per second. In the November through April period, the mean average daily flow of the river is in the range of 1,000 to 2,500 cubic feet per second. On 7 June 1964, the recording station at Gold Creek measured a flow slightly in excess of 90,000 cubic feet per second, which was the highest flow recorded for the upper Susitna River since recording started in 1950.

High summer discharges are caused by snowmelt, rainfall, and glacial melt. The main streams carry a heavy load of glacial silt during the high runoff periods. During the winter when low temperatures retard water flows, streams run relatively silt-free.

2.01.3 Cook Inlet. All of the major water courses which flow into Cook Inlet either originate from glaciers or flow through erosive soils; either type of stream carries a high suspended-solids load. The natural high flow period in streams tributary to Cook Inlet occurs during the summer months of May to September, the main period when sediment is transported to the Inlet.

Freshwater runoff into the upper Inlet is an important source of nutrients and sediments. Large quantities of nitrate, silicate, and surface-suspended sediment with particulate organic carbon enter the Inlet with fresh water. Concentrations are especially high in the initial runoff each spring and summer. These additions decrease in concentration down the Inlet upon subsequent mixing with saline oceanic water and with tidal action. The large input of fresh water dilutes and tends to reduce salinity and phosphate concentration around river mouths and in the upper reaches of Cook Inlet.

2.01.4 Geology/Topography.

2.01.4.1 General. The Railbelt area is characterized by three lowland areas separated by three major mountain areas. To the north is the

Tanana-Kuskokwim Lowland, which is delineated by the Alaska Range to the south. The Susitna Lowland is to the southwest, bounded to the north by the Alaska Range, and to the east by the Talkeetna and Chugach Mountains. The Copper River Lowland in the east is bounded on the north by the Alaska Range, and the west by the Talkeetna Mountains. Each basin is underlain by quaternary rocks surfaced with glacial debris, alluvium, and eolian deposits. The mountains are primarily metamorphic and sedimentary rocks of the Mesozoic, with several areas of intrusive granitic rocks in the Talkeetna Mountains and the Alaska Range, and Mesozoic volcanic rocks in the Talkeetna Mountains. Figure 5 delineates the major features.

2.01.4.2 Susitna Basin. The Alaska Range to the west and north and the Talkeetna Mountains to the east make up the high perimeter of the Lower Susitna River Basin. The Alaska Range is made up of Paleozoic and Mesozoic sediments, some of which have been metamorphosed in varying degrees and intruded by granitic masses. The Talkeetna Mountain Range, with peaks up to 8,850 feet, is made up of a granitic batholith rimmed on the Susitna basin side by graywackes, argellites, and phyllites. Much of the interior portion of the basin is fluvial-glacial overburden deposits. Glaciers, in turn, carved the broad U-shaped valleys. Glacial overburden covers the bedrock, which is composed mainly of shale and sandstone with interbedded coals, Paleozoic and Mesozoic sediments, and lava flows.

The Upper Susitna River Basin is predominantly mountainous, bordered on the west and south by the Talkeetna Mountains, on the north by the summits of the Alaska Range, and on the south and east by the flat Copper River plateau. Valleys are floored with a thick fill of glacial moraines and gravels.

2.01.4.3 Transmission Line Corridor. Beginning at sea level at Point MacKenzie, the transmission line corridor rises to an elevation of 500 feet at Talkeetna. The corridor traverses a wide river valley with rolling terrain east of the Susitna River and extremely flat land to the west. The valley flattens and widens to the south, is poorly drained, and has many bogs and lakes.

From Talkeetna to Gold Creek, the corridor follows a moderately narrow valley floor widening to the south. Maximum elevation is 900 feet.

The corridor from Gold Creek to Watana is common to both the Fairbanks and Anchorage power distribution system. It rises to an elevation of about 2300 feet on the plateau south of Devil Canyon before descending to the Watana damsite.

LEGEND

SEDIMENTARY AND METAMORPHIC ROCKS

QUATERNARY
Surficial deposits, alluvium, glacial debris, eolian sand and silt

TERTIARY
Sandstone, conglomerate, shale, mudstone; nonmarine and marine

MESOZOIC
Sandstone and shale; marine and nonmarine; includes some metamorphic rocks

PALEOZOIC AND PRECAMBRIAN
Sandstone, shale, limestone; mostly marine; includes some early Mesozoic rocks

PALEOZOIC AND PRECAMBRIAN
Metamorphic rocks: schist, gneiss, etc.; mainly Paleozoic

IGNEOUS ROCKS

Quaternary and Tertiary volcanic rocks

Mesozoic intrusive rocks; mainly granitic

Mesozoic volcanic rocks

Paleozoic volcanic rocks

Paleozoic intrusive rocks; granitic and ultramafic

Fault
(Dashed where inferred)

Source: U.S.G.S.
APA-1975

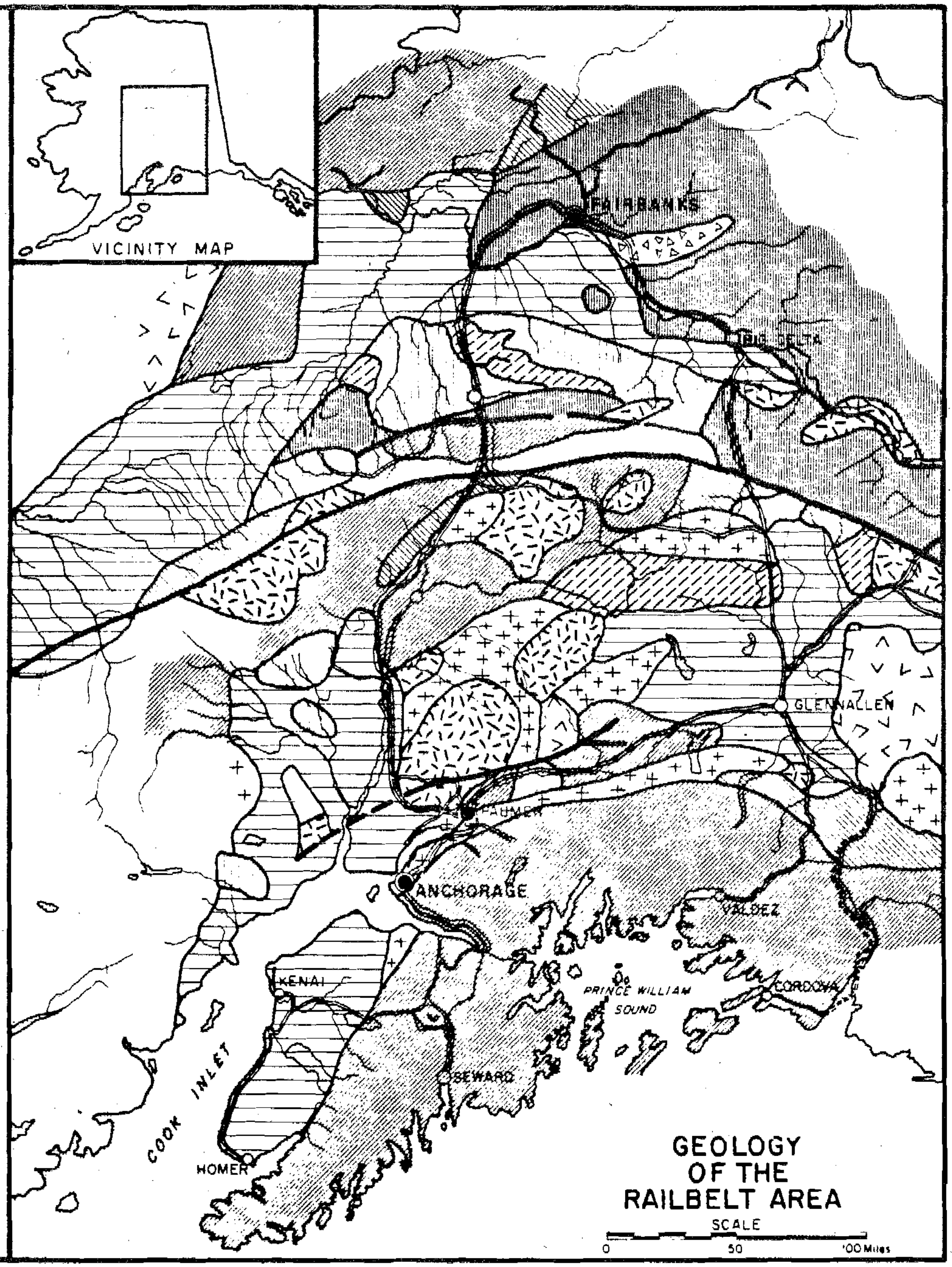


FIGURE 5

Between Gold Creek and Cantwell, the corridor rises to a 2400-foot elevation. It traverses a wide valley with moderately incised rivers in the south, becoming a very wide depression in Broad Pass with rolling valley bottom continuing to the northeast.

From Cantwell, elevation 2200 feet, the Nenana River valley narrows to the north into a series of tight canyons separated by the wide valley of Yanert Fork. The corridor emerges from the canyon into a wide rolling plain south of Healy, with stream terraces adjacent to the Nenana River. The corridor is bisected by the Denali Fault at Windy Creek. Elevation at Healy is 1400 feet, dropping to 350 feet at Nenana, and rising again to 1500 feet in the Goldstream Hills southwest of Ester.

2.01.4.4 Seismic Areas. The southcentral area of Alaska is one of the world's most active seismic zones. In this century, 9 Alaskan earthquakes have equalled or exceeded a magnitude of 8.0 on the Richter Scale, and more than 60 quakes have exceeded a magnitude of 7.0. Several major and minor fault systems either border or cross the Susitna River basin. The March 1964 Alaska earthquake, with a magnitude of 8.4, which struck southcentral Alaska, was one of the strongest earthquakes ever recorded. A total of 115 lives were lost, 98 by quake-associated tsunami (seismic sea waves).

Much of southcentral Alaska falls within seismic zone 4 (on a scale of 0 to 4) where structural damage caused by earthquakes is generally the greatest. This area of Alaska and the adjoining Aleutian chain are just part of the vast, almost continuous seismically and volcanically active belt that circumscribes the entire Pacific Ocean Basin.

2.01.4.5 Minerals. Most of the Susitna basin above Devil Canyon is considered to be highly favorable for deposits of copper or molybdenum and for contact or vein deposits of gold and silver. One known deposit of copper of near-commercial size and grade is near Denali. Also, the Valdez Creek gold placer district, from which there has been some production, is within the proposed project watershed.

Though a number of mineral occurrences are known and the area is considered favorable for discovery of additional deposits, much of the drainage basin has never been geologically mapped. Thus, geologically, the basin constitutes one of the least known areas in the State except for a few areas in the vicinity of Denali where some geologic mapping has been done.

Geologic information for the project area is not detailed enough to assess mineral resource potential within the proposed reservoir impoundment areas.

The Alaska State Department of Natural Resources states that there are "active" and "non-active" mining claims in the upper Susitna River drainage area between Devil Canyon and the Oshetna River. Many of these claims are in upper Watana Creek above the maximum reservoir pool elevation, and in the surrounding drainage areas where copper activity is moderately extensive.

2.01.5 Climate. The Susitna basin has a diversified climate. The latitude of the region gives it long winters and short summers, with great variation in the length of daylight between winter and summer. The lower Susitna basin owes its relatively moderate climate to the warm waters of the Pacific on the south, the barrier effect of the Alaska Range on the west and north, and the Talkeetna Range on the east. The summers are characterized by moderate temperatures, cloudy days, and gentle rains. The winters are cold and the snowfall is fairly heavy. At Talkeetna, at an elevation of 345 feet, which is representative of the lower basin, the normal summer temperature ranges between 44° and 68°F, with winter temperatures ranging between 0° and 40°F. The extreme temperature range is between -48° and 91°F. The average annual precipitation is about 29 inches, including about 102 inches of snowfall.

The upper Susitna basin, separated from the lower basin by mountains, has a somewhat colder climate and an average overall annual precipitation rate of approximately 30 inches.

The climate of the transmission line corridor from Devil Canyon to Point MacKenzie is transitional, with mild, wet conditions prevailing toward the southern end of the segment. The northern corridor has extremely variable climate related to differences in elevation. From Gold Creek to Cantwell, the annual temperature averages 25.9°F and annual precipitation 21.85 inches. From Cantwell to Healy, the annual temperature is 27.7°F and annual precipitation 14.5 inches. High winds are reported in this segment. North from Cantwell, the climate is typical of the interior, with an average temperature of 26.4°F and annual precipitation 11.34 inches.

2.02 Biological Characteristics.

2.02.1 Fish.

2.02.1.1 Anadromous Fish. Fish inhabiting the Susitna basin are divided into two major groups: resident and anadromous. The anadromous fish spends a portion of its life cycle in salt water, returning to the freshwater streams to spawn. In this group are included five species of Pacific salmon: red (sockeye); coho (silver); chinook (king); pink (humpback); and chum (dog) salmon. All five species of salmon die soon after spawning. Dolly Varden, a char, is widely distributed in the streams of Cook Inlet and is present in the Lower Susitna River Basin with both anadromous and resident populations. Smelt runs are known to occur in the Susitna River as far upstream as the Deshka River about 40 miles from Cook Inlet.

Salmon are found to spawn in varying numbers in some of the sloughs and tributaries of the Susitna River below Devil Canyon. Salmon surveys and inventories of the lower Susitna River and its tributaries have been made over a number of years, resulting in considerable distribution data; however, population studies and additional resource studies are needed. The surveys indicate that salmon are unable to ascend the turbulent Devil Canyon, and, thus, are prevented from migrating into the Upper Susitna River Basin.

The 14 million pounds of commercial salmon caught in Cook Inlet during 1973 comprised about 10 percent of the 136.5 million pounds of salmon harvested in Alaska during the year. Chum, red, and pink salmon totaled about 94 percent of the salmon catch for Cook Inlet during 1973. (1973 Catch and Production--Commercial Fisheries Statistics--Leaflet #26, State of Alaska Department of Fish and Game).

The 1973 commercial catch figures do not approach the maximum sustained yields for Cook Inlet, but do present the latest available commercial catch information, and are representative of the last several years of commercial salmon fishing. Sport and subsistence fishing for salmon in Cook Inlet and in the Susitna basin are also important considerations.

According to the Alaska Department of Fish and Game, a significant percentage of the Cook Inlet salmon run migrates up the Susitna River and as far as Portage Creek, about three miles downstream from the Devil Canyon damsite to spawn in the river's clearwater sloughs and tributaries. A 1974 assessment study, by the Alaska Department of Fish and Game, of anadromous fish populations in the Susitna River watershed estimated 24,000 chum, 5,200 pink, 1,000 red, and between 4,000 and 9,000 coho salmon migrated up the Susitna River above the river's confluence with the Chulitna River during the 7-week study period from 23 July through 11 September when most of the salmon were migrating up the river. The report indicated that chinook salmon were also present.

A minimum of 1,036 pink, 2,753 chum, 307 coho, and 104 sockeye salmon spawned during the August and September spawning period in the streams and sloughs of the Susitna River between the Chulitna River tributary and Portage Creek as determined from peak slough and stream index escapement counts, according to the study. The assessment also indicated that a portion of the pink salmon spawn in the study area may have been destroyed by a late August-early September flood.

Chinook (King Salmon). The king salmon spends from one to three years in fresh water before migrating to sea. It is not unusual for this species to attain a weight of over 40 pounds. The maximum age is 8 years. In 1973, over 5,000 kings were caught in Cook Inlet; the total commercial catch comprised about 1.5 percent of the total weight of salmon caught in this area. The 1973 catch figures for king salmon were very low when compared to the average yearly catch for this species.

Red Salmon (Sockeye). The red salmon averages between 6 and 8 pounds, with a range of from 2 to 12 pounds. This species spends from 1 to 3 years in a river system in which there are connecting lakes. The maximum age attained by this salmon is 7 years, but most return to spawn at 4 or 5 years of age. The landlocked variety of this species is called a kokanee and usually attains a length of from 12 to 15 inches. In 1973, almost 700,000 reds were caught in Cook Inlet, with a total weight of over 5 million pounds, or 37.0 percent of the total weight of the Cook Inlet commercial salmon catch. About 14.5 percent of the red salmon catch in Alaska were caught in Cook Inlet.

Coho Salmon (Silver). The coho or silver salmon spends from 1 to 2 years in fresh water and returns from the ocean to spawn at 3 or 4 years of age. Mature coho average about 10 pounds; some reach weights of over 30 pounds. The 106,000 cohos caught in Cook Inlet during 1973 weighed just over 648,000 pounds and comprised about 4.5 percent of the total commercial salmon catch for the area.

Pink Salmon (Humpback). The pink salmon migrates to sea immediately after hatching and returns to spawn at 2 years of age. The average weight of a mature pink is 3 to 4 pounds, with some pinks weighing up to 10 pounds. The 624,000 pink salmon caught in Cook Inlet during 1973 weighed over 2,260,000 pounds and comprised about 16.2 percent of the total weight of the commercial salmon catch in the area. Historically, odd-year catches of pink salmon are poor. Even-numbered year catches average about 2 million pinks.

Chum (Dog Salmon). Chum salmon attain weights of up to 30 pounds, with an average mature weight of 8 to 9 pounds. This species migrates to sea immediately after hatching and matures between 3 and 6 years of age. The 742,000 chums caught in Cook Inlet during 1973 weighed almost 5,800,000 pounds and made up over 41.0 percent of the total commercial salmon catch for the area, the largest percentage of any of the 5 species of Pacific salmon. About 12.5 percent of the 1973 Alaskan chum salmon catch were caught in Cook Inlet.

Salmon eggs hatch in late winter or early spring following the summer and fall spawning periods. The eggs incubate in gravelly streambeds and cannot tolerate high levels of siltation or low flows that dewater the streambeds during the incubation or alevin (pre-emergent) stages.

2.02.1.2 Resident Fish. Grayling, rainbow trout, lake trout, Dolly Varden, whitefish, sucker, sculpin, and burbot (ling) comprise the principal resident fish population of the Susitna River basin. Although distribution studies have been made in the past, the magnitude of resident fish populations in the Susitna drainage is largely unknown.

During the warmer months of the year, when the Susitna River is silt laden, sport fishing is limited to clearwater tributaries and to areas in the main Susitna River near the mouths of these tributaries.

Resident fish, especially grayling, apparently inhabit the mouths of some of the clearwater streams on the Susitna River between Devil Canyon and the Oshetna River; however, most of the tributaries are too steep to support significant fish populations. Some of the upper sections of these clearwater tributaries, such as Deadman Creek, support grayling populations. Lake trout are also prominent in many of the terrace and upland lakes of the area.

2.02.2 Birds.

2.02.2.1 Waterfowl. The east-west stretch of the Susitna River between the Tyone River and Gold Creek is a major flyway for waterfowl. The majority of the waterfowl nesting areas in the Upper Susitna River Basin are on the nearby lakes of the Copper River Lowland region, on the Tyone River and surrounding drainage areas, and on the ponds and lakes of the wide flood plain in the Denali area.

The Upper Susitna River Basin has a moderate amount of use by waterfowl when compared with the Lower Susitna River Basin. The lower basin has a substantially greater amount of waterfowl habitat, and a greater number and variety of waterfowl seasonally use the thousands of lakes and ponds in this area to nest and to raise their young. Large numbers of migrant birds also use the Susitna River basin for feeding and resting during spring and fall flights to and from Alaska's interior and north slope. Distribution and density of waterfowl habitat within the Railbelt area is shown on Figure 6.

2.02.2.2 Raptors. Raptors, including golden eagles, bald eagles, and various species of hawks, owls, and falcons, occur throughout the entire Susitna River basin but in smaller numbers in the river canyon between Portage Creek and the Oshetna River. A June 1974 survey of cliff-nesting raptors conducted by the U.S. Fish and Wildlife Service, determined that the population densities of these birds between Devil Canyon and the Oshetna River are low and that no endangered species of peregrine falcons, American or arctic, appear to nest along the upper Susitna River. Peregrines have occasionally been sighted within the area of the upper Susitna basin and along migration routes through the Broad Pass area of the upper Chulitna River.

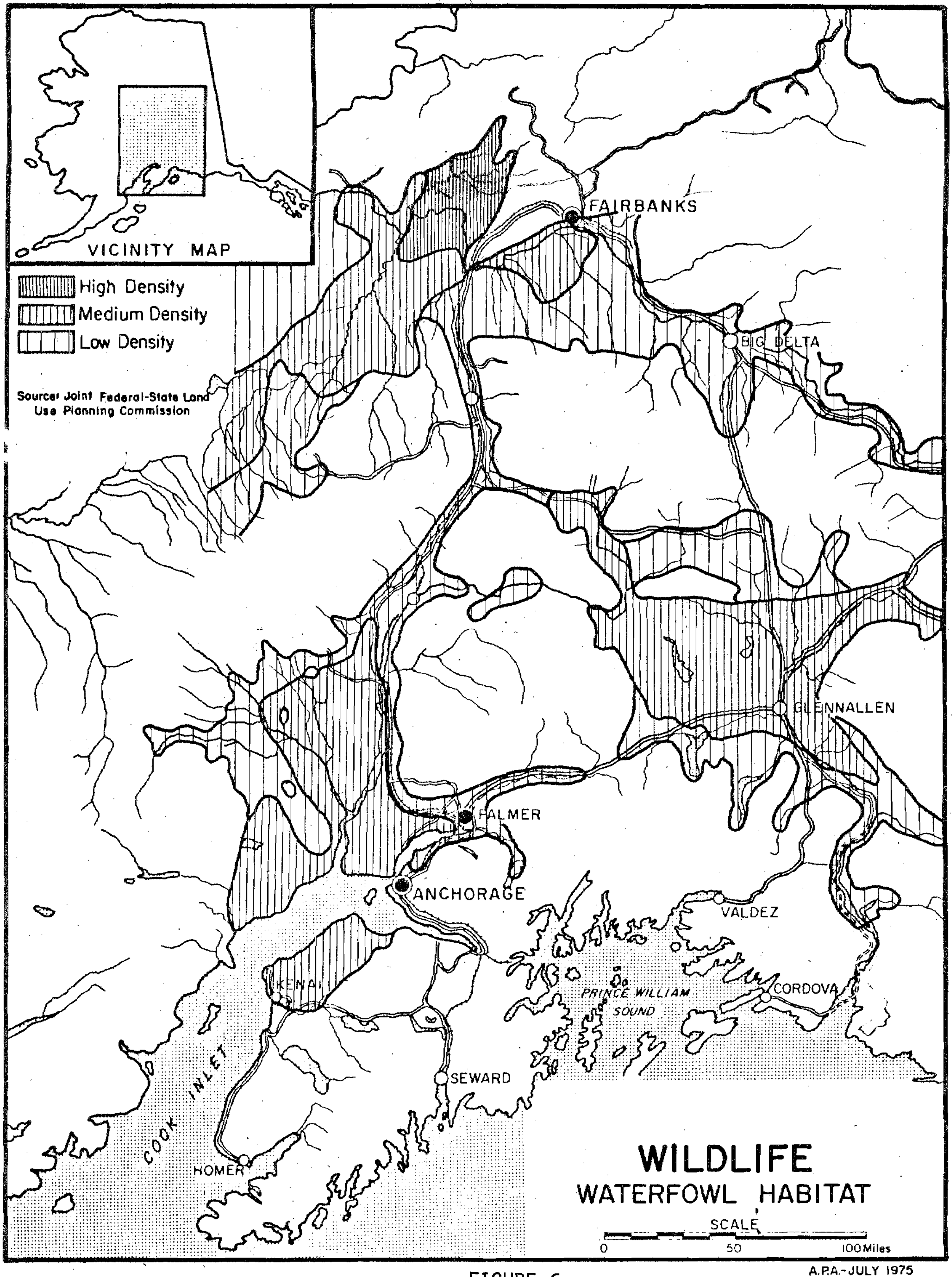

VICINITY MAP
High Density
Medium Density
Low Density
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
CORDOVA
KENAI
PRINCE WILLIAM SOUND
SEWARD
COOK INLET
HOMER
WILDLIFE
WATERFOWL HABITAT
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 6

On the basis of the 1974 U.S. Fish and Wildlife Service findings, other raptor populations in the canyon area of the upper Susitna River were determined to be minor, although minimal data were acquired on the tree-nesting raptors. Several nesting pairs of bald eagles and gyrfalcons were observed in or near the canyons of this area, and golden eagles frequently occupied upland cliffs in the vicinity of Coal Creek.

