SUSITNA HYDROELECTRIC PROJECT

ENVIRONMENTAL REPORT

TASK 7: ENVIRONMENTAL

SUMMARY ANNUAL REPORT --1980

MAY 1981

for:

Prepared by:

Terrestrial Environmental Specialists, Inc.

ALASKA POWER AUTHORITY

SUSITNA HYDROELECTRIC PROJECT

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SUSITNA HYDROELECTRIC PROJECT

TASK 7

ENVIRONMENTAL STUDIES

SUMMARY ANNUAL REPORT - 1980

MAY 1981

by

TERRESTRIAL ENVIRONMENTAL SPECIALISTS, Inc.
Phoenix, New York 13135

for

ACRES AMERICAN, INCORPORATED
Liberty Bank Building, Main at Court
Buffalo, New York 14202

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1 - INTRODUCTION

Terrestrial Environmental Specialists, Inc. (TES), on behalf of the Alaska Power Authority (APA) and as a subcontractor to Acres American, Inc. (Acres), is performing environmental studies as part of a feasibility study and Federal Energy Regulatory Commission (FERC) license application effort for the Susitna Hydroelectric Project. The environmental program consists of baseline studies, impact analysis, and mitigation planning, each of which is being conducted in two phases: preceding submission of the license application (Phase I) and following the license application (Phase II).

Work is being performed for TES by subcontractors (University of Alaska, Frank Orth & Associates) and consultants (M. Bell, C. Atkinson, R. Williams, R. Taber, B. Kessel). Studies to describe the existing fish and big game ecology are being performed by the Alaska Department of Fish and Game (ADF&G) under a direct agreement with APA. A water quality program is being performed by R&M Consultants as a subcontractor to Acres.

This report summarizes the accomplishments and findings of the 1980 environmental program. Details of the program objectives and design may be found in the Plan of Study (Acres American, Inc., February 1980), in which the environmental program is referred to as Task 7, and in the Procedures Manuals prepared for the major environmental subtasks by TES and its subcontractors. Complete results of the 1980 studies may be found in the Annual Reports for the various specific subtasks. These and other Task 7 reports are listed in Section 4.

2 - THE STUDY AREAS

The study areas for the subtasks of the Susitna Hydroelectric Project vary considerably; some subtasks require larger study areas than others. By necessity, there is even variation in study areas among portions of some subtasks. The following descriptions indicate the areas that are being studied. The accompanying maps (Figures 1-17) delineate these study areas.

2.1 - Subtask 7.05: Socioeconomic Analysis

Several levels of socioeconomic analysis are being carried out; thus, there are four basic study areas (Figure 1). Study Area 1 includes the proposed dam sites, most of the transmission and access road corridors, and some project staging areas.

Study Area 2 includes the Matanuska-Susitna Borough and Valdez-Cordova (formerly Valdez-Chitina-Whittier) census divisions. This study area contains the primary political units within which the project and, to a substantial degree, its impacts will occur.

Study Area 3 is the Railbelt Region and data from this region form the basis for most of the quantitative analyses regarding many of the economic variables. Analysis of the Alaska socioeconomic structure leads to the inclusion (in this study area) of major census divisions: Anchorage, Kenai-Cook Inlet, Seward, Valdez-Cordova, Matanuska-Susitna, Southeast Fairbanks, and Yukon-Koyukuk.

Study Area 4 encompasses the State of Alaska. It will be used primarily for purposes of comparing existing statewide conditions with those resulting from the project, and for general comparison with data for the total nation.

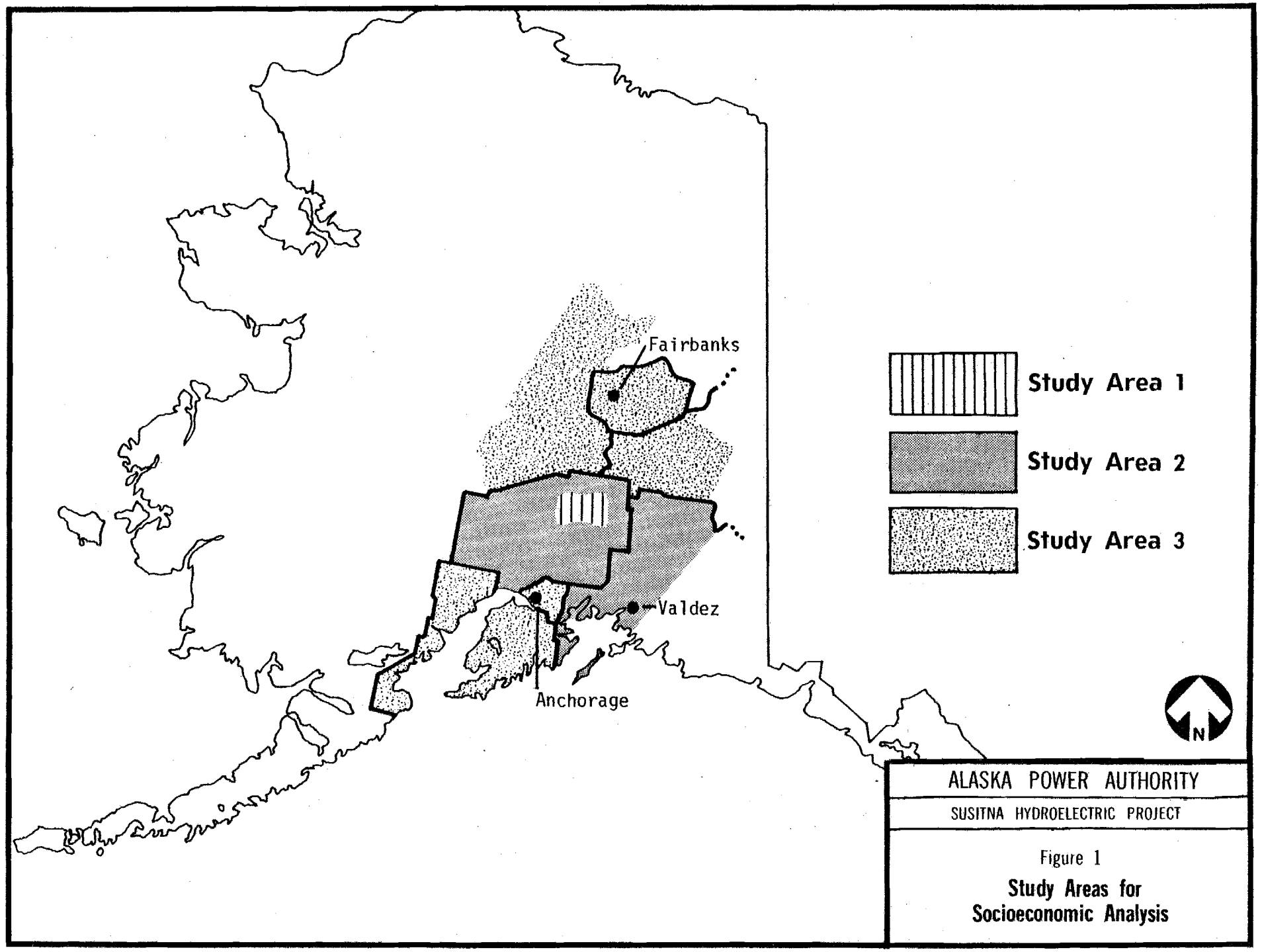

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Figure 1

Study Areas for Socioeconomic Analysis

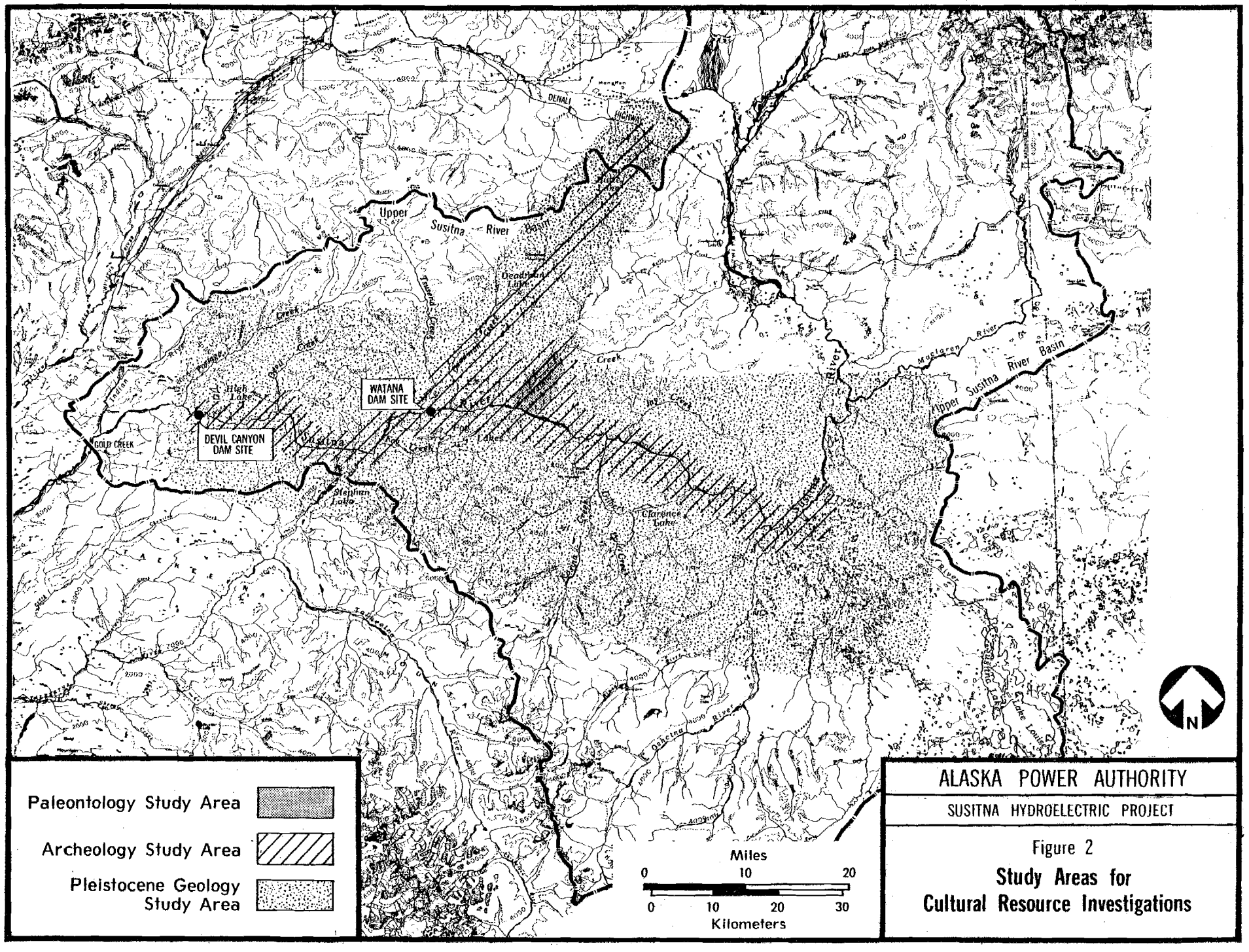

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Figure 2

Study Areas for Cultural Resource Investigations

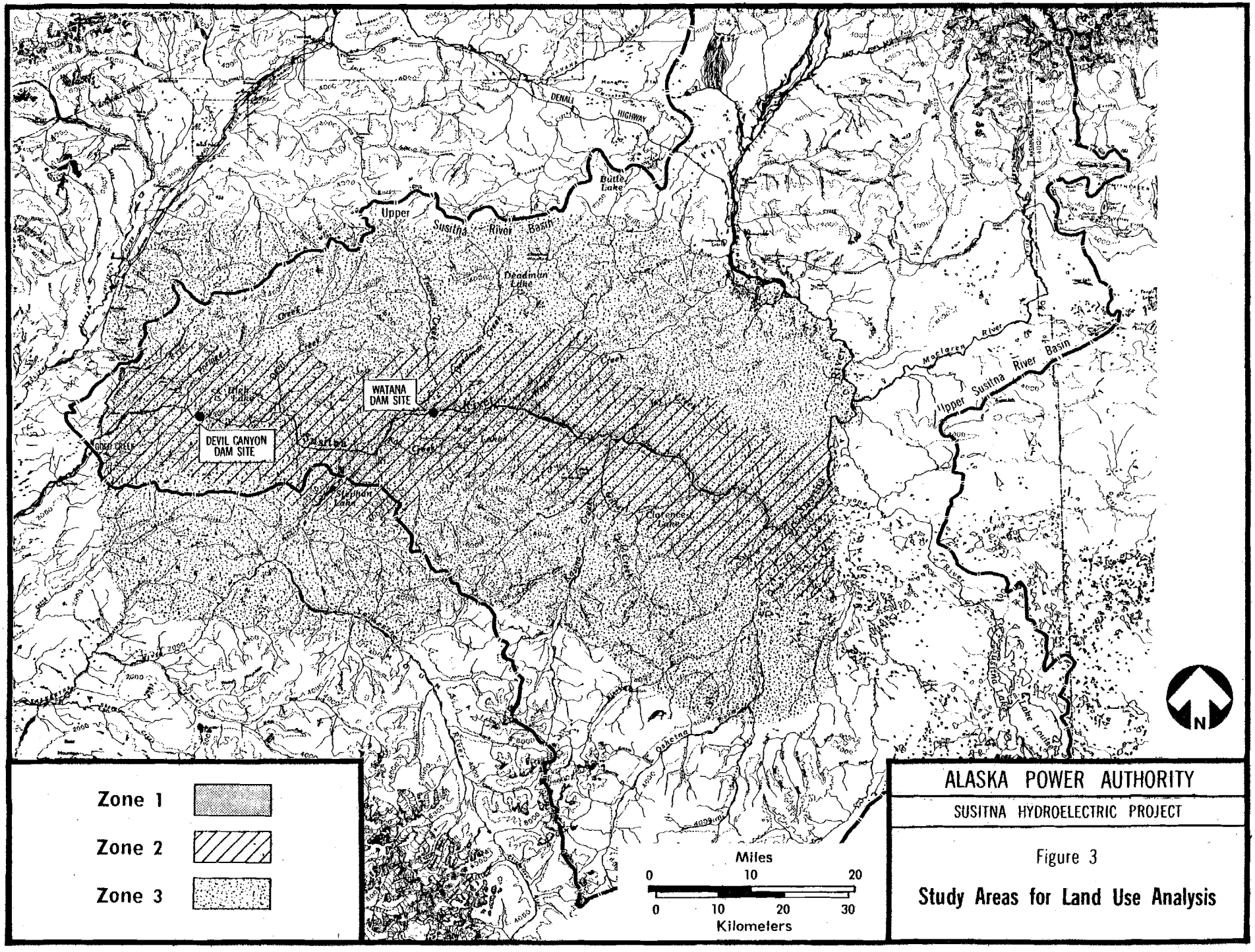

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Figure 3

Study Areas for Land Use Analysis

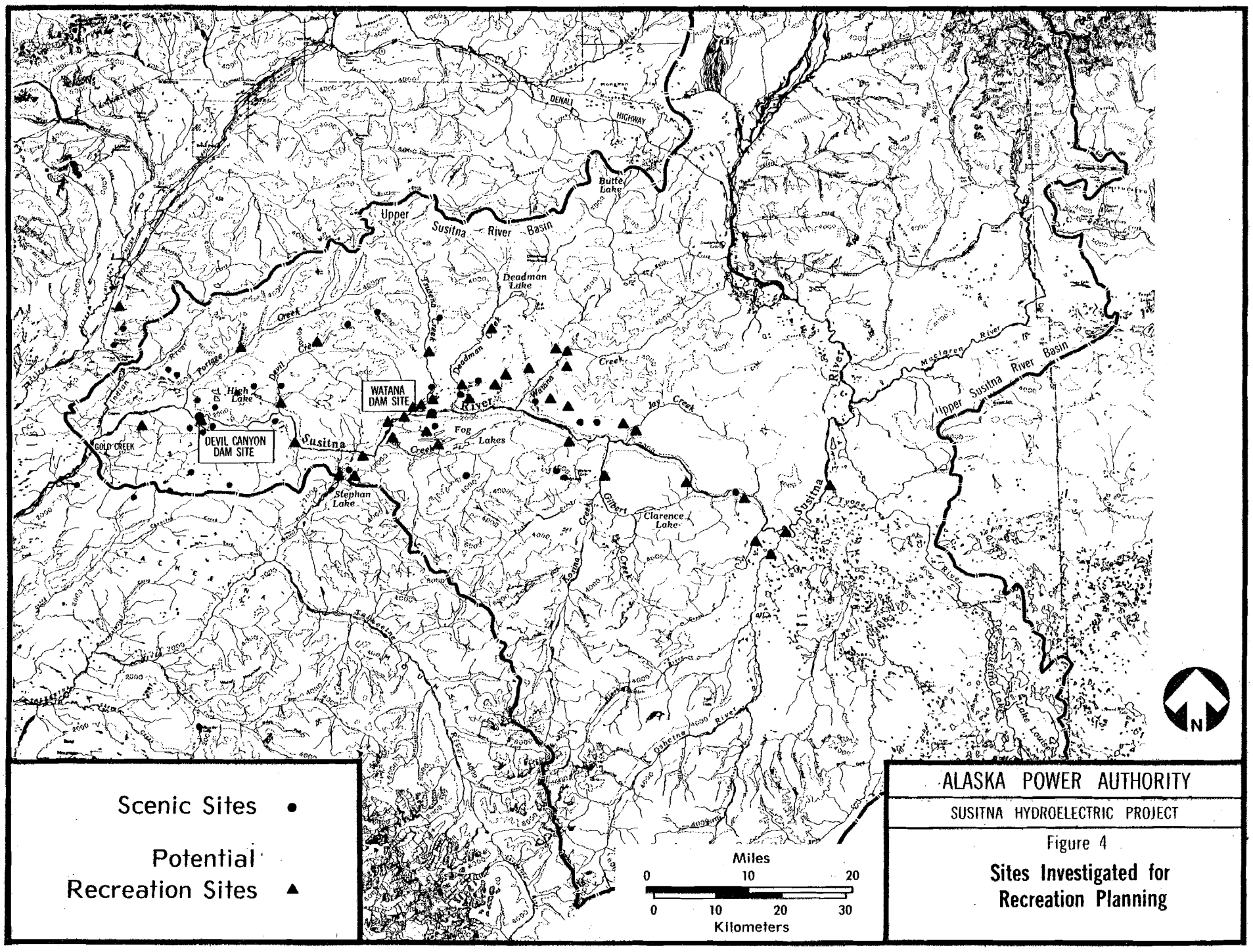

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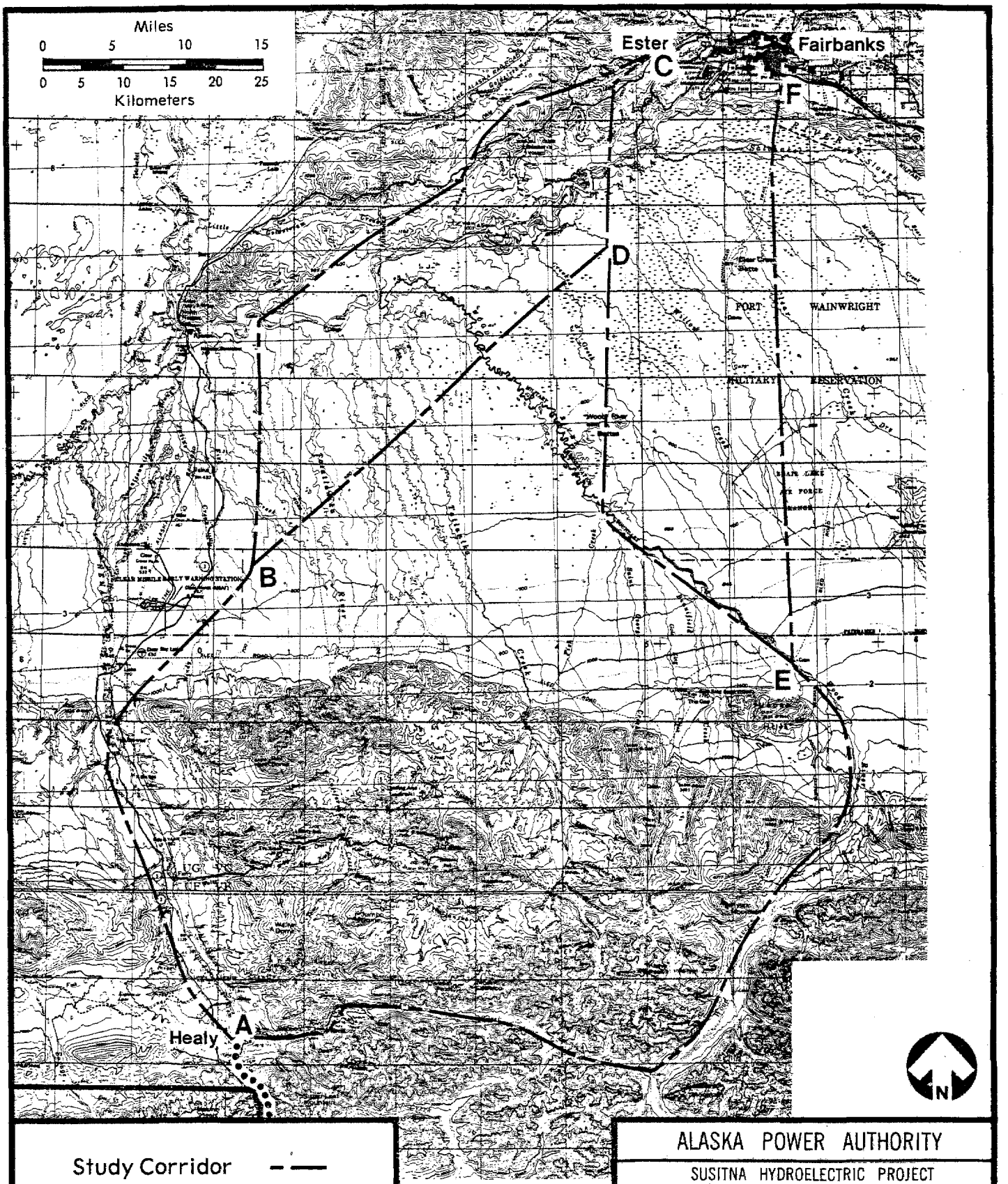
Figure 4

Sites Investigated for Recreation Planning



Study Corridor

Intertie (Hypothetical)

