SUSITNA
HYDROELECTRIC PROJECT

FEDERAL ENERGY REGULATORY COMMISSION
PROJECT No. 7114

PHASE I REPORT: BACKGROUND RESEARCH AND PREDICTIVE MODEL FOR CULTURAL RESOURCES LOCATED ALONG THE SUSITNA HYDROELECTRIC PROJECT'S LINEAR FEATURES

VOLUME I

PREPARED BY

HISTORICAL RESEARCH
ASSOCIATES

UNDER CONTRACT TO

HARZA-EBASCO
SUSITNA JOINT VENTURE

FINAL REPORT

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SUSITNA HYDROELECTRIC PROJECT

PHASE I REPORT: BACKGROUND RESEARCH AND PREDICTIVE MODEL FOR CULTURAL RESOURCES LOCATED ALONG THE SUSITNA HYDROELECTRIC PROJECT'S LINEAR FEATURES

VOLUME I
CHAPTERS 1-7

Report by
Historical Research Associates
Missoula, Montana

With Contributions from
Alaska Heritage Research Group, Inc.

T. Weber Greiser, Project Manager
Sally T. Greiser, Co-Investigator
Glenn H. Bacon, Co-Investigator
Thomas A. Foor, Predictive Modeling Consultant
Priscilla Russell Kari and James Kari, Ethnographers
Daniel H. Gallacher, Project Historian
Janene M. Caywood, Supervisory Archeologist

Under Contract to
Harza-Eb. 3co Susitna Joint Venture

Prepared for
Alaska Power Authority

Final Report
June 1985

NOTICE

ANY QUESTIONS OR COMMENTS CONCERNING
THIS REPORT SHOULD BE DIRECTED TO
THE ALASKA POWER AUTHORITY
SUSITNA PROJECT OFFICE

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EXECUTIVE SUMMARY

Historical Research Associates (HRA) was subcontracted by the Harza-Ebasco Susitna Joint Venture, Inc., to develop and test a predictive model for the location and density of cultural resources along the Susitna Hydroelectric Project's Linear Features. The Alaska Power Authority's (APA) Susitna project is lcated on the Susitna River, approximately 140 miles northeast of Anchorage, Alaska. The proposed Linear Features consist of three transmission lines which will interconnect railbelt communities from Anchorage to Fairbanks with power plants on the Susitna River; a railroad spur from Gold Creek to Devil Canyon; and an access road from the Denali Highway south to the Watana construction campsite, then west to Devil Canyon. The APA submitted an application to the Federal Energy Regulatory Commission (FERC) for a license to develop the project in February 1983. In May 1984, FERC issued a Draft Environmental Impact Statement (DEIS) for the project.

The goal of the current project is to develop a model which can be used to predict the occurrence and density of cultural resource site types, by age and cultural affiliation if possible, within defined environmental units along the Linear Features corridors. This study will utilize research units 0.5 mile square located along the corridors. The resulting model eventually will be used by the Authority and its contractors to:

(1) assist in the final design and siting of the Susitna Hydroelectric Project's Linear Features;

(2) determine the nature, methods, and extent of additional cultural resources survey which may be necessary along the Linear Features; and

(3) anticipate the types, amounts, and costs of measures which may be needed to mitigate the adverse effects on significant cultural resources of constructing and operating the Project's Linear Features.

This report presents the results of the first phase of work, Background Research and Model Development. Phase I tasks included an extensive literature search and data source review; compilation and analysis of pertinent data; development of a predictive model; presentation of sample research units selected to test the model; and field methods to be used. Phase II, which will be reported separately, shall include implementing the field work, comparing the results with the initial model, and refining the model.

The literature review resulted in preparation of environmental and cultural overviews which develop the setting for the project area and a framework for assessing Phase I and II data. Environmental units, described as specific Terrain and Vegetative Units, are defined in the text and are plotted on Linear Feature maps. Seven environmental and cultural variables from 398 sites consisting of 476 identifiable stratigraphic components or individual activity loci form the data base for development of the Phase I predictive model. These sites are located on or near the Linear Features.

Non-metric factor analysis of the entire data set was then conducted, to investigate bivariate association of site type by Terrain Unit, site type by Vegetative Unit, chronological period by Terrain Unit, and chronological period by Vegetative Unit. This resulted in the development of the predictive model for prehistoric, ethnographic, and historic sites within the Linear Features.

The Linear Features were then divided into 552 160-acre Research Units. Environmental data were then recorded for each Research Unit, and totalled for the entire study area. Upon completion of the above plotting, 110 160-acre Sample Units were selected on the basis of weighted environmental units to allow proportionate representation within the population. A field survey research design has been developed to test the accuracy of the model in predicting the distribution of cultural resources. Data derived from results of Phase II field work will be analyzed and reported separately. Model revisions, including density projections, will be presented as part of the Phase II report.

1.0 INTRODUCTION

T. Weber Greiser
Historical Research Associates

1.1 Project Description

Historical Research Associates (HRA), of Missoula, Montana, was subcontracted by the Harza-Ebasco Susitna Joint Venture, Inc., to develop and test a predictive model for the location and density of cultural resources along the Susitna Hydroelectric Project's proposed transmission lines, access roads, and railroad spur (the Linear Features). The Alaska Power Authority's Susitna Hydroelectric Project is located on the Susitna River, approximately 140 miles northeast of Anchorage, Alaska. The Linear Features will consist of:

(1) 76.3 miles of new access road corridor from the Denali Highway south to the Watana construction campsite, then west to Devil Canyon;

(2) 10.2 miles of railroad access corridor from a railhead facility at Gold Creek to Devil Canyon.

(3) 36.2 miles of transmission line corridor from power plants at Watana and Devil Canyon dams to a new substation at Gold Creek;

(4) 94.4 miles of transmission line corridor from Healy to the new Ester substation, west of Fairbanks; and

(5) 64.4 miles of transmission line corridor from Willow to the new Knik Arm and University substations in the Anchorage area.

Figure 1-1 presents the general location of the Linear Features in relation to southcentral Alaska. The Alaska Power Authority submitted an application for a license to develop the project to the Federal Energy Regulatory Commission (FERC) in February 1983. In May 1984, FERC issued a Draft Environmental Impact Statement (DEIS) for the project.