Substantial populations of ravens were found in reaches of the Susitna River above Gold Creek. The nests of this large bird are often used by raptors, including peregrines and gyrfalcons. However, there was no evidence that the nests observed were being used by raptors.

2.02.2.3 Other Birds. Limited numbers of game birds, such as spruce grouse and willow ptarmigan, inhabit the Upper Susitna River Basin. Some incidental hunting takes place along the Denali Highway, but hunting pressures are practically nonexistent in most of the area.

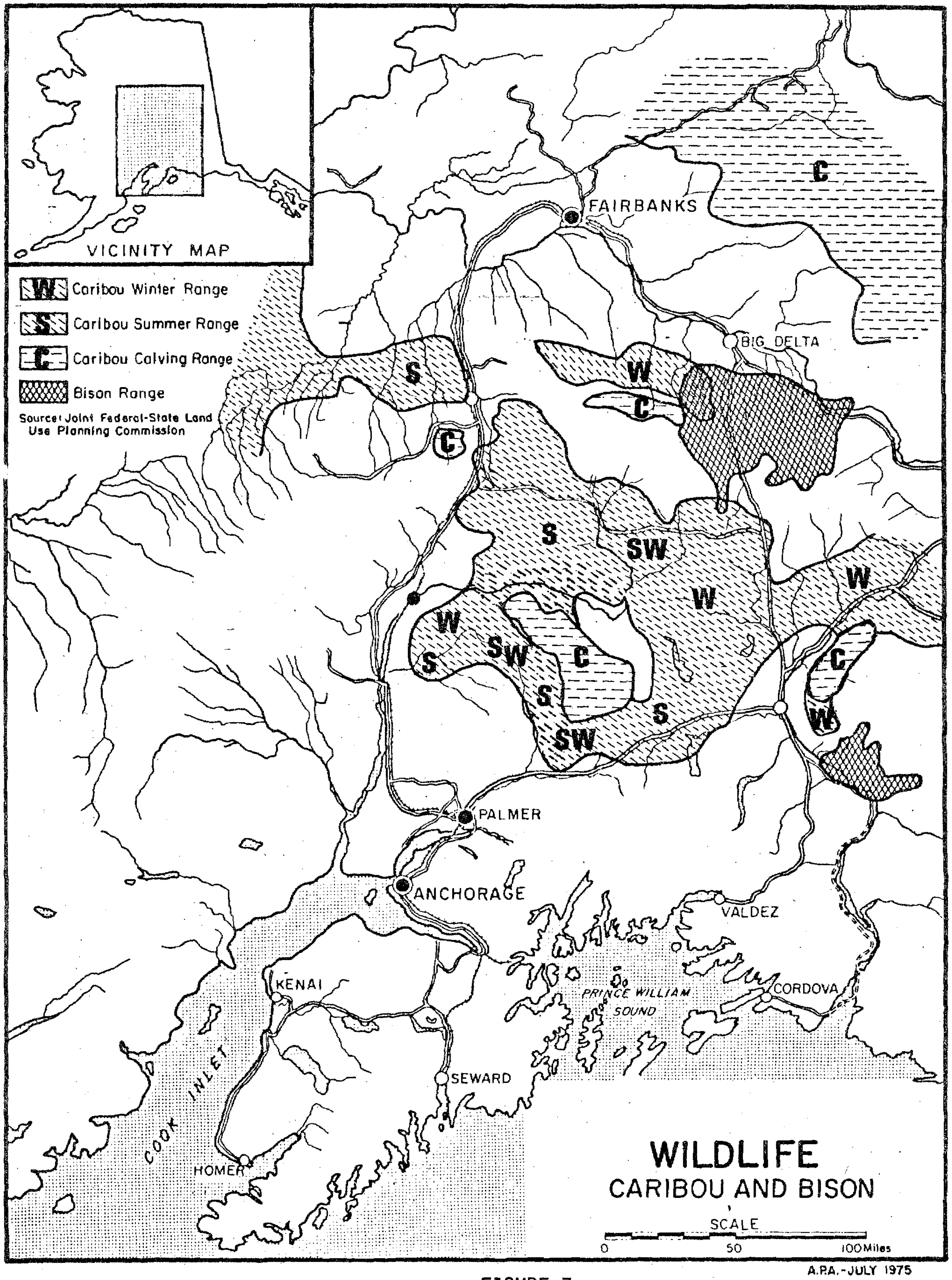
Various other species of birds including songbirds, shorebirds, and other small birds are found throughout the Upper Susitna River Basin in varying numbers.

2.02.3 Mammals.

2.02.3.1 Caribou. One of the most significant wildlife resources of the Upper Susitna River Basin is the wide-ranging Nelchina caribou herd. This herd, a major recreational and subsistence resource in the south-central region, declined from a population high of about 71,000 in 1962 to a low of between 6,500 and 8,100 animals in 1972. This spectacular decline has been attributed to various factors, including migration to other areas, bad weather, predation, and overhunting. Motorized all-terrain vehicle access to the backcountry has improved hunting success even in the face of a rapidly declining caribou population.

Segments of the Nelchina herd periodically range throughout much of the Upper Susitna River Basin. (See Figure 7.) The major calving area for the herd is on the northeast slopes of the Talkeetna Mountains on the upper reaches of the Kosina Creek, Oshetna River, and Little Nelchina River drainages. Calving generally takes place between mid-May and mid-June. Except for intermittent seasonal migration routes across the Susitna River in areas upstream from Tsusena Creek, caribou are not resident to the main Susitna River canyon between Devil Canyon and the Oshetna River.

Caribou depend upon climax range, especially for winter forage; any alteration of the vegetation, especially of sedges and lichens, has a detrimental impact upon their distribution and numbers. A trait of the Nelchina herd is an almost constant change of winter ranges, a phenomenon that has undoubtedly characterized Alaska's caribou populations for centuries.



VICINITY MAP
W Caribou Winter Range
S Caribou Summer Range
C Caribou Calving Range
Bison Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
PALMER
ANCHORAGE
VALDEZ
KENAI
CORDOVA
PRINCE WILLIAM SOUND
SEWARD
COOK INLET
HOMER
WILDLIFE
CARIBOU AND BISON
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 7

The Alaska Department of Fish and Game considers the Nelchina herd to be one of the State's most important caribou populations. Several thousand hunters from Anchorage and Fairbanks participate in the annual hunting of this species. Additional thousands of non-hunting recreationists view the migrations of caribou as they cross the State's major highways. In addition, the herd provides sustenance to predators and scavengers such as wolves, grizzly bears, black bears, wolverines, lynx, and various species of birds.

Caribou are essentially limited in distribution within the transmission line system to the 136-mile segment extending north from Cantwell. In the mountainous area between Cantwell and Healy, they concentrate south of canyons. They are found in concentrations on the west bank of the Nenana River north of Healy and south of Clear Air Force Base.

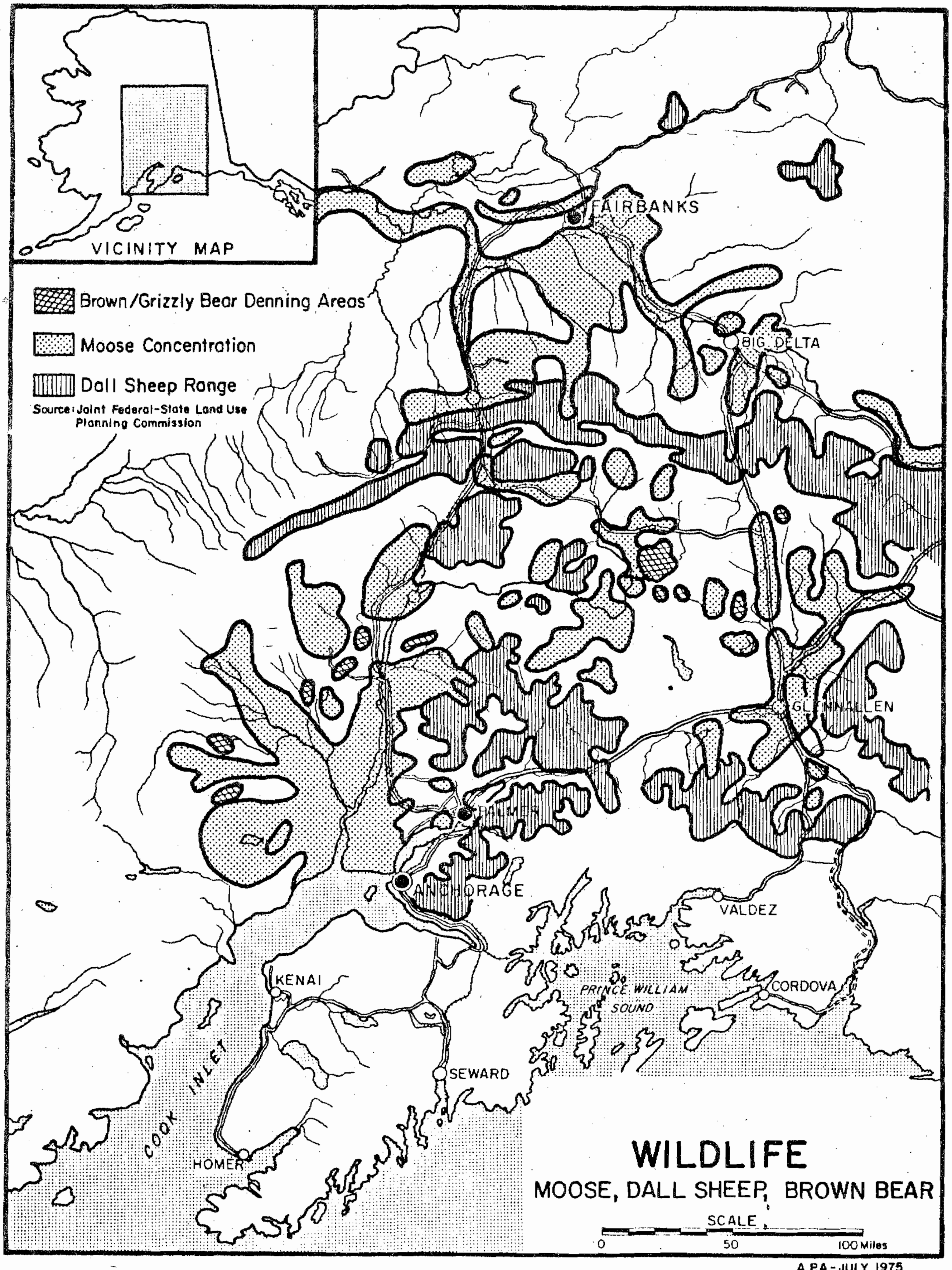
2.02.3.2 Moose. Moose range throughout much of the Upper Susitna River Basin (Figure 8). Wide fluctuations of populations have occurred over the years. A 1973 Alaska Department of Fish and Game fall aerial count resulted in sighting of approximately 1,800 moose in the upper Susitna River drainage. Numbers of moose in the southcentral region of Alaska have been reduced in recent years due mainly to weather conditions, hunting pressures, wolf predation, unbalanced age-sex ratios, and elimination of habitat.

Much of the Upper Susitna River Basin is at or above timberline, resulting in large amounts of "edge" at timberline which produce considerable quantities of willow, an important winter forage for moose. Successional vegetation changes following fire also contribute heavily to areas favoring moose habitat.

Limited numbers of moose inhabit the Susitna River bottom between Devil Canyon and the Oshetna River, because of a restricted amount of suitable habitat. However, the available habitat provides critical winter range for moose that do utilize this area.

Moose inhabit the entire length of the transmission line corridor but are more abundant in the lower valleys. In mountainous terrain, they are more commonly found in more open parts of canyons.

2.02.3.3 Grizzly/Brown Bears. Grizzlies are common throughout the Susitna River drainage and are fairly numerous in the upper Susitna despite the absence of salmon (see Figure 8). Alpine and subalpine zones are the habitats most frequently used by grizzlies, although the more timbered areas are seasonally important. Denning begins in October, and all bears are in dens by mid-November. Bears usually reappear during May, depending on weather conditions. Important spring foods include grasses, sedges, horsetails, other herbaceous plants, and



VICINITY MAP
Brown/Grizzly Bear Denning Areas
Moose Concentration
Dall Sheep Range
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
WILDLIFE
MOOSE, DALL SHEEP, BROWN BEAR
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 8

carrion when available. On occasion, moose or caribou calves are taken. Berries--lowbush and highbush cranberries, blueberries, and bearberries--provide major summer food supplements. A prime consideration for grizzly bears is to minimize direct conflict with humans as the grizzly is adversely affected by contact with man.

Hunting for grizzly bears in this area often occurs incidentally to other hunting during the short fall open season.

Within the transmission line corridor, grizzly bears are limited in distribution to the higher areas, primarily between Cantwell and Healy.

2.02.3.4 Black Bears. The Upper Susitna River Basin supports fair black bear densities. The larger populations are in semi-open forested areas with readily accessible alpine-subalpine berry crops. River bottoms, lake shores, and marshy lowlands are favorite spring black bear areas. Black bears generally eat many of the same types of food as are eaten by grizzlies. Denning habits are also somewhat similar to the grizzly bear's.

Natural fires generally benefit black bears, especially when dense mature spruce stands are burned. Most other land uses do not seriously affect bear numbers in this area, and black bears are not as adversely affected by contact with man as are grizzlies.

Black bears are found in forested areas throughout the length of the transmission line corridor.

2.02.3.5 Dall Sheep. These sheep are present in many areas of the Alaska Range, Talkeetna Mountains, and in the higher elevations of the Susitna River basin (Figure 8). The greatest concentrations of Dall sheep in the Susitna basin occur in the southern portions of the Talkeetnas; herds become scattered on the northern portion of the range, where parts of the mountains are uninhabited by sheep. Dall sheep are also found in the Watana Hills. Because of the relatively gentle nature of much of the Talkeetna Mountains and Watana Hills, predation in this area has more effect on sheep numbers than in more rugged habitats. Sheep have always furnished some of the diet of wolves and other carnivores in this area.

Within the transmission line corridor, Dall sheep are essentially limited to the mountainous area between Cantwell and Healy.

Hunting pressure for rams is fairly heavy due to relatively good access from highways, by air, and by ATVs (all-terrain vehicles). Nevertheless, as is true elsewhere in the State, ram-only hunting seems to have little effect on overall numbers. Sheep populations are almost entirely controlled by natural factors such as habitat, weather conditions, predation, and disease. Conflicts between man's activities and critical sheep habitat, such as lambing or wintering areas, can adversely impact Dall sheep populations.

2.02.3.6 Mountain Goats. Goats occur in low numbers in various areas of the Talkeetna Mountains and in the Watana Hills area, and do not provide a significant amount of hunting in the upper Susitna basin. The goats generally inhabit rougher terrain than do Dall sheep, and are thus less susceptible to man's activities.

2.02.3.7 Wolves. Wolves occur throughout most of the Upper Susitna River Basin. Populations are subject to rapid fluctuations, and estimates should be viewed with extreme caution. Wolf numbers have been estimated from a low of 13 in 1943, after predator control efforts, to a high of 400 to 450 in 1965. Currently an estimated 300 wolves populate the area encompassing the upper Susitna, the Talkeetna Mountains, and the upper Copper River drainage area. The wolf has been removed from predator classification and is now classified as a game animal in Alaska.

Alaska Department of Fish and Game management studies concluded that, from 1957 to 1967, wolf predation neither adversely affected other game populations, nor reduced hunting success for sportsmen. However, absolute conclusions were uncertain since moose and caribou populations may have reached their highs during this period. The study proved that wolves and men can often coexist while competing for game animals, but that at times man must accept reduction of available game by wolves.

2.02.3.8 Wolverines. This area of Alaska has consistently produced more wolverines than any other area of comparable size in the State. Regularly throughout the area, it is not unusual for a hunter returning to a kill site to find a wolverine feeding on his moose or caribou. Wolverines have withstood human encroachment and trapping without any noticeable reduction in numbers or range.

2.02.3.9 Other Mammals. Fur animal species of the upper Susitna in addition to wolf and wolverine include beaver, muskrat, otter, mink, Canada lynx, fox, marten, and weasel. Found in varying populations throughout much of the Upper Susitna River Basin and transmission corridor, each of these species has its own unique habitat requirements. However, except for a limited number of beaver, the river canyon area between Devil Canyon and the mouth of the Oshetna River is not considered good quality fur animal habitat for most of these species.

Other mammals found in this area include coyotes, snowshoe hares, ground squirrels, tree squirrels, pikas, marmots, and several species of voles, shrews, and mice. As with other animals, the populations of the various species vary as adverse or beneficial factors are encountered. Some populations fluctuate greatly while others remain fairly stable.

Susitna River between Watana and Vee damsites. Heavier vegetation, in this case upland spruce-hardwood forest, is limited to the valley slopes, the vegetative biome on the upper plateaus is generally moist tundra, muskeg, and alpine tundra.

2.02.4 Threatened Wildlife of the United States. The only species in the U.S. Fish and Wildlife Services publication, Threatened Wildlife of the United States, that might be resident in or migrate through the Upper Susitna River Basin are the two subspecies of the peregrine falcon: Falco peregrines anatum (American) and Falco peregrines tundrius (arctic). Although no peregrines appear to be nesting along the upper Susitna River at present, there have been occasional sightings within the area and along known migration routes for this species as they move through the Broad Pass area on the upper Chulitna River. These migrating peregrines are occasionally reported to include members of the two endangered subspecies.

Several species of wildlife that are considered threatened or depleted in the Lower 48 States have substantial populations within Alaska. Such species include the American bald eagle, the wolf, and the grizzly bear.

2.02.5 Vegetation. The major ecosystems of Alaska are divided into marine and land groupings, with the land group divided into freshwater, tundra, and coniferous systems. The freshwater system includes glaciers and ice fields, lakes, and riverine ecosystems; the tundra system is subdivided into moist, wet, and alpine tundras; and the coniferous system is divided into six plant-related classifications.

The Upper Susitna River Basin includes the following four broad land ecosystem classifications: moist tundra; alpine tundra; upland spruce-hardwood forest; and lowland spruce-hardwood forest. The largest percentage of the basin is classified as moist or alpine tundra with most of the area in and adjacent to the main river channel below the Maclaren River classified as either upland or lowland spruce-hardwood forest.

At Gold Creek, the bottomland forest of white spruce and black cottonwoood is very much in evidence on well drained banks. Ascending the river, balsam poplar replaces the cottonwoods around Fog and Tsusena Creeks. Thin hardwoods and white spruce become less and less in evidence but still occur in small stands on well drained river bars and tributary fans upstream to Butte Creek. Above this tributary, only scattered stands of black spruce occur, growing up to the glaciers. The lower hillsides have a low brush cover with moist tundra in the lower areas. The periodically flooded river flats are in willow, sedges-high brush, and wet tundra. Since much of the drainage basin is uplands, alpine tundra is one of the most prominent vegetation types.

Alpine tundra is composed of low mat plants, both herbaceous and shrubby. Moist tundra usually forms a complete ground cover and is very productive during the growing season. Plant types vary from almost continuous cottongrass with a sparse growth of sedges and dwarf shrubs to stands where dwarf shrubs dominate. Tundra ecosystems are especially fragile and are very susceptible to long-term damage or destruction from overuse. Regeneration is extremely slow, with some lichens requiring more than 60 years to recover.

Most of the timber ecosystems in the upper Susitna basin are located adjacent to the river and tributaries on the canyon slopes and on the surrounding benchlands. The major timber species include birch, balsam poplar, black cottonwood, white spruce, and black spruce. Overall, the timber quality in this area is not good, with a wide variety of sizes, mostly smaller and noncommercial. Much of the birch and spruce is more suitable for pulp than for sawtimber; however, a fair yield of sawlogs could be obtained from stands of black cottonwood and balsam poplar.

The transmission line corridor transects five generally distinct vegetation types. Three of these--upland spruce-hardwood, lowland spruce-hardwood, and alpine tundra--are common within the upper Susitna basin, as discussed above. Two are related to distinctly different land forms. Bottomland spruce-poplar is confined to broad flood plains and river terraces, and warmer slopes of major rivers. Characteristic vegetation is white spruce, balsam poplar, birch, and aspen. Low bush, bog, and muskeg are another distinct type usually formed on outwash, and old river terraces, in filling ponds and sloughs, and throughout lowlands. Characteristic plants are tamarack, black spruce, alders, willows, and berries.

Progressing northward from Point MacKenzie, the corridor is principally characterized by bottomland spruce-poplar, lowland spruce-hardwood, and muskeg bog to Talkeetna. From this point to Gold Creek, bottomland spruce-poplar is interspersed with upland spruce-hardwood. The segment leading from Gold Creek to Cantwell is typically bottomland spruce-poplar interspersed with upland spruce-hardwood, and low brush-bog/muskeg. Through the Alaska Range between Cantwell and Healy, the vegetation is a mixture of upland spruce-hardwood, lowland spruce-hardwood, alpine tundra, and some low brush-muskeg/bog. From Healy to Ester, the vegetation is characterized by bottomland spruce-poplar, upland spruce-hardwood, lowland spruce-hardwood, and low brush-muskeg/bog.

2.03 Cultural Characteristics.

2.03.1 Population. The Southcentral Railbelt area of Alaska contains the State's two largest population centers, Anchorage and Fairbanks, and almost three-fourths of the State's total population. The Anchorage area alone has over half the residents in the State. Recently revised estimates for 1975 indicate over 386,000 people will be in Alaska by the end of the year, compared to slightly over 302,000 counted in the 1970 census, an increase of about 28 percent in that period. Other estimates by the Alaska Department of Labor indicate an expected State population of almost 450,000 for the year 1980, an additional 16 percent increase over 1975, and a population increase of nearly 50 percent in 10 years. The largest growth in the State has been in the Southcentral Railbelt area, and this trend is expected to continue. With the possible relocation of Alaska's capital from Juneau to the Railbelt area, an additional population impact will be exerted on this area of the State.