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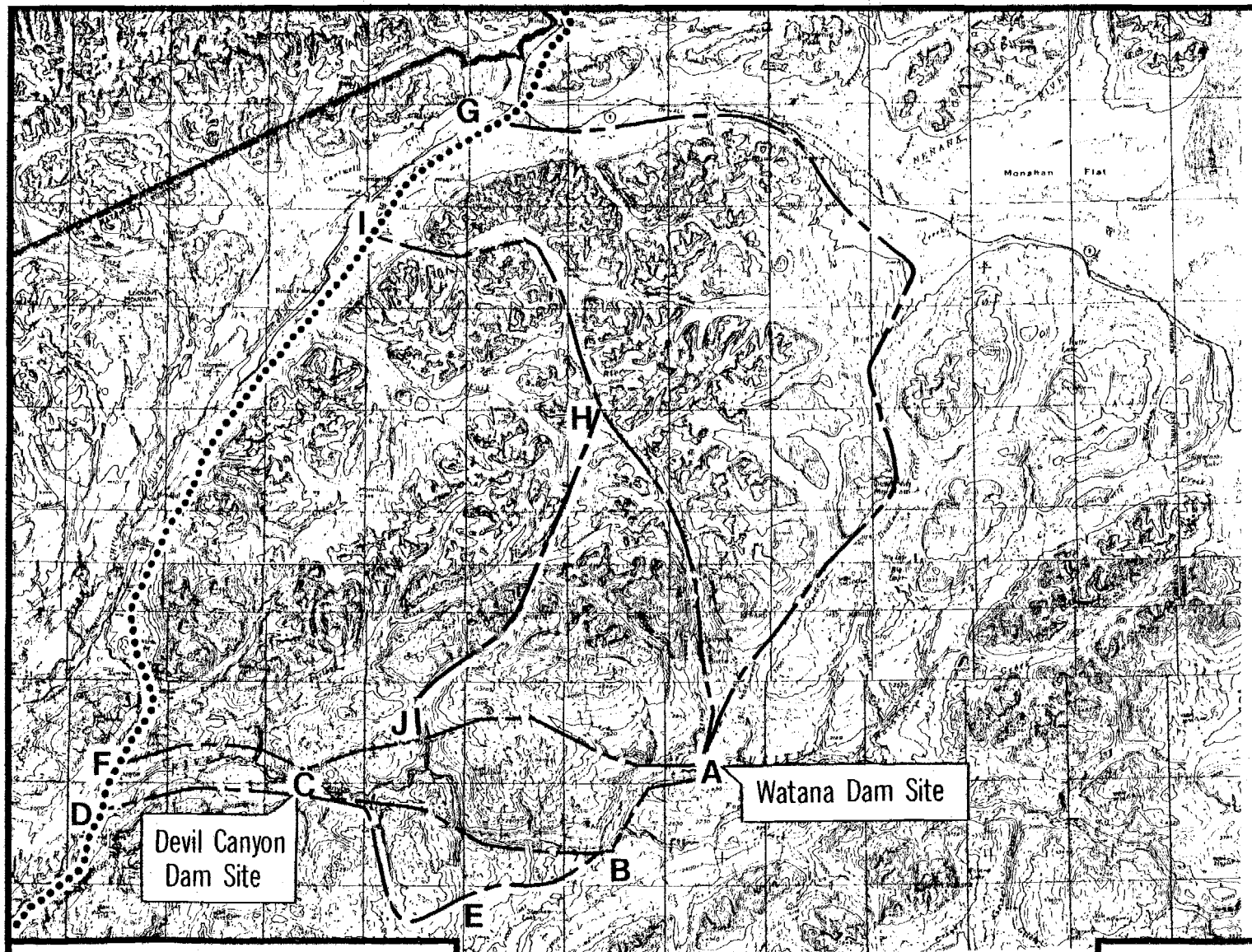
Figure 5

Transmission Corridors Evaluated

Northern Study Area



Study Corridor

Intertie (Hypothetical)

Miles
0 5 10 15
0 5 10 15 20 25
Kilometers

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Figure 6

Transmission Corridors Evaluated

Central Study Area

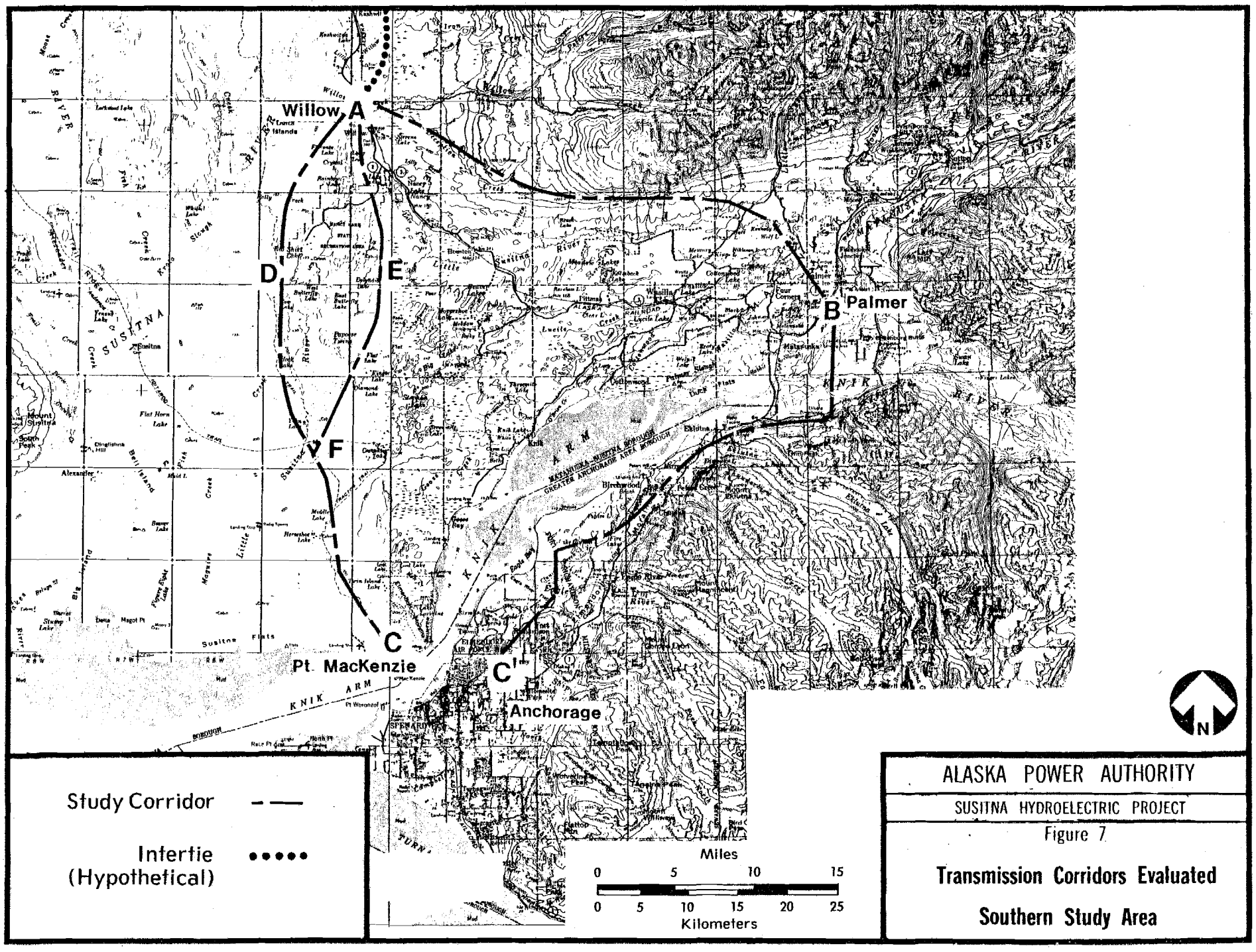

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Figure 7

Transmission Corridors Evaluated

Southern Study Area

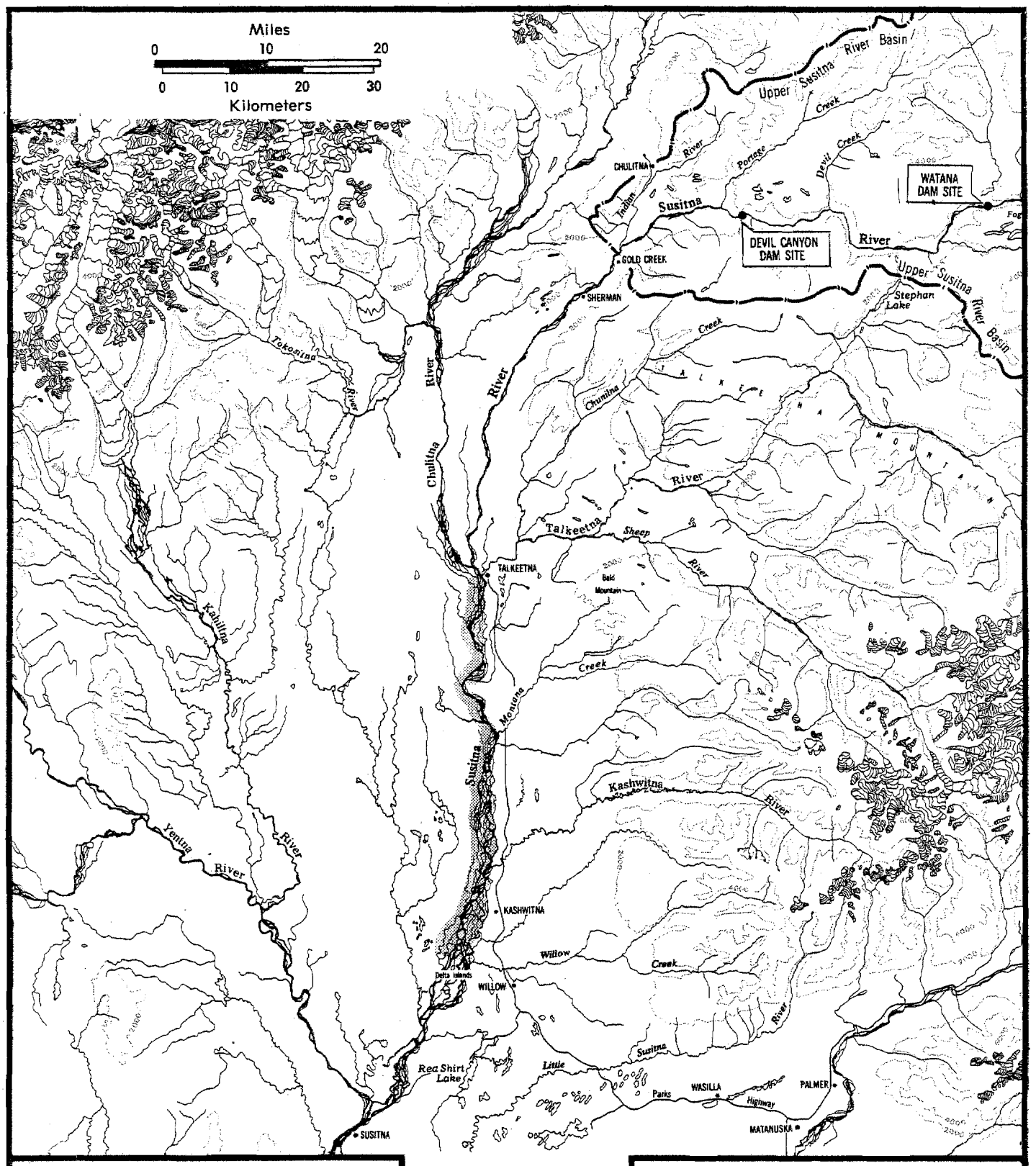
Miles
0 10 20
0 10 20 30
Kilometers
Upper Susitna River Basin
Upper Susitna River Basin
CHULITNA
Indian River
Susitna River
Portage Creek
Devil Creek
WATANA DAM SITE
DEVIL CANYON DAM SITE
GOLD CREEK
SHERMAN
Stephan Lake
Tokositna River
Chulitna River
Chunilna Creek
ALASKA MOUNTAINS
Talkeetna River
Talkeetna
Sheep Mountain
TALKEETNA
Kahiltna River
Montana Creek
Susitna River
Kashwitna River
Yentna River
KASHWITNA
Willow Creek
Delta Islands
WILLOW
Rea Shirt Lake
Little Susitna River
Parks Highway
WASILLA
PALMER
MATANUSKA
SUSITNA
1980
Study Area
N
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Figure 8
Fish Ecology Study Area

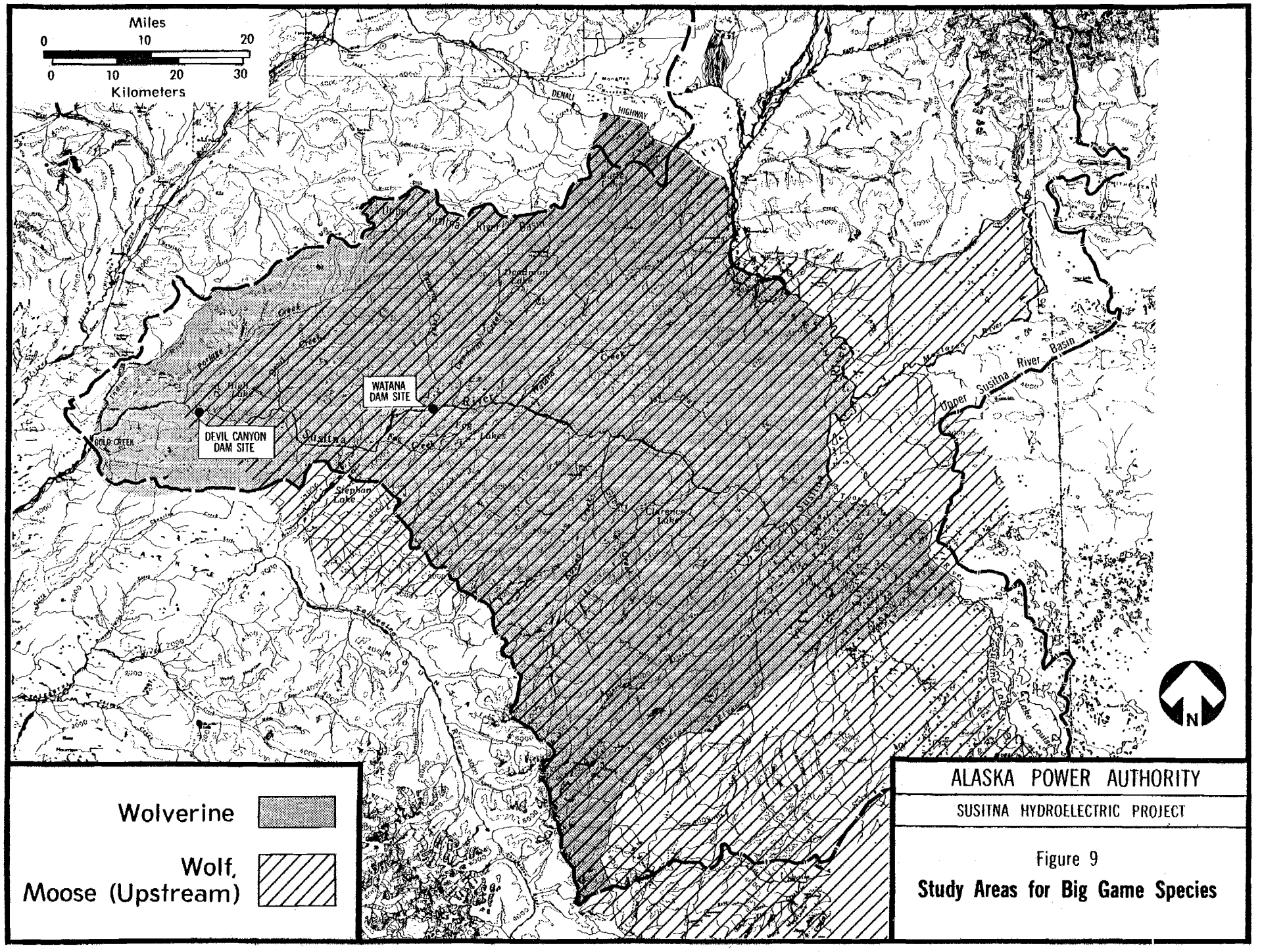

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Figure 9

Study Areas for Big Game Species

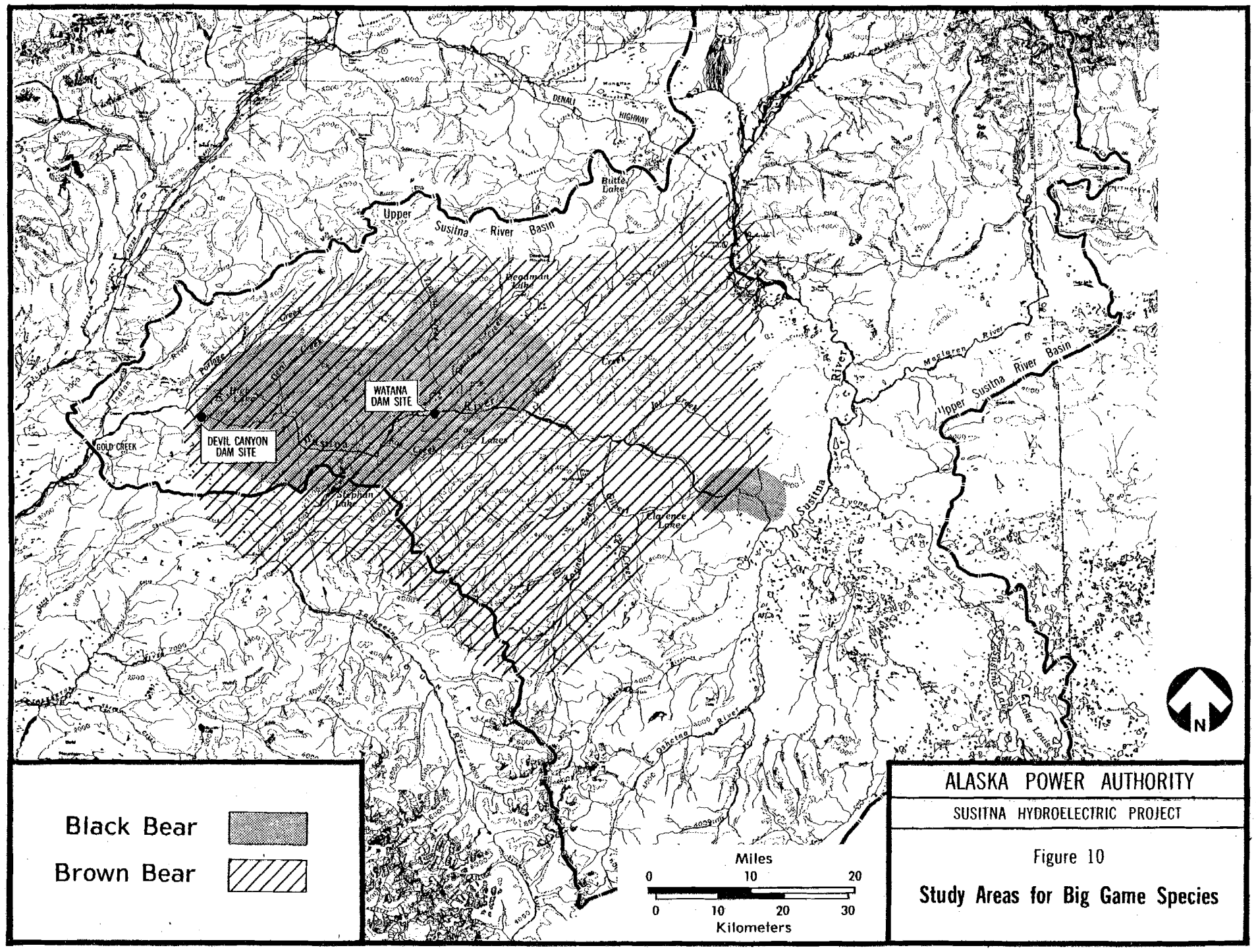

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Figure 10

Study Areas for Big Game Species

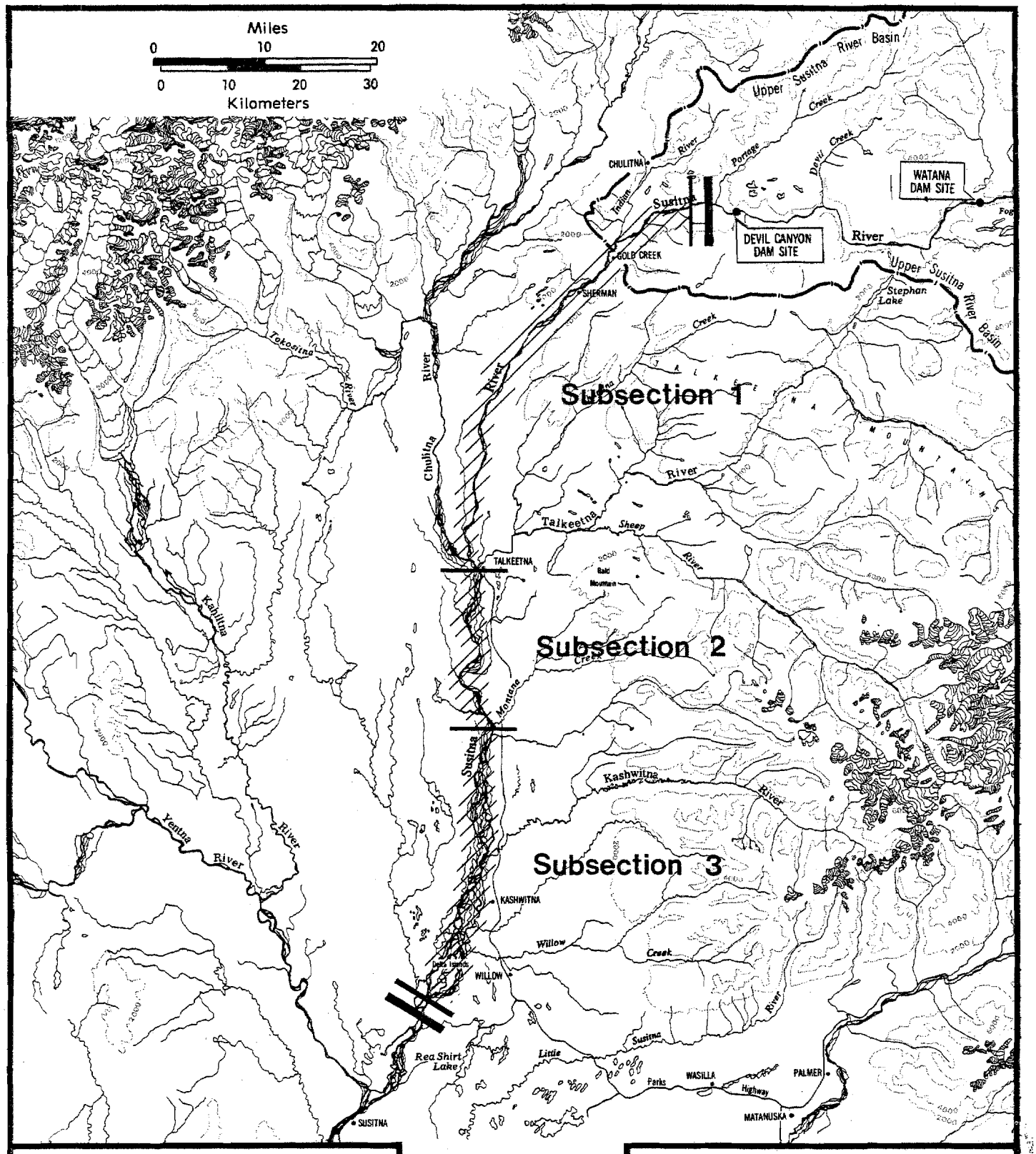
Miles
0 10 20
0 10 20 30
Kilometers
Upper Susitna River Basin
Upper Susitna River
CHULITNA
Portage Creek
Devil Creek
WATANA DAM SITE
DEVIL CANYON DAM SITE
GOLD CREEK
SHERMAN
Stephan Lake
Tokositna River
Chulitna River
Subsection 1
Talkeetna Mountains
Talkeetna River
Sheep Creek
TALKEETNA
Bald Mountain
Subsection 2
Kahiltna River
Montana Creek
Susitna River
Kashwitna River
Subsection 3
Yentna River
KASHWITNA
Willow Creek
WILLOW
Rea Shirt Lake
Little Susitna River
Parks Highway
WASILLA
PALMER
MATANUSKA
SUSITNA
Study Area
N
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Figure 11
Study Area for Moose Downstream