The goal of the current project is to develop a model which can be used to predict the occurrence and density of cultural resource site types, by age and cultural affiliation if possible, within defined environmental units along the Linear Features corridors. This study will utilize research units 0.5 mile square located along the corridors. The resulting model eventually will be used by the Authority and its contractors to:

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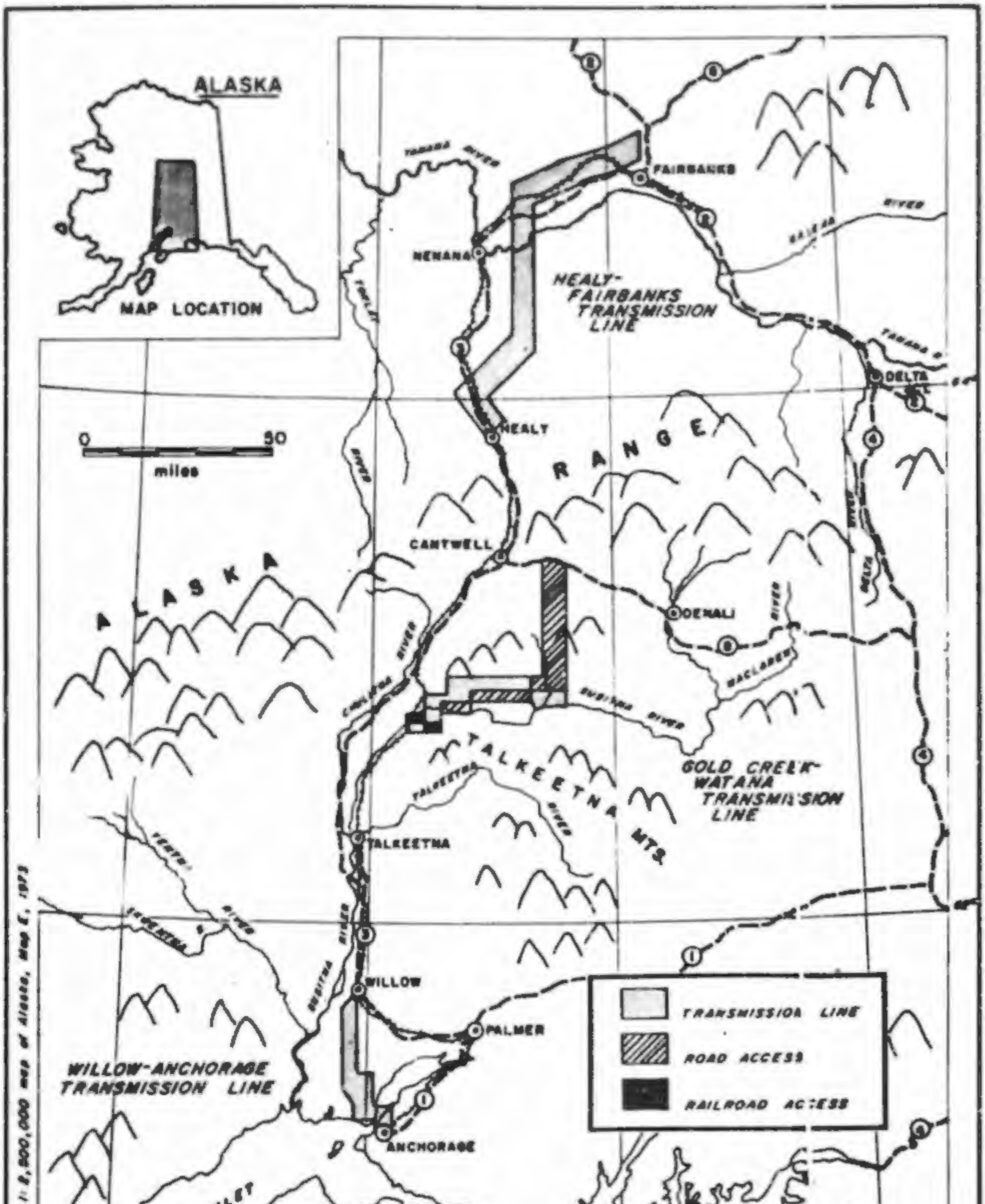

Figure 1-1. Map of the general locations of the Susitna Hydroelectric Project Linear Features.

1.2 Phase I Task Descriptions

Phase I has been divided into seven tasks, including preparation of this report. A summary of work conducted under each task is as follows.

1.2.1 Task 1 -- Background Research

Background research was initiated concurrently with the post-contract award conference, held from January 14 to January 19, 1985, in Anchorage and Fairbanks, Alaska. During this time, research of cultural resource and environmental materials was conducted at the Harza-Ebasco offices and at the Alaska Heritage Resources Survey (AHRS) Office of History and Archeology (Alaska Division of Parks and Outdoor Recreation, Department of Natural Resources) in Anchorage; and at Alaska Heritage Research Group, Inc. (AHRG), offices in Fairbanks. Background research has been conducted by HRA staff, AHRG staff (Appendix A), consulting historian Terrence Cole, and consulting ethnographer Priscilla Russell Kari, using data collected by James Kari (Appendix B).

Major sources include Arctic Bibliography, Bibliography of Books on Alaska Published Before 1868, indexes for the U.S. Geological Survey (USGS) Bulletins and Professional Papers, proceedings of the Alaskan Science Conference, Arctic, Arctic Anthropology, Anthropological Papers of the University of Alaska, American Antiquity, and other pertinent journals. In addition, bibliographies presented in University of Alaska Museum (UAM) studies for the Susitna Hydroelectric Project (Dixon et al. 1981, 1982, 1983, 1984) and the nearby Fort Wainwright study (Dixon et al. 1980), the 1983 U.S. Department of Agriculture Susitna River Basin Study Cultural Resource Assessment, and the Commonwealth Associates/AHRG Anchorage to Fairbanks Transmission Intertie Cultural Resource Survey (Bacon et al. 1983) were reviewed for pertinent references. During the initial literature search, references were checked at libraries at the University of Montana, the University of Alaska-Fairbanks, the University of Pennsylvania, Bryn Mawr College, and the American Philosophical Society (Philadelphia). Documents pertinent to the current research not accessible to HRA researchers at the University of Montana Mansfield Library were borrowed and/or copied through the other institutions.

The literature review provided the background information necessary to prepare the environmental and cultural overviews for the study area. As in most research areas, the best documented cultural and climatic data are for the recent past, with the amount and degree of detailed information rapidly decreasing as one researches earlier time periods.