Looking upstream at Susitna River near Gold Creek about 15 miles below Devil Canyon. Note Alaska Railroad bridge.

At the present time, only a few small settlements are located along the Parks Highway between Anchorage and Fairbanks and the Alaska Railroad in the Susitna River valley. Except for the small settlement at Denali, there are few, if any, permanent full-time residents in the Upper Susitna River Basin above Devil Canyon.

2.03.2 Economics. Both Anchorage and Fairbanks are regional economic centers for the Southcentral Railbelt area. Government, trade, and services comprise the major portion of the area's total employment. Construction and transportation are also important. Making relatively less significant contributions are the financing, mining, and manufacturing industries, while agriculture, forestry, and fisheries contribute less than one percent of the employment dollar to the economy of the Railbelt area. In 1972 the wages and salaries for the southcentral region of Alaska amounted to more than $704,000,000.

In the government groups, employment is divided more or less equally between Federal, State, and local sectors. The area's major Federal employer is the Department of Defense, with most of its employees concentrated in four military installations. State and local government employment includes employees from agencies of the State of Alaska and the cities and boroughs within the area.

After government, the two groups having the largest employment are trade and services. Their importance as sources of employment for the Railbelt area residents is a further manifestation of the region's two relatively concentrated population centers and of the high degree of economic diversity, as well as levels of demand for goods and services, which are substantially higher than in most other parts of Alaska. The importance of construction is largely due to the high level of expansion experienced by the Anchorage and Fairbanks areas since 1968. This growth can partly be attributed to the trans-Alaska pipeline project, which is encouraging much new construction in both public and private sectors.

High levels of employment in the region's transportation industry reflect the positions of Anchorage and Fairbanks as major transportation centers, not only for the Southcentral Railbelt area but for the rest of the State as well. The Port of Anchorage handles most of the waterborne freight moving into southcentral and northern Alaska. International airports at Anchorage and Fairbanks serve as hubs for commercial air traffic throughout Alaska and are important stopovers for 37 major international air carriers. Anchorage also serves as the transfer point for goods brought into the area by air and water, which are then distributed by air transport, truck or by Alaska Railroad to more remote areas.

Although exerting relatively little direct impact on total employment, mining, finance, insurance, and real estate play important roles in terms of the secondary employment they generate in the region. Most people employed in mining engage in activities relating to petroleum extraction from fields in Cook Inlet and the Kenai Peninsula. A substantial portion of the royalties and taxes collected by the State as a result of oil production in the area is returned to the area in the form of jobs in State government and through revenue sharing with various local governments. The total value of oil and gas production in the southcentral region for 1972 was almost $240 million. Similarly, the Anchorage financial sector, in spite of its small employment, exerts considerable economic leverage as the banking center for Alaska.

Most agricultural activities in the Southcentral Railbelt area take place in the Matanuska, Susitna, and Tanana Valleys. The potential for agriculture in these areas of Alaska is considered favorable, although development of the industry has not been extensive.

Commercial fisheries activity is the oldest cash-based industry of major importance within the region. The industry has changed substantially during the past 20 years and continues to be modified as a result of both biologic and economic stimuli. The salmon industry has always been a major component of the industry in terms of volume and value. Since 1955, the king crab, shrimp, and Tanner crab fisheries have undergone major development, and halibut landings have increased substantially in recent years. The total wholesale value of commercial fish and shellfish for the southcentral region of Alaska in 1972 was just over $100 million including a catch of almost 110 million pounds of salmon with a wholesale value of nearly $38 million.

The southcentral region of Alaska includes the Kodiak-Shelikof area, the Cook Inlet area, and the Copper River-Gulf of Alaska area. The Southcentral Railbelt area is that portion of the southcentral and Yukon subregions that is served by the Alaska Railroad.

The region's timber output is less than 10 percent of the total timber harvested commercially in Alaska. The timber industry is shifting from supplying the local market to production aimed at the export market. Stumpage value of timber cut from State and National forest lands in the southcentral region during 1972 was about $130,000.

The tourist industry plays an increasingly important role in the economy of the region. Precise data on tourism are not available, but the numbers of Alaskan visitors have increased from about 130,000 in 1971 to approximately 216,000 in 1973. A forecast by the Division of Tourism in 1973 estimated 288,000 people would visit Alaska in 1975 and about 554,000 in 1980.

Looking north along the Denali Highway to the Amphitheater Mountains. Morainal ridges run across the middle of the photo. The biome along most of the eastern half of the Denali Highway is moist tundra.

With population trend projections showing a substantial increase in the number of future residents in the State and especially in the Southcentral Railbelt area, there will be a related increase in the demand for jobs, goods, energy, and services. Alaska has a wealth of reserves in renewable and nonrenewable resources that will have to be addressed in the very near future.

The world consumption of nonrenewable resources for energy production such as oil and gas has reached or will soon reach a critical point in time where alternative means to produce energy must be developed. The need for the development and utilization of those renewable resources must be weighed against the adverse effects that these developments would have on an ever decreasing regime of natural environment.

2.03.3 Transportation.

2.03.3.1 Rail. The Alaska Railroad runs from Seward on the Gulf of Alaska, past Anchorage, up the Susitna Valley, past Mount McKinley National Park, and down to Fairbanks on the Tanana River, a distance of 483 miles. The Federally constructed and operated Alaska Railroad was built between 1914 and 1923.

2.03.3.2 Roads. Paved roads in the Railbelt area include: the 227-mile Sterling-Seward Highway between Homer and Anchorage, with a 27-mile side spur to Seward; the newly-constructed 358-mile Parks Highway between Anchorage and Fairbanks; a 205-mile section of the Alaska Highway that connects Tok Junction with Fairbanks; the 328-mile Glenn Highway connecting Anchorage with Tok Junction; and the 266-mile Richardson Highway from Valdez, on Prince William Sound, to its junction with the Alaska Highway at Delta Junction, 97 miles southeast of Fairbanks.

The only road access through the upper Susitna basin is the 135-mile gravel Denali Highway between Paxson on the Richardson Highway and Cantwell on the Parks Highway, and the 20-mile gravel road from the Glenn Highway to Lake Louise. The Denali Highway is not open for use during the winter months.

2.03.3.3 Air. In addition to major airlines within Alaska, there are numerous small commercial operators plus the highest per capita ratio of private aircraft in the nation. Many small remote landing strips are scattered throughout the Susitna basin, and float planes utilize many lakes and streams to ferry freight and passengers to the remote backcountry areas. In many areas of the State, the only access is provided by the bush plane.

2.03.3.4 Other Forms of Transportation. ATVs and other types of off-road vehicles provide transportation into areas in the upper Susitna basin where there are no developed roads. Several developed trails are shown on maps of the upper basin. Trails are utilized by ATVs, trail bikes, hikers, horseback riders, and winter travelers.

Shallow-draft river boats, small boats, canoes, rubber rafts, and kayaks utilize sections of the upper Susitna River, a few tributary streams, and some of the lakes for recreation purposes. Except for these few areas, boating use is practically nonexistent within much of the upper basin.

2.03.4 Recreation.

2.03.4.1 Access. The greatest constraint on recreation activities for most of the 5,800-square-mile Upper Susitna River Basin is the shortage of road access. Except for a 20-mile gravel road from the Glenn Highway to the southern shores of Lake Louise on the upper drainage of the Tyone River, the main access to the area is by way of the gravel Denali Highway through the upper part of the basin.

Float planes are used to fly in hunters, fishermen, and other recreationists to various areas within the basin, but, except for a few larger isolated lakes, this form of access is relatively minor. All-terrain vehicles and snowmobiles also provide off-road access to areas within the upper Susitna basin. Boats are used to some extent to provide access on the Tyone River drainage and to areas of the Susitna River between the Denali Highway and Devil Canyon.

Much of the Upper Susitna River Basin has very little recreational activity at the present time. Great distances, rough or wet terrain, and lack of roads limit use of most of this area to a few hardy souls who enter these wild lands for recreational purposes, or to the wildlife residents and migrant birds and animals that pass through the region.

2.03.4.2 Hunting. A major recreational use of the upper Susitna area is big-game hunting and associated recreational activities. The greatest hunting pressures are exerted from a few fly-in camps, and from areas along the Denali Highway. Most wolves and bears harvested are taken while hunting caribou or moose. The increased use of ATVs to provide access and to haul big game is a significant factor in improved hunting success, even in the face of declining game populations. The mechanized ATV can penetrate deeply into previously inaccessible country, leaving few areas that provide havens for the reduced numbers of caribou and moose. It appears that the use of ATVs for hunting, already prohibited in some areas, may have to be further controlled.

The hunting of Dall sheep, mountain goats, and waterfowl is minimal in the upper basin even in areas of road access such as the Denali Highway.

2.03.4.3 Fishing. Access is again the major factor in determining areas that are utilized in fishing for grayling, rainbow trout, whitefish, and lake trout. The Susitna and Maclaren Rivers are silt laden throughout their entire courses during the warmer months of the year. Therefore, sport fishing is limited to lakes, clearwater tributaries, and to areas in the main Susitna near the mouths of these tributaries.

Sport fishing pressure in the upper Susitna basin is light. Many lakes and some areas of the river afford landing sites for float-equipped aircraft. A few areas along the main Susitna and some tributaries, such as the Tyone River and Lake Louise, have some pressure from boat fishermen. An increasing number of hunters use ATVs to get into and out of the back country, exerting incidental fishing pressure in some areas.

As previously stated, salmon do not migrate into the upper Susitna River above Devil Canyon so are not a factor in the sport fishery of this area.

2.03.4.4 Boating. A minor amount of recreational boating occurs in the waters of the upper Susitna basin. Some lakes such as Lake Louise have a heavier amount of boating activity, and some rivers such as the Tyone and the Susitna have a lighter amount of boating activity. Some kayakers utilize portions of the main Susitna River, but very few have braved the violent waters of the Susitna through the area known as Devil Canyon.

2.03.4.5 Camping. Most camping use in this area is incidental to other recreational activities such as hunting, fishing, boating, and highway travel. Some developed campground facilities are located at Lake Louise and at three campgrounds along the Denali Highway outside the upper Susitna basin. Tourism during the summer months involving the use of campers, trailers, and similar recreational vehicles is increasing at a dramatic rate in Alaska. Many of these vehicles camp along the roads where adequate facilities do not exist and where these activities are creating ever increasing adverse impacts upon the land.

2.03.4.6 Other Outdoor Recreational Activities. Most other recreational activities in the Upper Susitna River Basin exert varying environmental impacts on the area. Many activities such as hiking, backpacking, and photography take place incidentally to other recreational pursuits such as hunting, fishing, boating, camping, and driving for pleasure. Trail bikes, snowmobiles, four-wheel-drive vehicles, and other mechanical equipment can cause extreme adverse environmental damage to the fragile ecosystems of the basin when used in a careless, uncontrolled manner.

At the present time, recreation is one of the major uses of the upper Susitna River drainage area, but the overall utilization of this area by humans remains comparatively light.

2.03.5 Historic Resources. The current National Register of Historic Places has been consulted, and no National Register properties will be affected by the project. A historical-archaeological study recently completed for the Corps of Engineers by the Alaska Division of Parks (Heritage Resources Along the Upper Susitna River, August 1975) indicates 11 historic sites within the study portion of the upper Susitna basin. These are all essentially related to the discovery of gold. Most of the early mining activity occurred on Valdez Creek, where the town of Denali was established. Nine of the sites are located in that general area. Two sites, both designated as cabins, are located on Kosina Creek, one near its mouth, and one about six miles upstream. The apparent dearth of historical locations between Devil Canyon and the Maclaren River is explained by the following excerpt from the Alaska Division of Parks' report (in discussing the first mapping of the area in 1912): "Except for a few prospects on the Oshetna River, the USGS never received any reports of gold being found on the Susitna between Devil Canyon and the Maclaren in significant quantities. Though the Tanaina and Ahtna Indians did a great deal of hunting and fishing on the river in this area, the white man found little gold, an almost unnavigable river, and no reason to settle anywhere near the 'Devil's Canyon'."

In 1920 the Alaska Railroad was completed, giving general access to Mount McKinley National Park. Highways followed in the 1940's and 1950's, and the primary use of the area became recreational. The road approach to Mount McKinley Park was by way of the gravel Denali Highway until the recent completion of the Parks Highway between Anchorage and Fairbanks.

2.03.6 Archaeological Resources. Only one archaeological site has been examined within the study area portion of the upper Susitna basin, and it has never been excavated. This is the Ratekin Site, located near the Denali Highway several miles east of the Susitna River. Three other late prehistoric archaeological sites have been reported, one on upper Valdez Creek, and two on the Tyone River. Very little information is presently available on the aboriginal uses of the Upper Susitna River Basin. Based upon the knowledge of the prehistory of contiguous areas, the Alaska Division of Parks' report concludes that the Upper Susitna River Basin was likely inhabited as early as 10,000 years ago, during Late Pleistocene/Early Holocene times, with use continuing in intensity during Late Prehistoric/Early Historic times.

Two archaeological sites within the general vicinity of the proposed transmission line corridor are listed in the National Register of 4 February 1975. These are the Knik and Dry Creek sites.

Extensive archaeological remains have been found in the Tangle Lakes area outside the Upper Susitna River Basin near the Maclaren River drainage, and the area has been entered on the National Register of Historic Places. The remains are apparently associated with a large proglacial lake that existed during and after the last period of glaciation, dating back some 10,000 to 12,000 years. It is reasonable to expect further remains to be found around the lakebed margins when more detailed investigations are made.

2.04 Energy Needs. Power requirements for the Railbelt are increasing rapidly, and substantial amounts of new generating capacity and additional transmission system development will be needed in the near future. The Railbelt now derives most of its power from oil and natural gas. Past planning has contemplated that natural gas and, eventually, fuels from the Alyeska Pipeline would continue as long-range energy sources for Railbelt power systems. However, recent changes in the national and international energy situation indicate that other alternatives such as the abundant coal and hydro resources of the Railbelt should be reconsidered.

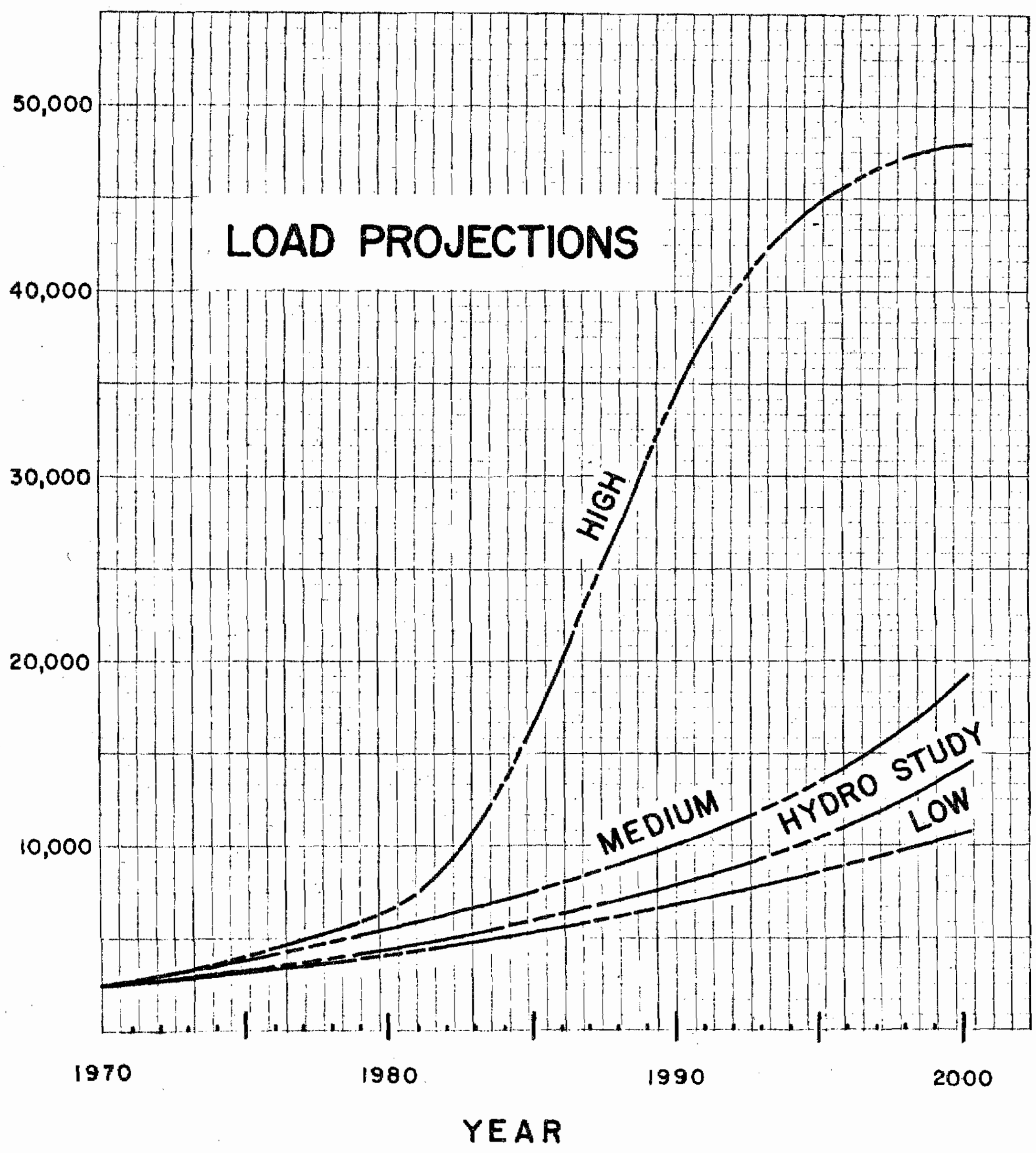
The energy demand curve used in the hydropower study is based on 1975 projections provided by the Alaska Power Administration. The curve represents the combined demand of the southcentral and Yukon regions and presumes that substantial progress in energy conservation will be made with resultant lowering in the mid-range demand curve. Approximately 80 percent of the energy demand within these two regions is estimated to lie in the Anchorage and Fairbanks population centers within the Southcentral Railbelt area. Figure 9 shows both the 1975 projected demand curve for these two load centers and the high, mid-range, and low projections from the 1974 Alaska Power Survey.

Because of lead time needed for coal and hydroelectric development, immediate needs for the next decade will have to be handled by additional oil and gas-fired units. However, the opportunity exists for hydro and coal to become the main energy sources for Railbelt power by about 1985, if priority is attached to these resources.

Studies by the advisory committees for the current Alaska Power Survey provide estimates of costs for alternative power supplies from coal, natural gas, and oil-fired plants. Indications are that power from Susitna hydroelectric development would be comparable in cost to present gas-fired generation in the Cook Inlet area and would be less expensive than alternatives available to other Southcentral Railbelt power markets.

There are many questions concerning future availability and costs of natural gas and oil for power production. Oil prices have increased dramatically in the past few years, and there are many pressures to raise natural gas prices. There are also arguments that natural gas reserves are needed for petrochemical industries and for other non-power uses. Many people in Government and industry question the use of natural gas and oil for long-range power system fuels.

On 31 December 1974 the Congress enacted Public Law 93-577. This act established a national program for research and development in non-nuclear energy sources. One of the sections of the law stipulated that heavy emphasis should be given to those technologies which utilize renewable or essentially inexhaustible energy sources.



PROJECTED
ENERGY DEMAND
SOUTHCENTRAL RAILBELT

FIGURE 9

3.0 RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS.

3.01 Present Land Status. Lands in the general project area of the proposed Upper Susitna River Basin hydroelectric development at Devil Canyon and Watana are under Federal jurisdiction and administered by the U.S. Bureau of Land Management. These lands have been classified as power sites by Power Site Classification Number 443, dated 13 February 1958. The project areas are designated in the Power Site Classification by approximate damsite locations and contour designations as follows:

Devil Canyon: This area begins approximately 1.4 miles upstream from the mouth of Portage Creek and includes all lands upstream from this point below the 1500-foot contour.

Watana: This area begins approximately 1.5 miles upstream from Tsusena Creek and includes all lands upstream from Tsusena Creek and from this point below the 1,910-foot contour.

Transmission Corridor: Most of the route segments lie in lands that are pending or tentatively approved State selections, native village withdrawals, and native regional deficiency withdrawals, all of which are in a state of flux at the present. There is very little privately owned land within the proposed corridor. Most of the affected lands between Point MacKenzie and Talkeetna are potential State selections. Native village withdrawals relevant to the settlements of Montana Creek, Caswell, and Knik are indeterminate. From Talkeetna to Gold Creek, the corridor transects State selected land and borders on Denali State Park. Between Gold Creek and Devil Canyon, the lands are 50/50 State selections and native regional deficiency. From Gold Creek to Cantwell, the lands are comprised of native withdrawals and State selections. From Cantwell to Healy, the route is State selected land bordering on Mount McKinley National Park. Route lands between Gold Creek and Healy also fall within the Mount McKinley Cooperative Planning and Management Zone. From Healy to Ester, the route primarily transects State selected land with some existing Federal withdrawals and native village withdrawals. Land status described above is subject to change as determinations are made for ultimate disposal.

3.02 Alaska Native Claims Settlement Act. The Power Site Classification withdrawals are in an area designated under the Alaska Native Claims Settlement Act (Public Law 92-203) for regional deficiency withdrawals: lands which can be selected by native regional corporations who cannot meet their selection entitlement from the withdrawals in their regions.

The U.S. Department of Interior, Bureau of Land Management, stated in correspondence of 13 March 1975: "The land within the power site reserve is segregated from a deficiency withdrawal under ANCSA because it is 'reserved public land' and Congress did not give the Secretary (Interior) the authority to make deficiency withdrawals from reserved lands."

3.03 Utility Corridors. The U.S. Bureau of Land Management has prepared a report suggesting a Primary Corridor System for the State of Alaska. The report was prepared in accordance with the provisions of Section 17 (b)(3) of the Alaska Native Claims Settlement Act (Public Law 92-203).

The Primary Corridor System is defined as a network of corridors intended for the systematic transport of high-value, energy-related resources from their point of origin to processing or transshipment points in other regions of the State. The network is intended to identify transportation routes for resources of national or statewide significance and is analogous to the transportation network that already exists in conterminous states consisting of navigation, highway, railroad, and pipeline systems.

The Susitna project is one of the hydroelectric power developments sufficiently advanced in the planning phase to warrant corridor consideration for high-voltage power transmission lines. The transmission lines from the proposed Susitna project have been identified in the suggested Primary Corridor System.

4.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

4.01 Hydrology and Water Quality. About 86 percent of the total annual flow of the upper Susitna River occurs from May through September. Average daily flows from the latter part of May through the latter part of August fluctuate in the range of 20,000 to 32,000 cubic feet per second (cfs). November through April the average daily flows range between 1,000 and 2,500 cfs. The river also carries a heavy load of glacial sediment during the high runoff periods. During the winter when low temperatures reduce water flows the streams run practically silt-free.