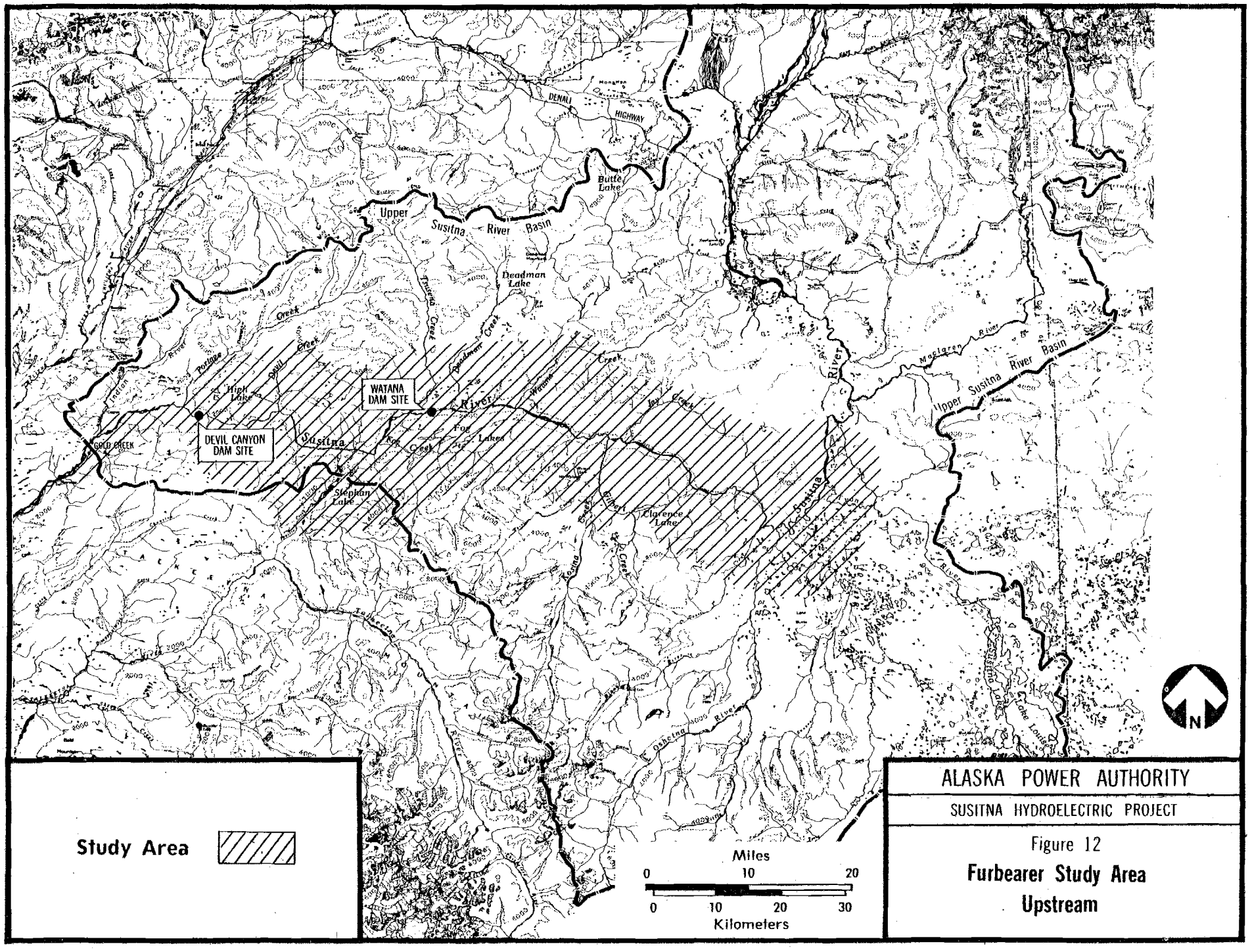

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Figure 12

Furbearer Study Area
Upstream

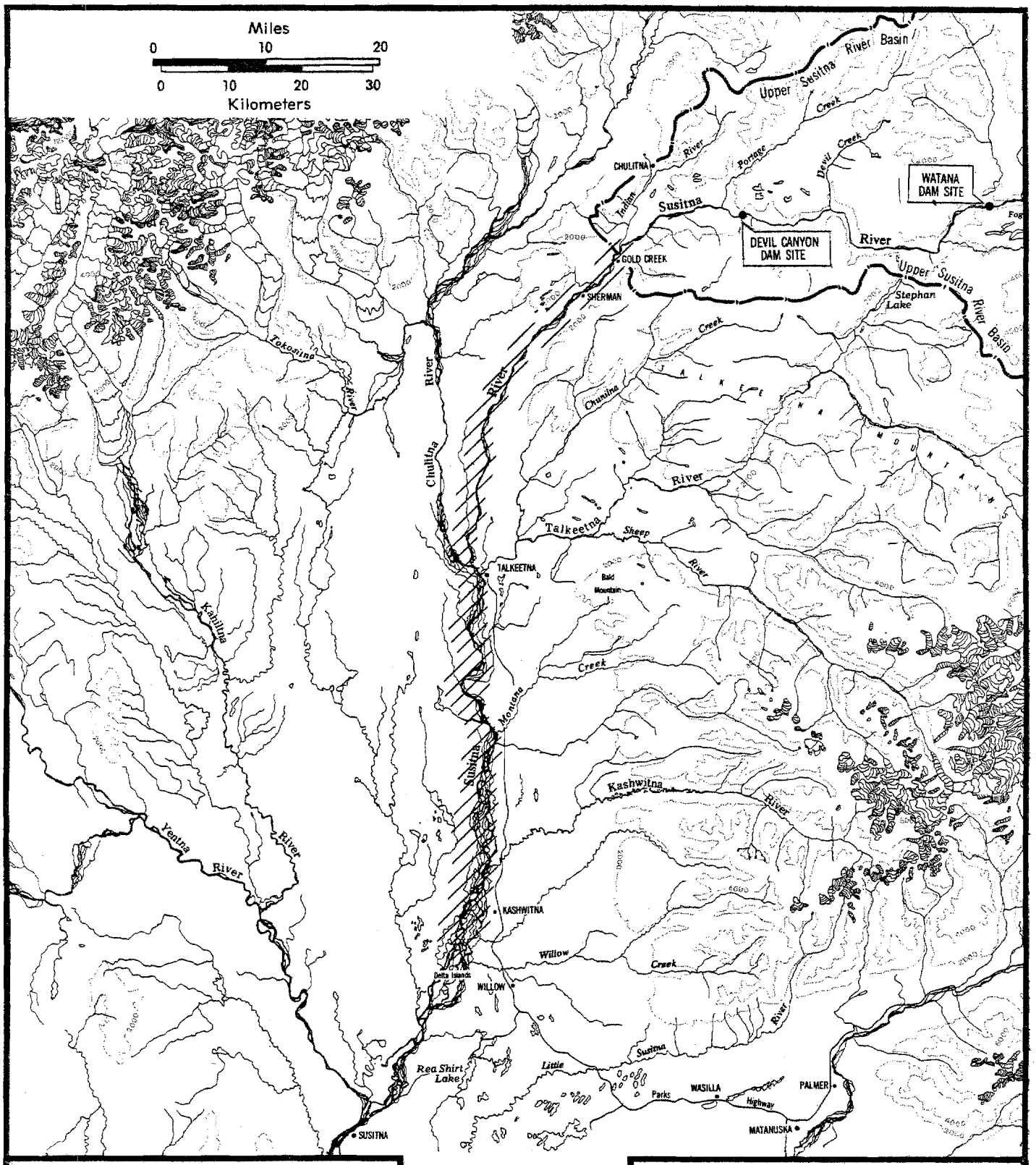
Miles
0 10 20
0 10 20 30
Kilometers
Upper Susitna River Basin
Upper Susitna River Basin
CHULITNA
Indian River
Portage Creek
Dewey Creek
WATANA DAM SITE
DEVIL CANYON DAM SITE
Susitna River
GOLD CREEK
SHERMAN
Stephan Lake
Tokositna River
Chulitna River
Chunina Creek
ALASKA MOUNTAIN
Talkeetna River
Sheep Creek
TALKEETNA
Bald Mountain
Kahiltna River
Susitna River
Montana Creek
Kashwitna River
Yentna River
KASHWITNA
Willow Creek
Delta Islands
WILLOW
Rea Shirt Lake
Little Susitna River
Parks Highway
WASILLA
PALMER
MATANUSKA
SUSITNA
Study Area
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Figure 13
Furbearer Study Area
Downstream

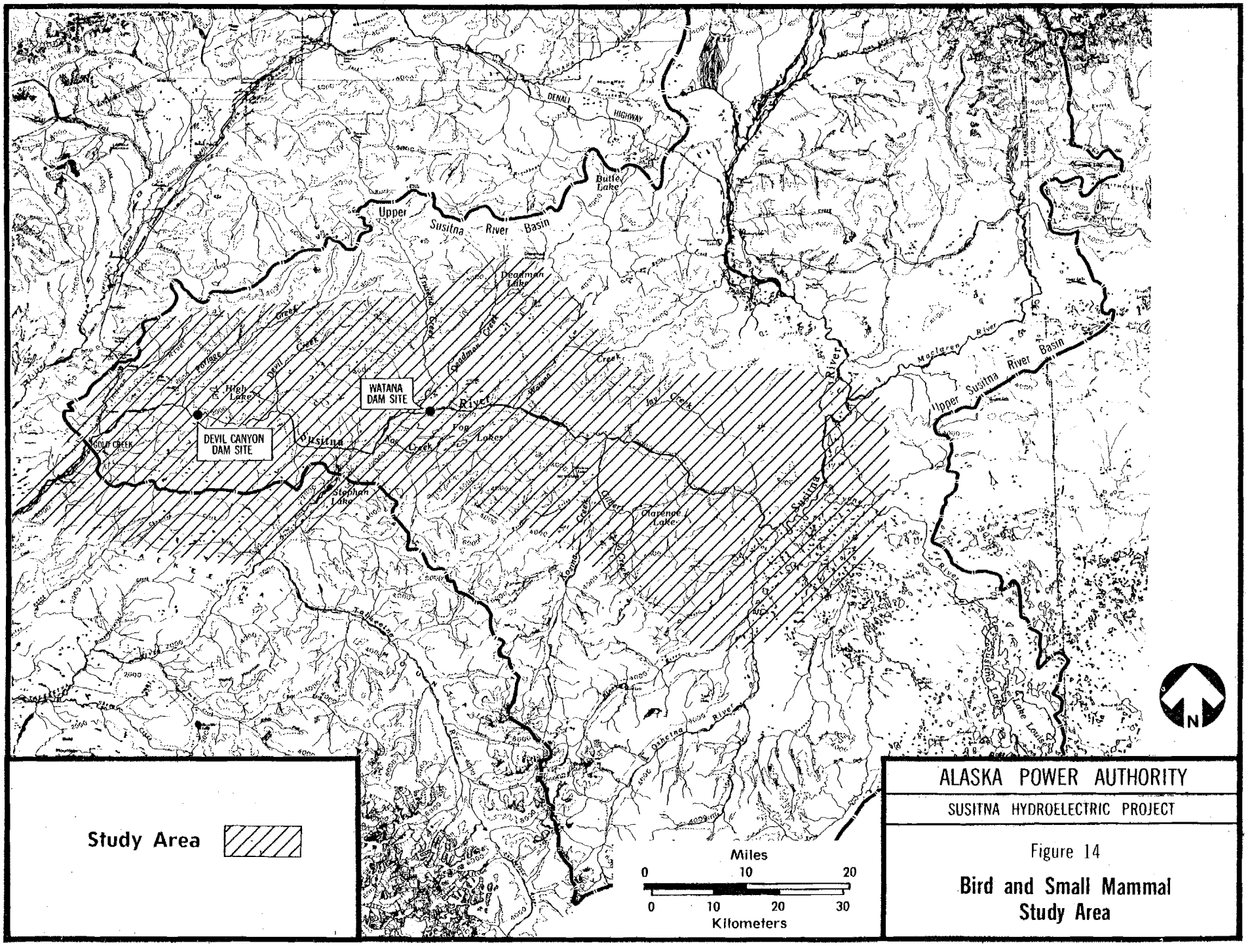

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Figure 14

Bird and Small Mammal Study Area

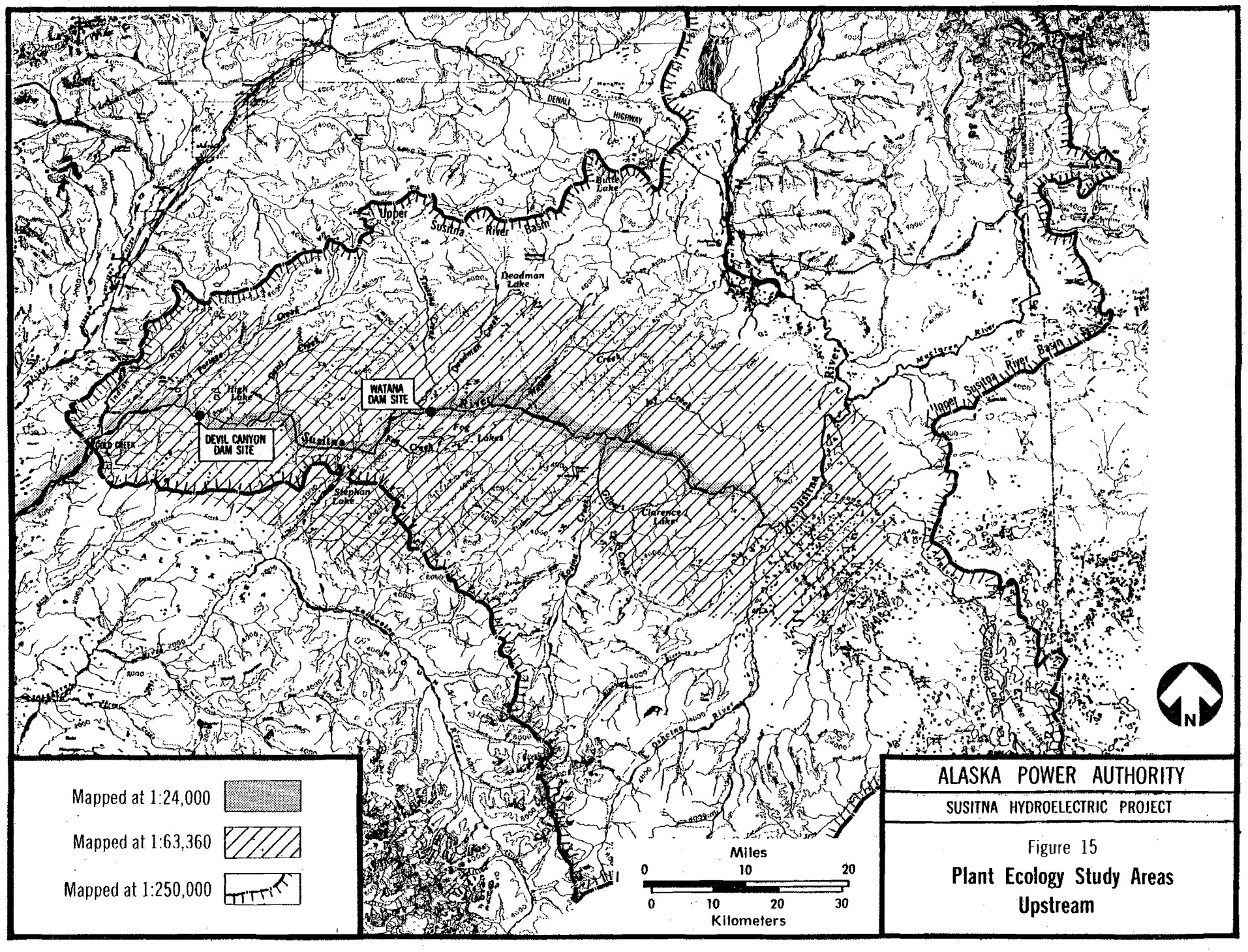
DENALI HIGHWAY
Upper Susitna River Basin
Butte Lake
Deadman Lake
Deadman Creek
Tyone River
Indian River
Gold Creek
High Lake
WATANA DAM SITE
DEVIL CANYON DAM SITE
Susitna River
Fog Lakes
Stephan Lake
Clarence Lake
Jay Creek
Watana Creek
Kosina Creek
Oshetna River
Maclaren River
Upper Susitna River Basin
Lake Louise
Mapped at 1:24,000
Mapped at 1:63,360
Mapped at 1:250,000
Miles
0 10 20
0 10 20 30
Kilometers
N
ALASKA POWER AUTHORITY
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Figure 15
Plant Ecology Study Areas
Upstream

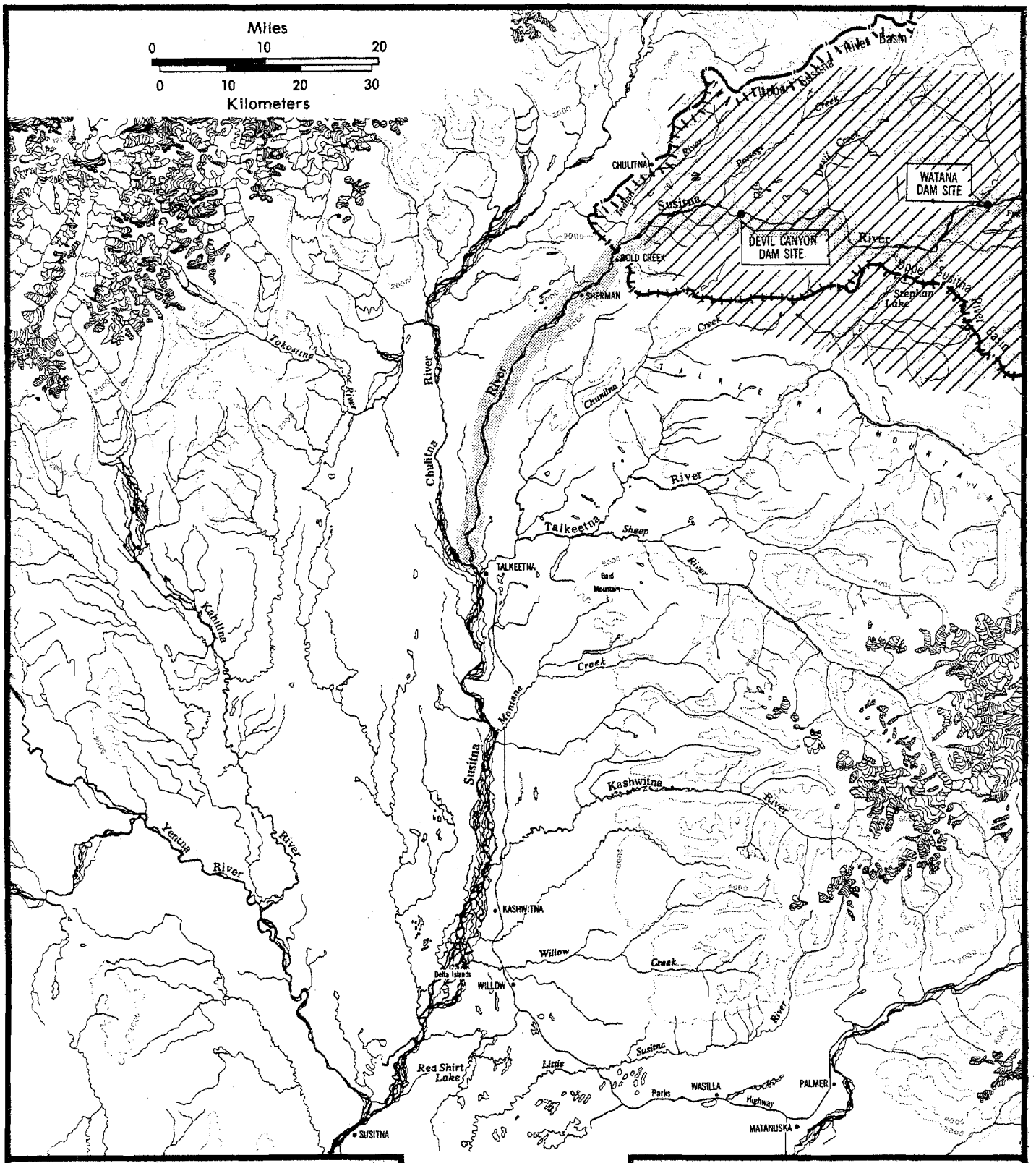

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Figure 16

Plant Ecology Study Areas Downstream

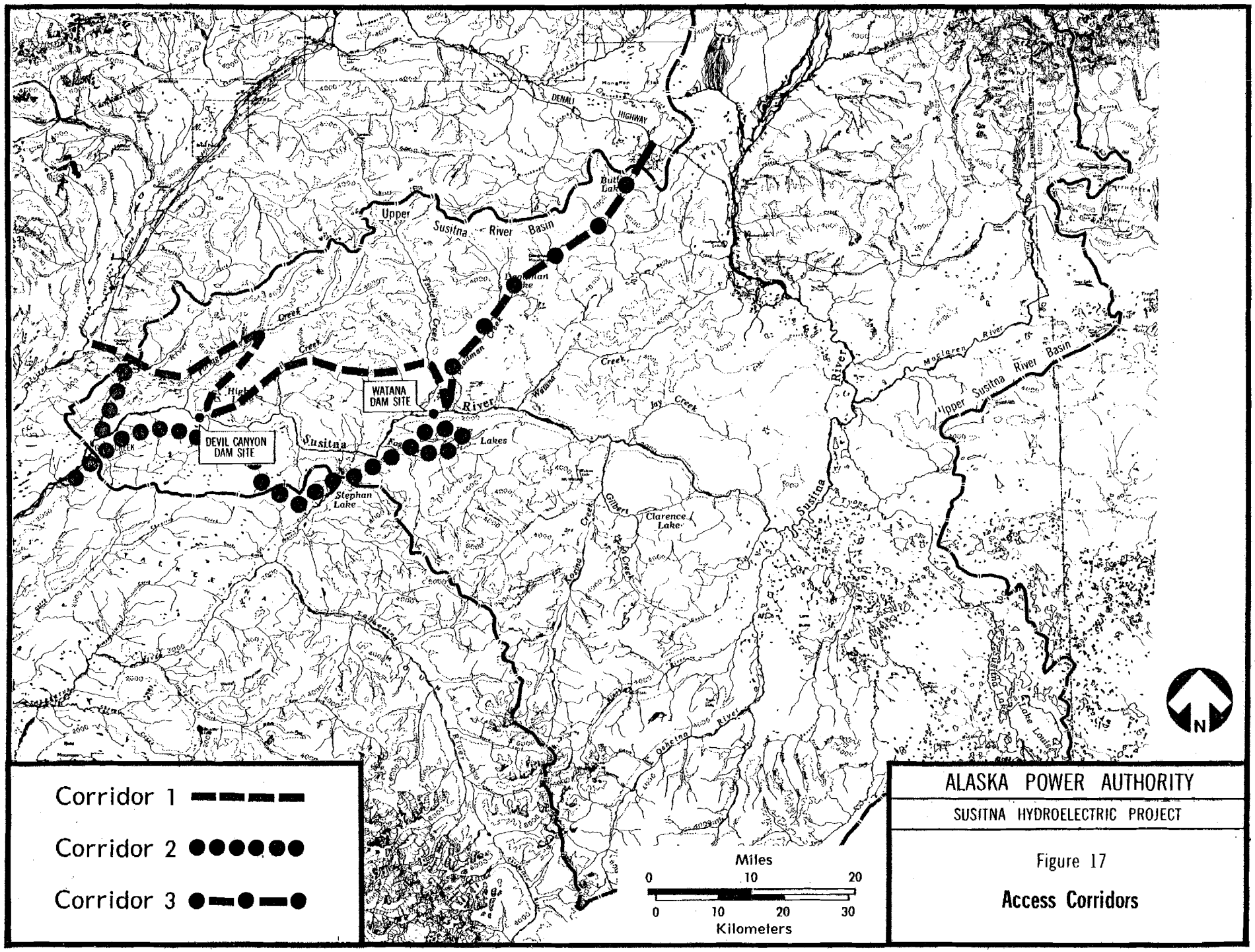

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Figure 17

Access Corridors

2.2 - Subtask 7.06: Cultural Resources Investigation

The cultural resources studies include these components: archeology, geology, and paleontology. The study areas for each of these components are indicated in Figure 2.

For 1980, the study area for archeological investigations is defined as those lands within approximately 3 km (2 miles) of the Susitna River from just below Devil Canyon to the mouth of the Tyone River. In addition, a corridor approximately 2 km (1.2 miles) wide from the Watana Camp north to the Denali Highway was studied.

The study area for geological studies, which support the cultural resource analysis, extends approximately 16 km (10 miles) on each side of the Susitna River, from the Portage Creek area to the mouth of the Maclaren River. When necessary, contiguous areas were examined.

The study area for paleontological studies is confined to the Watana Creek vicinity. This locale was selected because it was the only area identified within the entire Susitna basin that provided suitable deposits for the study of pre-Pleistocene paleontology.