Intensive research of the ethnographic data for the study area, including review of literature from published and unpublished data and interviews with Native informants, was conducted by Priscilla Russell Kari and James Kari. Their results are presented in a report that synthesizes annual rounds of Native inhabitants and presents lists of place names keyed to area maps (Appendix B). The annotated place name data is variable in quality, depending upon available informants and other available sources. The best data available are for the Dena'ina (Tanaina) (Anchorage to Willow and Gold Creek) area. The data available are moderately good for the Ahtna (access road) area, in that ethnographies are available and place names have been researched, although there is little supportive documentation. The Tanana (Fairbanks to Healy) area has not had comparable research conducted and provides the weakest data set. The emphasis of Kari's ongoing research as part of this project will be to conduct additional research through informant interviews for the Healy-Fairbanks area.

1.2.2 Task 2 -- Definition of Environmental Units

As part of the research conducted at the Harza-Ebasco offices in Anchorage, it was determined that maps were available in scales ranging from 1:2,000 ft. to 1:5,250 ft., with extensive geomorphological, geological, and vegetative information. These maps cover both the main inundation area of the Susitna project and all Linear Feature areas. Environmental units, which consist of Terrain and Vegetative Units, were transferred from their respective maps onto Exhibit G Linear Feature maps. This data transfer resulted in definition of a total of 38 Terrain Units and 9 Vegetative Units. For development of the cultural resource location model, previously recorded sites were interpreted in terms of these same Terrain and Vegetative Units.

1.2.3 Task 3 -- Definition of Site Types and Cultural Periods

Research conducted under Task 1 yielded 398 sites to be used as the primary data base for developing the predictive model. These site data allowed HRA staff to develop working definitions of functional site types which might be anticipated along the Linear Features. Certain site types, known ethnographically but not yet archeologically recorded, are also presented because of their potential for being located in the study area. In addition to site type, specific data sets recorded for these sites include site size, distance to water, appropriate Vegetative and Terrain Units, and whenever possible, age or cultural affiliation. As discussed in Chapter 3, the local chronology is poorly documented and the numerous proposed chronologies are confusing. The presence of volcanic ash lenses at many of the UAM sites in the Susitna Basin holds promise for development of a controlled local chronology, even though absolute dates of occupation are generally lacking.

1.2.4 Task 4 -- Environmental Mapping and Model Development

As discussed, defined Terrain and Vegetative Units were superimposed on the Linear Features. In addition, 551 160-acre research units were plotted along the Linear Features, overlying the environmental data. The units are oriented to a projected township grid and, where possible, are placed so that Linear Features are centered within them. Due to curves or angles in the various Linear Features and the need to use 160-acre-square units, some research units may have only a small portion of a Linear Feature in one corner.

As part of the actual model development, our predictive modeling consultant, Dr. Thomas Foor, aided HRA in developing computer codes for various types of data, which were entered onto the University of Montana's mainframe computer. Foor applied his knowledge of predictive modeling to determine appropriate computer applications for this study. A total of 476 cases from 398 sites were coded. The higher number of cases reflects that a number of sites had more than one locus recorded, which may have had a different function or have been occupied at a different time, and that some sites were stratified, with more than one occupation identified.

Non-metric factor analysis of the entire data set was then conducted, to investigate bivariate association of site type by Terrain Unit, site type by Vegetative Unit, chronological period by Terrain Unit, and chronological period by Vegetative Unit. This resulted in the development of the predictive model for prehistoric, ethnographic, and historic sites within the Linear Features.

1.2.5 Task 5 -- Development of Research Strategy

A field survey research design has been developed to test the accuracy of the model in predicting the distribution of cultural resources. The field survey will be conducted on no more than 20% and no less than 15% of the total Linear Features area. A total of 110 160-acre sample units have been selected for field survey, so that major Terrain and Vegetative Units identified are represented in sufficient quantity to interpret the validity of hypothesized relationships among the defined environments and cultural resources. Information on average site size within each Terrain Unit and Vegetative Unit has been computer generated. These data are used to determine appropriate intervals between field surveyors, and to guide testing strategy for potential sites that lack surface indication.

1.2.6 Task 6 -- Phase I Report Production

This task included preparation and submission of an annotated Phase I report outline early in February 1985. This outline was reviewed by Harza-Ebasco personnel, and recommendations for revisions and questions about the outline were submitted to HRA. The following report generally follows the accepted outline.

1.2.7 Task 7 -- Quality Control and Project Management

During Phase I, the Project Manager monitored research work and progress of all in-house personnel, personnel supplied by AHRG, and other consultants. Research and writing progress was monitored on a weekly basis, and monthly reports were prepared and submitted to Harza-Ebasco. These reports included task-by-task progress information, anticipated problems, and suggested recommendations for solving those problems. The object of quality control and project management was to ensure that all Phase I tasks were completed thoroughly and efficiently.

1.3 Phase I Report

This report contains six additional chapters, presenting the results of background research in the form of environmental and cultural overviews, analysis of environmental and cultural data, development of the predictive model, methodology for field testing the model, and discussion of additional research considerations. These chapters are followed by a complete literature bibliography.

Chapter 2 presents the environmental overview, which includes methods used to research available data on environments, presentation of Late Pleistocene and Holocene reconstructed environments, and data on the current environment. Supportive figures and tables are included.

Chapter 3 presents overviews of the prehistory, ethnography and ethnohistory, and history of southcentral Alaska, with emphasis on the Linear Feature areas. Pertinent references for the archeological, ethnographic, ethnohistoric, and historic literature from within the general study area are cited as is appropriate. Local Athapaskan settlement and subsistence patterns are presented as a guide to understanding Native land use patterns in the study area. Again, graphic display is used when and where appropriate.

Chapter 4 presents a review of data sources, with brief evaluations of their utility in developing the predictive model. A copy of the coded data is then presented, with keys defining the Terrain Units, Vegetative Units, and other data recorded for use in this report.

Chapter 5 is the presentation of the predictive model, with an introductory discussion of data modeling and how the site location model was developed. Following the presentation of the model, observed patterns of cultural resource distribution through time and space are discussed.

Chapter 6 presents the sample units selected for field testing the model, and methods to be employed during field work. A rationale for sample selection is presented and, where environmental variables dictate, variation in methods or techniques also are discussed.

The final chapter summarizes the current state of cultural resource information and recommends methods to be applied in southcentral, interior Alaska. Furthermore, previous attempts at predictive modeling are reviewed and suggestions for a systematic approach to behavioral interpretations are presented.