Some of the impacts that would be caused by the project downstream from Devil Canyon Dam are discussed below.

Significant reductions of the late spring and early summer flows of the river and substantial increases of the winter flows would occur. The flow of the river during the period 1950 through 1973 averaged about 9,300 cfs. The projected average regulated downstream flows for a Devil Canyon-Watana system computed on a monthly basis would range between about 6,800 cfs in October to almost 18,000 cfs in August. In extreme years, the monthly averages would range from about 6,000 cfs to nearly 32,000 cfs. The average monthly regulated flows compared to the average unregulated flows based on the period from 1950 through 1973 are as follows:

TABLE I

Month	Regulated cfs	Unregulated cfs
January	8,782	1,354
February	8,368	1,137
March	8,031	1,031
April	7,292	1,254
May	7,347	12,627
June	7,603	26,763
July	11,266	23,047
August	17,937	21,189
September	12,704	13,015
October	6,776	5,347
November	7,394	2,331
December	7,936	1,656

The heavier sediment material now carried by the river during high runoff periods between Devil Canyon and the junction of the Chulitna and Talkeetna Rivers with the Susitna River would be substantially reduced, and a year-round, somewhat milky-textured "glacial flour" (suspended glacial sediment) would be introduced into the controlled water releases below the dam. Preliminary studies by the Corps of Engineers indicate that the suspended sediment would be at low levels (15-35 ppm). Although the average sediment load in summer months is less than 1000 ppm, loads sometimes reach a maximum of 5000 ppm in the unregulated river. Reduction of existing summer sedimentation peaks should have a beneficial effect on anadromous and resident fish populations for some distance downstream from Devil Canyon Dam.

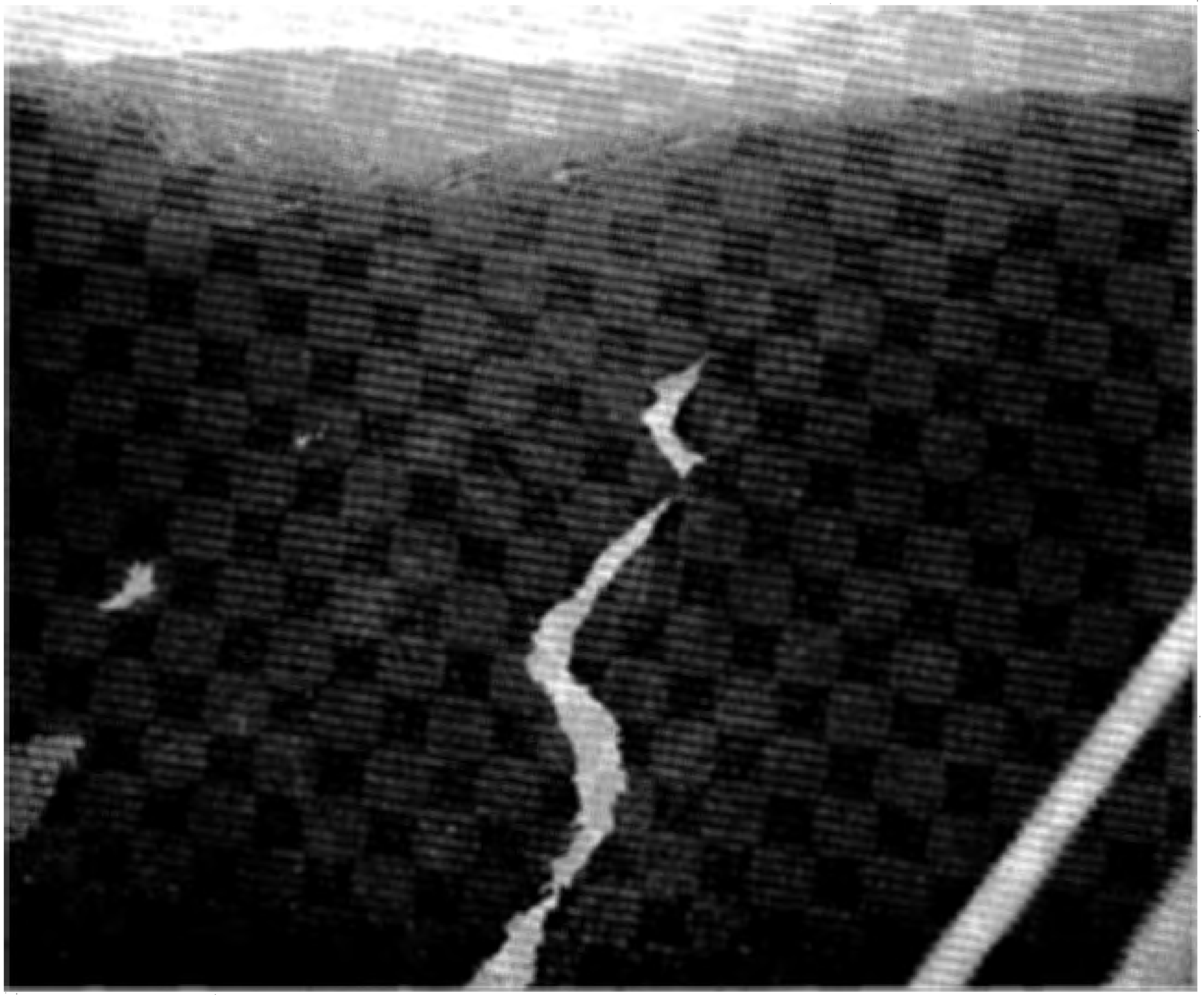
On rare occasions after the development of upstream storage when spilling water over Devil Canyon Dam would be necessary during some periods of extreme high flows, super-saturated nitrogen could be introduced into the river below the dam. Fish exposed to high levels of this condition can suffer gas-bubble disease (like bends to a deep-sea diver) which can be fatal.

With appropriate operational procedures, it is estimated that spilling excess flows at Devil Canyon would occur on the frequency of once every 10 years with an average duration of 3 days. However, any supersaturated nitrogen and dissolved oxygen thus introduced should be reduced substantially in the turbulent river section just downstream from the dam. The proposed spillway at Watana Dam is not conducive to nitrogen or oxygen supersaturation.

Temperature of the water released from Devil Canyon Dam would approximate the river water temperature under natural conditions. This would be made possible by the proposed incorporation of multiple level discharge outlets into the dam structure.

Variations in water releases at Devil Canyon Dam would cause less than a one-foot daily fluctuation of downstream water levels in the river during the May through October period since the reservoir would not be used for peaking purposes. The regulated daily fluctuations during the winter months could range up to two feet under normal peaking conditions. According to U.S. Geological Survey studies, the natural normal daily fluctuations in the Susitna River below Devil Canyon range up to about one foot.

Stratification conditions within the reservoirs could cause some temperature and dissolved oxygen problems in the river for some distance downstream from the Devil Canyon Dam and within the reservoirs themselves. These conditions could have an adverse impact on the downstream fishery. However, this problem can be minimized by multiple-level water release structures which are proposed for incorporation into both dams. This would provide the capability of selective withdrawal of water from any level within the reservoir to moderate release temperatures and dissolved oxygen content.



Looking downstream on Susitna River at Devil Canyon damsite. Dam would be located near bottom of photo. Vegetation is mostly white spruce.

General channel degradation caused by a river's attempt to replace the missing sediment load with material picked up from the riverbed is not expected to be a significant concern along the coarse gravel bed reaches of the Susitna River between Talkeetna and Devil Canyon. However, this phenomenon would be the subject of future detailed studies to determine the distance at which sediment loads would become reestablished.

Upstream from the dams the major environmental impacts would be caused by the reservoir impoundments. Under the proposed two-dam system, the reservoir behind the Devil Canyon Dam would fluctuate up to 5 feet during the year, while Watana reservoir would fluctuate between 80 and 125 feet during the year under normal operating conditions. The maximum daily fluctuation at Devil Canyon reservoir under normal operating conditions would be in the range of one to two feet.

Devil Canyon reservoir would cover about 7,550 acres in a narrow steep-walled canyon (1/4 to 3/4-mile-wide) with few areas of big game habitat and a minimal amount of resident fish habitat at the mouths of a few of the tributaries that enter the Susitna River in the 28-mile section above the proposed damsite. The reservoir would also flood approximately 9 miles of the 11-mile, whitewater section of Devil Canyon.

Watana reservoir, with a structural height of 810 feet and a pool elevation of 2,200 feet, would flood about 43,000 acres in a 54-mile section of the Susitna River that would reach upstream about 4 miles above the Oshetna River confluence. Except in a few areas near the mouths of tributaries such as Deadman Creek, Watana Creek, Jay Creek, and Kosina Creek, the Watana reservoir would be contained within a fairly narrow canyon 1/3-mile to 1 mile in width for much of its length.

The spillway design at Watana diverts the excess river flows into the Tsusena Creek drainage approximately 2.5 miles above the creek's confluence with the Susitna River. On the rare occasions when it would be necessary to divert excess river flows over the spillway, the adverse environmental impact on fish and vegetation resources in lower Tsusena Creek could be significant.

Watana reservoir would flood reaches of the Susitna River upstream from Tsusena Creek that are sometimes used as caribou crossings. It would also flood some moose winter range in the river bottom. The reservoir would also cover existing resident fish habitat at the mouths of some of the tributaries in this section of the river and possibly would create other fish habitat at higher elevations on these tributaries.

Potential water quality impacts caused by construction of transmission facilities are the increased siltation of rivers and lakes;

alteration of stream flows; eutrophication (increased nutrient levels) and pollution of lakes and streams; and disruption of aquatic habitat due to gravel borrow, fill, and excavation.

4.02 Fish. One of the environmental impacts caused by the proposed Devil Canyon-Watana project would be the reduction of natural river flows during the latter part of June and the early part of July when salmon start migrating up the Susitna River. The projected average monthly regulated flows during August and September, when the majority of the salmon are spawning, approach the average natural flows of the river during this period (see Table I, page 45).

In a 1974 study by the Alaska Department of Fish and Game on surveys conducted to locate potential salmon rearing and spawning sloughs on the 50-mile section of the Susitna River between Portage Creek and the Chulitna River, 21 sloughs were found during the 23 July through 11 September study period. Salmon fry were observed in at least 15 of these 21 backwater areas. Adult salmon were present in 9 of the 21 sloughs. In 5 of the sloughs the adult salmon were found in low numbers (from 1 to 24 with an average between 6 and 7). In 4 other sloughs large numbers were present (from 107 to 681 with an average of just over 350).

During December 1974 and January and February 1975, the Alaska Department of Fish and Game investigated 16 of the 21 sloughs previously surveyed during the summer of 1974. Of the 16 sloughs, 5 indicated presence of coho salmon fry. The numbers captured in the 5 sloughs at various times ranged from 1 to 21. Many of the 16 sloughs surveyed were appreciably dewatered from the summer/fall state.

The report also stated that a number of coho fry were captured in the Susitna River near Gold Creek indicating that some coho salmon fry do overwinter in the main river.

The winter investigations indicated that the Susitna River between Devil Canyon and Talkeetna was transporting suspended solid loads ranging from 4 ppm to 228 ppm.

It is reasonable to assume on the basis of existing data that there will be some changes in the relationship between the regulated river and access to existing salmon rearing and spawning sloughs and tributaries downstream from Devil Canyon Dam. It appears feasible to develop a program to improve fish access to and from some of the sloughs and tributaries in the Susitna River as a consequence of the project's stabilizing effect on summer flows. Such a program would be a project consideration.

Periodic flood conditions that presently destroy salmon eggs in this stretch of the river would be almost completely eliminated by regulation of the upper Susitna River flows.

Reduction in flows, turbidity, and water temperatures below Devil Canyon Dam might cause some disorientation of salmon migrating into the section of the Susitna River between Portage Creek and the Chulitna River during an initial period after construction of the dams and until future salmon stocks readjusted to the change in regulated river conditions.

During the period in which the newly-constructed reservoirs would be filling with water, downstream flow maintenance would be coordinated with the fish and wildlife agencies to prevent unnecessary damage to downstream fishery resources. It is proposed to construct Watana Dam first starting in about 1981, and Devil Canyon approximately five years later.

According to a study discussed in the Journal of Fisheries Research Board of Canada--Volume 32, No. 1, January 1975, Ecological Consequences of the Proposed Moran Dam on the Fraser River, some of the beneficial downstream impacts of the dam could include the following:

The higher regulated winter flows might increase the survival of salmon eggs in the river downstream from the dam. The increased flows could insure better coverage and better percolation through the gravel and presumably increase egg and alevin survival. Salmon alevin are young fish with attached egg-sacs that remain in the gravel beds until they emerge as fry.

An additional consequence of reduced turbidity below the dam might be a gradual reduction in the percentage of fine materials in the salmon spawning areas near the mouths of sloughs and tributaries as they enter the Susitna River. This could also lead to improved percolation through the gravel in the streambed and possibly improve survival of eggs.

Reduced siltation during the summer months should prove beneficial for both anadromous and resident fish species for some distance downstream from the proposed Devil Canyon Dam. General channel degradation caused by the river's attempt to replace the missing sediment load with material picked up from the riverbed is not expected to be a significant impact along the gravel bed reaches of the Susitna River between Talkeetna and Devil Canyon. It is also reasonable to expect that some additional salmon spawning and rearing habitat would develop within the section of reduced sediment load.

Other hydrologic factors previously discussed would also affect the fishery resource downstream from the dams. These and other changes could also influence the food and life cycles for fish in this section of the river. Biological and physical changes likely to occur are the subjects of ongoing studies by State and Federal agencies under the direction of the U.S. Fish and Wildlife Service. Results of which will be used in determining needs for more detailed final design phase studies, feasible project modification, and mitigative or ameliorative measures.

Upstream from the dams, the major impact on the resident fish populations would be caused by the reservoir impoundments. Under the proposed plan, Devil Canyon reservoir would fluctuate very little. Even though the steep-walled canyon of this reservoir might prove less than desirable for a program to develop a resident fish population, some species of fish might be able to adapt to this reservoir and provide some future sport fishing benefits.

Watana Dam would have a widely fluctuating reservoir which would generally prove detrimental to the development of resident fish populations. Suspended glacial sediment could be a factor in both of the reservoirs after the heavier glacial sediments have settled out; however, many natural lakes in Alaska such as Tustumena and Tazlina, with heavy inflows of glacial debris sustain fish populations under similar conditions, so to develop populations of fish under related conditions may be feasible.

Most resident fish populations, especially grayling, utilize some of the clearwater tributaries of the Susitna River or areas near the mouths of these streams as they enter the glacially turbid main river channel during periods of high runoff. Many of these tributaries would be flooded in their lower reaches by the proposed reservoir impoundments. The resident fish populations would be affected by the increased water levels in the proposed reservoirs; but in some areas, access to tributaries for resident fish may be improved by increased water elevations.

It appears highly unlikely that anadromous fish such as salmon could be successfully introduced into the Upper Susitna River Basin. With the succession of very high dams and the related problems and costs of passing migrating fish over and through these dams, such a program appears infeasible (Report, Ecological Consequences of the Proposed Moran Dam on the Fraser River). This report states in reference to high dams: "The choice is clearly between upstream salmon stocks or dams." However, the introduction of a resident salmon species, such as sockeye (kokanee) or others to some waters of the upper Susitna basin might prove feasible with further studies.

Fish would experience high mortality rates if they attempted to move downstream through turbines or outlet works in the proposed series of high-head dams. According to Corps of Engineers studies, a 35 percent mortality rate could be expected on fish such as young salmon at each dam.

Impact upon aquatic life from the transmission line should be small because of the care that would be taken to prevent degradation of streams within the corridor. However, the aquatic food chain in the taiga (boreal forest) and tundra is extremely simple, and as a result, disruption of habitat for one species quite often indirectly affects many other species. Potential impacts are: increased siltation of rivers and lakes; alteration of flows; eutrophication and pollution of lakes and streams; and disruption of habitat due to gravel borrow, fill, and excavation.

4.03 Wildlife. Reservoir impoundments, transmission line corridors, and access roads would have varying degrees of environmental impact on wildlife.

The Devil Canyon reservoir would be located within the confines of a narrow, steep-walled canyon with few areas of big-game habitat and no major migration routes for big-game animals. In some cases, animals such as moose and caribou may find it easier to cross the narrow reservoir than they would the present fast-moving river at the bottom of a deep, steep-sided canyon.

The proposed Watana Dam would be generally contained within a fairly deep and narrow river canyon. Watana reservoir would lie across one of the intermittent seasonal caribou migration routes between the main calving area of the Nelchina caribou herd, located south of the river in the northeast foothills of the Talkeetna Mountains, and some caribou summer range on the north side of the Susitna River. Calving generally takes place during a month-long period starting in the middle of May.

Ice-shelving conditions caused by winter drawdown on Watana reservoir or spring ice breakup conditions on the reservoir could cause problems for caribou, moose, or other animals if they attempt to cross this reservoir when these adverse conditions exist. As caribou are strong swimmers, they should have fewer problems crossing the narrow reservoir during July after calving than they would crossing the swollen glacial river during periods of high runoff. Some caribou could also migrate around the upper reaches of the proposed Watana reservoir area as indicated in existing spring migration patterns. Caribou migration patterns for the Nelchina herd are continually changing, as stated in Alaska Department of Fish and Game study reports. Their studies also indicated the use of the Watana reservoir site by Nelchina caribou for grazing and crossing was minimal during the period November 1974 through April 1975. Under adverse ice conditions, the reservoirs could result in increased mortality in some segments of the herd. Also, there could be some permanent changes in historical herd movement patterns.

Within the transmission line corridor system, impacts to caribou would be limited to the 136-mile segment extending north from Cantwell. There is no significant caribou use of areas to the south. Although the transmission line and related access roads would not impose a physical barrier to migration of caribou, construction and maintenance work during certain seasons may inhibit herd movement. Since caribou are primarily confined to the west bank of the Nenana River, they will not be significantly affected in this area if the line runs along the east bank. Although physical destruction of caribou habitat will not be a significant impact of power line construction, there are indirect consequences which could be significant. Increase of fires resulting from manmade causes could destroy tundra lichen which is their prime source of winter food. It is estimated that approximately 50 years are required for a burned area to recover a usable cover of lichen for caribou. Noise generated by the transmission lines could also modify normal behavior, as could public accessibility provided by transmission line roads.

A moose survey conducted in early June 1974 by the Alaska Department of Fish and Game indicated that, although spring counting conditions were less than ideal, a total of 356 moose were seen along the upper Susitna River and in the lower drainage areas of the major tributaries. A 1973 fall count in the same general area sighted a total of 1796 moose.

Of the 356 moose counted in the June 1974 survey, 13 were seen in the area of the proposed Watana reservoir below Vee Canyon. None were sighted within the proposed Devil Canyon reservoir impoundment. Although moose habitat does exist within the pool areas of the proposed Devil Canyon and Watana reservoirs, the overall loss of preferred or critical winter forage areas would affect but a small percentage of the upper Susitna moose population.

During the June 1974 survey, one grizzly was sighted on the upper Oshetna and one on the Maclaren River. Five black bears were sighted on the Susitna River. A total of 56 caribou were sighted in the survey area.

Moose are found throughout the length of the transmission line corridor. The greatest adverse impact to these animals would be the increased hunting access provided by roads and the openness of the corridor itself. Habitat, on the other hand, would overall be improved. Subclimax growth within the transmission line corridor would increase moose browse.

The proposed reservoirs at Devil Canyon and Watana are located along a major flyway for waterfowl. Very few waterfowl appear to nest on the sections of the river that would be flooded by these reservoir proposals. On the other hand, the reservoirs would provide suitable resting areas for waterfowl migrating through the basin.

Migrating birds would possibly suffer some mortality from collisions with towers or lines, but such losses should be negligible. The line would generally parallel normal north-south migration routes. The cables would be large enough to have a high degree of visibility and would be widely enough spaced to be ineffective snares. Electrocution of birds is also unlikely since the distance between lines and between lines and ground would be great enough to make shorting out by birds almost impossible.

A transmission line per se will not have many impacts upon wildlife; most of the impacts will be as a result of construction and maintenance. Direct destruction will affect the less mobile animals such as the small mammals, whose territories may be small enough to be encompassed by the construction area. The significance of this impact to these animals is small in relation to their population in surrounding areas.

The loss of habitat for bears, wolves, wolverines, Dall sheep, and other animals also appears to be minimal. However, losses to any significant element of the food web will affect consumers. Thus, losses to moose or caribou would impact upon predator species. Other birds, including raptors, songbirds, shorebirds, and game birds, do not appear to be significantly affected by the reduction of habitat in the area of the proposed dams and reservoirs and on the transmission line corridor, although some habitat will be lost for all species of wildlife that utilize the affected areas.

Road access to the two damsites and to the transmission line would have a significant impact on fish and wildlife resources in areas opened to vehicle encroachment. Specific areas such as Stephan Lake, Fog Lakes, lower Deadman Creek, and the northern slopes of the Talkeetna Mountains could be significantly impacted by hunters, fishermen, and other recreationists by an access road to the Watana Dam. The same would be true along various segments of the transmission line. State game management policies could control some of the adverse impacts on fish and wildlife in these areas. However, this increase in public accessibility would significantly increase the necessity for intensified law enforcement and fire prevention measures.

4.04 <u>Recreation</u>. Much of the Upper Susitna River Basin has little or, in many areas, no recreational activity at the present time. A combination of poor road access, rough terrain, and great distances from population centers presently limit the use of the 5,800-square-mile basin, especially the lands directly impacted by the proposed project, to a few hunters, fishermen, and other hardy souls who utilize these wild lands for recreational purposes.

The construction of the proposed hydroelectric project would have an impact on a number of present and projected recreational activities both in the immediate dam and reservoir areas and downstream from the dams. (See Figure 10.)