2.3 - Subtask 7.07: Land Use Analysis

Three basic study areas (Zones 1, 2, and 3) were defined for the Land Use Analysis (Figure 3). These zones were designated according to geographic and land use relationships with the Susitna Hydroelectric Project and extend to varying widths from the river between Gold Creek and the mouth of the Tyone River.

Zone 1 was designated to include those structures and land uses which would be affected by inundation. Zone 2, extending about 10 km (6 miles) from the river, is based upon the locations of lakes which characterize aggregations of land use. Zone 3, which extends approximately 20 km (12 miles) beyond Zone 2, is characterized by fewer aggregations of land use; existing structures and land use are sparse.

2.4 - Subtask 7.08: Recreation Planning

The overall objective of this subtask is to develop a recreation plan for the Susitna Hydroelectric Project. A considerable number of scenic and potential recreation sites were considered during the first year's effort. These sites are indicated in Figure 4.

The 1980 study concentrates on the immediate project zone within 60 m (200 feet) of the shoreline of the proposed impoundments. Adjacent lands and areas along alternative access routes are also considered.

2.5 - Subtask 7.09: Susitna Transmission Corridor Assessment

The study areas involved in the Susitna Transmission Corridor Assessment are geographically separated from each other, because the intertie between Willow and Healy is not part of the Susitna Project. The three study areas are described as the northern, the central, and the southern (Figures 5-7). The northern study area encompasses transmission corridors from Healy to the Fairbanks/Ester area. Alternative corridors lie to the east as far as the Wood River and Fort Wainwright Military Reservation and on the west along the Nenana River and the Parks Highway. The central study area encompasses the corridors originating at the Devil Canyon and the Watana dam sites. These corridors generally run westward to the Gold Creek/Canyon area or northward to the Cantwell/Summit area. The southern study area encompasses the transmission corridors from Willow to the Anchorage area via Palmer or via more westerly corridors in the Red Shirt Lake and Lynx Lake areas.

2.6 - Subtask 7.10: Fish Ecology Studies

The area for the Fish Ecology Studies includes the entire Susitna River from its confluence with the Tyone River downstream to Cook Inlet. It includes areas (i.e., subreaches of the Susitna River mainstem, sloughs and side channels, tributary confluences, lakes and ponds) that are likely to be affected by post-project flows.

For Phase I work, the Susitna River has been divided into three segments: Cook Inlet to Talkeetna, Talkeetna to Devil Canyon, and Devil Canyon to the Tyone River.

In 1980, sampling was conducted by ADF&G at road accessible areas near following: Willow Creek, Caswell Creek, Rabideaux Creek, Montana Creek, Kashwitna River, the Rustic Wilderness Subdivision and the Parks Highway Bridge. Additional sampling in the Susitna River was done at roadside locations from Willow Creek to Talkeetna (Figure 8).

2.7 - Subtask 7.11: Wildlife Ecology Studies

The Wildlife Ecology Studies are divided into three major efforts: big game, furbearers, and birds and non-game mammals. The study areas vary in size for each effort.

2.7.1 - Big Game

The land areas studied by ADF&G for the big game program vary depending upon the species that are being radio-collared. The largest study area is for caribou. This study area consists of the entire range of the Nelchina herd, although monitoring is more frequent in the vicinity of the proposed impoundments. This area extends north of the Denali Highway to the foothills of the Alaska Range and south to the Glenn Highway, and from the foothills of the Talkeetna Mountains and the Parks Highway on the west to the Copper River Basin and the foothills of the Wrangell Mountains on the east.

Study areas for wolves and upstream moose populations are basically the same (Figure 9). The area is bordered on the north by the Denali Highway and extends south to the Little Nelchina River. The eastern boundary extends from the Maclaren River at the Denali Highway south to Tyone Lake and Lake Louise, then to the Glenn Highway. The western boundary is generally defined as northwest from the Little Nelchina River along the upper elevations of the Talkeetna Mountains to near the mouth of Portage Creek and then northeast to the Denali Highway.

Study areas for wolverines (Figure 9) and brown bears (Figure 10) are generally within this same area, although the boundaries differ in various places. Black bears (Figure 10) are being studied in two considerably smaller areas within the basin.

Moose are also being studied in a downstream area (Figure 11) from near Portage Creek to the Delta Islands. Moose were radio-collared along the river in this area; browse availability and utilization were measured and pellet group counts were made. An intensive study area for browse availability/utilization and pellet group transects was also investigated. This area consists of several islands near the mouth of Goose Creek and the north end of Sheep Creek Slough.

2.7.2 - Furbearers

The area for the furbearer studies includes the impoundment areas, the area within 12 km (7.5 miles) of the impoundments, and the downstream floodplain to the Delta Islands. The most intensive study is being performed upstream of Gold Creek (Figure 12). Downstream surveys of furbearer sign and habitat preference were made from 3 km (1.9 miles) above the confluence with the Indian River to 4 km (2.5 miles) below the confluence with the Kashwitna River (Figure 13).

2.7.3 - Birds and Non-game Mammals

The area for bird and small (non-game) mammal investigations extends from near Sherman up the Susitna River to the mouth of the Maclaren River and to approximately 15 km (10 miles) on either side of the river (Figure 14). Intensive study plots, mammal trapping sites, bird survey transects, and waterbodies surveyed for waterfowl are within this area.

2.8 - Subtask 7.12: Plant Ecology Studies

The study area for Plant Ecology during 1980 includes the upper Susitna River drainage and the floodplain of the Susitna River from Gold Creek to Talkeetna (Figures 15-16). Within this area, vegetation was mapped at several scales.

The entire upper Susitna River basin was mapped at a scale of 1:250,000. Vegetation within 16 km (10 miles) of the proposed impoundment areas was mapped at a scale of 1:63,360. The vegetation within 0.8 km (0.5 mile) of the proposed impoundments, the borrow sites, and the floodplain from Portage Creek to Talkeetna was mapped at a scale of 1:24,000. Sampling locations for vegetation were concentrated in the area of the 1:24,000 maps after reconnaissance level surveys in each major vegetation type.

2.9 - Subtask 7.14: Access Road Environmental Analysis

After initial screening of numerous alternative corridors for the access route, three corridors were chosen for environmental analysis (Figure 17). Corridor 1 is a road access route north of the Susitna River from the Parks Highway to Devil Canyon and Watana. Corridor 2 is access to Devil Canyon and Watana on the south side of the Susitna River, either by road from the Parks Highway or by rail from the Alaska Railroad. Corridor 3 is a road access route to Watana from the Denali Highway.

3 - SUBTASK SUMMARIES

As described in the Plan of Study, the various components of the environmental program are subtasks within Task 7 of the overall feasibility study for the Susitna Hydroelectric Project. Summaries of the 1980 activities and findings by TES and ADF&G in each of these subtasks follow, including a summary of TES involvement in Task 12, Public Participation. Complete results of the 1980 program in the major environmental disciplines may be found in the discipline-specific Annual Reports (Section 4).

3.1 - Subtask 7.01: Coordination of Environmental Studies

The objectives of this subtask are diverse and include planning and implementation of contractual matters, logistics, technical aspects of the program, reports, quality assurance, and agency consultation. During 1980, the administration and coordination of the environmental program required intensive effort by TES.

Contractual matters included ensuring conformance with the details of formal agreements between Acres and TES, as well as between TES and its subcontractors and consultants. Manpower and cost projections, and actual expenditures, were continuously provided to the prime contractor. All project equipment was inventoried in the prescribed manner. At the end of the year, the environmental program was on schedule and within its projected annual budget.

Complex logistics are involved in implementing the field program in this large and remote study area (Section 2). The TES Resident Manager at the Anchorage Project Office and the TES Field Representative at Watana Base Camp (see Subtask 7.02) worked closely with Acres and other team members to ensure that the logistical needs of the environmental team were met during 1980.

Logistics of a different scale are involved in scheduling the overall environmental program, and require the continuous exchange of current information among the various participants of the feasibility study. During 1980, TES met these needs with reports, written correspondence, meetings, and phone conversations. To identify the input required by TES and its subcontractors (from Acres, Acres' other subcontractors, and ADF&G), TES developed a Master List and Schedule of Information Needs, which covers the remainder of the Phase I period.

Technical coordination of the environmental studies involved providing direction concerning the Procedures Manuals, Semi-Annual Reports, and Annual Reports (Section 4). The Procedures Manuals were prepared as practical subtask-specific documents designed for (1) the exchange of program design details among TES subcontractors during the first field season, (2) TES control of adherence to the program by TES subcontractors, and (3) assurance of continuity in the event of changes in project personnel. Semi-annual Reports for the major disciplines were prepared by TES subcontractors solely as a means of exchanging information among disciplines. Annual Reports, which were not scheduled for completion during 1980, will serve as a means of information exchange during 1981, as well as a formal reporting of activities and findings of the various subtasks. Editorial review, as well as some technical review, was also performed under the Coordination Subtask. In addition, TES distributed such reports among the investigators in the various, related environmental disciplines.

Technical coordination also involves making modifications to the environmental program. Since the Plan of Study was issued in February, 1980, a number of refinements have been made. The most notable changes are as follows: additional emphasis on fish and wildlife mitigation planning, additional emphasis on areas downstream of the proposed dam sites, and acceleration of the recreation planning effort. An acceleration of the socioeconomic studies and a boater-use survey were proposed during 1980. Other refinements have been or may soon be made in response to findings of the first year's program, concerns of state agencies, and the possible implementation of revised FERC license application guidelines.

Coordination and consultation with state and federal agencies were among the activities of the 1980 program. A list of authorities contacted during the year is presented in Section 5. Many additional ADF&G personnel were contacted, in their capacity as feasibility study team members, concerning the fisheries and big game studies. Related activities included TES representation at various meetings with agency representatives, such as a field visit by and meetings with the Susitna Hydroelectric Project Steering Committee in July. Also during 1980, TES prepared and submitted to Acres written responses to agency concerns and comments, including the Steering Committee's review of the TES Procedures Manuals, comments by the U. S. Fish and Wildlife Service, and concerns raised during the July field visit.

3.2 - Subtask 7.02: Monitoring of Field Activities for Environmental Acceptability

A TES Field Representative was stationed at the Watana Base Camp full-time during the 1980 field season, and made field visits as needed during the remainder of the year. Although the role of this Field Representative was not one of an environmental inspector, she did observe field activities and make suggestions to lessen the environmental impact of the feasibility study. The TES Field Representative kept aware of proposed ground disturbance activities, and informed Project Archeologists so that such areas could be investigated for possible cultural resources in advance. Consideration was also given to environmentally sensitive areas such as denning sites and nesting locations. Through cooperation among the various groups, especially the helicopter pilots, these areas were for the most part avoided.

The majority of the Field Representative's time was spent assisting the environmental study groups by scheduling helicopters and getting provisions to the field tent camps. Assistance in data collection was occasionally provided. Wildlife observations, including those made by field personnel not involved in the environmental studies, were recorded and reported to the appropriate environmental study group. Numerous coordination, scheduling and information retrieval activities were also performed under this subtask throughout the year.

3.3 - Subtask 7.03: Evaluation of Alternatives

When a notice to stop work on Task 1 of the Susitna Hydroelectric Project was received from Acres, little effort had been invested in this task by Terrestrial Environmental Specialists, Inc. TES had begun to search the literature on hydroelectric alternatives and to develop logic diagrams for proposed approaches to each of the subtasks (1.03 and 1.05) in which TES was involved. The results of this effort were presented to Acres in a Termination Report filed in August 1980. Environmental evaluation of alternatives to Susitna is now being performed in a separate study by Battelle, and Acres has assumed responsibility for the environmental evaluation of Susitna alternatives.

During 1980, TES did provide some input to Acres in the evaluation of alternative development schemes, although the work was performed under other subtasks. Two pertinent reports were prepared by TES: (1) a preliminary environmental assessment of tunnel alternatives (December 1980), and (2) a report on environmental considerations of alternative hydroelectric development schemes for the upper Susitna basin (January 1981). TES also provided input concerning mitigation through design, primarily under the Fish Ecology Subtask (7.10).

3.4 - Subtask 7.04: Water Resources (Quality) Analysis

The water quality program is being performed for Acres American by R&M Consultants under Task 3. To ensure that parameters needed for fish ecology impact analysis would be measured, TES provided input into the design of the Task 3 program.

Water quality data collection was performed during the 1980 field season by R&M. These data are included in the Water Quality Data Collection Annual Report (Subtask 3.03) prepared by R&M. A list of project reports on the lower Susitna is also available. Both of these documents have been supplied to TES. All pertinent reports and available data are being analyzed in relation to fish ecology impacts by TES, and this procedure will continue as more information is made available.

3.5 - Subtask 7.05: Socioeconomic Analysis

The Socioeconomic Analysis is designed to identify social and economic factors that will be affected by the Susitna Hydroelectric Project and to determine the extent of change. Phase I entails four Work Packages: a literature review, development of a socioeconomic profile, preliminary socioeconomic impact studies, and a forecast of future socioeconomic conditions in the absence of a Susitna project.

Specific objectives for Phase I include the following: (1) review impacts resulting from energy-development projects and assess their applicability to the proposed hydroelectric project in the upper Susitna basin, (2) develop descriptors (categories of variables) for socioeconomic conditions and determine which variables are most likely to be influenced by development, (3) geographically delineate impact areas, (4) identify and describe important socioeconomic conditions in areas likely to be affected by development, (5) review forecasting models and assess their applicability to forecasting socioeconomic conditions in the impact areas, (6) adopt, modify, and/or develop a methodology for forecasting socioeconomic conditions and for conducting preliminary and final impact analyses, (7) conduct a preliminary socioeconomic impact analysis of hydroelectric development, including consideration of a one or two dam scheme, access routes, transmission facilities, and other areas, concerns and issues that may be appropriate, and (8) forecast socioeconomic conditions in the impact areas assuming there will be no hydroelectric development in the upper Susitna basin.

At the end of the first year, the first four Phase I objectives were accomplished. Work relating to the next three objectives was in process, and work relating to the last objective had not begun.

Results of the baseline study include a description of current socioeconomic conditions in geographic areas that could be affected. Information concerning places and communities in or near the Susitna basin is provided subject to the availability of secondary data.

Preliminary 1980 census figures indicate that Mat-Su Borough has a population of 17,938, and Valdez-Cordova 8,546. The Railbelt contains 285,011 people, 71% of the state population of 400,331. The 1980 state population is up 32% from the 1970 total of 302,361. Tables 1 and 2 contain additional details.

Housing in Mat-Su Borough is primarily single-family, year-round units. Of 5,844 such units, 5,546 are occupied, resulting in a vacancy rate of 5.1% (298 units); Valdez has a vacancy rate of 3.1% (31 units); Fairbanks has a vacancy rate of 9.1% (1,072 units); and Anchorage has a vacancy rate of 10.2% (5,769 units). In addition to year-round units, Mat-Su Borough has some 1,141 recreational units. Additional details are presented in Tables 3 and 4.

Government structure, taxation, and existing infrastructure (Table 5) vary by community in the Railbelt according to its classification, population, and other factors. Larger areas generally have more developed services and infrastructure, and therefore are able to support or accommodate significantly greater economic development activity.

Communities and other developed areas in the Railbelt (Table 5) generally have basic urban utilities, electricity, and telephone service. Fire, police, and health services vary according to the size of the population. Communities in the southern portion of Mat-Su Borough are served by various fire service districts; some have local police protection, although the Alaska State Police provides service to remote areas. Electric and telephone service usually are not available in isolated areas.

Mat-Su Borough operates seventeen elementary, junior, and senior high schools and a community college. Anchorage and Fairbanks are fully served by primary and secondary schools and the University of Alaska (Table 5).

TABLE 1

TOTAL RESIDENT POPULATION AND COMPONENTS OF CHANGE
BY STUDY AREA: 1970 - 1980

	Study Area 2		Study Area 3*	Study Area 4
	Matanuska-Susitna Borough	Valdez-Cordova		
1980 Preliminary Census	17,938	8,546	285,011	400,331
1970 Census	6,509	5,000	200,023	302,361
Net Change	+11,429	+3,546	+84,988	+97,970
Percent Change	+175	+71	+42	+32
Change in Military Pop	+141	+58	-4,730	-8,102
Natural Increase (Births & Deaths)	+1,430	+844	+45,107	+61,142
Implied net Civilian Migration	9,858	2,644	40,111	44,930

*Fairbanks, S.E. Fairbanks Mat-Su, Anchorage, Kenai Peninsula, and Valdez-Cordova Census Divisions

Source: Alaska Department of Labor, Administrative Services Division. January 1, 1981. Alaska's 1980 Population: A Preliminary Overview. Juneau, AK. p. 26.

TABLE 2

COMMUNITY POPULATION:
MATANUSKA-SUSITNA BOROUGH CENSUS DATA
1939, 1950, 1960, 1970, 1976, 1980

Community	1939	1950	1960	1970	1976	1980*
Talkeeta	136	106	76	182	328	265
Willow	- -	-	78	38	384	134
Wasilla	96	97	112	300	1566	1548
Palmer	150	890	1181	1140	1643	2143
Montana	-	-	39	33	76	40
Big Lake	-	-	74	36	721	412
Butte	-	-	559	448	2207	-
Chickaloon	11	-	43	22	62	20
Eska Sutton	14	54	215	89	496	-
Curry						2

COMMUNITY POPULATION:
OTHER COMMUNITIES NOT IN MATANUSKA-SUSITNA BOROUGH

Community	1950	1960	1970	1976	1980*
Nenana	242	286	382	493	471
Healy	-	-	79	503	333
Cantwell	-	85	62	-	95
Denali	-	-	-	-	3
Paxson	-	-	20	-	30
Glennallen	142	169	363	-	488
Copper Center	90	151	206	-	213
Gakona	50	33	88	-	85
Gulkana	65	51	53	-	111

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* Alaska Department of Labor, Administrative Services Division. January 1, 1981. Alaska 1980 Population: A Preliminary Overview. Juneau, AK; pp. 14-24.

Source: Matanuska-Susitna Borough Planning Department. April 1978. Phase I: Comprehensive Development Plan. Palmer, AK; p. 50.

TABLE 3

ESTIMATED HOUSING AND VACANCY RATES

AREA	TOTAL YEAR-ROUND HOUSING UNITS	OCCUPIED UNITS	VACANT UNITS	VACANCY RATES (%)
Anchorage[1]	56,823	51,054	5,769	10.2
Valdez[2]	979	948	31	3.1
Fairbanks[1]	11,809	10,737	1,072	9.1
Matanuska-Susitna[3]	5,844	5,546	298	5.1
Valdez-Chitina-Whittier	N/A	N/A	N/A	N/A

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1 Fairbanks North Star Borough, Community Research Center. Fall 1980. Community Research Quarterly, A Socioeconomic Review. Fairbanks, AK; p. 81

2 U.S. Environmental Protection Agency, Region 10. December 1979. Alaska Petrochemical Company, Refinery and Petrochemical Facility: Environmental Impact Statement; Appendix Vol. II. Valdez, AK; p. II-93.

3 Overall Economic Development Program, Inc. July 1980. Volume II: Economic Conditions, Development Options and Projections, Palmer, AK; pp. 76.

TABLE 4

HOUSING STOCK ESTIMATES BY AREAS OF MAT-SU BOROUGH

Areas	Total Year-Round Units n	Total Year-Round Units %	Estimated Recreational Units
1 Talkeetna, Montana Caswell	214	3.7	97
2 Willow	173	3.0	274
3 Houston	225	3.8	92
4 Big Lake	425	7.3	530
5 Goose Bay, Knik, MacKenzie	83	1.4	13
6 Wasilla	2,020	34.6	133
7 Sutton, Chickaloon Independence Mine	143	2.4	--
8 Palmer	1,502	25.7	2
9 Butte	519	8.9	--
10 Roadless Areas	540	9.2	Unknown
TOTAL	5,844	100.0%	1,141

Source: Overall Economic Development Program, Inc. July 1980. Volume II: Economic Conditions, Development Options and Projections; p. 76.

TABLE 5

COMMUNITY FACILITIES SUMMARY

	Schools																								Government				
	Elementary	Secondary	Higher	Water	Sewer	Solid Waste Disposal	State Trooper Post	Local Police	Court System	Fire Hall	Health Center	Long Term Care Fac.	Mental Health Facility	General Hospital	Roads	Railroad	Public Transportation	Airstrip	Library	Community Building	Post Office	Park System	Power	Telephone Service	Communication/Media	Home Rule	First Class	Second Class	Unincorporated	Unified Home Rule
Nenana	*	*		*	*	*	*			*	*				*	*		*		*	*	*	*	*	*		*			
Cantwell	*					*	*				*				*	*		*		*	*		*	*	*				*	
Talkeetna	*					*	*			*					*	*		*	*	*	*	*	*	*	*				*	
Willow	*					*									*	*		*	*	*	*		*	*	*				*	
Palmer	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*					
Wasilla	*	*	*			*				*	*		*		*	*		*	*	*	*	*	*	*	*				*	
Paxson						*									*			*					*	*	*				*	
Glennallen	*	*				*	*		*	*	*	*		*	*			*	*	*	*		*	*	*				*	
Copper Center	*		*			*				*	*				*			*		*	*		*	*	*				*	
Gakona						*									*			*		*	*		*	*	*				*	
Healy	*	*		*	*	*	*				*				*	*		*			*		*	*	*				*	
Gulkana				*	*	*					*				*					*			*	*	*				*	
Valdez	*	*		*	*	*	*	*	*	*	*	*	*	*	*			*	*	*	*	*	*	*	*	*					
Anchorage	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					*	
Fairbanks	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*					

Alaska relies heavily on air and marine transportation, owing to its small, dispersed population. The southcentral and interior regions have the most comprehensive transportation networks. Valdez is the State's largest port in terms of annual tonnage (60 million tons). Virtually all (99%) of this involves shipment of crude petroleum from the pipeline. The ports of Anchorage and Whittier handle some 2.2 million tons and 0.4 million tons, respectively. Paved roads in the Railbelt area include the following: the 127 mile Seward-Anchorage Highway which includes 38 miles of the 174 mile Sterling Highway between Seward and Homer, the 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 to its junction with the Alaska Highway at Delta Junction.

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.

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. Annual traffic volume varies between 1.8 and 2.3 million tons; coal and gravel account for 75% of this. It is estimated that the system is working at only 20% of its capacity. 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, airplanes provide the only access.

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 (Tables 6-8). Construction and transportation are also important. Smaller employers are the financing, mining, and manufacturing industries, while agriculture, forestry, and fisheries employ fewer still. Federal, state, and local governments are the largest employers and were responsible for $3.3 billion in wages in 1976. After government, the two groups having the largest employment are trade and services. Their importance as sources of employment for residents of the Railbelt area is a further manifestation of the region's two relatively concentrated population centers and of the high degree of economic diversity in the Railbelt, 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 due to the high level of expansion experienced by Anchorage and Fairbanks since 1968. This growth can partially be attributed to the trans-Alaska pipeline project, which encouraged new public and private construction.

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 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.

Mining, finance, insurance, and real estate play important roles in terms of the secondary employment they generate in the state. Most people employed in mining are engaged in petroleum extraction from fields in the North Slope, 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 in the form of jobs in state government and through revenue sharing with various local governments. The total value of oil

TABLE 6

STUDY AREA 3 ANNUAL NONAGRICULTURAL EMPLOYMENT BY SECTOR

	1970		1975		1979		PERCENT OF STATE 1970	1975	1979
	Total	%	Total	%	Total	%	%	%	%
TOTAL[1] - Nonagricultural Industries	62,690	100.0	113,818	100.0	113,204	100.0	67.8	70.4	68.0
Mining	1,610	2.6	2,243	2.0	2,822	2.5	53.7	59.2	48.9
Construction	5,264	8.4	16,359	14.4	8,257	7.3	76.3	63.6	81.8
Manufacturing	1,850	3.0	2,596	2.3	3,705	3.3	23.7	26.9	28.9
Transportation - Communication & Utilities	6,021	9.6	12,094	10.6	12,062	10.7	66.2	73.4	72.2
Wholesale Trade	12,111	19.3	5,366	4.7	5,083	4.5	79.2	90.8	92.2
Retail Trade			15,965	14.0	18,309	16.2		78.6	76.7
Finance-Insurance and Real Estate	2,520	4.0	4,696	4.1	6,139	5.4	81.3	77.9	76.4
Services	8,868	14.1	20,995	18.4	19,674	17.4	77.8	83.5	69.4
Federal Government	12,372	19.7	13,022	11.4	12,728	11.2	72.4	71.2	71.0
State and Local Government	11,585	18.5	17,799	15.6	21,130	18.7	62.6	60.9	57.7
Miscellaneous	52	.1	217	.2	712	.6	26	19.0	98.9

[1] Figures may not total correctly because of averaging and disclosure limitations on data.