2.0 ENVIRONMENTAL SETTING

T. Weber Greiser and Sally T. Greiser
Historical Research Associates

2.1 Late Pleistocene and Early Holocene Environments

Knowledge of past environments is essential to the understanding of human adaptations through time. Although it is widely recognized that climate and, thus, environment have changed on global, regional, and even local levels, our review of available literature revealed that the study of paleoclimate in interior Alaska is in its infancy and relatively little is known about the specifics of climatic and environmental change through time. For the study area, the last decade is marked by a burst of activity in the realm of paleoenvironmental reconstruction (Hopkins et al. 1982; Péwé 1975, 1983; Powers et al. 1983). Even with this burst of activity, only the most obvious environmental changes can be distinguished. Accordingly, the following reconstruction of past climates (Fig. 2-1) is tentative and general, at best, but does serve as a backdrop from which to consider human adaptations.

2.1.1 Late Pleistocene (ca. 30,000-14,000 B.P.)

Most researchers agree that the end of the Late Pleistocene, 30,000 to 14,000 years B.P., was characterized by a cold and dry climate and steppe-tundra habitat in unglaciated areas. Matthews (1982:127) describes the Late Pleistocene environment of Beringia as a "treeless region composed of a mosaic of communities, among which were large tracts that can only be termed steppe-like." Similarly, Hopkins (1982:151) describes Late Pleistocene vegetation of Beringia as:

> a mosaic of vegetation types differing from present-day Beringian vegetation in its near absence of forests and

	Climatic Characteristics	Flora	Fauna
Modern		Essentially modern	
2,000 B.P.	Essentially modern; Macroclimatic trend of Neoglaciation shows little or no effect on local vegetation		Essentially modern
4,000 B.P.			
6,000 B.P.		Decline in spruce	
		Tree line maximum	Diminution of large mammal species -- most notably bison
8,000 B.P.		Dominance of spruce-birch forests	
		Wide-spread peat accumulation	
10,000 B.P.		Spruce in lowlands	
12,000 B.P.	Drier, warmer summers; increased precipitation; increased winter snow cover	Abrupt change to mesic shrub tundra	Less diversity in large mammals due to extinctions
14,000 B.P.	Approximate Holocene/Pleistocene boundary		
16,000 B.P.	Colder, drier, & more continental than present; spring dominant storms	Steppe-tundra	Large mammals more varied than today; fauna generally diverse & abundant

Figure 2-1. Preliminary reconstruction of past climates.

> woodlands, a much more restricted role for shrublands and marshes, and a predominance of very extensive steppe-tundra biotopes characterized by discontinuous herbaceous vegetation in which xerophytes were prominent.

Guthrie's (1983:250-253) reconstruction of a "mammoth steppe" biome in southcentral, interior Alaska fits well with the descriptions of Beringian environments presented above.

Bliss and Richards (1982) assume, on the basis of pollen spectra and modern plant community distribution, that:

> four major habitat types occupied regional landscapes in Beringia. Tall-shrub willow communities of _Salix alaxensis_, _S. pulchra_, and _S. arbusculoides_ occupied flood plains and low river terraces. A rich understory of herbs and grasses in open areas no doubt occurred as with present shrub communities. In poorly drained lowlands, sedge-moss meadows prevailed with a species composition and plant structure similar to those found in similar habitats today. . .

and

> a mosaic of upland sedge. . ., grass, and _Artemesia_ occupied the better-drained rolling uplands (Bliss and Richards 1982:252).

Climate during this interval is described as colder and drier than present (Hopkins 1982), but also more continental, with comparatively warm summers over much of Beringia north of the Alaska Range (Young 1982).

The Late Pleistocene steppe-tundra supported an abundant and diverse fauna (Guthrie 1968a, 1968b, 1983). Large herbivores included mammoth, bison, horse, sheep, goat, wapiti, saiga, deer, musk oxen, and others. Non-herbivorous mammalian species also were diverse and abundant. Seasonal distribution of these species is unclear because so many factors are unknown. As Guthrie (1983) points out, winter range cannot be reconstructed for Late

Pleistocene mammals because of the lack of information about winter snow cover at the time, other than that it was light (Guthrie 1968a, b).

2.1.2 Terminal Pleistocene/Incipient Holocene (ca. 14,000-10,000 B.P.)

The Pleistocene came to a relatively abrupt end with a climatic change that resulted in rapid invasion of dwarf birch shrubs between 14,000 and 12,000 years ago throughout interior Alaska (Ager 1975, 1982, 1983; Hopkins 1982). Summers were warmer and drier and there was an increase in precipitation.

This same period coincides with general deglaciation, ca. 13,300 to 9,600 years ago, as derived from minimum dates on soil. Fluctuations, including readvances of the Cordilleran ice sheet, affected parts of the area until approximately 12,000 years ago (Porter et al. 1983). Alpine glaciation extended well into major valleys such as the Nenana, at least into the 13th millenium B.P. The youngest glacial advance known in the Alaska Range, restricted to the heads of the highest mountain valleys, occurred sometime before 9,800 years ago (Porter et al. 1983:81).

Young (1982), in describing vegetational changes in land-bridge Beringia during this time, suggests that the invasion of dwarf birch was so rapid and widespread as to be termed catastrophic. He interprets the influx of birch pollen as "being the result of a rapid shift from a highly continental climate associated with the vast land areas of the Bering land bridge to a more maritime climate caused by the expansion of the seas" (Young 1982:191). The changed vegetation affected changes in soils (Young 1982), as is evidenced by the initiation of widespread peat accumulation by 10,000 B.P. (Hopkins 1982). The raised water table and vegetational changes had profound effects on other elements of the ecosystem (e.g., large mammals and humans) (Young 1982). Only relict steppe tundra remained, imposing stress on the varied, large, grazing species adapted to this habitat. Furthermore, the increased precipitation would have resulted in increased snow cover which, in turn, would have affected winter range for large mammals. These factors certainly influenced the rate of extinction of large Pleistocene mammals that occurred during these millenia. Concurrently, many of those species which survived experienced diminution or dwarfing.

2.1.3 Early Holocene (ca. 10,000-6,000 B.P.)

Spruce began to penetrate interior Alaska some 10,000 years ago. This invasion may have been enabled by the continued recession of the continental glaciers and the widening of the "corridor." The warming trend, which marked the Pleistocene/Holocene boundary, continued until approximately 6,000 years ago, when tree lines reached their maximum elevation. This tree line maximum coincided with the Thermal Maximum. (Some researchers use an age of 4,000 years for the Thermal Maximum, e.g., Anderson 1975.)