At the present time, the Susitna River upstream from Portage Creek to the Denali Highway bridge is a free-flowing river with few signs of man's activities and minimal public use. The project would significantly

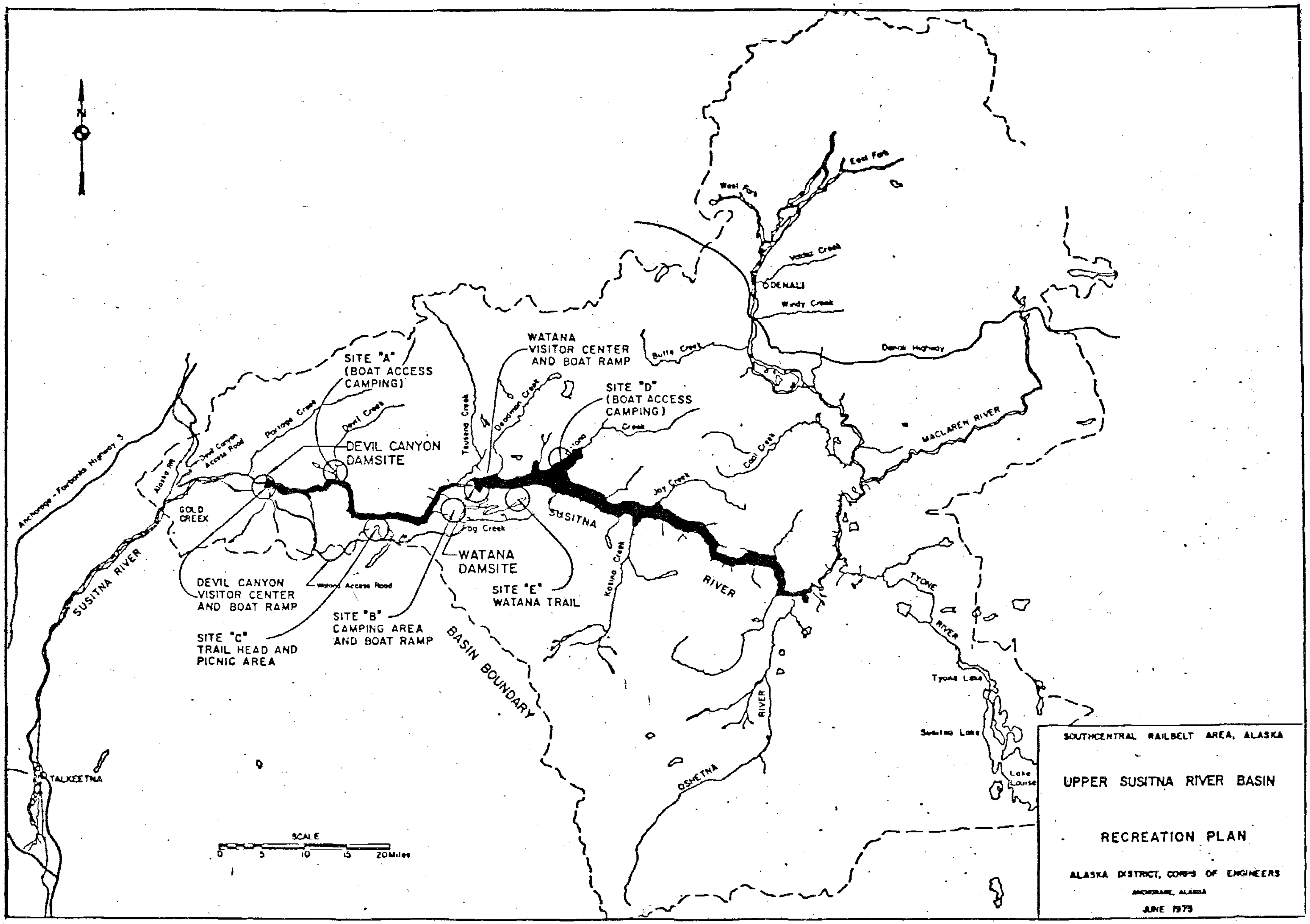

SITE "A" (BOAT ACCESS CAMPING)
DEVIL CANYON DAMSITE
WATANA VISITOR CENTER AND BOAT RAMP
SITE "D" (BOAT ACCESS CAMPING)
DEVIL CANYON VISITOR CENTER AND BOAT RAMP
SITE "C" TRAIL HEAD AND PICNIC AREA
SITE "B" CAMPING AREA AND BOAT RAMP
WATANA DAMSITE
SITE "E" WATANA TRAIL
BASIN BOUNDARY
SUSITNA RIVER
GOLD CREEK
TALKEETNA
DENALI
Denali Highway
MACLAREN RIVER
TYONE RIVER
Tyone Lake
Susitna Lake
Lake Louise
OSHETNA RIVER
Kosina Creek
Joy Creek
Coal Creek
Fog Creek
Tsusena Creek
Deadman Creek
Portage Creek
Devil Creek
Watana Access Road
Anchorage - Fairbanks Highway 3
Butte Creek
Valdez Creek
Windy Creek
West Fork
East Fork
SCALE
0 5 10 15 20 Miles
SOUTHCENTRAL RAILBELT AREA, ALASKA
UPPER SUSITNA RIVER BASIN
RECREATION PLAN
ALASKA DISTRICT, CORPS OF ENGINEERS
ANCHORAGE, ALASKA
JUNE 1975

FIGURE 10

change both the present riverine setting and human use of the area. Improved road access into the upper Susitna basin would substantially increase pressures on all the resources impacted by outdoor recreation activities within these areas. Along with increased hunting pressure, the construction of project-oriented recreational facilities would further increase public use in the immediate vicinity of the proposed dams and reservoirs. These recreational developments would eventually include visitor centers at the dams, boat launching ramps on the reservoirs, campgrounds, picnic areas, trail systems, and other related developments, as shown in Figure 10. It is estimated that with the recommended development plan, the initial annual visitation to the project area would be about 77,000 people.

The possible relocation of the state capital to the Lower Susitna River Basin could have a substantial impact on the extent of development of recreational facilities within the Devil Canyon-Watana project area. At the present time, few people reside within a 100-mile radius of the project area, and day-use of the project by local residents would be minimal under existing growth conditions.

Any project-related recreational development program would involve cooperation between the appropriate Federal, State, and local interests and would require State or local sponsorship, sharing of costs for construction, and maintenance of the developed recreational facilities by the appropriate State or local sponsor. The State of Alaska (Division of Parks) has indicated an interest in sponsoring a program of recreational development in the area of the proposed project.

4.05 Historical Resources. Although a preliminary investigation by the Alaska Division of Parks (Heritage Resources along the Upper Susitna River, August 1975) indicates the location of 11 historic sites within the upper Susitna basin hydropower study area, only one of these would be directly affected by the currently proposed two-dam development. This site is located near the mouth of Kosina Creek and would be inundated by the Watana reservoir. The significance of this site, a cabin, is not disclosed in the State report. However, on the basis of the limited early modern history associated with the upper Susitna basin, particularly the downstream portion above Devil Canyon, it is most likely that the site is related to early exploratory mining in the area. No sites would be affected within the transmission line corridor.

4.06 Archaeological Resources. Of the four presently known archaeological sites in the upper Susitna basin, all lie upstream from the influence of the Watana Dam and reservoir, according to the Alaska Division of Parks report of August 1975. On the basis of probable highest game diversity in early times, the report selects areas most likely to have been inhabited by people, and thus identifies sites for potential archaeological exploration. These sites are most generally designated as being near the confluence of streams where habitat diversity was likely highest. The report concludes that "--the entire river system should be regarded as an area of extremely high archaeological potential." The report further states: "While it is difficult to measure the amount of adverse impact each of the four dam complexes will have on heritage resources, it is possible to ascertain that the Devil Canyon Dam will have the least effect. The Watana Dam will have the second lowest adverse impact, followed by Denali Dam. The construction of the Vee Dam site will have the most adverse impact on significant heritage resources." (The Vee and Denali Dams are not in the proposed plan of development.)

More intensive reconnaissance of the affected areas will be necessary following project authorization to determine the actual existence and locations of sites.

The Knik and Dry Creek archaeological sites are located in the vicinity of the proposed transmission line corridor. Neither site will be affected by development within the proposed route.

4.07 Vegetation. All of the vegetation within the pools of the proposed reservoirs and in the proposed road locations would be eliminated if the dams were constructed. Trees would also be cleared in areas within transmission line corridors. Most of the trees and shrubs would be cleared during construction operations, and some of the commercial timber would probably be marketed. Most of the residue slash material and debris would be burned or buried.

Much of the existing tree and shrub cover in the Upper Susitna River Basin is located in the river and creek bottoms and on the steep canyon slopes above the streams and would be lost during dam construction. The operations to clear the vegetation within the reservoir impoundments and other areas would require a network of temporary roads and work areas for personnel, equipment, and vehicles within and around the areas to be cleared. Controls over the clearing and related operations would include provisions to reduce or prevent many of the adverse environmental impacts of these activities including the possibility of uncontrolled fires.

The major ecosystems of the upper Susitna basin include the upland and lowland spruce-hardwood forest systems and the moist and alpine tundra systems. All these ecosystems are susceptible to long-term damage or destruction; the predominant tundra systems are especially vulnerable. Particular care would have to be taken to protect the land and the vegetation from unnecessary damage, and remedial actions would also need to be taken to make feasible repairs to whatever damage should occur. Except for the river itself the area within the proposed reservoir pool is dominated by the upland spruce-hardwood forest ecosystem.

Most of the direct impacts of the transmission line and required access roads upon vegetation would be relatively small with respect to the magnitude of surrounding unaffected land. Up to 3,800 of the approximately 5,300 acres of right-of-way would have to be cleared.

The effect on scenic quality would be a major impact of the cleared right-of-way. Regrowth beyond a limited height would be prevented by maintenance, thus cuts through forested areas would be permanently visible. This effect would not be as significant in more open areas at higher elevations, such as Broad Pass, where no tree clearing is required. On the other hand, in such areas the transmission line itself would be more visible. This effect is more fully discussed under the heading of Esthetics.

The disposal of slash and debris, whether by burning, burying, chipping, or stacking has potentially adverse effects upon remaining vegetation and other resources. Although stacked or dispersed slash may provide habitat for small animals, there is a high potential that slash may result in increased fire hazard and increases in insect populations which could damage surrounding forests. Chipping is very expensive and requires more machinery to travel along the right-of-way. Disposal of chips is a problem because they should be dispersed to prevent killing the plants on the ground. Since decomposition rates are slow, chips may not revert to humus for quite some time. Vegetation along most of the transmission line corridor is conducive to a high rate of fire spread and is considered to be of medium to high resistance to fire control. However, with proper precautionary measures, burning would probably be the most desirable method of slash and debris disposal from an environmental viewpoint.

Significant impacts to wildlife would result from habitat modification resulting from impacts upon vegetation. Clearing in forest areas and maintenance of a subclimax plant community of brush and low plants would improve habitat for some species by increasing primary productivity in the cleared areas. Browse for moose will be increased; the conjunction of good cover in the original forest with a swath of browse creates a diverse "edge" habitat for many animals dependent on subclimax growth. Animals dependent on climax or near-climax vegetation will suffer loss of habitat; examples are the red squirrel and northern flying squirrel, both of which depend upon white spruce.

4.08 Mining. The U.S. Department of Interior, Bureau of Mines office in Juneau, Alaska, has stated that the Susitna River basin in the proposed reservoir impoundment areas is generally favorable for various types of mineral deposits, but the area has never been mapped geologically.

4.09 Agriculture. No project benefits are anticipated for irrigation at this time, and except for providing reasonably priced electrical power to farms and agricultural activities, no other major impacts on agriculture are expected.

Presently most agricultural activity in the State, from crop farming to dairy farming, occurs in the Cook Inlet subregion. Of the 2.5 million acres of land that have soil characteristics conducive to the production of cultivated crops in the Cook Inlet-Susitna Lowlands, about 70 percent occurs in the valleys of the Matanuska and the Susitna Rivers and their tributaries. Most of this land is as yet undeveloped.

4.10 Roads. Permanent roads would be built to provide access from the Parks Highway to the Devil Canyon and Watana damsites and some segments of the transmission line. Permanent roads would also provide access to proposed recreation facilities within the project area. Temporary roads for project construction and reservoir clearing operations would also be constructed. No roads would be built within the transmission line corridor in the 39-mile reach between Cantwell and Healy, and the 10-mile reach between Gold Creek and Chulitna.

The impact of road access to areas within the proposed hydroelectric developments would be significant; also, the roads themselves would have a definite impact upon the land. Resource values impacted by proposed roads include fish, wildlife, vegetation, recreation, scenery, water, and soils. Air and noise pollution related to road construction and dust generated by vehicle travel on unpaved roads could also be significant adverse environmental impacts.

In sections where permanent transmission line access roads are required, the road would be built and maintained to a standard suitable for four-wheel-drive vehicles. Not all sections will have access roads; in critical areas, winter construction or helicopter construction will be used.

Proposed right-of-way restoration after construction includes removal of temporary structures and temporary roads, disposal of slash and refuse, and where necessary, revegetation.

Design, location, construction, rehabilitation, and maintenance of a project road system will be given prime consideration with the utilization of good landscape management practices.

4.11 Construction Activities. Proposed project-related construction activities include the building of the dams and their related facilities; the clearing of reservoir areas; the construction of roads, electrical distribution systems, and recreation facilities; and the building of facilities for workers. The construction of the Devil Canyon and Watana project is estimated to take from 10 to 12 years to complete, with an estimated 5 to 6 years required for construction at each of the two sites.

The impact of these construction activities on the existing environment would be significant. The activities themselves would cause varying degrees of physical pollution to the air, land, and water within the project area and to some areas outside the development area. Fish, wildlife, vegetation, visual resources, soils, and other resource values would be adversely impacted by construction activities within the project area. General construction activities would intrude on existing fish and wildlife habitat, cause soil erosion problems with related reduction of water quality, clear areas of vegetation, cause noise and dust problems, intrude on natural visual resource values, introduce air pollutants into the atmosphere by burning slash and debris, and cause other related environmental impacts. For instance, breaking the surface mat of vegetation and disruption of surface drainage can result in wind and water erosion, and melting of permafrost, resulting in subsidence and disruption of groundwater tables which in turn results in erosion.

Most of the damage to soils along the transmission line would occur during the construction phase. The construction schedule would be arranged so that work requiring use of an access road, such as delivery of materials, could be done in winter and spring, when the ground is least vulnerable to physical disturbances. This would eliminate the need for extensive filling and consequent use of borrow pits or quarries.

To obtain materials from borrow sources and quarry sites for the construction of the dams, roads and other facilities would be necessary. Borrow areas would be located within the proposed reservoir pool areas where feasible. Any borrow or quarry sites necessary outside of the pool area would be rehabilitated. Areas will also be needed to dispose of some materials and debris. All construction activities would be controlled to minimize or to prevent adverse environmental impacts.

4.12 Workers' Facilities. No communities within commuting distance to the proposed project area could absorb the number of workers required for the construction of the dams and related facilities. Some type of temporary construction camps with the necessary facilities would need to be provided during the construction periods, and permanent facilities would need to be built for maintenance and operational personnel after completion of the construction phase.

The construction and operations of the workers' camps would comply with State and Federal pollution control laws and standards, and all activities would be controlled to minimize adverse environmental impacts presented by the camps. Lands used for operating the temporary camp areas would be rehabilitated when the project work was completed.

4.13 Esthetics. The proposed project would be located in areas that presently have practically no permanent signs of man's presence. The land between Portage Creek and the Denali Highway is a natural and scenic area that would probably qualify for wilderness classification under most definitions of the term.

The construction of the proposed hydroelectric project would have a significant impact on the existing natural scenic resource values within the project area. Any dam construction on the upper Susitna would change a segment of what is now a natural, free-flowing river into a manmade impoundment. Within a 12-month period, Devil Canyon reservoir could fluctuate up to 5 feet while Watana reservoir would fluctuate up to 125 feet under normal operating conditions. The proposed Watana impoundment is located in a narrow, steep, isolated canyon where the seasonal fluctuation would not have a substantial scenic impact. The violent, whitewater section of the Susitna River through Devil Canyon would be substantially inundated by a dam at Devil Canyon. Roads and transmission lines would also impact the natural scenic resource values of the area.

Since it is expected that a considerable number of tourists and State residents would visit the damsites, every effort would be given to minimizing the adverse visual impacts of construction activities. A great deal can be accomplished to maximize scenic resource values that will remain after construction. Good landscape management practices would add substantially to the recreational experience of the project visitor with facilities that are well planned and well maintained.

The proposed transmission line corridor would cross no existing or presently proposed scenic, wild, or recreational rivers, nor would it cross any existing or presently proposed wilderness areas or wildlife refuges. In most segments, the transmission line would parallel existing corridors or traverse no significantly large areas of intact wilderness. However, in some segments where the transmission line would pioneer a corridor through a previously intact area, the quality of wilderness would suffer, especially where the transmission line is easily visible.

The transmission line would have minimum impact on scenic quality from Point MacKenzie to Talkeetna since it could be concealed or in some areas be laid parallel and adjacent to existing line clearings. The line would have a moderate impact on scenic quality between Talkeetna and Gold Creek. The line could be hidden well from raillines unless the corridor were consolidated. From Gold Creek to Devil Canyon, the line could either be largely concealed from the road or could be used as the road access route itself. Between Gold Creek and Cantwell, a visible line would have substantial impact, particularly if located west of the highway and railroad. The line through this area could be somewhat concealed, with the exception of

Broad Pass which has the least vegetative cover. From Cantwell to Healy, the line would have a severe impact on scenic quality; not only is the canyon an area of high scenic quality, concealment of the line is difficult and the west bank of the Nenana is Park land. The impact would be moderate near Healy and in the Goldstream Hills and low along the lower Nenana River. Impact would be less if Golden Valley Electric Association right-of-way were joined.

4.14 Earthquakes. Several major and minor fault systems either border or cross the Upper Susitna River Basin, and the southcentral area of Alaska is in one of the world's most active seismic zones. One of the strongest earthquakes in recorded history struck southcentral Alaska in March of 1964; the magnitude of the quake was 8.4 on the Richter Scale. The quake was centered just north of the Prince William Sound area, approximately 120 miles from the proposed damsites.

Devil Canyon and Watana Dams will be designed to withstand a Maximum Credible Earthquake of 8.5 magnitude with an epicenter of 40 miles at a focal depth of 20 miles, which is the approximate distance of both damsites to the Denali Fault system, and is the most likely source of a seismic event of this magnitude. The Susitna Fault, truncated by the Denali Fault, bisects the region in a northeast to southwest direction approximately 2.5 miles west of the Watana damsite.

4.15 Sedimentation. Reservoir sediment inflow would vary at each reservoir. Under the proposed system, Devil Canyon reservoir would lose approximately 6.5 percent of its total storage area to sedimentation during a 100-year period. Watana reservoir would have a 100-year sediment inflow that would equal about 3.6 percent of the reservoir's storage capacity.

Both proposed reservoirs have a dead storage area that is not utilized for power production; therefore, much of the initial 100-year sedimentation for the reservoirs would be contained within this "dead storage space," which would not have any significant effect on reservoir operations. Much of the heavier sediment deposited in Watana reservoir would collect at the head of the 54-mile-long reservoir. With adequate maintenance, the useful life of the proposed project is estimated to be in excess of 500 years. If at some future time a feasible program of sediment removal were developed, the useful life period could be substantially increased.

4.16 Climatic Conditions. The severe climatic conditions in the Upper Susitna River Basin could have a substantial environmental impact on the design, construction, and operation of the proposed hydroelectric development. Permafrost conditions, extreme cold winter temperatures, a long period of cold weather, and ice conditions on the reservoir and river are some of the significant climatic conditions that would have to be considered.

The Upper Susitna River Basin is underlain by discontinuous permafrost, so some project areas will have to contend with permafrost and other areas will not.

Extremely cold winter temperatures and long periods of cold weather will place substantial restrictions on many project construction activities and increase the time needed to complete the construction of the project to a total of 10 to 12 years.

Icing conditions on the reservoirs and the river may cause a wide range of adverse impacts both on project construction activities and on project operations. An ice-free stretch of warmer, open water below Devil Canyon Dam could cause ice-fog conditions in that area during periods of extreme cold weather. Regulations of winter flows are not expected to have any significant effects on river ice conditions necessary for the continued use of the stream for winter travel downstream from Talkeetna.

4.17 Air Pollution. Most of the existing electrical power in the Southcentral Railbelt area is produced by gas, coal, and oil-fired generating units which cause varying degrees of air pollution.

Cook Inlet gas is a clean fuel that causes few serious air pollution problems at the present time. The existing gas turbines have very low efficiencies and emit visible water vapor emissions during the colder winter months. Also, nitrogen emissions could be of significant concern for any proposed larger gas-fired plants.

Hydroelectric energy could replace the burning of fossil fuels for electric power generation in much of the Fairbanks area and could help to alleviate the severe winter ice fog and smoke problems in that area.

Hydroelectric projects provide a very clean source of power with practically no direct air pollution-related problems. This type of electrical power generation could reduce a substantial number of future air pollution problems associated with the burning of gas, oil, and coal. It would be necessary to burn some of the residue slash material and debris during project construction and clearing operations, and fires would be controlled as necessary.

4.18 Social.

4.18.1 Population. Substantial increases in population are expected within the Southcentral Railbelt area through the year 2000 and, with the possible relocation of Alaska's State capital from Juneau to the Railbelt, an additional population impact can be expected in this area.

The population of the area will increase with or without the development of hydroelectric projects proposed for the Susitna River; construction of the project is not expected to have any significant long range effect on overall population growth, but is rather designed to fullfill presently projected needs of a growing population as one alternative means of producing power which will have to be provided in one way or another. Thus the total amount of power generated by the proposed Susitna hydroelectric project would generally be an alternative source, which would have as one of its major considerations a renewable energy source, rather than being an additional power source. Projected power requirements based on mid-range estimates show that the proposed Susitna hydroelectric development program could supply a substantial portion of the Railbelt's projected electric power needs starting in about 1985. The proposed upper Susitna River hydro projects will not create large blocks of excess electric power for heavy energy-consuming industries. If larger amounts of electric energy are needed for a program of heavy industrial development, additional energy-producing sources will have to be constructed. In summary, the project is designed to serve projected population needs--not to stimulate population growth as a consequence of industries which would be attracted by large blocks of excess electrical energy.

A 10- to 12-year Devil Canyon-Watana hydroelectric development program would have an economic impact on the Southcentral Railbelt area that would be felt to a greater degree during the construction phase of project development.

It is expected that this proposed project would have some stabilizing influence on the overall economy of the Railbelt area during the period of construction starting in about 1980, since construction would be initiated several years after the Alaskan oil pipeline has been built and about the time the proposed gas pipeline is scheduled for completion. The number of men required to construct this project is estimated to range between 500 and 1,000 men during the peak construction period.

Various community, borough, state, and private facilities and agencies would be impacted to varying degrees by the workers involved in the construction of the proposed project. Workers' camps would be constructed in the vicinity of some of the various construction activities, but additional impacts would be created by the families of the construction workers living in various nearby communities who would require additional facilities and services. It is also expected that due to adverse climatic conditions, much of the construction on the project facilities would be restricted to the warmer months of the year--probably April through October. The seasonal nature of the construction work would have an adverse impact on the local economy during the winter months.

After the construction of the project, a small number of people would be required to operate and maintain the project and project-related facilities--these people would not create a significant social or economic impact on the railbelt area.

5.0 ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

Approximately 50,550 acres of land would be flooded by the reservoirs (7,550 acres at Devil Canyon, 43,000 acres at Watana) at normal pool elevation. This encompasses an almost continuous 84-mile reach of the upper Susitna River. Approximately 2 miles of natural river would remain unflooded between the two reservoirs. All woodlands and other vegetation within the reservoir pools would be permanently lost. Transmission line clearing would be required essentially the full length of the 136-mile-long Susitna corridor for a total of about 2,300 acres. Only about half of the 198-mile-long Nenana corridor would require clearing, or approximately 1,500 acres.

Water released from the reservoirs would be slightly turbid throughout the year, whereas under existing conditions the stream normally runs clear from late fall until early spring breakup. Studies to date indicate that the sediment in suspension would not be high, ranging probably from 15-35 ppm. On the other hand, heavy sediment loads now carried by the stream during the warmer months of spring through early fall would be significantly reduced.