Source: Alaska Department of Labor. Statistical Quarterly. Juneau, AK. (various issues)

TABLE 7

MATANUSKA-SUSITNA BOROUGH ANNUAL NONAGRICULTURAL EMPLOYMENT BY SECTOR

	1970 Total	1970 %	1975 Total	1975 %	1979 Total	1979 %	PERCENT OF STUDY AREA 3 1970 %	1975 %	1979 %
TOTAL[1] - Nonagricultural Industries	1,145	100.0	2,020	100.0	3,078	100.0	1.8	1.8	2.7
Mining	*	-	*	-	11	.3	*	*	.0
Construction	120	10.5	188	9.3	184	6.0	2.3	1.1	2.2
Manufacturing	*	-	30	1.5	40	1.3	*	1.2	1.1
Transportation - Communication & Utilities	114	9.6	218	10.8	316	10.2	1.9	1.8	2.6
Wholesale Trade	174	15.2	44	2.2	49	1.6	1.4	.8	1.0
Retail Trade			271	13.4	696	22.6		1.7	3.8
Finance-Insurance and Real Estate	22	1.9	62	3.1	129	4.2	.8	1.3	2.1
Services	179	15.6	288	14.3	447	14.5	2.0	1.4	2.3
Federal Government	106	9.3	124	6.1	97	3.1	.9	1.0	.8
State and Local Government	376	32.8	758	37.5	1,101	35.8	3.2	4.3	5.2
Miscellaneous	*	-	*	-	21	.7	*	*	1.8

* Data unavailable due to disclosure policy.

[1] Figures may not total correctly because of averaging and disclosure limitations on data.

Source: Alaska Department of Labor. Statistical Quarterly. Juneau, AK. (various issues)

TABLE 8

VALDEZ-CHITINA-WHITTIER ANNUAL NONAGRICULTURAL EMPLOYMENT BY SECTOR

	1970		1975		1979		PERCENT OF STUDY AREA 3		
	Total	%	Total	%	Total	%	1970 %	1975 %	1979 %
TOTAL[1] - Nonagricultural Industries	831	100.0	4,763	100.0	2,180	100.0	1.3	4.2	1.9
Mining	*	-	*	-	*	-	*	*	*
Construction	21	2.5	2,518	52.9	86	3.9	.4	15.4	1.0
Manufacturing	*	-	14	.3	19	.9	*	.5	.5
Transportation - Communication & Utilities	61	7.3	389	8.2	472	21.7	1.0	3.2	3.9
Wholesale Trade	95	11.4	62	1.3	18	.8	.8	1.2	.4
Retail Trade			321	6.7	181	8.3		2.0	1.0
Finance-Insurance and Real Estate	*	-	73	1.5	70	3.2	*	1.6	1.1
Services	99	11.9	709	14.9	445	20.4	1.1	3.8	2.3
Federal Government	63	7.6	58	1.2	46	2.1	.5	.4	.4
State and Local Government	464	55.8	613	12.9	840	38.5	4.0	3.4	4.0
Miscellaneous	0	0.0	*	-	*	-	0.0	*	*

* Data unavailable due to disclosure policy.

[1] Figures may not total correctly because of averaging and disclosure limitations on data.

Source: Alaska Department of Labor. Statistical Quarterly. Juneau, AK. (various issues)

production revenues for the State is estimated to be $3.3 billion in 1981, 90% of total unrestricted State revenues. The total value of crude petroleum in 1979 was $5.5 billion; other mineral values (natural gas, sand and gravel, gold, and others) totaled $259 million.

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 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 domestic commercial fish and shellfish for Alaska in 1979 was over $1.2 billion, including a catch of 459 million pounds of salmon with a wholesale value of $704 million.

The Alaskan forest products industry centers on the resources of two national forests, the Chugach in southcentral Alaska and the Tongass in southeastern Alaska. These two forests are the largest in the United States and account for roughly 93% of the annual Alaskan timber harvest. The industry is concentrated in the Southeast, and the principal products of the industry are pulp, cant lumber, and round logs. Over 50% of Alaska's forest products are exported to foreign countries, principally Japan. Most of the remainder is shipped to the Lower Forty-Eight. The transfer of lands to native corporations is expected to increase the availability of timber resources, especially round logs. In general, the industry is cyclical depending upon housing construction patterns in the United States and abroad.

The tourist industry plays an increasingly important role in the economy of the region. The numbers of Alaskan visitors have increased from about 130,000 in 1971 to approximately 505,000 in 1977. Visitors spent approximately $374 million in 1977.

The results of the baseline study (the socioeconomic profile) will be utilized in the development of the forecast. During 1980, all relevant forecasting models used by Alaskan institutions, and other potentially relevant models and studies, were identified and information concerning them was collected. Next, evaluation criteria were developed and applied to each relevant model or study in order to compare them. It was concluded that the primary approach to forecasting would be causal (i.e., the level of one variable, the "causal variable," determines the level of another variable, the "forecasted variable"). It was further determined that time series or trend analysis and qualitative (judgemental) analysis would serve as supporting approaches, where appropriate.

Two types of causal models remained under consideration at the close of 1980. These were economic base and econometric models. Several methodological structures for an economic base model are being developed. The advantages and disadvantages of each alternative structure will be weighed against those of the existing, or of a modified, Man in the Arctic Program (econometric) model.

The conclusions of the preliminary impact analysis and assessment of alternative access routes are that socioeconomic impacts will vary both in magnitude and area of concentration depending upon which access route or combination of access routes is selected, and whether a road or railroad is used. With the socioeconomic assessment of access schemes, there is more concern with the origin and type of access than with the actual route, because these will affect communities throughout the southcentral part of the state.

With a road from the Parks Highway to the dam site(s), effects generally would be concentrated on the western side of the project area. An easily accessible road corridor would provide for transport of construction materials, equipment and labor as well as post-construction uses of the upper Susitna basin (such as recreation).

The impacts of a railroad from the same side would likewise be concentrated on the western side. However, in every socioeconomic category, impacts would be the same or less than with the road. The single exception would be in rail industry activities, which would experience major changes.

With a road constructed from the Denali Highway to the dam site(s), impacts along the Parks Highway-Alaska Railroad corridor would depend upon whether materials were to be shipped by road or rail to Cantwell before being transported along the Denali Highway to the access road.

Mitigation planning should include the selection of the route and mode of access that will avoid or minimize potentially adverse socioeconomic impacts. The location and relative magnitude of impacts in almost every socioeconomic impact category will vary considerably depending upon which mode and origin are chosen for access.

Mitigation planning should also consider minimizing irreversible impacts on socioeconomic resources. Existing and potential mining claims and recreational activities should enter into the dam(s) siting and design decision processes.

3.6 - 7.06: Cultural Resources Investigation

The University of Alaska Museum developed a five step program to assist the APA, Acres American, and TES in complying with federal and state law and regulations concerning protection of cultural and paleontological resources. The five steps aim toward the following: (1) locating and documenting archeological, historical, and

paleontological resources in the study area (reconnaissance level survey), (2) intensively testing and evaluating these resources to determine their significance, and (3) proposing mitigation measures to avoid or lessen the adverse impact which may result from the proposed project.

The methods and defined study area (Figure 2) varied for each aspect of the study, i.e., archeology, geology, and paleontology. In preparation for field studies, all necessary permits were obtained, literature pertaining to the archeology, ethnology, history, geology, paleoecology, paleontology, flora and fauna in and near the study area was reviewed, and available aerial photographs were examined. A tentative cultural chronology for the study area was developed and types of archeological site locales for each cultural period within geochronologic units were defined.

Geological analysis performed under this subtask generated data which were used in selecting archeological survey locales. Data concerning surficial geological deposits and events of the last glaciation were compiled and provided limiting dates for the earliest possible human occupation of the upper Susitna River basin. This information was collected by literature review and field studies. All the assembled background data, coupled with paleoecological information, were used to select the sixty locales which were surveyed in 1980.

A review of the paleontological literature and aerial reconnaissance of the upper Susitna River basin delineated an area suitable for paleontological investigations. Paleontological studies were conducted (1) to develop baseline paleontological data within the study area, and (2) to assess the significance of these deposits and develop appropriate mitigation measures for these resources.

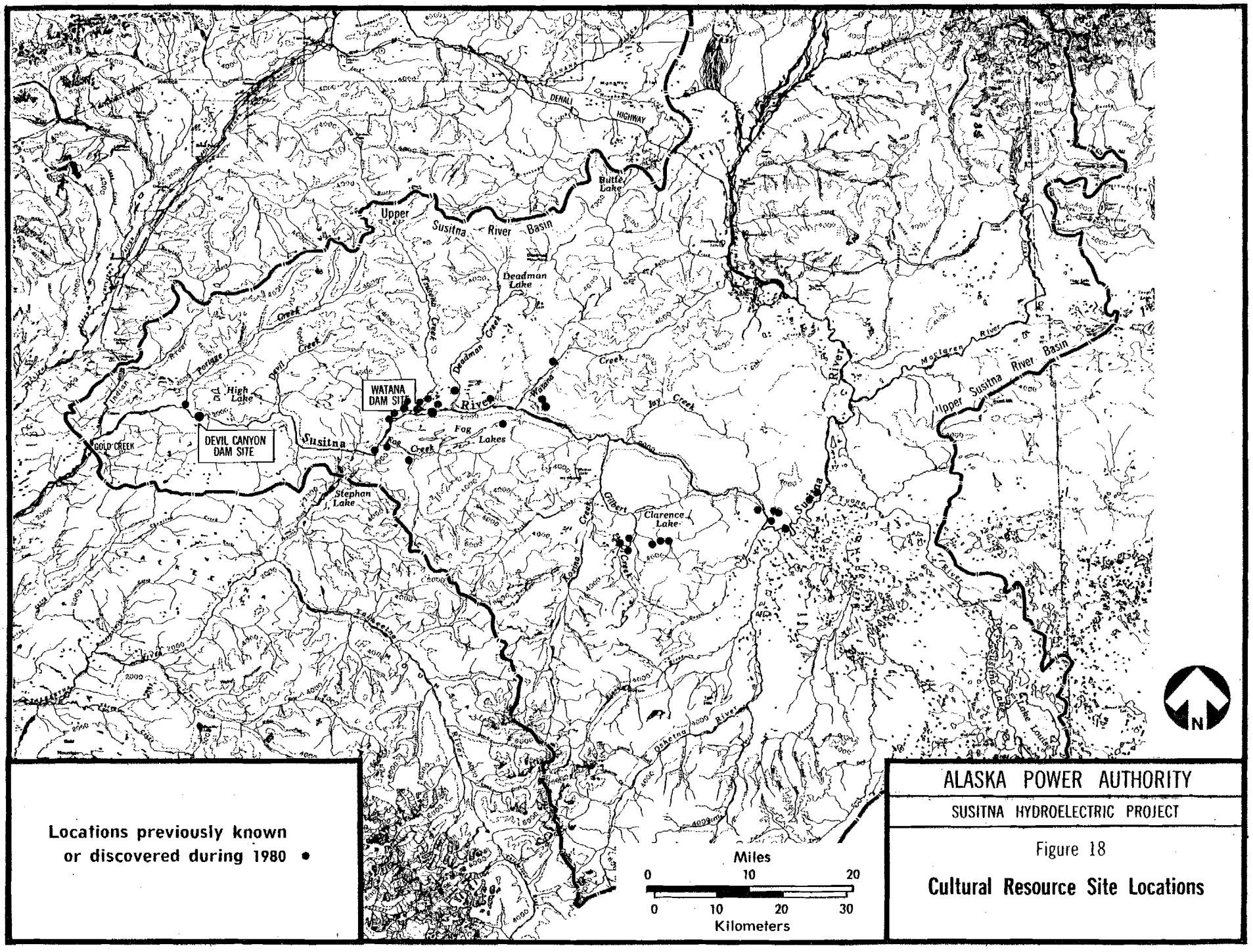
The archeological reconnaissance implemented surface and subsurface testing within each of the selected survey locales in an effort to locate historic and archeological sites. Data were consistently and systematically recorded on Site Survey forms for each site and survey locale.

The 1980 archeological reconnaissance located and documented one historic and thirty-three prehistoric sites. An additional four sites were discovered during a brief survey of one alternative access route (Corridor 3, Figure 17) north of Watana base camp. The thirty-seven archeological sites found during the 1980 field season and four sites previously known (from studies sponsored by the Corps of Engineers) total forty-one archeological sites now known within the study area. Site locations are shown on Figure 18; each dot may represent several sites because of their proximity. It is expected that continued survey in 1981 will locate additional sites. Sites adjacent to the study area (and not shown on Figure 18) are known to occur near Stephan Lake, Fog Lakes, Lakes Susitna, Tyone and Louise, and along the Tyone River.

A large proboscidean femur, probably the bone of a mammoth, was found in situ in a bluff exposure at the mouth of the Tyone River. This documented find, dated at 29,450 $\pm$ 610 ^{14}C yr. B.P., extends the range for Pleistocene fauna and possibly steppe-tundra conditions southward at least 150 km (93 miles).

For each archeological site which was located, regional maps, site maps, soil profiles, photographs, and other data were recorded. All specimens collected were accessioned by the University of Alaska Museum. Sites were given both University of Alaska Museum accession numbers and Alaska Heritage Resources Survey numbers. In addition, sites where surface disturbing activities were to occur (e.g., seismic trenches, bore holes, and borrow areas) were surveyed to determine if any cultural material was present. Clearance was given to conduct geotechnical activities if no cultural material was found.

Impact on cultural resources will vary in relation to the type of activities that occur on or near them. Based on the Devil Canyon and Watana dam proposal, most of the sites known to date within the study area will likely receive direct or indirect impact during construction and subsequent use and operation of the facility. The impact of transmission facilities, recreational activities, and upriver and downriver changes in hydrology and land access and use cannot be assessed at this time.



Locations previously known or discovered during 1980 •

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Figure 18

Cultural Resource Site Locations

Intensive testing, scheduled for 1981, is designed to collect the data necessary to evaluate the significance or the cultural resources discovered during 1980. Following intensive testing and completion of ancillary studies, the effect of the Susitna Hydroelectric Project on individual sites can be determined and the appropriate mitigation measures recommended. Mitigation measures cannot be suggested until the extent and significance of the sites are known. It is recommended that non-archeological personnel and preconstruction activities avoid documented sites until investigations are complete.

3.7 - Subtask 7.07: Land Use Analysis

The Land Use Analysis involves an assessment of the direct land use effects of the proposed Susitna Hydroelectric Project. The analysis is designed to evaluate changes in land use which would occur with and without the proposed project, including the effects of the proposed dam(s) and reservoir(s), access transportation system, and transmission line corridors. The objectives of the Land Use Analysis are to describe past, present, and future land use trends, identify the potential major changes in land use that would result with the development of the project, and evaluate these changes.

The methodology for the Land Use Analysis is comprised essentially of assessing historic, existing, and future land use. The first year has dealt only with recent historic and present land use. Specific steps include a literature review, aerial photography and map reconnaissance, interviews of area residents and agency personnel, field reconnaissance, and reconstruction of history.

Existing land use in the Susitna Project area is characterized by broad expanses of open, wilderness area. Those areas where developments have occurred typically include small clusters of cabins. There are also many single cabins scattered throughout the basin.

Most of the existing structures are related to the historical development of the area which initially involved hunting, mining and trapping, and then guiding activities associated with hunting and, to a lesser extent, fishing. Today there are a few lodges mostly used by hunters and other recreationists. Many lakes in the area also include small clusters of private year-round or recreational cabins.

There are approximately 109 structures within 30 km (18 miles) of the Susitna River between Gold Creek and the Tyone River. These include four lodges involving some 21 structures. Significant concentrations of residences, cabins, or other structures are found near the Otter Lakes area, Portage Creek, High Lake, Gold Creek, Chunilna Creek, Stephan Lake, Clarence Lake, and Big Lake.

Perhaps the most significant use activity for the past forty years has been the study of the Susitna River for potential hydroelectric development. Hunting, boating, and other forms of recreation are also important uses. There are numerous trails throughout the basin used by dog sled, snowmobile, and all-terrain vehicles (ATVs). Air access is significant; the many lakes provide landing areas for planes on floats.

There has been little land management activity for the area. However, federal and state agencies, native corporations, and the private sector have been involved heavily in the selection and transfer of land ownership under the Alaska Statehood Act and the Alaska Native Claims Settlement Act. Most of the lands in the project area and on the south side of the river have been selected by the native corporations. Lands to the north are generally federal, and are managed by the Bureau of Land Management.

Impacts associated with the proposed dam(s) and reservoir(s) include the inundation of four cabins and structures in the Devil Canyon area. Travel patterns of the few trappers in the upper portion of the proposed Devil Canyon inundation area will also be affected. A major impact will be the elimination of Devil Canyon itself, a significant scenic resource. The Watana reservoir would inundate an area with seven cabins or other structures. The Watana reservoir also would affect travel patterns of trappers, but to a greater extent than the Devil Canyon reservoir as this area contains more of the secondary drainages utilized for trapping activity.

Impact assessment during the first year concerning land use analysis of access alternatives is summarized below. A road from the west to the dam site(s) on the north side of the Susitna (Corridor 1, Figure 17) would create increased traffic and activity affecting the Parks Highway and communities situated on it. It is likely that commercial and residential uses would be affected with corresponding effects on land values. Some twenty-four cabins and other residential structures along this corridor would be affected, in addition to two lodges involving ten structures.

A road from the west, located on the south side of the river (Corridor 2), would create impacts similar to those of Corridor 1 on the Parks Highway and the communities there. Residential and commercial use and land values would be affected. Ten buildings associated with Stephan Lake Lodge and seventeen other cabins and residences would be affected.

With a rail route from the west (Corridor 2), there would be some increase in activity in communities near the Alaska Railroad, but probably less than with a road corridor. Rail would tend to restrict public access to land more than a road would. However, as a rail-head, the general area of the communities of Sherman, Gold Creek, and Canyon might be affected in terms of residential and commercial uses. The same impacts on structures as with a road corridor would occur.

A road constructed from the Denali Highway to the dam site(s) (Corridor 3) would affect the fewest number of structures (four) and one small lodge. Impacts along the Parks Highway-Alaska Railroad corridor would depend upon whether materials were shipped by road or rail to Cantwell before being transported along the Denali Highway to the access road. Because of the openness of the land traversed by this corridor, ATV use and associated impacts could be expected to increase considerably.

The most significant aspect of the analysis of access route schemes relates not so much to various impacts associated with a given individual scheme, but to the concept of access itself, in any form, to the interior of the Susitna basin. The provision of a means by which the general public can easily and frequently venture inland to an essentially pristine wilderness area potentially will induce profound alterations

in the character of the Susitna area, affecting both small concentrations and isolated residences, peripheral commercial and transportation systems, resource utilization and the level of recreational activity, visual and aesthetic factors, and the overall natural character of the area. In addition, these effects will have ramifications concerning the extent, adequacy, and need for management activity (e.g., fish and game, land, etc.), and concerning changes in land values and development.

3.8 - Subtask 7.08: Recreation Planning

The Recreation Planning effort involves the preparation of a Recreation Plan for the proposed Susitna Hydroelectric Project. Subtask 7.08 was modified during 1980 to incorporate the objective of Subtask 10.06 (to prepare Exhibit R of the FERC license application), as described in the Plan of Study. Assessment of the effects of the hydroelectric project on existing recreational use of the Susitna basin is being performed under Subtasks 7.05 and 7.07 (Socioeconomic Analysis and Land Use Analysis).

The Recreation Planning effort focuses on the immediate reservoir area(s) and any additional lands recommended for acquisition for recreational purposes. The objective of this effort is to develop a plan for an optimal mix of public recreational opportunities. As such, the planning process will do the following: (1) result in a variety of activities and level of development desired by the public, (2) analyze the environmental setting and recommend developments consistent with the environmental limitations of the area, (3) balance the development of facilities with the capacity of natural resources to sustain the resultant use, (4) incorporate unique natural features into the plan, (5) result in a plan consistent with the planning guidelines and objectives of the agency ultimately responsible for managing the public use of recreational lands and waters, and (6) maximize compatibility of the plan with the total hydroelectric operation.

The methods for recreation planning include the following: (1) a literature review of recreation data, (2) a summary of resource data, (3) an assessment of recreation resource potential, including field data collection and site analysis, (4) the identification of potential management structure, (5) the development of initial concept plans, (6) a concept plan survey, (7) the selection of the best concept plan, (8) a public participation survey, (9) detailed site feasibility studies, (10) agency and public review, and (11) the development of the final plan.

During 1980, the first six steps were completed. Field work included analysis of project lands for potential as recreation sites. Seventy-eight sites currently are under consideration.

Also during the first year, several preliminary plan sketches were developed. These were narrowed to five concept plans incorporating the various possible recreation sites. The plans provide a range of facilities and recreational opportunities, from minimal, wilderness development and primitive facilities to a full spectrum of highly developed facilities. These plans are briefly summarized below.

Approach "A" - A Minimally Developed and Managed Wilderness

This approach could be used in the event that public access by road to the Susitna reservoir areas were restricted or not permitted at all. In this case, development would probably be limited to a visitor information center on the Parks Highway. Access by float plane would likely be extended to include the reservoirs. Access by canoe, kayak, and river boat via the upper Susitna, Maclaren, and Tyone Rivers would continue. Land use surrounding the project area would probably be much the same as at present with management limited to fish and game and the regulation of mining activities.

Approach "B" - Managed Wilderness with Limited Access

In the event that road access to both reservoirs were possible, the area could be managed as a wilderness recreation area, with development limited to minimal interpretive services, primitive campgrounds, and simple boat ramps at both dam sites. These ramps would facilitate

access by boat to the reservoir shorelines and adjacent areas for camping, hunting, fishing, and other backcountry activities. As in Approach "A", a visitor center would be built on the Parks Highway. Information would be provided on the Denali Highway should access be available at this location. A tour boat service would be offered at the Devil Canyon dam site for day tours of the reservoir.

Approach "C" - Watana Reservoir Development

One possible approach to more extensive recreational development is to offer highly developed facilities at the Watana dam site and only minimal interpretive services at the Devil Canyon dam site. In addition to the services offered at both reservoirs in Approach "B", there would be greater development at the Watana dam site to accommodate increased visitor use. Simple backcountry camp sites would be provided at selected locations around the Watana reservoir; additional improvements would be made at the mouth of Jay Creek. More intensive resource management would be necessary around the Watana reservoir, but the remaining project area would still be managed as wilderness. As in Approaches "A" and "B", visitor information would be available at the highway entrance(s).

Approach "D" - Devil Canyon Reservoir Development

In this approach highly developed facilities would be offered at the Devil Canyon reservoir and dam site and only minimal facilities at the Watana dam site. The Devil Canyon area would be developed and managed intensively to provide a diversity of recreational opportunities, while the Watana reservoir area could be developed and managed in a manner that would maintain its wilderness character.

Approach "E" - Development and Management Throughout

This approach involves a high level of recreational development and offers a wide variety of recreation activities around both reservoirs. Complete visitor facilities would be located at the dam sites, with additional improvements made at the Jay Creek site, and backcountry boat-in camp sites built at five locations. Intensive resource management would be necessary throughout much of the recreation area to reduce conflicts between uses and to maintain the quality of the environment.

To solicit public reaction to Approaches "A" through "E" a concept plan survey was developed and distributed to 2250 randomly selected persons in Anchorage, Fairbanks, and the Railbelt area. Results of this survey, input from a public workshop in March, 1981, and identification of an access scheme by the Alaska Power Authority will be used in developing and selecting the best concept plan during 1981.