Holocene glacial cycles have been documented in some areas for the period 8,500 to 6,000 years ago (Péwé 1975). Landscape alterations were notable. The "geologic components of the landscape has changed significantly during this time as a result of late- and post-glacial fluvial, eolian and cryopedologic processes" (Anderson 1975:43). Landscape alterations are obviously important to consider in the context of a predictive model of human settlement.

Faunal distributions mimicked habitat distributions. Grazers continued to be pressured into reduced areas of appropriate habitat and the boreal forest provided abundantly for the more solitary browser species which favored that biome.

2.1.4 Late Holocene (ca. 6,000 B.P.-Present)

Most researchers agree that the climate of the last 5,000 to 6,000 years has been fairly constant. Although on a large scale, climate has not been constant through these millenia, climatic trends such as neoglaciation apparently have not been of sufficient magnitude to create a notable change in the pollen record from the study area (Ager 1972:96; Anderson 1975:45). This is not to say that minor alterations in plant communities did not occur, but that general composition and distribution have remained essentially the same. This is surprising, given the magnitude of glacial re-advance during the last 3,000 years, such as the entire filling of Glacier Bay with glacial ice (Pewe 1975).

Given the relative vegetative stability of the last six millenia, faunal composition and distribution also have remained essentially stable, except as they may have been affected by glacial expansion, at least until early historic times. As a result of intensive hunting pressures on such fur-bearing and prey species as beaver, the composition of the faunal community during historic times was altered. For the entire Late Holocene period, the reader is referred to the following section on Recent Environment for descriptive details.

2.2 Present Environment

Geology, climate, vegetation, and wildlife are briefly summarized in the following discussion. All aspects of the environment previously have been researched, reported on, and summarized as part of the Federal Energy Regulatory Commission (FERC) application process. For specific details, the reader is referred to the Draft Environmental Impact Statement (DEIS) prepared by FERC using Alaska Power Authority (APA) baseline data; various baseline data collection studies which have been conducted or are in progress in relation to the Susitna Hydroelectric Project; and additional pertinent sources, as referenced.

The principal portion of the Susitna Hydroelectric Project is located in the middle Susitna Basin of southcentral Alaska, between the Alaska Range to the north and west, the Talkeetna Mountains to the south, and the Copper River lowlands to the east. The Linear Features associated with the Susitna Project, which are the subject of the current study, run north and a little west through the Alaska Range into the Yukon-Tanana Basin to Fairbanks, and south along the Susitna River nearly to the coast, and then east across Knik Arm into Anchorage.

2.2.1 Physical Environment

The general study area which includes the Linear Features transects four physiographic provinces, as defined by Wahrhaftig (1965). These provinces, from south to north, are the Coastal Trough, which includes the Susitna Basin; the Alaska-Aleutian Province, which includes the Alaska Range; western Alaska, which runs north from the Alaska Range foothills to the Yukon River and includes most of the lower Yukon-lower Tanana-Kuskokwim basins; and the periphery of the Northern Plateaus, which extend east into Canada from near the confluence of the Yukon and Tanana Rivers.

The four physiographic provinces are further broken into physiographic divisions by Wahrhaftig (1965). Seven of these divisions are located either within or adjacent to the study area and, from north to south, are as follows (Fig. 2-2).

The South Intertie or southern transmission line originates in Anchorage, crosses Cook Inlet, and follows a westerly, then northerly, route across the formerly glaciated, Cook Inlet-Susitna Lowland division. The elevation is less than 500 feet