Downstream water quality problems related to temperature, dissolved oxygen, and supersaturated nitrogen could occur. These would be held to minimal, and possibly insignificant levels by spillway design and the incorporation of multiple-level water withdrawal structures.

Approximately 9 miles of the existing 11-mile whitewater reach through Devil Canyon would be lost through inundation.

The lower 2.5 miles of Tsusena Creek, which would be utilized as a spillway for excess river flows (this would occur rarely), will suffer adverse impacts to fish and on-shore vegetation during such periods.

Some moose habitat within the canyon floor and adjacent slopes would be inundated by the reservoirs. Most of the present use is upstream from Tsusena Creek, thus the greatest impact to moose would result from the Watana reservoir. The amount of habitat is limited, but its loss would be permanent.

The reservoirs would lie between the spring calving grounds and portions of the summer range of the wide-ranging Nelchina caribou herd. Increased mortality to caribou attempting to cross the reservoirs between these two areas could result from ice-shelving conditions which might occur, particularly on Watana reservoir, and other difficulties which might be encountered in swimming both reservoirs. The reservoirs could conceivably alter historical herd movement and distribution, although the animals do not exhibit any readily definable patterns, other than in the broadest of terms, at the present time.

Although other major wildlife species, such as bears, wolves, wolverines, and Dall sheep are not expected to be directly affected by the project to a significant extent, there will inevitably be some secondary impacts resulting from disruption of existing predator-prey relationships. Overall, terrestrial wildlife habitat will be reduced. Small animals resident to inundated areas will be lost. Within the transmission line corridors, those species dependent upon climax or near-climax vegetation will be the most adversely affected. Examples are the red squirrel and northern flying squirrel.

Resident fish populations above Devil Canyon Dam (there are no anadromous fish under existing conditions above this point) could be adversely affected to some extent by the change from a riverine to lake environment within the reservoir pools. The resident sport fishery is not believed to be significant within the main river channel. Primary impacts would occur near the mouths of clearwater tributaries which provide some known grayling habitat. The intricate changes expected to occur downstream from Devil Canyon will result in both beneficial and adverse impacts to resident and anadromous fishes. Adverse impacts could result from possible reduction in nutrients and primary productivity, cutting, and erosion of existing streambed configuration, increased turbidity during the winter months, and changes in the hydraulic and biological regime of salmon rearing and spawning sloughs. (As pointed out in Section 4, many of the anticipated changes downstream from Devil Canyon Dam could prove beneficial to both the anadromous and resident fishery. Determinations as to the offsetting effects of these changes are the subject of on-going studies.)

Roads required for project construction, operation, and maintenance would impair visual quality and permit general public access into a largely pristine area. This would increase pressure on existing game populations through hunting, trapping, and general disturbance and harrassment. This in turn would require intensified game management and law enforcement practices and preventative measures for the control of wildfire. Another harmful effect would be the impact of some of the roads themselves where delicate ecosystems are traversed. Some of the inevitable consequences of road construction are destruction of vegetation and wildlife habitat, reduced insulation of frozen soils, and settling from permafrost destruction resulting in both erosion and alteration of the groundwater regime.

Degradation of visual quality in general would be a major adverse effect of project construction. This would be attributable primarily to roads, dam construction, right-of-way clearing for the transmission line, and the obtrusiveness of the transmission line itself. Although care would be taken to minimize these impacts to the greatest possible extent, the overall natural setting and scenic quality of the damsites and transmission line corridor would be permanently impaired.

Although only one historical cabin site and no archaeological sites are presently known to exist within the proposed reservoir pools or transmission line corridor, ground reconnaissance of the affected areas which would take place prior to any construction activity could result in the discovery of such sites. Where determined necessary, sites would be salvaged at project cost.

Disposal of slash and other woody debris resulting from reservoir and transmission line right-of-way clearing would have varying degrees and duration of impact. Material in the reservoir pools would most likely be disposed of by burning. This could increase the possibility of wildfire in woodlands adjacent to the clearing area, and would affect ambient air quality, and introduce ash and other material into the Susitna River during reservoir filling. These impacts, while temporarily harmful, would be of short duration. Other methods of disposal, such as stacking, burying, and chipping, have related adverse impacts, many of which are more severe or of longer duration than burning.

Mineral resource potential within areas which would be inundated by the reservoirs is not fully known. Inundation would obviate the practicability of future mining or extraction of such resources.

Future options concerning any other use of lands within the reservoir pools would effectively be foreclosed. Impacts on land use related to the transmission lines are more difficult to assess. There will be unavoidable impacts on present and future land use with foreclosure of some alternative future uses. These could be both adverse and beneficial. For instance, the transmission line would probably predate agricultural land use along much of the corridor. This could be beneficial since a right-of-way would provide cleared land at little or no expense to the farmer. On the other hand, irrigation and tilling methods would have to adapt themselves to the spacing of towers and land occupied by the tower bases would be unusable. Also, the transmission corridor could attract future corridors. This could be beneficial in preventing separate rights-of-way impacts such as more clearing and additional road construction, but might further impair visual impacts associated with additional structures within the existing corridor.

Both temporary and permanent facilities would have to be provided for project workers. Impacts from temporary facilities, while adverse, would be temporary. Permanent facilities would be located and designed to minimize adverse impacts. Small communities near construction activities would be impacted by an influx of temporary construction workers and their families, with resultant increased demand upon community services. The temporary nature of this influx of people would be difficult to cope with, and could well have community effects lasting well beyond the departure of this transient population. Another problem related to work generated by the project would be its seasonality. In many instances, construction activity would be limited to the warmer season, thus many of these workers would be seasonally employed.

6.0 ALTERNATIVES TO THE PROPOSED ACTION

6.01 General. Alaska has a wide variety of energy alternatives to produce electricity. Each of the major energy resources--oil, coal, natural gas, and hydroelectric potential could easily meet projected power requirements well beyond the year 2000. The nuclear energy alternative is also available, and geothermal resources could be significant in some parts of the State. Present energy generation systems depend heavily on fuel oils and natural gas with smaller amounts of electrical energy coming from hydro powerplants and coal.

It is assumed that hydroelectric power from the Upper Susitna River Basin could be operational by 1986 with the completion of the first dam and powerplant; thus economic and financial feasibility should be assessed in terms of realistic alternatives that could be made available in about the same time frame. Such alternatives include power from Cook Inlet oil and natural gas, coal resources in the Beluga and Nenana fields, oil from the Alyeska pipeline, natural gas from the North Slope, other hydro resources, nuclear power, and geothermal power.

Public Law 93-577 passed by the Congress on 31 December 1974 has emphasized the conservation of nonrenewable resources and the utilization of renewable resources where possible. The construction of the proposed hydroelectric dams on the upper Susitna River is a feasible project that utilizes a renewable resource to generate electrical power while helping to conserve the use of nonrenewable resources such as oil and natural gas. Present Alaskan power systems have a significant environmental impact on urban environments, but a relatively small environmental impact outside the urban areas. Substantial increases in Southcentral Railbelt power requirements will involve the development of future electric power systems, larger facilities, and some alternatives that have very important environmental implications.

Future power systems will also require approaches that include full consideration of environmental values and alternatives and must anticipate that Alaska and the nation will attach increasing importance to environmental protection, energy conservation, and conservation of nonrenewable resources. Additional requirements must be anticipated for long-range advance planning and site selection, public participation, and full consideration of the environment in planning, design, construction, and operation of power facilities.

The significant environmental impacts of the various proposed alternatives would vary depending on the location, design, construction, and operation of the facilities for each of the alternatives.

Solutions considered in this investigation to meet electrical needs in the Southcentral Railbelt area were grouped in three major categories:

alternative sources of power; alternative hydropower sources in the Railbelt area; and alternative hydropower plans in the Upper Susitna River Basin. The extent of study given to each potential solution was established by first screening each alternative for suitability, applicability, and economic merit in meeting needs. Each alternative was tested for physical, political, financial, institutional, economic, environmental, and social feasibility. Continuous coordination was maintained with area State and Federal agencies which have related interests. Alternative measures considered for power purposes are discussed in the following paragraphs.

6.02 Alternative Sources of Power.

6.02.1 No Action. If a hydroelectric system is not developed, alternative power sources would be required to satisfy projected future growth needs of the Railbelt area. Because of lead time involved in planning, financing, and construction of any currently viable alternative, oil and natural gas must continue to provide the bulk of the area's power supplies until the 1980's. On an equivalent time-frame basis, coal is the most likely future electrical energy source for the Railbelt area, if hydropower is not developed. The impacts of the coal alternative are discussed in the following paragraph.

6.02.2 Coal. Coal is the most abundant fossil fuel in the nation. Southcentral Alaska has two known extensive deposits (Figure 11). The Beluga River area northwest of Cook Inlet contains coal reserves of at least 2.3 billion tons or, energy-wise, an equivalent of almost 7 billion barrels of oil. Development of Beluga coals would enhance possibilities for coal-fired power generation at reasonable cost. Coal resources in the Nenana Fields in the Southcentral Railbelt south of Fairbanks near Healy, Alaska, are even more extensive than the Beluga River reserves, totaling at least 6 billion tons, or equivalent of about 18 billion barrels of oil.

In many cases, the major obstacle to increased coal usage is the problem of removing the high sulfur content in order to meet air pollution standards when the coal is burned. Other problems include strip and subsurface mining, with associated environmental impacts, and transportation of the coal. The Beluga coals have low amounts of sulfur but also have high ash and water content. Considerable refining would be needed to enable its use in power generation.

The coal alternative could be available on about the same time frame as other major new power sources such as hydropower and possibly nuclear power. It appears that baseload thermal plants could be utilized in the Railbelt area by 1990. Coal and hydro potential for the Southcentral Railbelt may be the least expensive alternatives for the new power supplies in the 1980's and beyond, but coal would be more expensive than hydro. Coal-fired plants should also be given consideration in remote areas which could be supplied by water transportation.

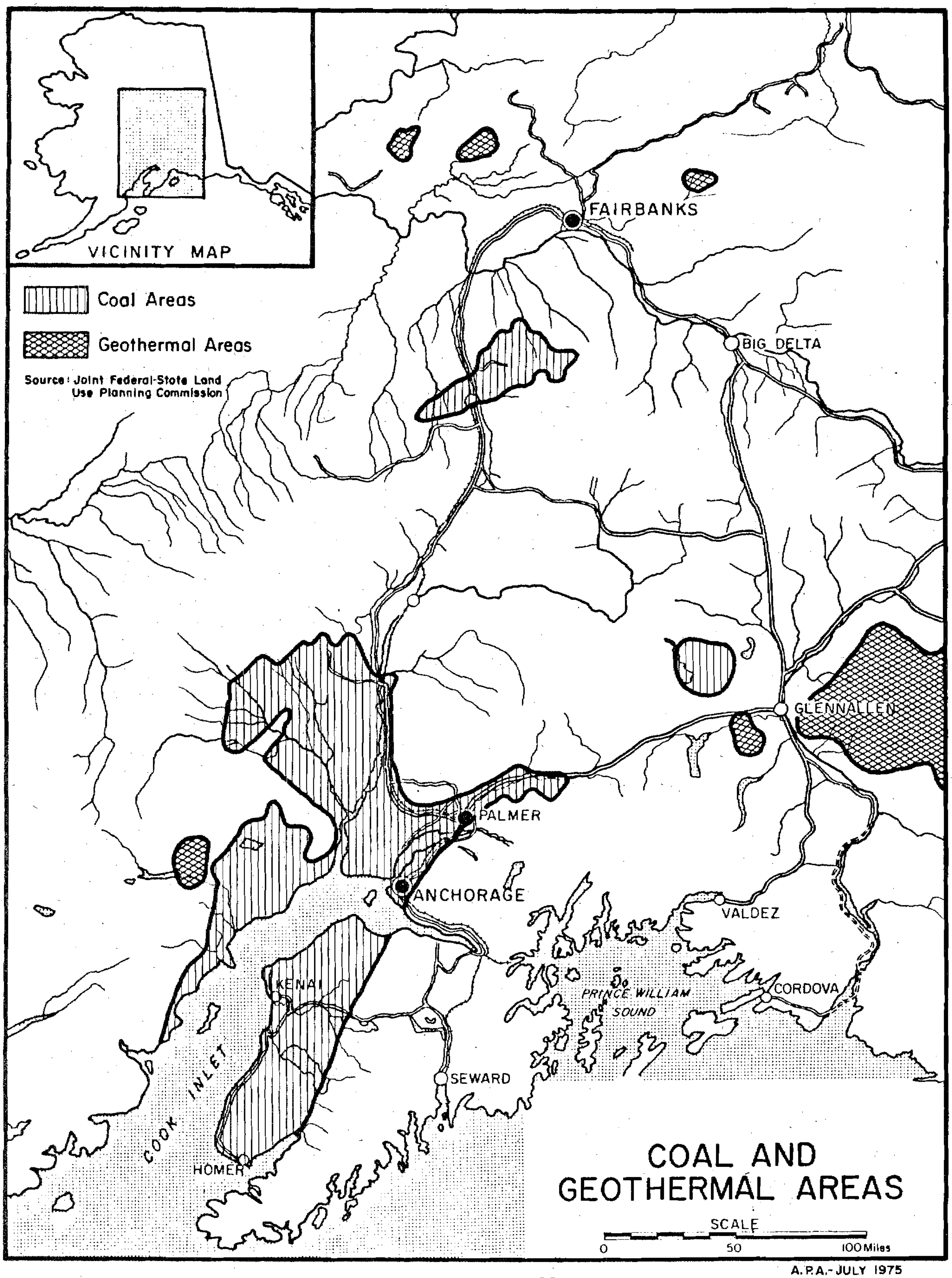

VICINITY MAP
Coal Areas
Geothermal Areas
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
CORDOVA
PRINCE WILLIAM SOUND
KENAI
SEWARD
COOK INLET
HOMER
COAL AND GEOTHERMAL AREAS
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 11

In the absence of major hydro development or the discovery of additional gas reserves, it is assumed that the Railbelt power system would shift from oil and gas-fired power units to coal as their principal energy source starting about 1985. It is further assumed that the coal plants would either be conventional steam or steam and gas turbine units located near the Beluga and Nenana coal fields.

In view of the quantities of coal involved and present-day mining practice, it is presumed that strip mining would be employed to obtain the coal. Without specific knowledge of the mining site, it is not possible to project how much acreage would be affected; however, it is assumed to be in the hundreds, possibly thousands, of acres. Much additional land would be required for stockpiling of overburden and mine wastes until such time as a portion of the pit became worked out and could be used for disposal. The immediate impacts would be the destruction of the overlying vegetation and thus loss of habitat for the resident animals and birds. Additional land would be altered for roads or other routes for working the mine(s) and transporting the coal to generation facilities. Air quality could be expected to suffer from large inputs of dust. Water in contact with coal and mine wastes generally become acidic and toxic to vegetation and animal life. It is difficult to prevent such water from entering either the underground water table or the natural drainage streams in the area and thus impacting water quality to some distance from the actual mine. Any scenic values in the mine area would be lost at least until the mine was exhausted and restoration completed.

Environmental qualities would also be affected at the generating facilities. Considerable land would be occupied by the structures and more by the operating coal stockpiles and access routes. The associated vegetation, habitat, and scenic values would be lost. Even with emissions controlled to legal levels, there would be an input of particulate matter and chemical compounds into the atmosphere. Large amounts of water would be needed for cooling ponds requiring either land for installation of the ponds and the removal of the water from natural sources or the use of a natural water body (lake or river) for the cooling element. In the latter case, the effects of "thermal pollution" on the receiving water would be substantial, especially as regards stimulation of vegetal growth and adverse impacts on fish, if present. Disposal sites for the waste combustion products would be needed and could require alteration of large quantities of land and its natural values.

Social impacts would be mixed in effect. The operation of the minepowerplant would provide long-term employment for many more people than for a like-sized hydroelectric facility. Because of this, the visible economic effects related to disposable income and the multiplier effect of additional cash circulating in the economic community would be much more evident than with a hydropower system. A coal-thermal facility would forego the recreational and flood control benefits provided by a hydropower project.

In view of the extensive adverse environmental impacts associated with the coal alternative, both in magnitude of effects and areas affected, this is determined to a less desirable source of energy production than hydroelectric development.

6.02.3 Oil and Natural Gas. In the period following the 1967 Department of Interior report, Alaska Natural Resources and the Rampart Project, most studies by Federal agencies and area utility companies focused on the Cook Inlet supplies of natural gas and, more recently, on pipeline fuels for Railbelt power. Location of potential oil and gas reserves in the Southcentral area are shown in Figure 12.

Cook Inlet gas is a clean fuel, and few serious air pollution problems exist for gas-fired units. Gas turbine exhaust is noisy, but modern noise suppression equipment can reduce this impact. Energy conservation aspects of gas-fired units may become significant because existing gas turbines have low efficiencies and emit visible water vapor emmissions during the colder winter months. Also, nitrogen emissions could be of significant concern for any proposed larger gas-fired plants.

Existing plans for the Cook Inlet area involve additional large, advanced-cycle gas turbine units at Beluga and additional turbines and waste-heat-recovery units in Anchorage. The Fairbanks area utility companies plan additional gas turbine units using pipeline fuels.

Plans for the near future include a number of measures to increase efficiency, including the advanced cycle and waste-heat-recovery units mentioned previously. However, because of lead time involved in planning, financing, and constructing alternatives, oil and natural gas must provide the bulk of the area's power supplies, at least until the mid-1980's.

Cook Inlet natural gas has provided low cost power benefits for the surrounding area in the recent past and, with substantial reserves under contract, should handle area power requirements for several more years. Also, additional reserves may be found in future exploration to meet future demands. It appears reasonable to assume that there will be substantial increases in costs for future oil and gas supplies as U.S. domestic reserves decline, worldwide demand increases, and foreign oil prices remain high.

Higher costs for fuels in the future, especially for oil and gas, should be considered in all future planning, and should anticipate serious national efforts to develop alternative energy sources that limit the use of oil and gas for power generation. To a very large extent these factors invalidate many previous power studies which were made on the assumptions that cheap, long range oil and gas fuel sources would be available.

Alaska power systems now depend on oil and gas for about 60 percent of total energy production, and by 1980 about 90 percent of the State's

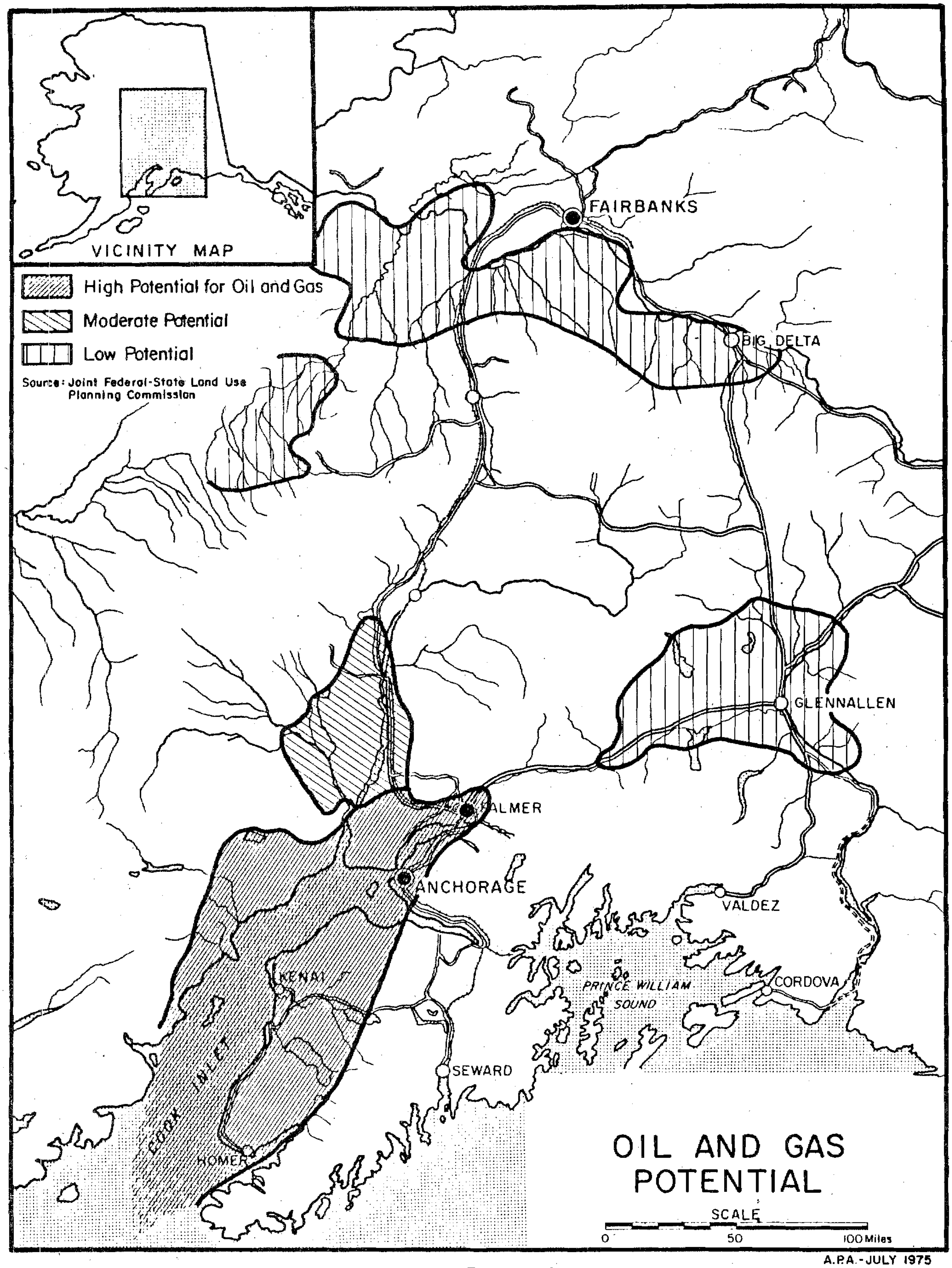

VICINITY MAP
High Potential for Oil and Gas
Moderate Potential
Low Potential
Source: Joint Federal-State Land Use Planning Commission
FAIRBANKS
BIG DELTA
GLENNALLEN
PALMER
ANCHORAGE
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
OIL AND GAS POTENTIAL
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 12