3.9 - Subtask 7.09: Susitna Transmission Corridor Assessment

The objectives of the Transmission Corridor Assessment performed to date are as follows: (1) to begin a literature search, (2) to review existing Susitna transmission studies, (3) to compare proposed transmission line corridors from an environmental standpoint, and (4) to make a preliminary identification of those corridors that warrant further consideration as viable routes.

The literature search was initiated. Information was gathered from several libraries, institutions, and authorities. This is an on-going effort.

Existing Susitna transmission studies were reviewed. These include the 1979 IECO/Retherford draft report for the Alaska Power Authority, the 1975 Corps of Engineers' Interim Feasibility Report, and other associated reports. A critical review of the Corps' report ("Critique of the Corps of Engineers' Assessment for Transmission Systems") was prepared by TES in February, 1981. It concluded that for a preliminary feasibility study the Corps' method of environmental inventory was quite complete but that their impact assessment could be found inadequate because the analysis was unquantified. The critique concurred with the transmission corridors preferred by the Corps.

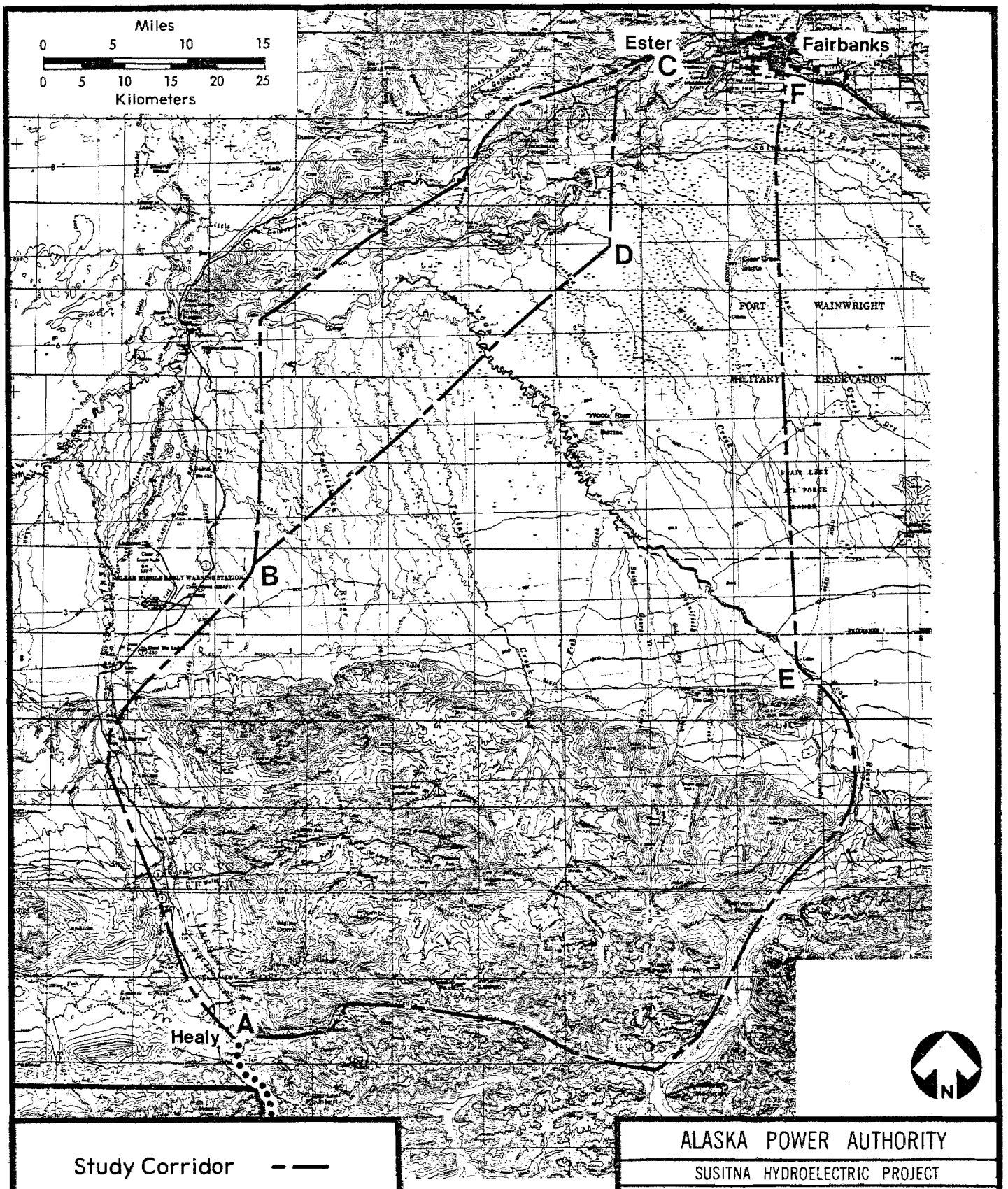
Locations of transmission corridors under consideration for the present Susitna study were obtained from Acres in November, 1980. Because another consultant to APA would be doing the feasibility analysis for an intertie between Willow and Healy, the effort of the Susitna Transmission Corridor Assessment was limited to investigations of

alternatives in three study areas: Healy to Fairbanks, dam sites to the Intertie, and Willow to Anchorage/Pt. MacKenzie. Habitat information was gathered and an aerial reconnaissance was made of corridors in these three areas.

In February, 1981, additional corridor alternatives in the three areas were received from Acres; these were to be included in the environmental evaluation. The locations of the alternative corridors are shown in Figures 5-7. The evaluation efforts culminated in the preparation of the TES report "Preliminary Environmental Screening of Alternative Transmission Corridors" in March, 1981.

Evaluation of the alternative corridors began with the development of an environmental inventory for segments of each corridor. The following parameters were included in the inventory: approximate length, approximate number of road and river/creek crossings, topography, soils, land ownership status, existing or proposed developments, existing rights-of-way, scenic quality and recreation, cultural resources, vegetation, fish resources, birds, furbearers, and big game. Environmental constraints were then identified for each corridor. These constraints included the following: length, topography and soils, land use, aesthetics, cultural resources, vegetation, fish resources, and wildlife resources. Each corridor was given an environmental rating to indicate whether it warranted, probably did not warrant, or did not warrant further consideration as a viable route. This was a subjective rating and indicated the relative worth of each corridor from an environmental standpoint.

One corridor each in the northern and southern study areas (ABC and ADC, respectively) and one corridor (encompassing corridor segments ABCD, ABCF, ACD, and ACF) in the central study area warrant further consideration (Figures 19-21). (Also shown on Figures 19-21 are those corridors rated as probably not warranting further consideration.)



Study Corridor ——

Intertie (Hypothetical) •••••

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Figure 19

Transmission Corridors Surviving Preliminary Screening Northern Study Area

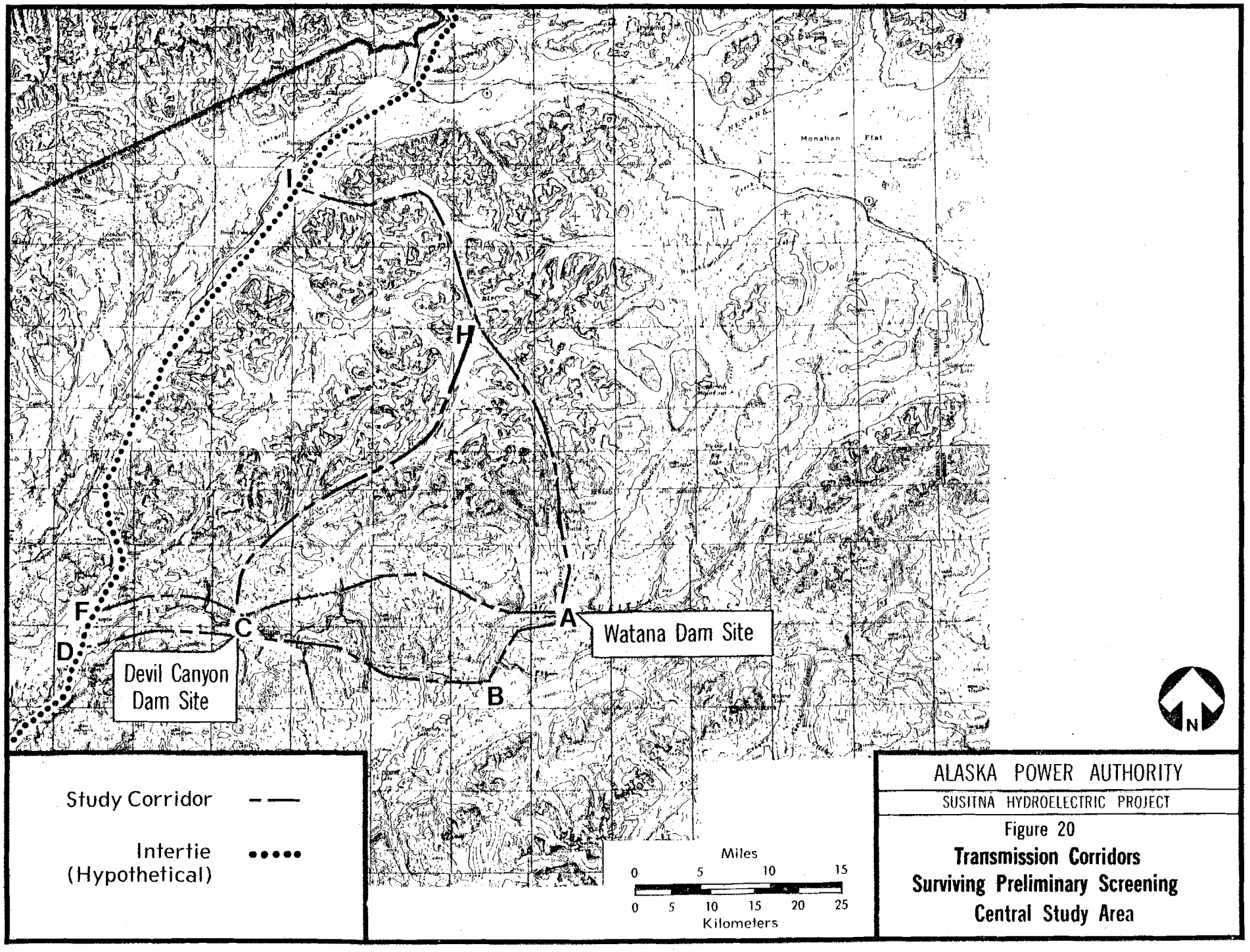

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Figure 20

Transmission Corridors Surviving Preliminary Screening Central Study Area

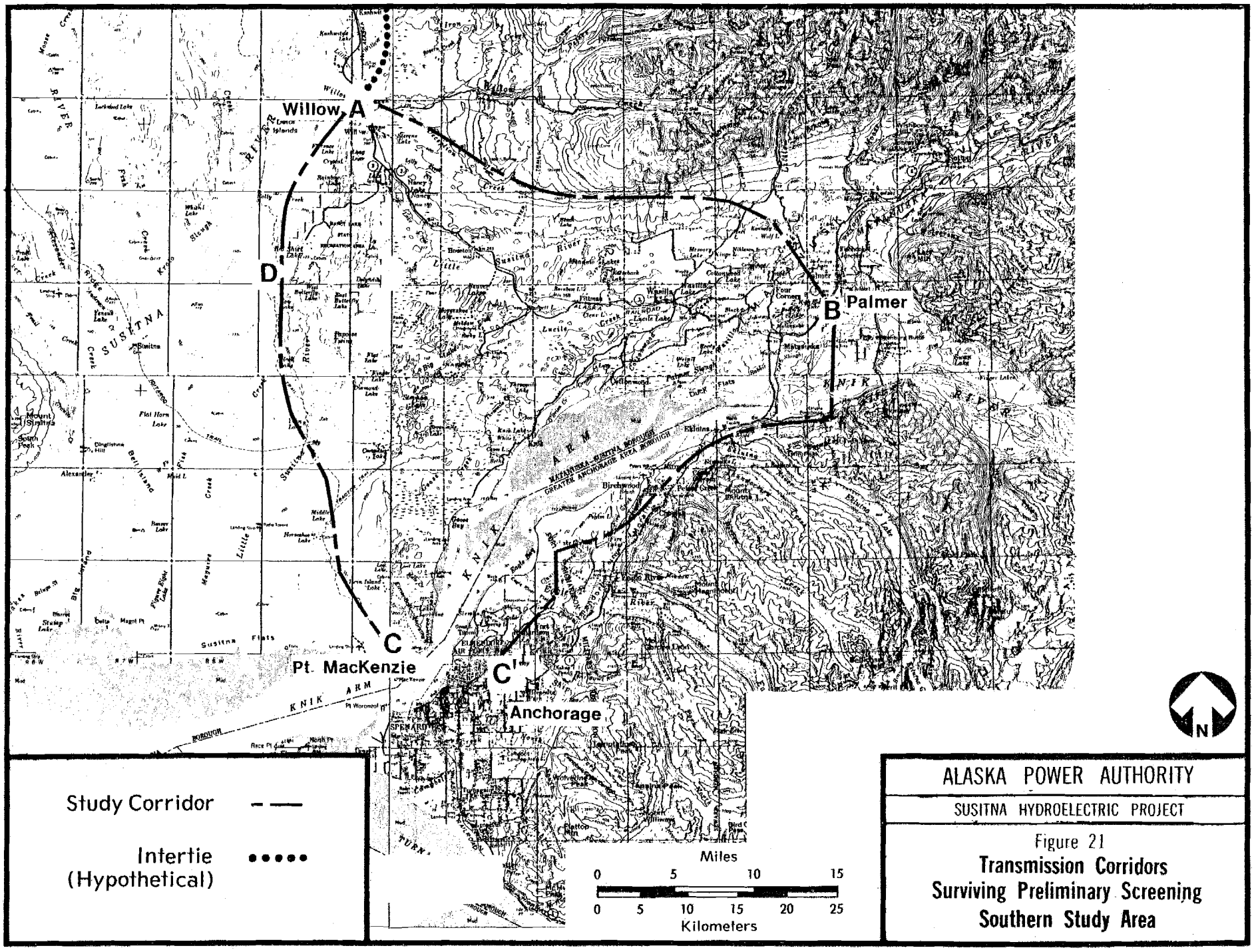

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Figure 21

Transmission Corridors Surviving Preliminary Screening Southern Study Area

Recommendations were made for use of construction techniques which would mitigate potential impacts. These included winter construction in wetlands, helicopter-based construction in areas that are remote or too wet for summer access, use of techniques that allow for minimum clearing of vegetation, and use of aesthetically designed towers.

3.10 - Subtask 7.10 - Fish Ecology Studies

The following are the specific objectives of TES with respect to fish ecology in the first year of the program: (1) identify areas of potential impact and the information necessary to assess these impacts, (2) locate available information applicable to the Susitna River and the Susitna Hydroelectric Project, (3) identify information deficiencies, and (4) aid in the selection of a project development scheme. In addition, assistance has been given (under Subtask 7.04) in the development of hydrology and water quality sampling programs that will be beneficial in ascertaining possible impacts upon the fishery resource and aid in mitigating these impacts.

ADF&G baseline fisheries studies commenced in late 1980. TES has assisted in the preparation of the ADF&G Procedures Manual. Data from the field studies will not be available until the completion of ADF&G's first 1981 Quarterly Report.

TES is collecting pertinent literature on impact assessment and mitigation measures applicable to the Susitna Hydroelectric Project. The compilation of fundamental life history and ecology information on selected anadromous and resident fishes has also been assumed by TES to supplement the fishery field program results. This information is being obtained by contacting individuals with expertise in specific facets of fish ecology, searching personal libraries and files, gathering information from university and federal agency libraries, reviewing indexes of appropriate foreign publications, examining "in-house" programs for research and progress reports of appropriate federal and state agencies, as well as universities, and reviewing reports from the management agents of the Alaska Department of Fish and Game for the Susitna-Cook Inlet area and adjacent waters.

As a guide to compliance with FERC's criteria for license application, potential impact issues (Table 9) and the kinds of engineering, hydrological and biological information required have been compiled. This information is to be supplied to TES from Acres, R&M Consultants and ADF&G.

Acres has been provided with, by request and for use in their design considerations, information and recommendations concerning downstream flow, total dissolved gas pressure, and temperature of the discharge water. Reregulation of downstream flow from daily peaking operations has been recommended as an essential part of any development plan.

Potential program modifications and the concerns of federal, state, and local agencies in regard to the fish ecology studies have been addressed by TES. Recommendations have been submitted to Acres American.

3.11 - Subtask 7.11: Wildlife Ecology Studies

The baseline ecology of big game is being studied by ADF&G. Much of the following summary concerning big game is taken from draft sections of the ADF&G 1980 Annual Report. Impact assessment and mitigation planning for big game is the responsibility of TES and its consultants, as are the studies of furbearers, birds, and non-game mammals.

3.11.1 - Big Game

Biometrics and Data Processing

Field investigations of big game are being facilitated by the use of radio-collars. The study involves (1) repeated habitat descriptions of habitats and repeated physical locations of big game, and (2) a body of data requiring initial standardization and periodic computer-aided analysis. Technical and conceptual problems associated with these requirements have been outlined and proposed solutions presented. Computer resource requirements have been identified; also, progress has been made in acquiring those resources and developing a production system.

TABLE 9

POTENTIAL FISH ECOLOGY IMPACT ISSUES BY PROJECT STAGE

Project Stages (a)	Potential Impact Issues
CC, CD, RD, O	Changes in the water quality
CD, O	Alteration of the temperature structure of the stream
CD	Possibility of excessive dissolved gas (nitrogen and oxygen) concentrations caused by plunging flows
CD, O	Changes in the chemical and physical conditions in spawning areas of anadromous fish
RD, O	Impact of temperature structure of reservoir on reservoir management and downstream conditions
CD, RD, O	Reduction of turbidity downstream during the summer, resulting in increased predation
CD, RD, O	Winter turbidity changes in the reservoir and downstream (including potential problem of silt trapped in layers because of density differences)
RD	Increase in nutrients in the reservoir and downstream from leaching
O	Changing water quality conditions under the ice as a result of operation
O	Development of new ice-free areas with increased predation and density of small fishes
O	Development of frazil ice downstream
O	Changed ice thickness downstream (because of increased winter flows) affecting temperature and downstream movement of fish
CD, O	Summer and winter flow changes and the impact on fish reproduction, growth, and predation as well as critical flows for transportation (including access to tributaries and sloughs)

a. Project stages:
CC - Construction of the cofferdam and river diversion
CD - Construction of the dam and reservoir filling time
RD - Development of limnological conditions and fishery management in the reservoir after filling
O - Operational stage including start-up

TABLE 9 (Cont'd)

Project Stages (a)	Potential Impact Issues
O	Effect on present type of fish collection devices
CD	Extension of upstream anadromous fishery (if Watana is constructed first)
O	Bank scour caused by piping effect of increased flows under the ice
CD, O	Bed scour as affected by changing flows and ice
O	Potential for increased production by the addition of new spawning areas and new rearing areas
CD, RD, O	Potential loss of many present productive areas
CD, RD, O	Formation (and management) of new lakes (impoundments)
CD, RD, O	Changes in tributary stream access for fish
RD, O	Changes in personal use fishery
CD, O	Potential stranding and exposure of redds due to diel variation
CD, RD, O	Changes in the habitats of resident fish populations
CD, O	Changes in the stream channel in terms of creation, alteration, or elimination of habitat
CD, RD	Loss of existing fishery in impoundment area
CD, O	In general, effects on rearing, fish passage and egg incubation in the Susitna River from its mouth upstream to Devil Canyon

Brown and Black Bear

Both black bear (*Ursus americanus*) and brown bear (*U. arctos*) populations in the vicinity of the proposed dam(s) appear to be healthy and productive. Brown bears occur throughout the study area (Figure 10) while black bears appear largely confined to the finger of forested habitat along the Susitna River. This finger becomes progressively narrower upstream. In 1980, twenty-seven brown bears and twenty-seven black bears were captured, utilizing helicopter darting techniques. Adults were marked and radio-collared and were periodically relocated.

Winter denning sites (1980-81) of nine radio-collared brown bears are well above the proposed impoundment level. Brown bear uses of areas that would be directly affected by the proposed impoundments appeared greatest in the early spring following the bears' emergence from dens. Brown bears may be attracted to these areas in the spring by the early availability of both vegetable and animal foods. The proposed impoundments will presumably reduce this spring habitat.

The most interior run of salmon known in the study area occurs at Prairie Creek, a feeder stream running from Stephan Lake to the Talkeetna River. Four of eleven radio-collared brown bears moved to Prairie Creek during the summer salmon run. Brown bear movements to or from Prairie Creek may be inhibited by impoundments or access routes, thereby reducing the availability of this salmon resource to an appreciable proportion of the bears in the study area.

Studies in the headwaters of the Susitna River conducted by ADF&G in 1979 estimated a brown bear density of 1 bear/41-62 km^2. It is conjectured that brown bear density in the impoundment area is roughly comparable. If so, the impoundment study area of 3,500 km^2 contains approximately seventy brown bears.

Records of capture and subsequent locations for black bears suggest that black bear distribution in 1980 was largely confined to or near the spruce forests found in the vicinity of the Susitna River and its major tributaries. These are the habitats which will be most severely affected by the proposed impoundments; the restricted nature of black bear distribution in the study area suggests that these populations may be highly vulnerable to habitat losses by inundation as well as to disturbances associated with construction and improved access.

Black bears were observed to cross the Susitna River more frequently than brown bears. This activity probably reflects the relative proximity of black bear home ranges to the river. The motivation for or importance of these river crossings for black bears is not known, nor is it yet known whether the proposed impoundments would represent a significant barrier to such crossings.

All five of the radio-collared black bears with 1980 dens in the vicinity of the Watana impoundment denned below 670 m (2,200 feet) elevation, which is the approximate, proposed high water mark of the Watana impoundment. Two of nine black bears denning in the vicinity of the Devil Canyon impoundment denned below 442 m (1,450 feet), which is the approximate, proposed high water mark for this impoundment. Thus, it seems clear that many den sites utilized by black bears in 1980 would be inundated by the proposed impoundments. The impact of this den inundation on black bear populations is as yet unknown.

Black bear density appeared variable throughout the study area. A very rough estimate of 1 bear/4.1 km^2 was offered for one area of relatively high density. Further study will ultimately permit a more accurate estimate of bear populations in the impact area.

Caribou

The Nelchina caribou herd, which occupies a range of about 50,000 km^2 (20,000 mi^2) in southcentral Alaska, has been important to hunters because of its size and proximity to population centers. The proposed Susitna impoundments would inundate a very small portion of apparently low quality caribou habitat. However, concern has been expressed that the impoundments and associated development might serve as barriers to caribou movement, increase mortality, decrease use of nearby areas and tend to isolate subherds. The overall objectives of the current study are to evaluate the potential impacts of the proposed hydroelectric project on Nelchina caribou and to suggest possible mitigating measures.

Because of the changeable nature of caribou movement patterns, short-term studies of distribution and movements must be tempered with historical perspective. It is fortunate that the Nelchina herd has been studied continuously since about 1948; records previous to that time have been reviewed also.

The primary methodology for this study is the repetitive location of radio-collared caribou. Population estimates are made with a modified version of the aerial photo-direct count-extrapolation census procedure.

Late winter distribution of caribou in 1980 was in the Chistochina-Gakona River drainages, the western foothills of the Alphabet Hills and the Lake Louise Flat. The two main routes to the traditional calving grounds in the northern foothills of the Talkeetna Mountains were (1) across the Lake Louise Flat into the calving area via the lower Oshetna River and (2) across the Susitna River in the area from Deadman Creek to the big bend of the Susitna. Calving occurred between the Oshetna River and Kosina Creek from 900 to 1,400 m (3,000 to 4,500 feet) elevation. The main summering

concentration of Nelchina caribou occurred on the northern and eastern slopes of the Talkeetna Mountains between Tsisi Creek and Crooked Creek, primarily between 1,200 and 1,800 m (4,000 and 6,000 feet). Most caribou were located on the Lake Louise Flat during the rut. During early winter, the herd was split in two groups; one was in the Slide Mountain-Little Nelchina River area, and the other was spread from the Chistochina River west to the Gakona River through the Alphabet Hills to the Maclaren River.