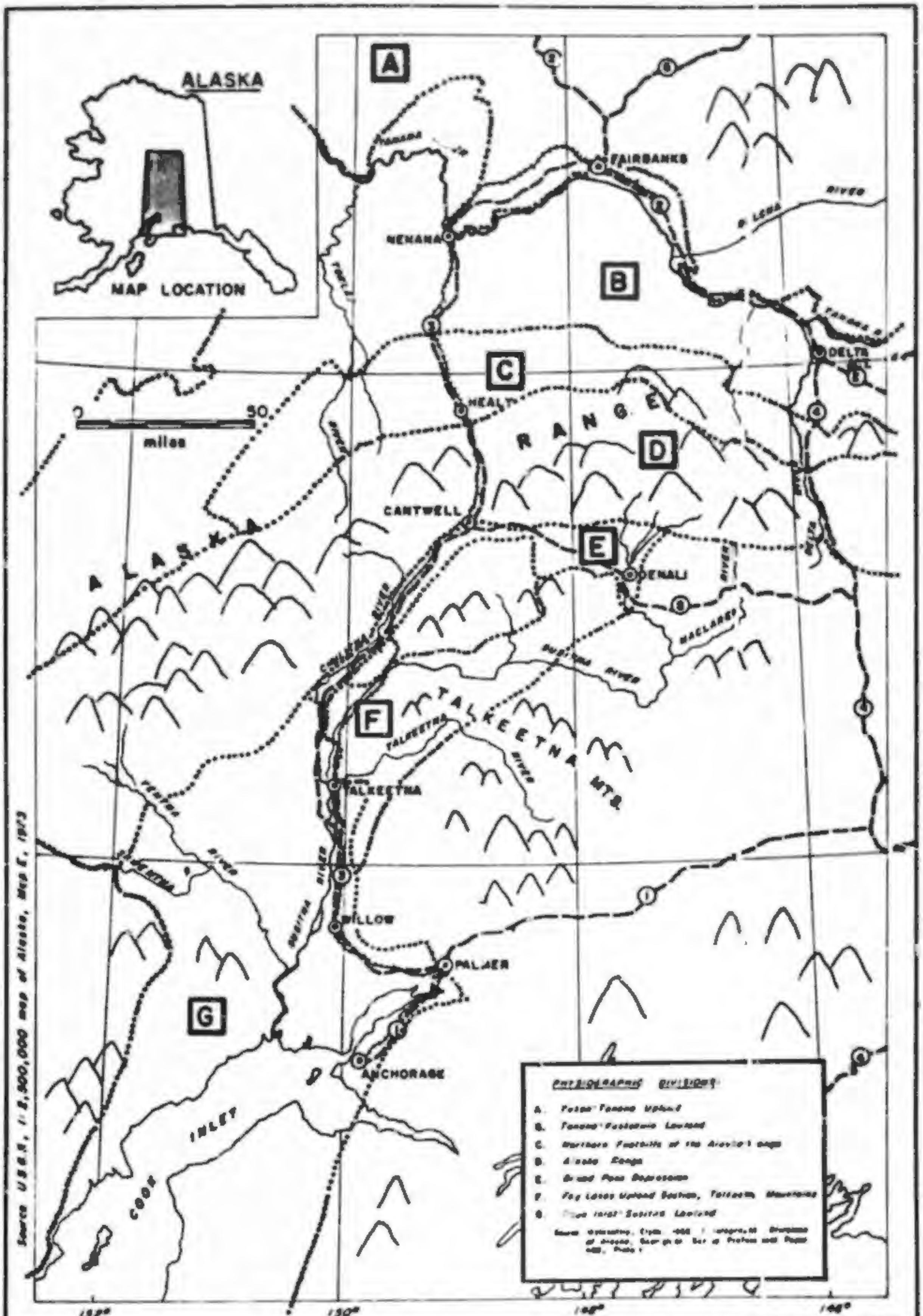

Figure 2-7. Physiographic divisions transected by or adjacent to the Susitna Hydroelectric Project Linear Features.

and features include ground moraines, stagnant ice topography, drumlin fields, eskers, and outwash plains. Near the Alaska Range and Talkeetna Mountains, rolling upland areas in this division rise to 3,000 feet. The Susitna River is the primary drainage in this structural basin. The area has only one glacier to the west and some permafrost in the north. Bedrock geology consists of Tertiary age, coal-bearing rocks covered by glacial moraine and outwash and marine and lake deposits.

The railroad access and lower three-fourths of the access road, as well as the middle Susitna River, are within the Fog Lakes Upland section of the Talkeetna Mountains division. The Upland section rises to elevations of 3,000 to 4,500 feet and varies from extensive glacial sculpturing in the southwest to high, flat, unglaciated terraces in the northeast. Portions of the access road transect foothills of the Chulitna Mountains section, which consists of a compact group of glaciated mountain blocks interspersed with low passes. Glaciers in the division are drained by large, braided tributaries to the Susitna and other rivers. The Susitna has a 1,000-foot, steep-walled gorge, Devil Canyon, where it has cut through the mountains. Lakes, primarily in the northern part of the division, are located in ice-carved, moraine-dammed basins, and are up to several miles in length. Geologic resources of the primary area of interest in the Talkeetna Mountains are northeast-trending belts of greenstones, graywacke, and argillite of Paleozoic and Mesozoic age.

The eastern portion of the Broad Pass Depression division is a broad, glaciated lowland which encompasses the northern quarter of the access road. The rolling morainal topography and central outwash flats are underlain by permafrost. This 1,000- to 2,500-foot elevation area contains the upper Nenana and Susitna Rivers. Since drainages originate in nearby glaciers, they are swift, turbid, and braided. Lakes are common and are considered morainal or thaw in origin. The main part of the Broad Pass Depression is underlain by Tertiary coal-bearing rocks in fault contact with slightly metamorphosed Paleozoic and Mesozoic rocks. The lowlands, east of the Tertiary Age graben, are mantled with ground moraine.

A small part of the central section of the Alaska Range division is included along the southern periphery of the Healy-Fairbanks Transmission Line. The Nenana Gorge, just south of Healy, is typical of the superposed drainages which cross-cut the 6,000-9,000-foot glacial ridges and enhance the 9,500 to 20,000-feet, snow-capped mountains. The Alaska Range contains numerous valley glaciers which produce swift, braided drainages. Major faults parallel the Range and a complex of synclines has forced rocks of Paleozoic and perhaps Precambrian age to the flanks. Tertiary rocks have easily eroded to form lowlands. A minimum of four periods of glaciation are recognized in the Range, permafrost is extensive and well developed, and solifluction features are present.

From Healy to between Browne and Rex, which includes the southern third of the Healy-Fairbanks Transmission Line, is the division known as the Northern Foothills of the Alaska Range. The foothills are broad, east/west, flat-topped ridges 2,000 to 4,500 feet high, interspersed with broad, rolling lowlands 700 to 1,500 feet high. Although primarily unglaciated, some valley glaciers from the Alaska Range extended into the foothills. Drainages, flowing mainly north-northwest across the foothills from the mountains, have cut very deep canyons into the ridges and created terraced valleys in the lowlands. Extensive badlands have been incised into the soft substrate of Tertiary age. Lakes and ponds in the division are of thaw or morainal origin. There are extensive permafrost, frost polygons, and solifluction features. Bedrock geology of the ridges is schist and granite intrusives, while the lowlands contain poorly consolidated Tertiary rocks and thick beds of subbituminous coal capped with coarse conglomerate.

The final portion of the Healy-Fairbanks Transmission Line is primarily in the Tanana-Kuskokwim Lowland division, which is under 1,000 feet in elevation. Surface topography includes outwash fans from the Alaska Range; bands of morainal deposits at the upper ends of some fans; broad, deep, terraced valleys associated with rivers originating in the Alaska Range; flood plains of the Tanana and Kuskokwim; and extensive, stabilized dune fields between Nenana and McGrath. Drainages include the major east/west-flowing rivers plus braided glacial streams originating in the Alaska Range. Thaw lakes occur in fine alluvium, while thaw sinks are in loess. The area is unglaciated and contains permafrost and dry permafrost. Coarse to fine outwash fan deposits and alluvial fill several hundred feet thick are the primary geologic features below the transmission line corridor.

The final division, along the north edge of the study area, is the Yukon-Tanana Upland. The area near Fairbanks consists of flat, alluvium-filled valleys, 1,000-1,500 feet in elevation, generally less than 0.5 mile wide, located between broad, gentle, generally flat-topped divide ridges and spurs between 1,500 and 1,300 feet, which are in turn topped by tight clusters of rugged mountains rising 4,000-5,000 feet. Although considered within the Yukon drainage basin. streams along the south half of the division flow into the Tanana River. There are few thaw lakes in valley floors and low passes. There are no glaciers, although active mass wasting occurs in the mountains, ice wedges are present in frozen valley mucks, and scattered permafrost is present. The portion closest to the study area has thick, windborn silts on slopes, with thick muck over deep gravels in the valleys.

2.2.2. Geology

The regional geology is best summarized in the following baseline description from Chapter 6 (Geological and Soil Resources) of the Susitna Hydroelectric Project FERC License Application (pp. E-6-3 through E-6-4). Based on the following description, one can gain an initial understanding of the physical environment which prehistoric occupants adapted to and exploited. Some idea regarding locally available lithic raw materials for manufacture of stone tools also is gained.