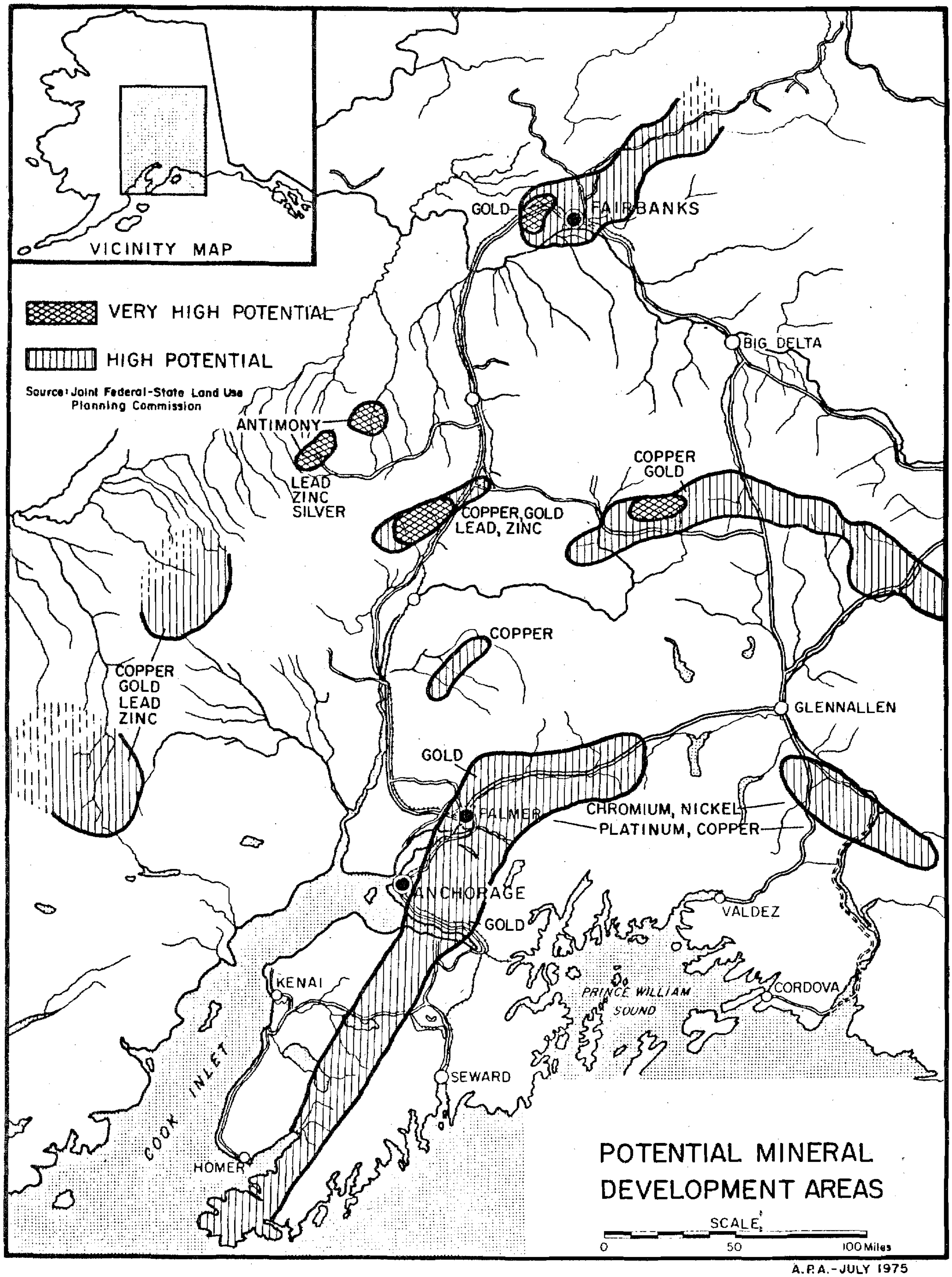

VICINITY MAP
VERY HIGH POTENTIAL
HIGH POTENTIAL
Source: Joint Federal-State Land Use Planning Commission
GOLD
FAIRBANKS
BIG DELTA
ANTIMONY
LEAD
ZINC
SILVER
COPPER, GOLD
LEAD, ZINC
COPPER
GOLD
COPPER
COPPER
GOLD
LEAD
ZINC
GLENNALLEN
GOLD
PALMER
CHROMIUM, NICKEL
PLATINUM, COPPER
ANCHORAGE
GOLD
VALDEZ
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
HOMER
POTENTIAL MINERAL DEVELOPMENT AREAS
SCALE
0
50
100 Miles
A.P.A.-JULY 1975

FIGURE 13

electric energy will come from these premium fuels. Estimated 1972 fuel use for Alaska's power systems included 1.4 million barrels of oil and 16 billion cubic feet of natural gas. If recent trends continue, the use would increase to about 26 million barrels of oil and 134 billion cubic feet of natural gas annually by the year 2000 under mid-range level estimates.

Since low cost natural gas became available for power production in the Cook Inlet area, the Upper Susitna River Basin hydro power development has not looked attractive to the area utilities.

Now the long range outlook for availability and cost of gas is changing; this, coupled with high power costs in the Fairbanks area, possibilities that pipeline fuels will also be quite expensive, and broader new interest in conservation of nonrenewable resources has created renewed interest in Susitna hydro potential.

A concentrated effort to develop alternatives for power generation such as coal, hydro, and eventually nuclear power could result in substantial reduction in demand for oil and natural gas. The lead times and large investments required to develop alternatives reinforce the point that oil and natural gas must supply near future requirements. For most smaller power systems, basically no economically feasible alternatives to diesel generation exist, at least for the present.

The availability of fuels in Alaska will undoubtedly improve as reserves and facilities are developed, which should lead to reduced dependence on costly imported diesel fuels and other petroleum products for power generation and other uses within the State. However, there is no longer any reason to anticipate that Alaskan oil and gas will provide an abundant, cheap energy source for the long term. These fuels will be expensive, if only because of pressures to export the fuels to areas where higher prices can be obtained. The present use of oil and natural gas as a source of electrical energy is viable for Alaska; however, a higher and better future use of these resources can and, in all probability will, be made.

In view of the national efforts to develop energy sources that limit the use of oil and gas for power generation, this alternative was rejected.

6.02.4 <u>Nuclear Power</u>. The use of nuclear power as a commercial electrical energy source for the nation is expected to increase considerably by the year 1985. Adverse environmental impacts are associated with surface and subsurface mining of uranium, changes in land use, disposal of waste heat, risk of accidents, and safe storage of highly radioactive wastes. In spite of these factors, more than 50 percent of the electrical power of the nation is expected to be generated by nuclear power by the year 2000. By the end of this century, breeder plants, which produce additional fuel while they produce power, will gradually take over a larger share of the production of electricity. Possibly at some time in the next century, nuclear fission plants and proposed nuclear breeder plants will be replaced by nuclear fusion reactors and by central generating stations running on solar power.

Nuclear power should be considered a likely long-range source of baseload power for the Railbelt area and is generally considered a distant option because of size of power markets, cost and environmental factors, and the availability of more favorable coal and hydro alternatives. The foreseeable future for nuclear power generation in Alaska should become materially more favorable only if there is either a breakthrough in costs and technology or significant new development in small-sized plants.

Because of the size of power markets, costs, and environmental factors, nuclear power development in Alaska is not considered to be an attractive alternative to cheaper, readily available power sources during this century.

6.02.5 Geothermal. Geothermal resources may eventually provide significant power generation in Alaska; the Southcentral Railbelt area has substantial geothermal potential. This source of energy is not considered a reasonable short term alternative to other more proven types of power generation, as increased utilization of geothermal resources depends upon additional technological development and economics. Geothermal power gneration is also considered to be a future supplement to other power sources rather than an alternative method of producing electricity.

Some of the possible problems associated with the generation of electric power from geothermal resources include siting of facilities, brine disposal, and corrosion. This renewable resource could also provide usable side products such as heat, water, and chemicals.

This is not considered a realistic alternative to other energy sources within the foreseeable future.

6.02.6 Solar. The radiant heat of the sun is another renewable source of energy that has considerable potential for generating power in this country and the world. Practical use of solar energy to produce electric power on a large scale is primarily a question of developing the technology to generate and to store large amounts of electricity produced by the sun's radiation. A major disadvantage wherever such development is pursued is the large land area required for reflector installation to provide usable amounts of power and thus the large environmental disturbances inherent in such a change in land use.

A second concern especially in Alaska is that during the winter, when demand for electrical power is greatest, the sun is either absent from or at best a brief visitor to local skies. Solar power generation is not considered a feasible planning alternative for Alaskan power systems in the near future.

6.02.7 Wind and Tidal. Research and development proposals for wind generators should improve future capabilities of wind-powered electrical generating systems. With increased diesel fuel costs, wind-generated electrical power is a possible alternative power source for remote areas with small loads. The extreme costs and environmental effects involved in most tidal flow hydroelectric proposals are major factors opposing this alternative method of generating electrical power. Neither alternative is considered feasible for provision of large amounts of energy at this time.

6.02.8 Wood. In parts of southeastern Alaska, wood is used to fire steam-generating power plants. Alaska does have vast forest reserves that could be used; however, these same trees have far higher and better alternative uses in wood, paper, and other industries. In addition, the esthetic, ecological, and environmental impacts of the large harvests necessary to allow production of large amounts of energy appear to be massive. Wood as an energy source is not considered a major alternative.

6.02.9 Intertie. Alaska could purchase surplus power from sources in Canada or the "Lower 48;" however, the cost of transmission facilities and the uncertainty of available dependable power would be major factors opposing such a scheme. Therefore, an intertie does not appear to be feasible at this time.

6.02.10 Solid Waste. The use of solid wastes was proposed by the Alaska Center for the Environment as an alternative source of energy at the intermediate public meeting held in Anchorage on 29 May 1975. There does not appear to be an adequate supply of solid waste products in the railbelt area to produce enough energy. Associated air quality and odor problems would also appear to be severe. This alternative is not considered feasible to meet the energy needs in the railbelt area.

6.02.11 Hydropower. The reconnaissance report on potential development in the State of Alaska made in 1948 by the U.S. Bureau of Reclamation, included hundreds of potential power development sites located throughout the five study regions of the State: Southeast; Southcentral; Yukon-Kuskokwim; Seward Peninsula; and Arctic. The two largest market areas for power are located in the Southcentral region, particularly the Anchorage-Cook Inlet area, and the Fairbanks-Tanana Valley area. The large amount of the available renewable water resource which could produce electric power has excellent potential to answer the energy needs of the Southcentral Railbelt area.

6.03 Alternative Hydrologic Basins in the Southcentral Railbelt Area

6.03.1 Rampart Canyon. The site for the proposed Rampart Canyon Dam is on the Yukon River approximately 140 miles northwest of Fairbanks, Alaska. The project has one of the greatest hydroelectric potentials in North America. The proposal would create a reservoir with a water surface area of approximately 10,600 square miles, with a maximum length of 280 miles and a maximum width of about 80 miles. The project would provide firm annual energy of 34.2 billion kilowatt-hours (the energy equivalent of over 74 million barrels of oil per year). However, the adverse environmental impacts on fish and wildlife in the Yukon Flats would be significant.

While Rampart is engineeringly feasible, it would provide enough excess energy to encourage further industrial development in Alaska, thereby introducing a number of secondary impacts not associated with the recommended alternative. Excess energy could also be transmitted to the "Lower 48" through an intertie system. However, this would be a major action not directly applicable to energy needs of the Railbelt Area. Justification would have to be based on a nation-wide plan which included Rampart as a recommended alternative to the development of other energy sources. Within the time-frame criteria established for fulfillment of projected growth needs in the Railbelt Area, this is not considered a viable alternative.

The tremendous financial investments, the substantial environmental impacts, the limited opportunities for marketing the enormous amounts of power, and the availability of favorable, less costly alternatives preclude recommending construction of the Rampart project at this time.

6.03.2 Wood Canyon. The site for the proposed Wood Canyon Dam is about 85 miles above the mouth of the Copper River in the Chugach Mountains of southcentral Alaska. A "high dam" would develop firm annual energy of 21.9 billion kilowatt-hours. A "low dam" would provide 10.3 billion kilowatt-hours of firm annual energy.

The construction of a dam at Wood Canyon would force relocation of two communities and would create serious environmental problems affecting both fish and wildlife values, especially to the large salmon runs on the Copper River. Unless the problem posed to migrating salmon could be solved satisfactorily, the project would have an extremely adverse effect on the major commercial fishing industry in a wide area of the Gulf of Alaska. This alternative is not considered feasible at this time.

6.03.3 Chakachamna Lake. The site for the proposed Chakachamna Lake Dam is located on the Chakachamna River which empties into the west side

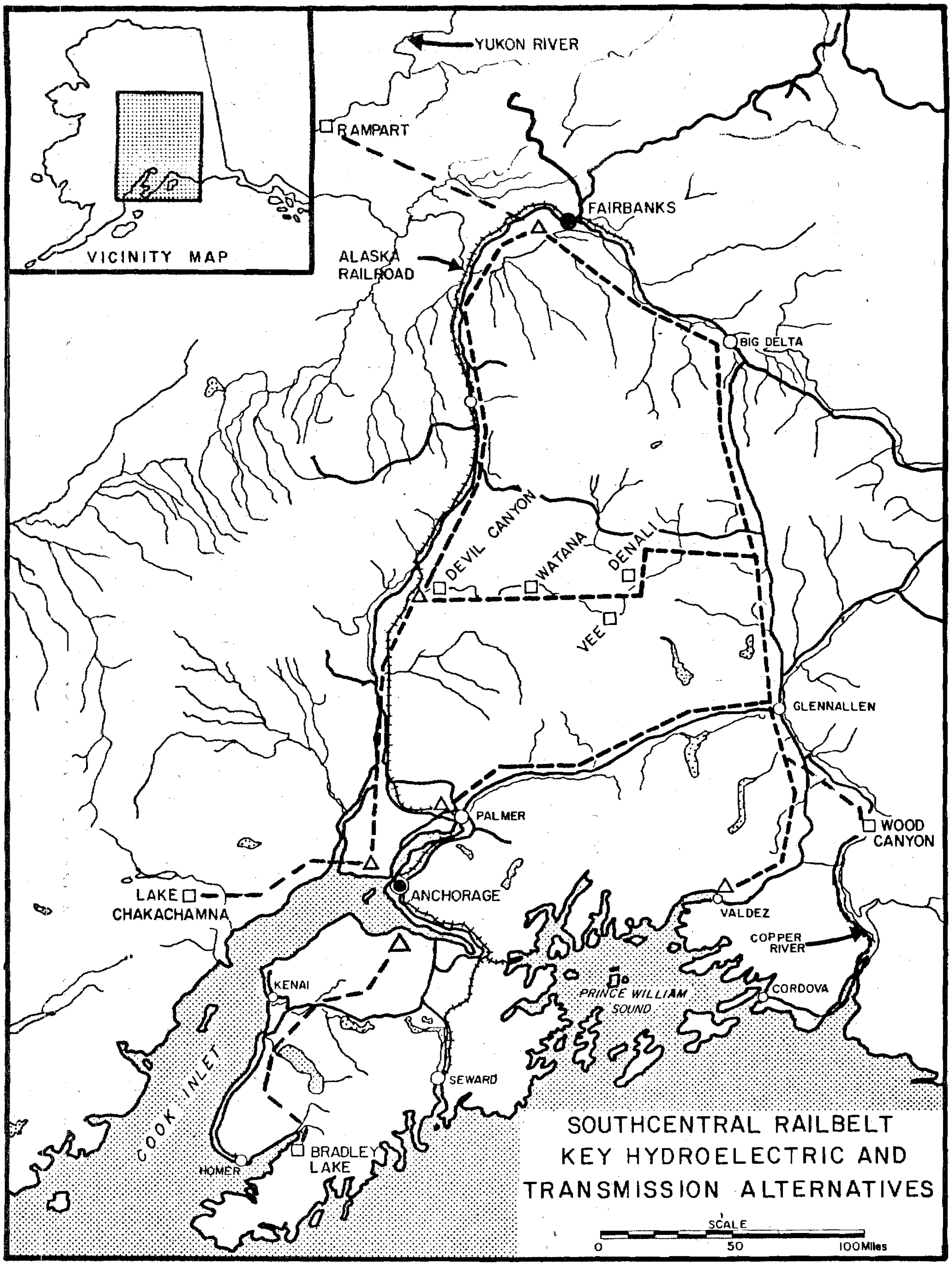

VICINITY MAP
YUKON RIVER
RAMPART
FAIRBANKS
ALASKA RAILROAD
BIG DELTA
DEVIL CANYON
WATANA
DENALI
VEE
GLENNALLEN
PALMER
WOOD CANYON
LAKE CHAKACHAMNA
ANCHORAGE
VALDEZ
COPPER RIVER
KENAI
PRINCE WILLIAM SOUND
CORDOVA
SEWARD
COOK INLET
BRADLEY LAKE
HOMER
SOUTHCENTRAL RAILBELT
KEY HYDROELECTRIC AND
TRANSMISSION ALTERNATIVES
SCALE
0
50
100Miles

FIGURE 14

of Cook Inlet approximately 65 miles west of Anchorage. The facility would generate 1.6 billion kilowatt-hours of firm annual energy. The project would require the erection of transmission facilities over difficult terrain to tie into a Southcentral Railbelt transmission System and the construction of a high-cost 11-mile tunnel for power generation. The adverse environmental impact would be substantially less than for many proposed Alaskan hydroelectric projects. However, the low energy output and the high costs render this alternative economically infeasible at this time.

6.03.4 Bradley Lake. The site for this proposed hydroelectric project is at Bradley Lake on the Kenai Peninsula at the head of Kachemak Bay near Homer, Alaska. The proposal would generate 0.4 billion killowatt-hours of firm annual energy and could serve as a southern peaking installation for a Southcentral Railbelt power system. Adverse environmental impacts of this proposed project would be relatively minor compared to the other hydroelectric development alternatives. If an economically feasible plan can be developed for Bradley Lake, the project could be integrated with future development of the Susitna River basin. By itself, the alternative is not viable at this time.

6.03.5 Susitna River. Surveys for potential hydropower development in the Susitna River basin were reported by the Corps of Engineers in 1950 and by the U.S. Bureau of Reclamation in 1948, 1952, 1961, and 1974. The 1952 USBR report indicated 12 potential hydropower sites in the basin; of these, the five damsites studied in the upper Susitna basin showed the highest potential. These studies showed the environmental impact from projects in the Upper Susitna River Basin would not be as severe as those from other basins, and the firm energy potential could contribute substantially to satisfying the needs of the Southcentral Railbelt area.

6.04 Alternative Hydroelectric Plans in the Upper Susitna River Basin:

6.04.1 General: Eight plans for hydroelectric development of the Susitna River basin including the proposed actions were studied as follows:

6.04.2 Devil Canyon. The possibility of a single dam development of the Upper Susitna basin located at the Devil Canyon damsite was investigated. The proposed thin-arch dam would have a water surface area of about 7,550 acres at the normal maximum pool elevation of 1,450 feet, m.s.l. The project would produce 0.9 billion kilowatt-hours of firm annual energy from an installed capacity of 220 megawatts. Because of the very limited storage capacity, the project has a low firm energy capability and is not considered economically viable.

6.04.3 Watana. This single dam development of the upper Susitna basin located at the Watana site would be an earthfill dam with structural height of about 810 feet. The reservoir would have a normal maximum pool elevation of 2,200 feet, would have a surface area of approximately 43,000 acres, and would extend about 54 river miles upstream to a point between the Oshetna and Tyone Rivers. The annual firm electrical production of Watana would be 3.1 billion kilowatt-hours from an installed capacity of 750 megawatts. Although feasible, the project develops less than half of the basin potential and is not viable in itself since more productive feasible plans are available.

6.04.4 Devil Canyon High Dam. In September 1974, Henry J. Kaiser Company prepared a report proposing an alternative hydroelectric development project on the upper Susitna River. The report states that preliminary investigations indicated that an 810-foot-high, concrete-faced rockfill dam located about five miles upstream from the proposed Devil Canyon site would provide 3.7 billion kilowatts of average annual energy, or 2.6 billion kilowatt-hours of firm annual energy (figures converted to standard Corps of Engineers evaluation parameters). This dam would inundate about 58 miles of the Susitna River with a reservoir of approximately 24,000 surface acres at a full pool elevation of 1,750 feet.

This project would be located in much of the same area of the Susitna River canyon occupied by the proposed Devil Canyon-Watana project and would have similar environmental impacts with some exceptions. Whereas the Devil Canyon reservoir in the two-dam proposal would remain nearly full all year, the Kaiser reservoir would fluctuate substantially.

Kaiser's proposed Devil Canyon High Dam, located about 25 miles downstream from the Watana site, would have proportionately fewer miles of permanent roads and transmission lines than the Devil Canyon-Watana project, therefore less environmental impact on resources affected by these facilities.

The recreation opportunities would be fewer for the one-dam proposal. The substantial fluctuation of the reservoir would reduce some recreation potential and reduce resident fish populations while increasing the adverse visual impact associated with reservoir drawdown. The plan was found to lack economic feasibility.

6.04.5 Devil Canyon-Denali. This alternative two-dam system would include the thin arch concrete dam at Devil Canyon and a 260-foot-high earthfill dam in the vicinity of Denali. The Denali Dam would provide storage only and would have no powerhouse. This system would generate 2.5 billion kilowatt-hours of firm annual energy from an installed capacity of 575 megawatts at Devil Canyon Dam. The surface acres flooded would total about 62,000 acres (Devil Canyon, 7,550; Denali 54,000). The plan would entail significant environmental impacts on waterfowl nesting areas, moose range, and archaeological/historical values in the Denali reservoir area. Economic feasibility is lacking.

Upstream view of Devil Canyon damsite.

Looking upstream at Susitna River near Denali. Tundra ecosystems with scattered areas of black spruce.

6.04.6 Three-dam System. A three-dam Devil Canyon-Watana-Denali hydroelectric development on the upper Susitna River could be built as an extension of the two-dam Devil Canyon-Watana project if the Denali storage site proved feasible. Such a dam system would provide a total of 6.9 billion kilowatt-hours of firm annual energy.

If a three-dam Devil Canyon-Watana-Denali project were constructed, it would include Devil Canyon and Watana dams previously described, and a 260-foot storage dam at Denali. This three-dam system would inundate approximately 104,550 acres and would take 13 to 17 years to construct. With a three-dam system, the 100-year storage capacity in Watana reservoir would be reduced by about 4 percent due to sedimentation.

Environmentally, this plan would result in the adverse impacts assocated with the Devil Canyon-Denali two-dam system, plus the added impact of inundating some additional moose range and bisecting a seasonal caribou migration route. Though the latter impact should not seriously impede caribou migration, it could result in increased caribou mortality if animals attempted to cross the reservoir during adverse ice conditions, including the possibility of ice-shelving during periods of reservoir drawdown.

This alternative has significantly greater total adverse environmental impacts than the recommended plan (Devil Canyon and Watana development would have almost identical impacts with either plan) and is not economically feasible.

6.04.7 Four-dam System. In May 1974, the Alaska Power Administration updated a March 1961 report of the Bureau of Reclamation which proposed development of the hydroelectric resources of the Upper Susitna River Basin. The report proposed an initial plan to build the Devil Canyon Dam and powerplant and an upstream storage dam and reservoir at Denali. Subsequent development of a four-dam system would include dams at both the Watana and Vee sites. The four-dam system would generate a total of 6.2 billion kilowatts of firm annual electrical energy. The Watana Dam under this plan would be about 300 feet lower than in the selected Devil Canyon-Watana proposal.