It appeared (based on only eight months data) that at least two small subherds with separate calving areas existed, one in the upper Talkeetna River and one in the upper Nenana-Susitna River drainages. Insufficient data were available to evaluate the status of the Chunilna Hills group.

The Nelchina caribou herd was estimated to contain 18,558 animals in October, 1980. Herd composition was estimated at 49.0% cows, 30.3% bulls and 20.7% calves.

It was apparent from historical records (and to a lesser degree from movements of radio-collared animals) that the proposed Watana impoundment would intersect a major migratory route. It seems possible that the impoundment could be a barrier to movement and a potential source of mortality, particularly during spring migration when females are in relatively poor condition and various combinations of ice shelving, ice sheets, overflow, ice floes and wind-blown glare ice could occur. The impoundment could tend to isolate the northwestern corner of the Nelchina range, an area which has been heavily used by caribou in the past. Access routes (roads, railroads, and air fields) could affect caribou movements depending on their locations and amount of use. The proximity of the calving grounds to the Watana impoundment is of concern because of the traditional fidelity to this calving ground and the possibility that increased human access and activity could result in reduced use.

The Devil Canyon dam site and impoundment appears to have virtually no potential to impact Nelchina caribou. The Watana site, however, would almost certainly have negative impacts, although the extent cannot yet be predicted.

Dall Sheep

No sheep were radio-collared, but an aerial survey of known or suspected Dall sheep habitat in the vicinity of the proposed project was conducted in July, 1980, to delineate sheep distribution. Three discrete areas of habitat were identified. Sheep in all three areas may be subject to disturbance from construction activities, helicopter traffic or access routes, although disturbance may be reduced or eliminated through routing or scheduling of human activities.

Sheep occupying the Watana Creek Hills were observed in lowland habitats that might be inundated by the proposed Watana impoundment. Little is known about the importance of this habitat to the population, but it is possible that some attractant such as a mineral lick occurs there. If so, assessment of the impact of the Susitna Project on this sheep population will be more complex than anticipated.

Wolverine

During April and May, 1980, five adult wolverines were captured and four (three males, one female) were radio-collared. Eighty-six radio locations were obtained during 1980. Only three occurrences of river crossings were documented during the study period. Within their home ranges, all radio-collared wolverines showed a fidelity to upland shrub (willow-birch) habitats and to southerly and westerly slopes.

Potential impacts on wolverines include the following: a loss of habitat due to inundation and construction (including roads and transmission lines), a probable reduction in prey densities, increased competition with other scavengers and predators, and a readjustment of home range size and seasonal movements.

There is evidence that wolverines are intolerant of human disturbance. Impacts from disturbance might be influenced by the timing and placement of construction activities. For example, activities on southerly and westerly slopes are more likely to affect wolverines than are those on northerly or easterly slopes.

Downstream Moose

The present study focuses on the seasonal distribution of moose populations using the lower Susitna, the relative magnitude of seasonal moose use of the Susitna floodplain, and the relative use of associated habitats. In April, 1980, ten moose were equipped with radio/visual collars. Periodic relocation flights were conducted to determine each moose's location, activity, and association with other moose and with habitat type. The small sample of marked moose, and the difficulty of spotting unmarked moose in the timber, made determination of major seasonal patterns of population distribution impracticable, although a variety of individual patterns was noted. More work on seasonal movement and distribution is needed.

A preliminary survey of browse distribution and use along the river showed a mean of 1.4 browse plants/m^2. Willow, most prevalent in early successional stages, was consistently well browsed. Birch, near the river, was also a preferred forage. Cottonwood, rose, and highbush cranberry were less used, and alder was largely unused.

Since moose forage is associated with the riparian area freqently disturbed by fluviatile processes, it would be expected that a major change in downstream flow patterns would influence downstream plant communities and, through them, downstream moose populations. The potential for such impact has not yet been assessed. The potential for managing downstream plant communities for increased production of moose forage, if this proves a desirable avenue of mitigation, appears excellent.

Upstream Moose

During April, 1980, forty adult moose were captured and each was radio-collared. Biological specimens were collected to evaluate the physical condition of each moose. Results were compared with those from a 1977 ADF&G study in the Susitna area and with data on other Alaskan moose populations.

The physical condition of Susitna moose appears to have deteriorated since 1977. This, in conjunction with the possibility of a lower pregnancy rate and an older age structure, suggests that this population is declining or is about to decline.

Forty-three radio-collared moose (three were from earlier studies) were radio-located on 563 occasions. Of that total, 9.2% occurred at elevations that would be inundated by the proposed impoundments. Most moose exhibited relatively short movement patterns, spending late winter and early spring at lower elevations and occupying upland areas in summer and fall. Only one moose was observed calving in the areas proposed to be inundated. Migratory moose were located in areas east of Jay Creek except for one moose located at Watana Creek. Moose river crossings on the Susitna by radio-collared animals were concentrated at the mouth of Fog Creek, between Watana and Jay Creek, and above Goose Creek. The proposed impoundment zones did not appear to harbor any significant rutting groups of moose.

Rates of calf production were comparable with those observed in 1977 and 1978. Mortality of newborn moose calves was high and comparable to that observed in 1977 and 1978 when brown bears were identified as the largest cause of mortality. Of the moose observed during a winter distribution survey conducted in March, 1980, 6% were located in areas to be inundated. Tracks suggested that considerably more moose had been in these areas earlier in the winter.

Sex and age composition surveys and a random stratified census were conducted in the study area during November, 1980. It was estimated that 2,046 $\pm$ 382 moose occupied the areas north and south of the proposed Watana impoundment. A crude population estimate of 1,151 moose was made for the project area lying west of Kosina and Watana Creeks.

The potential impacts of the proposed project include the following: loss of habitat and mortality of moose occupying the impoundment areas, decreased range carrying capacity of adjacent areas due to overstocking by the displaced moose, disruption and perhaps prevention of both sedentary and migratory moose crossings of the Susitna River, alteration of weather patterns causing increased mortality and decreased productivity, and an increase in accidental deaths. It was suggested that the Watana impoundment would have a larger impact on moose than the Devil Canyon impoundment.

Wolves

During 1980, Twenty-three wolves from five separate wolf packs were radio-collared in an effort to identify some packs which could be impacted by hydroelectric development. An additional four or five wolf packs were suspected of occupying parts of the project area, but no wolves from these packs were captured because of the late arrival of telemetry equipment and

poor snow conditions. During 1980, 556 radio locations were obtained on the twenty-three radio-collared wolves. A minimum of forty wolves were known to inhabit the study area in spring 1980. By fall, the packs had increased by 93% to an estimated seventy-seven wolves.

Territory sizes for the five studied wolf packs averaged 1,171 km^2 (452 mi^2) and ranged from 549 to 2,126 km^2 (212 to 821 mi^2). Known and suspected wolf territories were mapped. Based upon track counts, public sightings, and radio telemetry studies, it was determined that at least four and perhaps five wolf packs would be directly affected by the proposed impoundments. An additional five wolf packs could be indirectly affected by the proposed project if it results in lower moose densities or disrupts the movement patterns of migratory moose.

Radio-collared wolves were observed on forty-eight kills during 1980. Moose of all age classes comprised 52% of the kills. Calves were the most common moose age class. Caribou of all age classes comprised 38% of the observed kills.

During 1980 two packs were intensively monitored to determine rates of predation on moose. Predation rates varied from 1 kill/4.0 days for a pack of four wolves to 1 kill/4.9 days for a pack of eight wolves. Moose counts were conducted in each pack territory and the observed numbers were compared with predation rates. It was concluded that these two wolf packs were a significant cause of calf (short yearling) mortality.

The locations of seventeen wolf den and rendezvous sites have been observed in the study area since 1975. Thus far, two wolf packs have been discovered which have either den or rendezvous sites in areas that would be directly impacted by the project.

The most important potental impact of the Susitna Hydroelectric Project on wolves would occur indirectly due to reductions in prey density, particularly of moose. The disruption of movements or reductions in migratory moose densities may reduce wolf densities for considerable distances away from the areas actually inundated. Temporary increases in wolf density may occur in the project area due to the displacement of moose and caribou from the impoundment areas. Direct inundation of wolf habitat, particularly den and rendezvous sites, may also lower wolf densities. Additional wolf mortality will probably occur due to increased hunting and trapping activities resulting from publicity concerning the area's wildlife and as access becomes developed.

3.11.2 - Furbearers

Progress was made on all aspects of furbearer and habitat inventories and impact assessment during the first year of investigation. Emphasis was placed on population surveys and seasonal furbearer/habitat relationships. Furbearers that may inhabit the impact areas include red fox, coyote, lynx, mink, pine marten, river otter, short-tailed weasel, least weasel, muskrat and beaver.

General estimates of furbearer abundance and habitat use during periods of snow cover were based upon aerial transects and aerial checks of lakes and ponds. Surveys of aquatic furbearers were conducted from a river boat during August in the downstream area. Movements of individual foxes, marten and mink, and their preference for particular habitats were monitored by radio telemetry. Diets of carnivorous furbearers were investigated by identifying food remains in their droppings and food remains in the digestive tracts of furbearers taken by trappers in the area.

Populations of all furbearers identified for investigation exist within the impoundment areas and along the Susitna River from Devil Canyon to Cook Inlet; however, numbers of coyotes and lynx are presently low. Beavers and muskrats are present along much of the river and its main tributaries. Beaver numbers increase progressively from Devil Canyon downstream to the confluence of the Kashwitna River.

Five red foxes were outfitted with radio-collars. Red foxes in the study area used dens later in the autumn than has previously been reported for foxes. Some red foxes appear to utilize the shores of the Susitna River and deltas of tributaries during summer and autumn, then shift to alpine zones in winter as snow depth increases along the river. Other foxes appear to remain above timberline throughout the year.

Four pine marten and two mink were radio-collared during 1980. It appears that adult male marten have mutually exclusive home ranges during summer with creeks in some cases forming the boundaries. The activity data gathered during autumn suggest that marten at that time are generally nocturnal with a minor activity peak around noon.

Loss of habitat and reductions in furbearer numbers may be expected in areas inundated, where roads are constructed, and at borrow pits. It is expected that pine marten will be most severely affected, followed in decreasing order by mink, fox, otter and weasel. High levels of human activity and noise pollution during furbearer breeding and denning seasons could severely alter the reproductive success of all species. Projected changes in flow rates of the Susitna River downstream from the Devil Canyon impoundment could result in marked changes in the habitats available to aquatic furbearers. Beaver and muskrat could benefit from delayed freeze-up in autumn and possibly benefit from more stable rates of flow. The anticipated seasonal drawdown of the Watana impoundment is likely to prevent the impoundment from becoming suitable habitat for beaver, muskrat, mink and river otter.

Changes in impoundment design to lower and/or stabilize the pool levels would mitigate the negative impact on furbearers by reducing the loss of foraging and denning habitats. Loss of habitat from construction of dams, borrow pits, access roads and diversion tunnels could be minimized by utilizing borrow and fill sites as close as possible to actual construction. Regarding the access route to impoundment sites, the best access route would probably be Corridor 2, from Gold Creek (south of the river) to Devil Canyon, then across the river and following Corridor 1 from Devil Canyon to the Watana site (Figure 17). If only the Watana dam is to be constructed, Corridor 3 from the Denali Highway to the Watana site would be preferred from the standpoint of the impact on furbearers.

Creek drainages and adjacent areas are extremely important to furbearers. It is recommended that access roads and construction activities be outside creek valleys when practical.

3.11.3 - Birds and Non-Game Mammals

The first year's field studies of the birds and small (non-game) mammals of the upper Susitna River basin were conducted from 6 July to 4 October 1980. The overall study area extended from near Sherman on the west to the mouth of the Maclaren River on the east and for approximately 15 km (10 miles) on either side of the Susitna River channel (Figure 14). Within this region during 1980, (1) ten 10-ha (25-acre) intensive sites were established for subsequent animal-habitat studies, (2) thirteen small mammal traplines were established and, between 26 August and 2 September, small mammals in the respective habitats of these traplines were sampled, (3) a raptor survey was flown on 6 July, (4) fall waterbird surveys were flown between 7 September and 4 October, and (5) general bird and small mammal surveys were conducted throughout the period at a number of more-or-less random locations. Data for the region are still very limited, so interpretations made are preliminary in nature and conclusions are tentative.

Intensive study plots were established in vegetation types that represented each of the major woody avian habitats present in the region in sufficient size and uniformity to accommodate a square 10-ha plot: low birch shrub thicket, medium birch shrub thicket, low-medium willow shrub thicket, tall alder thicket, cottonwood forest, paper birch forest, white spruce-paper birch forest, white spruce forest, white spruce scattered woodland, and black spruce dwarf forest. Small mammal traplines were established in all but the low birch shrub thicket and, in addition, in sedge-low shrub meadow, tall forb meadow, and black spruce-white spruce forest.

Thirteen small mammal species were found during 1980, and the presence of three others was suspected. During the fall survey, red-backed voles and masked shrews were the most abundant species trapped; these, plus the dusky shrew, appeared to be habitat generalists, occupying a wide range of vegetation types. Meadow voles and pygmy shrews were least abundant and the most restricted in their habitat use, the former occurring only in meadows and the latter in forests.

Tall forb meadow, sedge-low shrub meadow, and cottonwood forest had the most small mammals and most diverse communities, while paper birch forest and white spruce forest had the fewest individuals and lowest diversities.

A total of 115 species of birds was recorded during the 1980 field season; the most abundant were scaup sp. and Common Redpoll. Blue-winged Teal, American Kestrel, White-tailed Ptarmigan, Short-eared Owl, Northern Phalarope, Greater Yellowlegs, Lesser Yellowlegs, Surfbird, Sanderling, and Pectoral Sandpiper were classified as "rare" on the basis of 1980 sightings. All, however, are represented by healthy breeding populations elsewhere, and future field work is expected to prove some of them more abundant in the study area than currently classified.

Ten active raptor/raven nests were counted during the raptor survey; of these, two Bald Eagle nests and at least four Golden Eagle nests would be flooded by Devil Canyon-Watana impoundments, as would about three currently inactive raptor/raven nest sites.

Little time was spent in wetland areas during the summer season, but cursory observations indicated a low population of waterbirds on the lakes of the region. Trumpeter Swans, however, nested on a number of the lakes between the Oshetna and Tyone Rivers. At least twenty-one species of loons, grebes, and waterfowl were identified during the fall aerial surveys. Species composition was similar to that in interior Alaska, with scaup sp. being the most abundant species (38% of observations) and American Wigeon the second most abundant (15%). The relative importance in the region of the waterbodies of the upper Susitna River basin for migrants appeared low; a lake near the mouth of the Maclaren River and the Stephan Lake area are relatively most important.

Assessment of impacts of the Susitna Hydroelectric Project can only be general at this stage of study and this stage of planning for construction and operation. The major impacts would be from habitat destruction due to flooding and from a range of habitat alterations due to various factors of construction and operation. Flooding would destroy a large percentage of the riparian cliff habitat and forest habitats upriver of the Devil Canyon dam. Raptors and ravens using the cliffs could be expected to find alternative nesting sites in the surrounding mountains, and the forest inhabitants are relatively common breeders in forests in adjacent regions. Lesser amounts of lowland meadow and of fluviatile shoreline and alluvia (each important to a few species) would also be lost. None of the waterbodies that appear to be important to waterfowl would be flooded, nor would the important prey species of the

upland tundra areas be thus affected. Impacts of other types of habitat alteration would depend on the type of alteration, e.g., which habitats are destroyed or altered or which replacement habitats develop. Generally, animals that are habitat generalists will be less affected than habitat specialists. Mitigation of potential impacts on waterfowl, raptors, and their habitats through avoidance is recommended, i.e., by keeping construction and related activities at a distance from potential raptor cliffs and from the Stephan-Murder Lake area.

3.12 - Subtask 7.12: Plant Ecology Studies

The objectives of the Plant Ecology Studies during 1980 were (1) to produce preliminary vegetation/habitat and wetlands maps, (2) to provide vegetation descriptions of each type mapped, and (3) to survey for proposed endangered and threatened species. The vegetation/habitat types found in the upper Susitna River basin and the floodplain down to Talkeetna were described, classified, and mapped. Reconnaissance of many locations throughout the study area was made in summer 1980 to obtain information on species composition and community structure. Ocular estimates of the cover of each species in each layer of vegetation were made, and these data were used to classify the vegetation according to the system developed by Viereck and Dyrness (A Preliminary Classification System for Vegetation of Alaska, U.S. Forest Service, 1980). High altitude (U2) color infrared photographs and LANDSAT imagery were used to map the vegetation cover types. Maps were produced at the scales of 1:250,000 for the entire basin and 1:24,000 for the direct impact areas. Additionally, the area extending 16 km (10 miles) in any direction from the proposed impoundment areas is being mapped at a scale of 1:63,360. A 1:24,000 scale map of apparent wetlands was also produced, based on the 1:24,000 scale vegetation map and the wetlands classification system used by the U.S. Fish and Wildlife Service (Cowardin et al., Classification of Wetlands and Deep-water Habitats of the United States, 1979). Surveys on foot and by helicopter were also made of several lakes and ponds within and adjacent to the direct impact areas to determine the composition and structure of plant communities occurring in or near the water.

TABLE 10

HECTARES OF DIFFERENT VEGETATION TYPES TO BE AFFECTED COMPARED WITH TOTAL HECTARES OF THOSE TYPES IN THE ENTIRE UPPER SUSITNA RIVER BASIN. (Number in parentheses is the percent of the vegetation type as found in the entire upper basin.)

	Impoundments		Borrow Areas					Upper Susitna River Basin
	Devil Canyon	Watana	A	C	D	F	H	
Woodland spruce	162 (0.09)	4766 (2.53)	228 (0.12)	77 (0.04)	15 (0.01)		227 (0.12)	188,391
Open spruce	862 (0.73)	3854 (3.24)	48 (0.04)	7 (0.01)			125 (0.11)	118,873
Open birch	73 (7.54)	318 (32.85)						968
Closed birch	470[a]	491[a]			1[a]			323
Open conifer-deciduous	300 (1.28)	1329 (5.68)			19 (0.08)	9 (0.04)	94 (0.40)	23,387
Closed conifer-deciduous	758 (4.75)	869 (5.44)			2 (0.01)			15,968
Open balsam poplar	7[b]							
Closed balsam poplar	10[b]	2[b]						
Wet sedge-grass	12 (0.25)	100 (2.07)	6 (0.12)		1 (0.02)			4,839
Mat and cushion tundra			78 (0.12)					65,001[c]
Tall shrub	19 (0.01)	580 (0.45)	18 (0.01)	23 (0.02)	8 (0.01)			129,035
Birch shrub	58 (0.17)	474 (1.41)	18 (0.05)	92 (0.27)	73 (0.22)			33,549
Willow	16 (0.15)	55 (0.52)					7 (0.07)	10,645
Low mixed shrub	6 (+)	785 (0.15)	101 (0.02)	113 (0.02)	109 (0.02)	55 (0.01)	46 (0.01)	471,461
Lakes	1 (+)	47 (0.22)	3 (0.01)			1 (+)		21,162
Rivers	835 (5.69)	2106 (14.35)		10 (0.07)		6 (0.04)		14,673
Rock	14 (0.01)	63 (0.06)			1 (+)			113,712
Total areas	3603 (0.22)	15839 (0.97)	500 (0.03)	322 (0.03)	228 (0.01)	71 (+)	499 (0.03)	1,211,992

[a] Hectares of closed birch are apparently greater in the impact areas than for the entire basin, because the basin was mapped at a much smaller scale, and many of the closed birch stands did not appear at that scale.

[b] Balsam poplar stands were too small to be mapped at the scale of which the upper Susitna River basin was mapped.

[c] Total hectares of mat and cushion tundra are much greater than this, but many hectares were mapped as a complex with sedge-grass tundra.

Results of reconnaissance surveys of the vegetation/habitat types show that at least 243 species in 130 genera and 55 families are present in the upper Susitna River basin. Of these, the presence of 21 represented extensions of the previously known ranges of the species. Special effort was made to locate any species which are currently under review by the U.S. Fish and Wildlife Service for possible status as endangered or threatened. Although some potential habitats of these species were located, none of the species was found.

The preliminary 1:250,000 scale vegetation/habitat type map of the entire upper Susitna basin (Figure 22) is provided in the back pocket of this report. The major vegetation/habitat types found in the upper basin study area are low mixed shrub, woodland and open black spruce, sedge-grass tundra, mat and cushion tundra, and birch shrub. These vegetation/habitat types are typical of those covering vast areas of Alaska and northern Canada. Characteristically these types are found on cold, wet soils and exhibit slow or stunted growth. Less than 3% of the upper basin area is vegetated by deciduous or mixed conifer-deciduous forests which, by contrast, have more robust growth characteristics.

The approximate area of each vegetation/habitat type to be inundated by the proposed impoundments and eliminated by proposed borrow areas, relative to the area of each type in the entire upper Susitna basin, are presented in Table 10. Deciduous and mixed conifer-deciduous forests occur primarily along the Susitna River where soils are better drained and the growing season is longer than elsewhere in the upper basin. Consequently, a large portion of deciduous and mixed forests found in the study area would be destroyed by the proposed impoundments. Other vegetation/habitat types (mixed shrub, birch shrub, tall shrub, and spruce) would also be lost by inundation, but in small degree relative to their availability across the entire upper Susitna River basin.

If that vegetation/habitat which is destroyed is found to have considerable importance as browse for moose, there may be some opportunity to create replacement browse supplies in adjacent areas either by burning or clearing to stimulate the regrowth of palatable shrubs. Generally speaking, however, losses of vegetation can not be mitigated. However, in those situations where the vegetation is only temporarily destroyed (e.g., around construction sites, along roads, and at borrow areas) revegetation by mulching and seeding with native species may quickly restore ground cover. Natural revegetation following fertilization also appears promising in mitigating temporary losses of vegetation.

3.13 - Subtask 7.13: Geological Analysis

This subtask is being performed as part of the studies conducted under Task 5 - Geotechnical Exploration. As such, TES has no formal involvement. However, the University of Alaska performed some geological analyses as background for the Cultural Resources Investigation (Subtask 7.06) and discussions have been held with other Project Geologists. Geological information of interest to Acres and its other subcontractors is contained in the 1980 Semi-annual Report and Annual Report for Subtask 7.06.

3.14 - Subtask 7.14: Access Road Environmental Analysis

The general objective of this subtask is to provide environmental input into the screening of alternatives and the selection of an access route to the dam site(s). The specific objectives are (1) to coordinate the exchange of information between those studying the engineering and those studying the environmental aspects of the route selection, and (2) to compile environmental input regarding specific potential impacts of routing for each alternative proposed.

The methods used consisted of initial screening of numerous alternative routes by aerial reconnaissance early in 1980. This initial screening resulted in narrowing the number of alternatives to three basic corridors (Figure 17). Information (maps) about these corridors was disseminated to environmental subcontractors and ADF&G so that preliminary screening could be accomplished during the summer of 1980. Input on potentially significant impact areas was solicited from these groups in the fall and early winter of 1980. Information was also solicited about the impacts on land use and the socioeconomic consequences of the various alternative corridors. Inputs from all disciplines were compiled by TES into a summary report submitted to Acres and APA in March, 1981. At the same time, locations of specific potential impacts were drawn on maps and supplied to R&M Consultants for inclusion in their engineering and cost report on access.

A summary of the potential cultural resource and biological impacts along the three corridors follows. Access routing as it affects socioeocnomic issues and regional and local land use is discussed in this report under Subtasks 7.05 and 7.07, respectively.

Archeological sites have been discovered near all access corridors. In addition, certain areas along the corridors (i.e., the margins of lakes, stream banks, confluences of drainages, and areas of high topographic relief with commanding views of the surrounding terrain) have higher probabilities for containing sites than do others. The access corridor from the Denali Highway (Corridor 3) has the potential for greater secondary impacts (deliberate or accidental disturbance of archeological sites by visitors), because the surrounding terrain is more open and accessible than other areas through which corridors pass.