2.2.2.1 Stratigraphy

"The oldest rocks which outcrop in the region are a metamorphosed upper Paleozoic . . . rock sequence which trends northeastward along the eastern portion of the Susitna River basin . . . . These rocks consist chiefly of coarse to fine grained clastic flows and tuffs of basaltic to andesitic composition, locally containing marble interbeds. This system of rocks is uncomformably overlain by Triassic and Jurassic metavolcanic and sedimentary rocks. These rocks consist of a shallow marine sequence of metabasalt flows, interbedded with chert, argillite, marble, and volcaniclastic rocks. These are best expressed in the project area around Watana and Portage Creeks. The Paleozoic and lower Mesozoic rocks are intruded by Jurassic plutonic rocks composed chiefly of granodiorite and quartz diorite. The Jurassic age intrusive rocks form a batholithic complex of the Talkeetna Mountains.

"Thick turbidite sequences of argillite and graywackes were deposited during the Cretaceous. These deposits form the bedrock at the Devil Canyon site. These rocks were subsequently deformed and intruded by a series of Teritary age plutonic rocks ranging in composition from granite to diorite and included related felsic and mafic volcanic extrusive rocks. The Watana site is underlain by one of these large plutonic bodies. These plutons were subsequently intruded and overlain by felsic and mafic volcanics. Mafic volcanics, composed of andesite prophyry, occur downstream from the Watana site.

2.2.2.2 Tectonic History

"At least three major episodes of deformation are recognized for the project areas:

(1) A period of intense metamorphism, plutonism, and uplift in the Jurassic;

(2) A similar orogeny during the middle to late Cretaceous; and

(3) A period of extensive uplift and denudation from the middle Tertiary to Quaternary.

The first period (early to middle Jurassic) was the first major orogenic event in the Susitna River basin as it now exists. It was characterized by the intrusion of plutons and accompanied by crustal uplift and regional metamorphism.

"Most of the structural features in the region are the result of the Cretaceous orogeny associated with the accretion of northwest drifting continental blocks into the North American plate. This plate convergence resulted in complex thrust faulting and folding which produced the pronounced northeast/southwest structural grain across the region. The argillite and graywacke beds in the Devil Canyon area were isoclinally folded along northwest-trending folds during this orogeny. The majority of the structural features, of which the Talkeetna Thrust fault is the most prominent in the Talkeetna Mountains, are a consequence of this orogeny. The Talkeetna Thrust is postulated as representing an old suture zone, involving the thrusting of

Paleozoic, Triassic and Jurassic rocks over the Cretaceous sedimentary rocks. . . . Other compressional structures related to this orogeny are evident in the intense shear zones roughly parallel to and southeast of the Talkeetna Thrust.

"Tertiary deformations are evidenced by a complex system of normal, oblique slip, and high-angle reverse faults. The prominent tectonic features of this period bracket the basin area. The Denali fault, a right-lateral, strike-slip fault 40 to 43 miles north of the damsites on the Susitna River, exhibits evidence of fault displacement during Cenozoic time. The Castle Mountain-Caribou fault system, which borders the Talkeetna Mountains approximately 70 miles southeast of the sites, is a normal fault which has had fault displacement during the Holocene.

2.2.2.3 Quaternary Geology

"A period of cyclic climatic cooling during the Quaternary resulted in repeated glaciation of southern Alaska. Little information is available regarding the glacial history in the upper Susitna River basin. Unlike the north side of the Alaska Range, which is characterized by alpine type glaciation, the Susitna Basin experienced coalescing piedmont glaciers that originated from both the Alaska Range and the Talkeetna Mountains which merged and filled the upper basin area.

"At least three periods of glaciation have been delineated for the region based on the glacial stratigraphy. During the most recent period (Late Wisconsinan), glaciers filled the adjoining lowland basins and spread onto the continental shelf. . . . Waning of the ice masses from the Alaska Range and Talkeetna Mountains formed ice barriers which blocked the drainage of glacial meltwater and produced proglacial lakes. As a consequence of the repeated glaciation, the Susitna and Copper River basins are covered by varying depths of glacial till and topographic features of glacial origin.

"Within the site region, the late Quaternary surfaces include those of Holocene and Pleistocene age (including the Wisconsinan and Illinoian stages). These surfaces range from a few years to approximately 120,000 years before present."

2.2.3 Terrain Units

During the initial phase of research for data on environments or microenvironments located within or adjacent to the Linear Features, a set of maps prepared in 1981 were made available to HRA. These maps illustrate individual landforms and closely correlated landforms, referred to as Terrain Units, which are physical divisions of the project environment and were determined to be a usable set of microenvironmental variables. The maps cover most of the Linear Features, plus all of the proposed inundation area (ACRES/R&M 1981a, 1981b). The area adjacent to Cook Inlet had not been mapped. Therefore, data presented by Schmoll and Dobrovolny (1972) has been adapted by HRA to the same format. The discussion below is extracted from cover pages of the ACRES/R&M (1981a) maps. It is followed by Table 2-1, which presents HRA's Terrain Unit numbers (A1-A38); ACRES/R&M unit symbols, names, topograhic and areal distribution, and soil stratigraphy; and the Linear Feature(s) that each unit is associated with, i.e., (1) South Intertie, (2) Road Access/Railroad Access, and (3) North Intertie. The Terrain Unit map scale for the access roads/inundation area is 1:24,000 and for the North and South Interties is 1:30,000. Finally, Terrain Units have been plotted on the Linear Features maps (FERC Application Plate G) and are included as a separate, but integral, part of this report (Fig. 2-3).

The primary object of definition and documentation of the Terrain Units was to develop data for use by engineers. However, geologic factors such as permafrost, slopes, erodible soils, buried channels, flood plains, and organic materials are usable in defining where various human activities might occur, as well as giving physiographic attributes to areas where human activities have been defined. As presented in the ACRES/R&M (1981a) report:

> A <u>landform</u> is defined (Kreig and Reger 1976) as any element of the landscape which has a defineable composition and range of physical and visual characteristics. Such characteristics can include topographic form, drainage pattern, and gully morphology. Landforms classified into groups based on common models of origin are most useful because similar geologic processes usually produce similar topography, soil properties, and engineering characteristics. The <u>terrain unit</u> is defined as a special purpose term comprising the landforms expected to occur from the ground surface to a depth of about 25 feet. . . . The terrain unit is used in mapping landforms on an areal basis.