Initial development of the four-dam system, Devil Canyon-Watana-Vee-Denali, would include only the construction of the hydroelectric dam at Devil Canyon and the storage dam at Denali. This combination of two dams would produce 2.5 billion kilowatt-hours of firm annual energy. This initial two-dam system would also be compatible with the three-dam Devil Canyon-Watana-Denali, alternative proposal.

The four reservoirs considered in this development would inundate approximately 85,000 acres of land and river in the upper Susitna basin, compared with about 50,550 acres flooded in the selected two-dam proposal.

TABLE II

DATA ON THE PROPOSED PROJECT AND SELECTED SUSITNA ALTERNATIVES

	Type of Construction	Structural Height	Normal Full Pool Elevation	Surface Acres	Total Storage Acre-Feet	Miles of River Inundated	Billion Kilowatt-Hours of Firm Annual Energy
Selected Plan:							
Devil Canyon	Concrete, thin-arch	635'	1450'	7,550	1,050,000	28	
Watana	Earthfill	810'	2200'	43,000	9,400,000	54	
Totals				50,550			6.1
Alternatives:							
Kaiser's High Devil Canyon	Earthfill	810'	1750'	24,000	4,700,000	58	(2.6)
Olson	Concrete, gravity	200'±	1020'	1,000	83,000	8	
Vee	Earthfill	455'	2300'	9,400	920,000	32	
Denali	Earthfill	260'	2535'	54,000	3,850,000	34	
Totals				88,400			5.6
Devil Canyon	Concrete, thin-arch	635'	1450'	7,550	1,050,000	28	
Watana	Earthfill	810'	2200'	43,000	9,400,000	54	
Denali	Earthfill	260'	2535'	54,000	3,850,000	34	
Totals				104,550			6.8
Devil Canyon	Concrete, thin-arch	635'	1450'	7,550	1,050,000	28	
Watana	Earthfill	515'	1905'	14,000	2,420,000	40	
Vee	Earthfill	455'	2300'	9,400	920,000	32	
Denali	Earthfill	260'	2535'	54,000	3,850,000	34	
Totals				84,950			6.2

Susitna River at Vee damsite. This demonstrates the typically incised character of the Upper Susitna from Devil Canyon to the Tyone River. Note that heavier vegetation is limited to slopes and creek valleys.

The two reservoirs proposed in the lower section of the upper Susitna River would have substantially fewer known adverse environmental impacts than the two upper area reservoirs at the Vee and Denali. Generally the further upstream a reservoir is located in the four-dam system, the greater the overall adverse environmental impact would be on fish, wildlife, and esthetic resources.

In a four-dam plan, Watana reservoir would cover a surface area of about 14,000 acres behind a 515-foot-high dam with a pool elevation of 1,905 feet. The reservoir would extend over 40 miles upstream from the damsite and would be contained in the narrow canyon for most of its length.

Under either Watana alternative, the reservoir would flood areas used by migrating caribou and would flood some moose winter range in the river bottom. It would also cover existing resident fish habitat at the mouths of some of the tributaries in this section of the river and possible would create additional stream habitat at higher elevations.

The 455-foot-high Vee Dam would be built only under the four-dam plan in conjunction with the lower height Watana Dam. Vee reservoir would inundate about 32 miles of glacial river and would have a pool elevation of 2,300 feet with a surface area of approximately 9,400 acres. The reservoir would flood a substantial amount of moose habitat on the main Susitna and on the lower reaches of the Oshetna and Tyone Rivers. Caribou migration routes along the south bank of the Susitna River would also be affected as would some waterfowl habitat of minor significance. Present resident fish habitat, especially grayling, would be flooded at the mouths of many of the clearwater tributaries in the area covered by the Vee reservoir.

Any road to the Vee damsite would open up larger areas of wild lands that are prime wildlife habitat and escapement areas (inaccessible to man) for caribou, bear, and moose, and would have a significant impact on these and other fish and wildlife resources within these areas.

Denali Dam, with a structural height of 260 feet, would form a 54,000-acre storage reservoir with a pool elevation of 2,535 feet. Large areas of wildlife habitat, especially for moose and waterfowl, would be inundated in an area between 2 and 6 miles wide and approximately 34 miles long. Many clearwater streams entering the Susitna River in this area have varying populations of arctic grayling; how the fluctuating reservoir would affect this fishery is generally unknown at this time. Substantial areas of lands would be exposed during the seasonal drawdowns of this storage reservoir; from an esthetic standpoint, this would be a substantial adverse environmental impact, especially when viewed from the well-traveled Denali Highway during the earlier summer months when the reservoir would be low.

Denali Highway bridge across upper Susitna River. This area would have been inundated by a dam at the Denali site.

The relocation of the Denali Highway necessary with the construction of a dam at the Denali site would provide additional access to this area with increasing pressures on the fish and wildlife resources in Coal Creek, Clearwater Creek, lower Maclaren River, Butte Creek, and the eastern slopes of the Watana Hills. There would be substantially less developed recreational potential at the Vee and Denali sites than at Devil Canyon because of travel distances involved and reservoir drawdown, especially at the Denali damsite.

It is expected that construction of the Vee project would take 5 to 6 years, while the Denali dam and reservoir would take between 3 and 5 years to construct. The construction period of the four-dam system would be between 18 and 23 years, if the dams were constructed in sequence. The magnitude of environmental impacts resulting from a four-dam system in the Upper Susitna River Basin clearly makes this a less desirable alternative than the one-, two-, or three-dam plans.

6.04.8 Kaiser Four-Dam System. An additional study of a four-dam system was made by the Corps of Engineers utilizing the Kaiser Devil Canyon High Dam as the main component in an upper Susitna basin system. This alternative included both the Vee and Denali Dams and a low reregulating dam just below the confluence of Portage Creek. This four-dam system could provide an estimated 5.6 billion kilowatt-hours of firm annual energy.

The environmental impacts of this four-dam system are a combination of the impacts of the Kaiser Devil Canyon High Dam, the Vee and Denali damsites, and a low reregulating dam downstream from Devil Canyon just below Portage Creek. The system would inundate about 88,250 acres. One of the major additional impacts would include anadromous and resident fishery impacts caused by the reregulating dam near Portage Creek. The plan is not economically feasible.

6.05 Alternative Power Transmission Corridors. Any development of hydroelectric power in the upper Susitna basin would require development of electric transmission facilities to the Railbelt load centers. In determining the preferred system, the Alaska Power Administration studied all feasible corridors joining the upper Susitna comples to Anchorage and FAirbanks. The most feasible corridor was selected on the basis of cost, reliability, and potential environmental impact; the remaining corridors represent alternatives of varying degrees of feasibility.

Four groups of alternatives were considered: first, those that led from Devil Canyon-Watana to Anchorage via the Susitna watershed; second, those that lead to Fairbanks via the Nenana and Tanana drainage; third, those that lead to Fairbanks via the Delta and Tanana drainages; and fourth, those that lead to Anchorage via the Copper and Matanuska drainages. Within each of the four basic corridor systems, a number of alternative corridor routes were considered. Figure 15 displays these various routes. Susitna 1 and Nenana 1 are the selected routes.

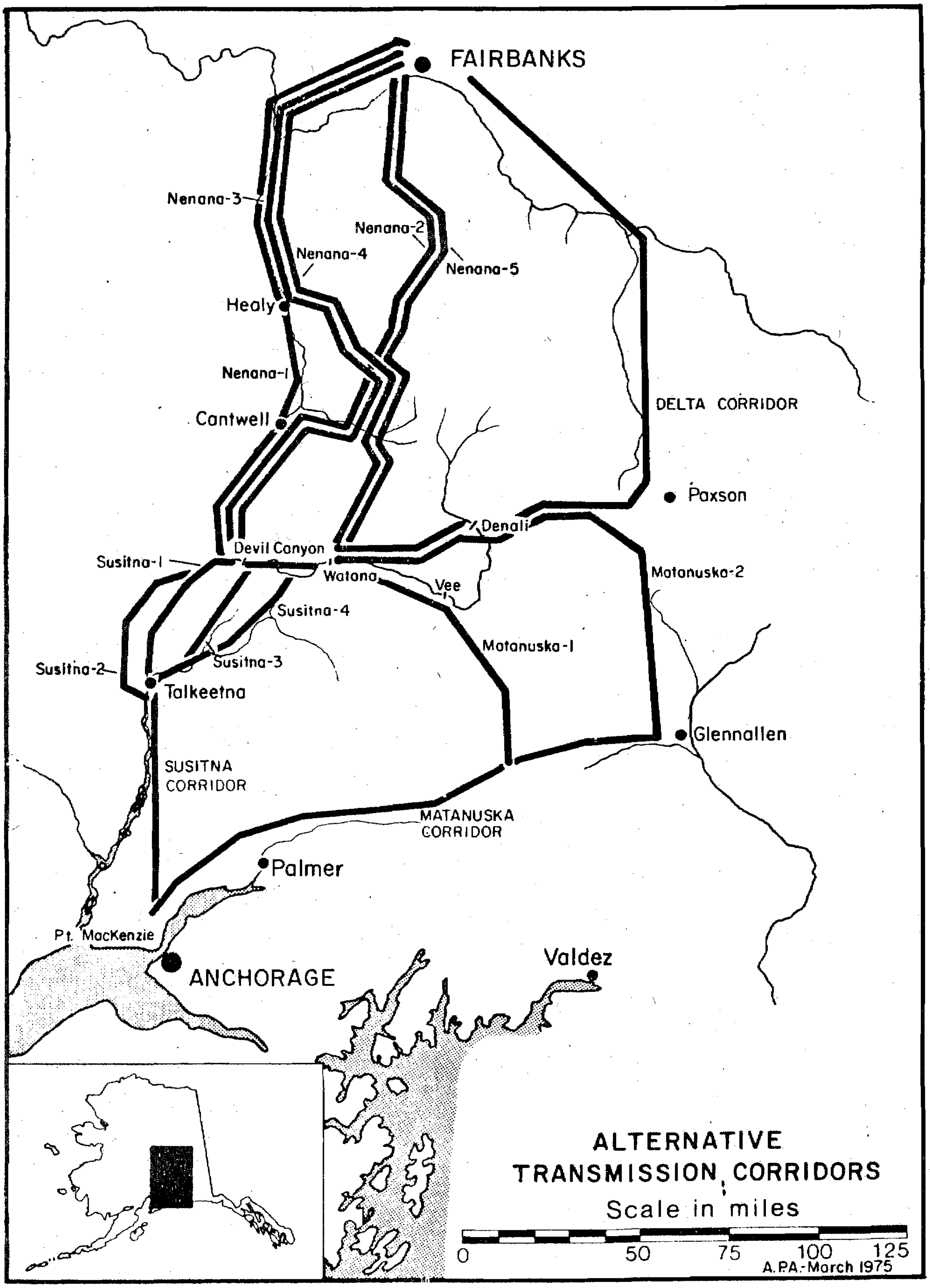

FAIRBANKS
Nenana-3
Nenana-2
Nenana-4
Nenana-5
Healy
Nenana-1
Cantwell
DELTA CORRIDOR
Paxson
Denali
Devil Canyon
Susitna-1
Watana
Vee
Matanuska-2
Susitna-4
Matanuska-1
Susitna-3
Susitna-2
Talkeetna
Glennallen
SUSITNA
CORRIDOR
MATANUSKA
CORRIDOR
Palmer
Pt. MacKenzie
ANCHORAGE
Valdez
ALTERNATIVE
TRANSMISSION CORRIDORS
Scale in miles
0
50
75
100
125
A.PA.-March 1975

FIGURE 15

7.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The project as presently conceived could have a useful life span in excess of 500 years based on the "dead storage space" within the reservoirs for sediment accumulation. Individual components would be replaced as necessary, but the overall system would remain essentially the same. Should the system last this long, or for any number of reasons be made inoperative at an earlier date (an example would be development of more desirable alternative sources of electrical power), many of the resources described above in Sections 4 and 5 would have been, for all practical purposes, committed to permanent foreclosure of options for alternative future uses.

In this sense, the long-term productivity of the directly affected environment will have been sacrificed for a shorter-term alternative use, since impacts attributable to the reservoirs will be of much longer duration than the useful life of the project for hydroelectric power production. By the same token, the project would contribute to a savings in nonrenewable energy sources with an energy equivalent of about 11.3 million barrels of oil, or approximately 80 billion cubic feet of gas per year. Although this savings is a principal factor in the consideration of a hydroelectric alternative, over the long haul, hydroelectric energy must be viewed as an interim measure for conserving the nation's nonrenewable energy sources until some more practical, permanent method of producing electricity is achieved which will not overburden the nation's or world's finite resources.

Some features of the project will have less lengthy impact on the environment than the dams and reservoirs. Many of the impacts will be encountered during--and for a relatively brief time following--the construction phase. Of the longer-term impacts, some would terminate or lessen immediately or shortly after retirement of a given project component. For instance, if the transmission line were to be removed, many of its impacts would soon disappear. Maintenance activity, noise and electromagnetic interference, and visual impacts associated with the lines and towers would be immediately eliminated. Roads could be removed, top soils replaced, and eventually natural revegetation processes would largely obscure the previous existence of the transmission system. Other impacts would, to varying degrees, be "imprinted" into the environment. Wildlife patterns may have been affected by continual hunting or habitat modification. Vegetative patterns, altered by continual maintenance or introduction of non-native plants, may continue for a long time. Land use patterns influenced by the project would linger after it ceased to function.

No extremely short-term benefits from the project are the basis for justifying the long-term, if not permanent, commitment of the productivity of the affected areas. The trade-off is essentially a long-term benefit which can be achieved only at the expense of even a longer-term commitment of the affected resources.

8.0 IRREVERSIBLE OR IRRETRIEVABLE COMMITMENTS OF RESOURCES IN THE PROPOSED ACTION.

8.01 Changes in Land Use. The development of hydroelectric dams on the upper Susitna River would present an irreversible change of land use from an existing wilderness type land-use situation, along a free-flowing river with limited access, to a land-use situation where public access would be provided to a series of manmade lakes created by the construction of hydroelectric dams within the river corridor and to recreation sites within the project area.

Proposed transmission lines and permanent roads would also be located in areas of existing wild lands or where transportation corridors presently exist.

8.02 Destruction of Archaeological or Historic Sites. At the present time, no archaeological sites are known to exist within the areas of the proposed impoundments, damsites, power line routes, or road locations. Should such sites be located during on-the-ground reconnaissance during the detailed study phase, measures will be taken to avoid disturbance where possible. Should they fall within the reservoir pools, salvage will be undertaken. In the latter event, however, the sites would be permanently lost to alternative future uses.

One old cabin site, probably related to early mining exploration, is located at the mouth of Kosina Creek within the Watana reservoir impoundment area. This site is designated as a historical site by the Alaska Division of Parks.

8.03 Change in River Use. If the proposed project is developed, the 84-mile portion of the river above the dams would be converted from a free-flowing river to a series of manmade lakes totaling about 50,000 surface acres. Such development would preclude any consideration for Wild and Scenic River classification.

The "whitewater" section of the river through Devil Canyon would be inundated, as would sections of the river bottom now used for wildlife habitat.

Downstream the initial 50-mile section of the river would be changed from an uncontrolled natural river, with very high summer flows and heavy glacial sedimentation and low winter flows with practically no sedimentation, to a river with regulated flows and a small amount of suspended glacial sediment. The 80-mile section of the river between Talkeetna and Cook Inlet would be affected to a lesser degree because of major tributaries.

8.04 Construction Activities.

8.04.1 Fuel Requirements. Significant amounts of fuel oils and gasoline for use in transportation and construction activities related to project construction would be irretrievably committed.

8.04.2 Manpower. Manpower resources during the construction and operation phases of the project would be irretrievably committed. The majority of these man-hours would be committed over a 10- to 12-year period, depending on the final development program.

8.04.3 Material. All the material used in project-related construction would constitute an irretrievable commitment of resources, as this material would not be available for other uses. Some amounts of material might be salvaged if the facilities were removed at some later date.

8.04.4 Land. Any land committed to project development such as reservoir impoundment areas, damsites, roads, etc., would be unavailable for other than project-related uses until such time as the facilities were no longer needed.

9.0 COORDINATION WITH OTHER AGENCIES

9.01 General. A public participation program was maintained throughout the investigation. Coordination with various agencies and groups was made to provide and to obtain pertinent information, and the following methods were used: public meetings, workshop meetings, and informal meetings.

9.02 Formal Public Meetings. Three sets of public meetings were held or are scheduled in Fairbanks and Anchorage, the two largest population centers in the study area, and also in the State. The initial public meetings were held on 6 May 1974 in Fairbanks, and 8 May 1974 in Anchorage, to notify the public that this investigation has been initiated and to furnish any available information and comments. The State of Alaska and several electric utility companies endorsed the study and several conservation groups and individuals asked that environmental aspects be studied also.

The interim public meeting was held in Anchorage on 27 May 1975 and 29 May 1975 at Fairbanks.

There has been no significant opposition to the proposed project as of September 1975, although some environmental groups withheld comment until more project data and a draft environmental impact statement were available for study. Concerns of these and other groups could be expressed after the draft environmental impact statement for the recommended project has been distributed to the public on 22 September 1975.

Late stage public meetings will be held on 7 October 1975 in Anchorage and in Fairbanks on 8 October 1975 when the selected plan will be discussed.

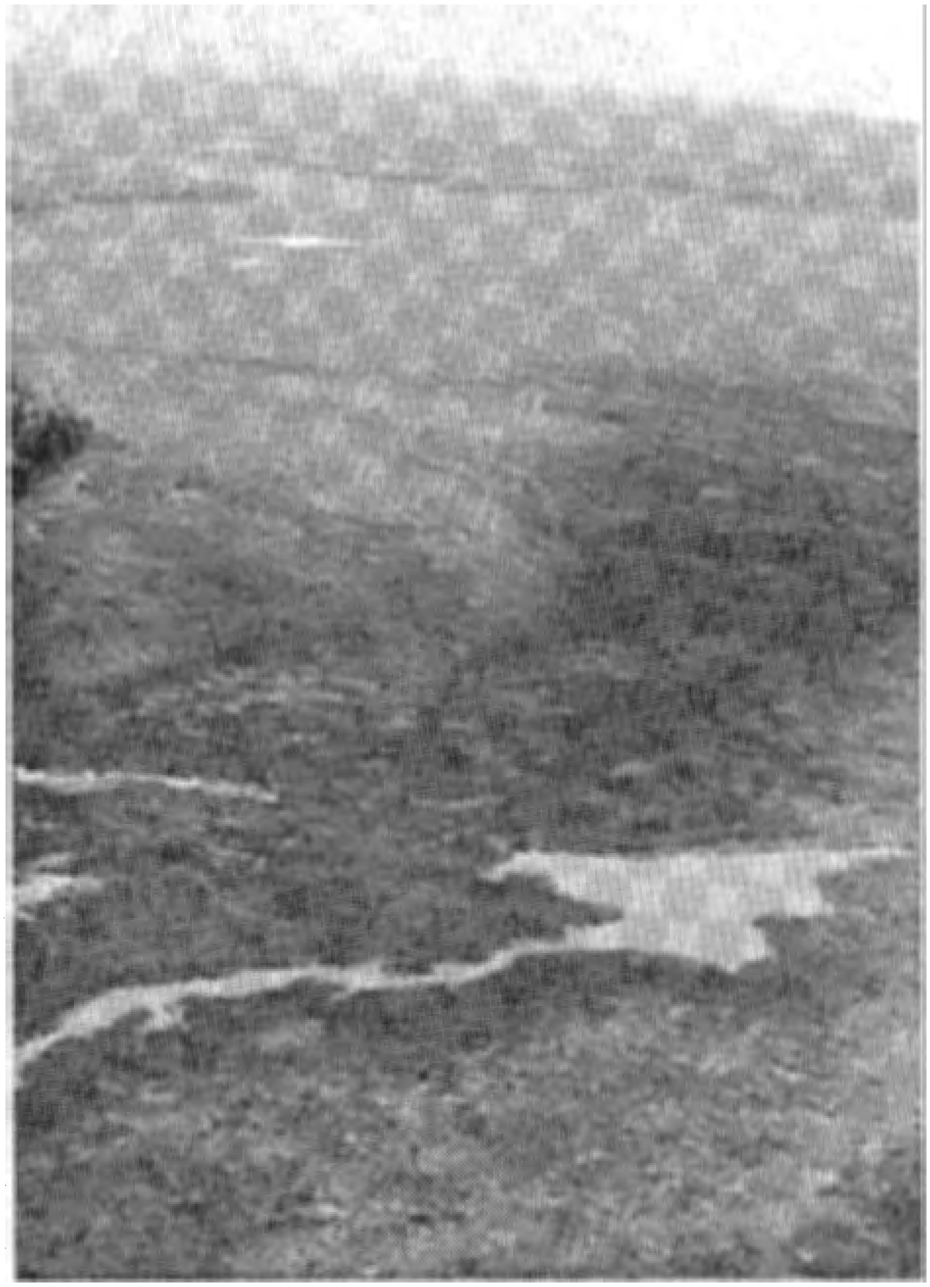
9.03 Workshop Meetings. The following workshop meetings were held:

1. 30 April 1974, with environmental groups
2. 29 October 1974, with Federal and State agencies
3. 12 March 1975, with Native Corporations.

9.04 Informal Meetings. Informal meetings with various Federal and State agencies were held throughout the study. Topics discussed included but were not limited to items related to the environment, economics, recreation, archaeology, fish and wildlife, transmission lines, land use, and power generation.

PROPOSED TRANSMISSION LINE CORRIDOR

(Photos courtesy of Alaska Power Administration)



Lower Susitna River Valley. This area is characterized by extensive muskegs, intermingled with bottomland spruce-poplar forests. Permafrost is absent or discontinuous in this area, although the soils are generally poorly drained.

Susitna River Valley. Lakes are prevalent and associated with muskegs, which succeed them in formation. Muskegs are succeeded in turn by forests dependent upon well-drained soils. The three stages of succession are shown here.

Town of Talkeetna. This town is at the confluence of the Talkeetna, Susitna, and Chulitna Rivers. The Alaska Railroad can be seen crossing the Talkeetna River near the right edge of the picture.

Near Honolulu on the Anchorage-Fairbanks Highway. Biomes shown on low brush muskeg in foreground and upland spruce-hardwood in background. Black spruce in foreground are associated with poorly drained soils and/or shallow permafrost tables.

Alaska Range from Anchorage-Fairbanks Highway near Broad Pass, late spring. Vegetation biome is lowland spruce-hardwood. Soils here are basically glacial deposits.

Looking south along Nenana River to Upper Nenana Canyon. The Anchorage-Fairbanks Highway parallels the left bank. Mount McKinley National Park and the Alaska Railroad are on the right bank of the river.

Very restricted canyon along Nenana River north of McKinley Park. Alaska Railroad is off left-hand edge of photo. Land left of river is within Mount McKinley National Park.

The Tanana River flood plain. This area is extremely flat and poorly drained. Three types of biome are represented in this picture: muskeg, lowland spruce-hardwood, and bottomland spruce-poplar. The dark forests are mainly black spruce. The sinuous lighter forest is white spruce, aspen and birch. This forest type prefers well-drained soils, and so is found on old levees of existing and extinct channels.

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