Impacts on vegetation due to the construction of an access road are fairly straightforward: habitat removal and/or disturbance. Major wetland areas have been and could be further avoided by slight realignments and do not necessarily constitute major environmental problem areas. No known locations of endangered or threatened plant species would be intersected by any of the alternative access corridors; searches for such species will continue during 1981.

Little is currently known about fish and fish habitat in the areas to be affected by any of the access corridors. The two routes from the west (Corridors 1 and 2) cross the Indian River and/or the Susitna River, and the corridor on the north side of the Susitna from the Parks Highway (Corridor 1) is also routed close to Portage Creek. In these cases, there is potential for disturbance to the salmon fishery. In addition, other stream crossings in the upper basin and construction of routes in proximity to streams and lakes may adversely affect resident fish and their habitats.

The primary impact on birds and small mammals by any access corridor would be through the actual removal or disturbance of habitats. Some species of birds, particularly raptors, may be secondarily impacted by disturbance due to human activity near their nesting habitat even if the nest site itself is undisturbed. Cliff-nesting birds of prey in areas such as near the confluence of Portage Creek and the Susitna River, in the Devil Canyon area (Corridor 1), and in cliffs along unnamed drainages on the south side of the river (Corridor 2) may be disturbed. Waterfowl may also be disturbed, particularly by the corridor that passes close to the Stephan Lake-Fog Lakes area (Corridor 2).

As for furbearers, habitat removal may have less impact on them than the indirect effects of increased access. There is some evidence that certain species of furbearers are more sensitive to the presence of man than others and therefore avoid areas near human activity. With furbearers, there also may be indirect, but possibly significant, impacts due to increased access by trappers after construction. Certain locations, through or near which alternative corridors pass, have been found to support high populations of furbearers. Examples of these areas are the Portage Creek drainage (Corridor 1), the High Lake area (Corridor 1), and the Stephan Lake-Fog Lakes area (Corridor 2).

Big game impacts are perhaps the most difficult to ascertain because of the mobility of these species and other biological factors. Site-specific impacts may be of lesser magnitude than indirect impacts due to increased human activity, including not only hunting but traffic and other kinds of activity. The corridor south of the Susitna River (Corridor 2) will intersect a brown bear summer migration route from the Susitna to the Prairie Creek drainage. This same corridor intersects good habitat for moose in the Stephan Lake area. Moose habitat is also intersected north of the Susitna River in the Tsusena Creek drainage (Corridor 1) and along Deadman Creek (Corridor 3). Finally, important caribou habitat is intersected by all three corridors: at higher elevations between Devil Creek and Deadman Creek (Corridor 1), a wintering area south of Devil Canyon (Corridor 2), and subherd calving areas in a large area south of the Denali Highway near Butte Lake (Corridor 3). Partial avoidance of this last area could possibly be accomplished by rerouting the northern portion of this corridor toward the west.

In summary, the potentially greatest impacts with respect to many different environmental disciplines would appear to be in three areas through which various portions of the alternative corridors pass: (1) the Portage Creek drainage, (2) the Stephan Lake-Fog Lakes area, and (3) the northern end of the route from the Denali Highway. Each alternative corridor would adversely affect one of these areas.

3.15 - Subtask 7.15: Preparation of FERC License Application Exhibit

This subtask will consist of the compilation and condensation of project reports from the various environmental disciplines into an environmental report, which will be incorporated by Acres into the feasibility report and FERC license application. No work on this subtask was scheduled for 1980.

3.16 - Task 12: Public Participation Program

TES personnel were involved in two specific public participation activities that occurred during 1980. In addition, environmental personnel cooperated with the APA public participation staff and Acres' Task 12 Coordinator throughout the year.

In July, 1980, several TES staff members and several consultants participated in an informational presentation of the Plan of Study to the Susitna Hydroelectric Project Steering Committee. Representatives of the FERC were also present at the meeting. The presentation included outlining plans for the environmental and other studies to be done to obtain the necessary information for the FERC license application submission. In November, 1980, a TES consultant and APA participated in a presentation in Soldotna to the Board of Directors of the Cook Inlet Aquaculture Association. The Susitna Project fisheries program was outlined and discussed, and questions concerning it were answered.

4 - REPORTS

The following reports have been prepared by TES and its subcontractors concerning the environmental studies for the Susitna Hydroelectric Project. For completeness and currency of reference, reports prepared through May, 1981, and reports under preparation are included, as well as reports by ADF&G.

4.1 - Reports by TES and Subcontractors

4.1.1 - Reports Prepared

Subtask 7.01: Coordination of Environmental Studies

February, 1980. Susitna Hydroelectric Project Plan of Study: Task 7 Environmental Studies.

March, 1981. Susitna Hydroelectric Project Environmental Studies: Plan for Agency Contact Coordination.

April, 1981. Susitna Hydroelectric Project: Task 7 Environmental Studies Status Report.

May, 1981. Susitna Hydroelectric Project: Task 7 Environmental Studies Summary Annual Report.

Subtask 7.03: Evaluation of Alternatives

August, 1980. Susitna Hydroelectric Project: Task 1 Termination Report - Subtasks 1.03 and 1.05.

December, 1980. Susitna Hydroelectric Project Environmental Studies: Preliminary Environmental Assessment of Tunnel Alternatives.

January, 1981. Susitna Hydroelectric Project Environmental Studies: Environmental Considerations of Alternative Hydroelectric Development Schemes for the Upper Susitna Basin. (Draft)

Subtask 7.05: Socioeconomic Analysis

June, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.05: Socioeconomic Analysis.

August, 1980. Susitna Hydroelectric Project Environmental Studies Semi-annual Report Subtask 7.05: Socioeconomic Analysis. (Draft)

May, 1981. Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.05: Socioeconomic Analysis.

Subtask 7.06: Cultural Resources Investigation

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.06: Cultural Resources Investigation.

August, 1980. Susitna Hydroelectric Project Environmental Studies Semi-annual Report Subtask 7.06: Cultural Resources Investigation. (Draft)

May, 1981. Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.06: Cultural Resources Investigation.

Subtask 7.07: Land Use Analysis

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.07: Land Use Analysis.

August, 1980. Susitna Hydroelectric Project Environmental Studies Semi-annual Report Subtask 7.07: Land Use Analysis. (Draft)

Subtask 7.08: Recreation Planning

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.08: Recreation Planning.

October, 1980. Susitna Hydroelectric Project Recreation Questionnaire.

Subtask 7.09: Susitna Transmission Corridor Assessment

February, 1981. Critique of the Corps of Engineers' Environmental Assessment for Transmission Systems.

March, 1981. Susitna Hydroelectric Project Environmental Studies: Preliminary Environmental Screening of Alternative Transmission Corridors.

Subtask 7.10: Fish Ecology Studies

August, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.10: Fish Ecology Impact Assessment and Mitigation Planning.

Subtask 7.11: Wildlife Ecology Studies

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.11: Wildlife Ecology - Big Game Impact Assessment and Mitigation Planning.

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.11: Wildlife Ecology - Furbearers.

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.11: Wildlife Ecology - Birds and Non-game Mammals.

August, 1980. Susitna Hydroelectric Project Environmental Studies Semi-annual Report Subtask 7.11: Furbearers Studies. (Draft)

April, 1981. Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.11: Birds and Non-game Mammals.

May, 1981. Susitna Hydroelectric Project Environmental Studies Annual Report Sutbask 7.11 - Furbearers Studies.

Subtask 7.12: Plant Ecology Studies

August, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.12: Plant Ecology Studies.

August, 1980. Susitna Hydroelectric Project Environmental Studies Semi-annual Report Subtask 7.12: Plant Ecology Studies. (Draft)

May, 1981. Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.12: Plant Ecology Studies.

Subtask 7.14: Access Road Environmental Analysis

July, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.14: Access Road Analysis.

February, 1981. Susitna Hydroelectric Project Environmental Studies: Environmental Analysis of Access Road Alternatives.

4.1.2 - Reports In Preparation

Subtask 7.07: Land Use Analysis

Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.07: Land Use Analysis.

Subtask 7.10: Fish Ecology Studies

Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.10: Fish Ecology Impact Assessment and Mitigation Planning.

Susitna Hydroelectric Project Environmental Studies Series of Mini-reports Subtask 7.10: Fish Ecology Studies -

Chinook Salmon	Dolly Varden
Coho Salmon	Burbot
Pink Salmon	Eulachon
Chum Salmon	Rainbow Trout
Sockeye Salmon	Lake Trout
Arctic Grayling	

Susitna Hydroelectric Project Environmental Studies Subtask 7.10: Fish Ecology Studies Bibliography of Impact Assessment and Mitigation Literature Applicable to the Susitna Hydroelectric Project.

Subtask 7.11: Wildife Ecology Studies

Susitna Hydroelectric Project Environmental Studies Annual Report Subtask 7.11: Big Game.

4.2 - Reports by Alaska Department of Fish and Game

4.2.1 - Reports Prepared

Wildlife Ecology Studies: Big Game

June, 1980. Susitna Hydroelectric Project Quarterly Reports: Caribou, Bears, Wolf, Downstream Moose, Upstream Moose, Wolverine.

September, 1980. Susitna Hydroelectric Project Quarterly Reports: Caribou, Bears, Wolf, Downstream Moose, Upstream Moose, Wolverine, Dall Sheep.

October, 1980. Susitna Hydroelectric Project Environmental Studies Procedures Manual Subtask 7.11: Wildlife/Big Game.

March, 1981. Susitna Hydroelectric Project Environmental Studies Annual Progress Report Subtask 7.11: Big Game.

4.2.2 - Reports in Preparation

Fish Ecology Studies

Susitna Hydroelectric Project Environmental Studies Phase I Procedures Manual Subtask 7.10: Fish Ecology Studies.

Susitna Hydroelectric Project Quarterly Report: Fish Ecology Studies.

Wildlife Ecology Studies: Big Game

Susitna Hydroelectric Project Quarterly Reports: Big Game Studies.

5 - AUTHORITIES CONTACTED

The following authorities were contacted by TES and its subcontractors between October 1, 1979 and December 31, 1980. Included are contacts with federal, state, and local agencies and other institutions, organizations and individuals. These contacts range from inquiries concerning pertinent available data to presentations concerning the approach of the environmental studies. This list is not intended to include those contacts made with other members of the Environmental Studies Team, although some project personnel are listed because of the capacity in which they were contacted.

5.1 Federal Agencies

United States Department of Agriculture

Agricultural Stabilization and Conservation Service

- Lola Britton: File Manager

Economics and Statistics Service

- Paul Fuglestad: Agricultural Economist

Farmers Home Administration

- Delon Brown

Forest Service, Institute of Northern Forestry

- Joan Foote: Biologist
- Fred Larson: Research Forester
- Vic VanBallenberghe: Wildlife Biologist
- Leslie Viereck: Principal Plant Ecologist

Soil Conservation Service

- Weymeth Long: Director of State Office
- Sterling Powell: Physical Engineer, Water Resource Specialists

United States Department of Commerce

National Marine Fisheries Service

- Bradley Smith, Fishery Biologist

United States Department of Defense

Army Corps of Engineers, Alaska District

- Loran Baxter: Civil Engineer
- Phillip Brna: Biologist
- James Caruth: Chief of Regulatory Functions

Army Corps of Engineers, Portland District

- Ruth Love: Sociologist

United states Department of Education

- Lee Hays

United States Department of Energy

Alaska Power Administration

- Robert Cross: Administrator
- Donald Shira

Federal Energy Regulatory Commission, Division of Licensed Projects

- Paul Carrier: Engineer
- Donald Clarke: Staff Counsel
- Ronald Corso: Director
- Quentin Edson: Chief, Environmental Analysis Branch
- Peter Foote
- Mark Robinson: Environmental Biologist
- Dean Shumway: Chief, Conservation Section
- Gerald Wilson: Chief, Project Analysis

United States Department of Housing and Urban Development

- Debra Pevlear
- E. Robinson

United States Department of the Interior

Bureau of Land Management

- Lee Barkow: Planner, Easement Identification Branch
- Stanley Bronczyk: Chief, Easement Identification Branch
- Gary Hennigh: Socioeconomic Specialist
- Paula Krebs: Remote Sensing Specialist
- Ray Leicht: Archeologist
- John Rego: Geologist
- Debbie Robertson: Land Management Officer, Division of Forest, Land and Water Management

- Charles Smythe: Socioeconomics Specialist
- Page Spencer: Remote Sensing Specialist
- Steve Talbot: Ecologist

Bureau of Mines

- Michael Brown: Chemist
- Joanne Gidlund: Public Affairs

Fish and Wildlife Service

- Robert Bowker: Field Supervisor, Western Alaska Ecological Services Unit
- Gregory Konkel: Habitat Evaluation Coordinator
- John Morrison: Supervisor, Biological Services Program
- Wayne Regelin: Research Biologist
- Mel Schamerger: Habitat Evaluation Procedures Group Leader, Biological Services Program
- John Trapp: Marine Bird Management Project Leader
- Richard Wilmot: Fisheries Research Project Leader

Geological Survey

- Robert Lamke: Chief, Hydrology Section

Heritage Conservation and Recreation Service

- Charles McKinney: Consulting Archeologist
- Gail Russell: Interagency Services Divison
- Bradley Smith
- William Weler
- Larry Wright: Review Section Chief, Federal Projects

United States Department of Transportation

Federal Railroad Administration, The Alaska Railroad

- Fred Hoefler, Traffic Officer

United States Environmental Protection Agency

Environmental Evaluation Branch

- Judi Schwartz: Environmental Protection Specialist

Environmental Impact Statement Review Section

- Dan Sternborn: Team Leader

5.2 - State Agencies

Alaska Department of Commerce and Economic Development

Division of Energy and Power Development

- Heinz Noonan: Economist
- David Reume

Alaska Department of Community and Regional Affairs

- Sylvia Spearon: Assistant Planner
- Richard Spitler: Planner
- Mark Stephens: Planner

Alaska Department of Environmental Conservation

- Robert Martin: Regional Supervisor
- David Sturdevant: Management and Technical Assistant Ecologist

Alaska Department of Fish and Game

- Ronald Skoog: Commissioner

Division of Boards

- Robert Larson: Biologist, Division Director

Division of Commercial Fisheries

- Dennis Haanpaa: Assistant Regional Supervisor
- Alan Kingsbury: Regional Research Supervisor

Division of Forest, Land and Water Management

- Raymond Mann: Southcentral District Planning Officer

Divison of Enforcement

- Lt. Mills

Division of Game

- Paul Arneson: Biologist
- Gregory Bos: Game Biologist IV
- Sterling Eide: Regional Supervisor
- David Johnson: Game Biologist
- Herbert Melchior: Game Biologist III
- Lee Miller: Fish and Game Technician V
- Sterling Miller: Game Biologist III
- Suzanne Miller: Statistician, Biometrician III
- Kenneth Pitcher: Game Biologist
- Charles Schwartz: Biologist II
- Karl Schneider: Research Coordinator
- Jerome Sexton: Game Biologist II

Division of Habitat Protection
- Dimitri Bader: Lands Coordinator, Habitat Biologist
- Richard Cannon: Habitat Biologist III
- John Clark: Assistant Chief
- Richard Logan: Chief
- Frances VanBallenberghe: Habitat Biologist III

Division of Sport Fisheries
- Christopher Estes: Fishery Biologist III, Susitna Aquatic Studies
- Larry Heckart: Fishery Biologist IV
- Michael Mills: Senior Fisheries Biometrician III
- Thomas Trent: Regional Supervisor, Susitna Aquatic Studies Coordinator, Vice Chairman of Susitna Steering Committee
- Kyle Watson: Clerk IV

Subsistence Division
- Ronald Stanek: Resource Specialist II

Alaska Department of Labor
- Rod Brown: Supervisor of Research, Administration Services, Research and Analysis Section
- Chuck Caldwell: Chief of Research and Analysis Section
- Cal Dauel: Labor Economist
- Neil Fried: Labor Economist
- Steve Harrison: Labor Economist
- Chris Miller: Labor Economist
- Sally Sadler: Labor Economist

Alaska Department of Natural Resources

Division of Forest Land and Water
- Mary Lou Harle: Water Management Officer

Division of Lands
- Dean Brown: Southcentral District Lands Officer
- Michael Franger: Special Projects Officer

Division of Parks
- Chip Dennerlein: Director
- Liza Holzapple: Park Planner, Division of Parks
- Jack Wiles: Chief

Divison of Pipeline Surveillance
- Elstun Lauesen: Socioeconomic Officer

Divison of Research and Development
- William Beatty: Planning Supervisor, Land Resources
- Randy Cowart: Planner
- Carol Larsen: Public Information Officer
- Robert Loeffler: Associate Planner
- Steve Reeve: Chief, Land and Resources Planning Section
- Ronald Swanson: Land Management Officer, Policy Research Land Entitlement Unit

Division of Water Resources
- Richard Stern: Historian, Research and Planning

Alaska Department of Revenue
- Linda Lockridge: Records and Licensing Supervisor, Fish and Game Licensing Division
- Hazel Nowlin: Administrative Assistant, Administration Services
- William Yankee: Economist II

Alaska Department of Transportation
- Jay Bergstrand: Transportation Planner IV
- Reed Gibby: Transportation Planner
- William Humphrey: Transportation Planner I
- Richard Quiroz: District Environmental Coordinator

Alaska State Housing Authority
- William Foster: Administrative Officer

Glennallen State Trooper Post
- Robert Cockrell: 1st Sergeant

House Power Alternatives Study Committee
- Hugh Malone: Committee Co-Chairman, District 13

Office of the Governor
Division of Policy Development and Planning
- David Allison: Policy and Planning Specialist

University of Alaska
- Lydia Selkreg: Professor of Resource Economics and Planning

Arctic Environmental Information and Data Center
- Chuck Evans: Research Associate, Wildlife Biologist
- Barbara Sokolov: Senior Research Analyst, Library Science

Geophysical Institute
- Ken Dean: Remote Sensing Geologist
Institute of Social and Economic Research
- Scott Goldsmith: Assistant Professor of Economics
- Lee Gorsuch: Director
- Lee Huskey: Associate Professor of Economics
Museum
- David Murray: Herbarium Curator
Urban Observatory
- Richard Ender

5.3 - Local Agencies

Copper River School District
- Dr. Krinke: Superintendent
Fairbanks North Star Borough
- Philip Berrian: Planning Director
Community Information Center
- Karen Fox: Research Analyst
Matanuska-Susitna Borough
Borough Office
- Rodney Schulling: Planning Director
- Alan Tesche: In-house Authority
- Lee Wyatt: Acting Borough Manager, Planning Director
School District
- Mr. Hotchkiss: Business Manager
Municipality of Anchorage
- Charles Becker: Economic Development Director
- Shawn Hemme: Assistant Planner
- Michael Meehan: Director of Planning
- Barbara Withers: Regional Economist
Valdez Police Department
Magistrates
- Sheldon Spector: Magistrate, Glennallen

5.4 - Other Institutions, Organizations and Individuals

Institutions and Organizations

Ahtna, Inc.
- Lee Adler
- Douglas MacArthur: Special Projects Director

Alaska Hospital

Alaska Miners' Association

Battelle Pacific Northwest Laboratories
- Lester E. Ebechardt: Terrestrial Ecology Section

Community Council Center Federation of Community Schools
- Mary Amouak
- Margaret Wolfe

Cook Inlet Aquaculture Association
- Floyd Heimback: Director
- Thomas Mears: Biologist
- Thomas Walker: Economist

Cook Inlet Region, Incorporated
- Marge Sargerser: Land Manager

Copper River Housing Authority
- Thea Smelcher

Copper River Native Association
- Billy Peters

Copper Valley Electric Association
- Daniel Teggler

Copper Valley Views

Darbyshire and Associates
- Charles Darbyshire

Doyon Corporation
- Doug Williams: Land Planner

Fairbanks Borough Community Information Center
- Karen Fox: Research Analyst

Fairbanks Chamber of Commerce
- Robert Dempsey

Fairbanks Town and Village Association for Development, Inc.
- Art Patterson
Fairbanks Visitor and Convention Bureau
- Karla Zervos: Executive Director
Guide License Review Board
High Lake Lodge
- John Wilson: Resident Manager
Knikatnu Incorporated
Land Field Services, Incorporated
- P. Sullivan
L.G.L. Alaska, Incorporated
Matanuska Electric Association, Incorporated
- Bud Goodyear: Public Information Officer
- Ken Ritchey: Manager, Engineering Services
Matanuska Telephone Association
- Graham Rolstad: Chief Engineer
- Donald Taylor
Ninilchik Native Association, Incorporated
Northern Prairie Wildlife Research Center
- Al Sargeant
Northwest Alaskan Pipeline Company
- Susan Fisson: Director, Socioeconomic Analysis
- Virginia Manna
Overall Economic Development Program, Incorporated
- Donald Lyon: Executive Director
Palmer Chamber of Commerce
Palmer Fire Hall
- Daniel Conteen
Palmer Valley Hospital
- Ann Demmings
Public Power Supply System, Richland, Washington
- Alice Lee: Coordinator
Puget Sound Power and Light Company
- Terry Galbraith: Public Relations Officer
Sagehen Creek Field Station, California
- Wayne Spencer; Biologist
- William Zielinski; Biologist

Salamatoff Native Association, Incorporated
Seldovia Native Association, Incorporated
Susitna Power Now
- E. Dischner
Tyonek Native Corporation
- nurse
Valdez Community Hospital
Valdez Vanguard
Yukon Wildlife Branch
- Ralph Archibald: Biologist

Individuals

Glenn Bacon: Consulting Archeologist
Warren Ballard: Game Biologist, Hunter
Dennis Brown: President Akland Air Service
Verna and Carrol Close: Owners of Talkeetna Roadhouse
Mike Fisher: Pilot, Talkeetna Resident
Jim and Vonnie Grimes: Pilots, Owners of Adventures Unlimited Lodge
Pete Haggland: President of Alaska Central Air, Pilot
Paul Holland: Owner-Manager of Evergreen Lodge, Boater
Cliff Hudson: Owner/Pilot of Hudson's Air Taxi, Talkeetna Resident
John Ireland: Alaskan Sourdough, Murder Lake Resident
Dave Johnson: Manager, Denali State Park
Dorothy Jones: President of Talkeetna Historical Society, Representative-elect of Mat-Su Borough Assembly
Frenchy Lamoureux: Hunter, Trapper, Wife and Mother of Big Game Guides
Harold Larson: Agent for Alaska Railroad at Gold Creek, Trapper
Don Lee: Manager Stephan Lake Lodge, Pilot
Ron Long: Trapper
Mary Kay McDonald: Trapper
Chuck McMahon: Pilot, Hunter, Trapper, Fisherman in Upper Susitna Basin
Cleo McMahon: Pilot, Hunter in Upper Susitna Basin
Tom Mercer: President of Denali Wilderness Treks, Bush Pilot, Dog Musher
James Moran: Pilot, Partner in Tsusena Lake Lodge

Don Newman: Trapper

Mrs. Ken Oldham: Co-owner of High Lake Lodge, Guide, Bush Pilot, Author

Butch Potterville: Sportfish Biologist in Upper Susitna Basin

Carol Resnick: Tsusena Creek Resident

Andy Runyon: Pilot, Hunter, Trapper

Roberta Sheldon: Partner in Sheldon Air Service, Talkeetna Resident

Leroy Shank: Trapper

Judy Simco: Hunter, Trapper

Roger Smith: Trapper

Kathy Sullivan: Owner of Genet Expeditions

Minnie Swanda: Widow of Master Guide, Talkeetna Resident

Jake Tansy: Native Hunter and Trapper

Bob Toby: Game Biologist, Hunter

Lee and Helen Tolefson: Subsistence Trappers/Hunters, Talkeetna Residents

Mrs. Oscar Vogel: Hunter, Trapper, Stephan Lake Resident, Widow of Master Guide

Jeff Weltzin: Devil Canyon Backpacker

Ed Wick: Talkeetna Resident

Glen Wingkte: Trapper