ACRES/R&M (1981a) have mapped the areal extent of each Terrain Unit and have identified each with letter symbols. The symbols include genetic origin (i.e., G = glacial), specific Terrain Unit, and whether the materials are frozen (i.e., -f). Specific composition of each bedrock material is designated, which again may aid in defining sources of lithic raw material. Where landforms were mapped as compound or complex Terrain Units, these data currently are being retained for the current report.

> Compound terrain units result when one landform overlies a second recognized unit at a shallow depth (less than 25 feet), such as a thin sheet of glacial till overlying bedrock or a mantle of lacustrine sediments overlying till. Complex terrain units have been mapped w[h]ere the surficial exposure pattern of two landforms are so intricately related that they must be mapped as a terrain unit complex, such as some areas of bedrock and colluvium. The compound and complex terrain units behave and are described as a composite of individual landforms comprising them.

Table 2-1

Terrain Units Located Within the Linear Features

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association*
A1	O	Organic materials	In swales between small rises overlying all other terrain units. Generally flat and very poorly drained.	Decomposed and undecomposed organic materials with some silt	1, 2, 3
A2	Fp	Flood plain deposits	Flat plains, slightly above and adjacent to the present Susitna River and its major tributaries	Rounded cobbles, gravel and sand sorted and layered. With or without silt cover.	1, 2, 3
A3	Gta	Ablation till	Tributary valley side walls and valley bottoms in general, between Tsusena and Deadman Creek hummocky rolling surface, numerous channels	Rounded and striated cobbles, gravel, and sand, no sorting or layering. Boulder-cobble lag covering surface.	2
A4	GFk	Kame deposits	Rounded to sharp-crested, hummocky hills	Rounded and striated cobbles, gravel, and sand. Crudely sorted and layered.	2
A5	$\frac{Gta}{Bxu}$	Ablation till over unweathered bedrock	Hummocky, rolling surface transitional to higher mountains adjacent to Deadman Creek	Rounded and striated cobbles, gravel and sand, no sorting or layering over bedrock	2

*Linear Feature Association Key: 1 = South Intertie
2 = Road Access/Railroad Access
3 = North Intertie

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A6	Gtb-f	Basal till (frozen)	Bottoms of larger U-shaped valleys and adjacent gentle slopes	Gravely silty sand and gravely sandy silt; no layering or sorting; cobbles and boulders poorly rounded and striated.	2
A7	$\frac{C}{Bxu}$ +Bxu	Colluvium over bedrock and bedrock exposure	High elevation mountain area; stream-incised hills and bedrock ridges throughout the corridor and in scarps along the Nenana River	Angular blocks of rock with some sand and silt overlying bedrock (Birch Creek Schist)	2, 3
A8	$\frac{L}{Gtb-f}$	Lacustrine deposits over basal till	Lowlands (below 3,000') between Stephan Lake and Watana Creek, and extending upstream past the Tyone River	Well-sorted silty sand and sandy silt overlying basal till	2
A9	Fpt	Terrace	Flat surface remnants of former flood plain deposits isolated above present flood plain	Rounded cobbles, gravel and sand with some silt covered by a thin silt layers. Sorted and layered.	1, 2, 3
A10	Ffg	Granular alluvial fan	Low cone-shaped deposits formed where high gradient streams flow onto flat surfaces	Rounded cobbles and gravel with sand and some silt; some sorting and layering of materials	1, 2, 3
A11	GFe	Esker deposits	Rounded to sharp-crested, sinuous ridges in upper Susitna area	Rounded and striated cobbles, gravel, and sand. Crudely to well sorted and layered.	2

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A12	Bxu	Unweathered, consolidated bedrock	Cliffs in river canyon; rounded knobs on broad valley floor and mountain peaks	—	2
A13	Cs-f/Fpt	Solifluction deposits (frozen) over terrace sediments	Smooth to lobate flows of frozen fine-grained materials, found on terrace of the Susitna, frequent between the Tyone and Oshetna Rivers	Silty, sand and sandy silt showing contorted layering over gentle sorted and layered rounded cobbles, gravel and sand	2
A14	Gtb-f/Bxu	Frozen basal till over bedrock	Rolling lowland areas and moderate to steeply sloping river canyon walls. Transitional to high mountain areas	Gravels, silty sand and sandy silt with no layering or sorting, overlying bedrock	2
A15	Ff-c+O/Ff	Fan cover deposits and organics over fan river bed deposits	Flat to gently sloping interchannel areas of the Totatlanika Fan, characterized by overbank deposition and organic material accumulation	Finely layered silt and sandy silt with associated organic materials overlying sandy channel deposits	3
A16	C/Scw +Scw	Colluvium over bedrock and bedrock exposure	Stream-incised hills; bedrock ridges and scarps throughout the corridor	Angular and rounded blocks of rocks, gravel, sand, and silt overlying weathered sedimentary congolmerate of the Nenana Gravel Formation	3

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A17	Mt	Marine tidal deposits	Marsh and mudflat areas, crossed by low gradient channels	Silt, sandy silt, and fine sand with some organic material	1
A18	GFo	Outwash deposits	Generally flat to gently sloping surfaces possibly with channels and numerous small scarps; found along the Nenana River	Rounded and striated cobbles, gravels, and sand, sorted and layered. Often with a silt cover.	1, 3
A19	$\frac{Cs}{GFo}$	Solifluction deposits over outwash	Smooth to lobate and striped flows of thawed outwash debris over in place older outwash materials	Gravels and sands with contorted layering and possible ice lenses over undisturbed outwash	3
A20	$\frac{C}{Nsu}$ +Nsu	Colluvium over bedrock and bedrock exposure	Stream-incised hills; bedrock ridges and scarp throughout the corridor	Angular and rounded blocks of rocks, gravel, sand, and silt overlying unweathered metamorphic schist of the Birch Creek Formation	3
A21	Gto	Glacial till	Subdued hummocky terrain found in isolated areas near Healy and on the high land south of Clear	Gravely silty sand and gravely sandy silty; no layering or sorting; cobbles and boulders poorly rounded and striated	1, 2
A22	$\frac{Cs}{Nsw}$	Solifluction deposits over weathered bedrock	Smooth to lobate and striped flows of thawed over frozen residual soil, colluvium, and till over weathered metamorphic schist of the Birch Creek and Totalanika Formations	Gravels, sands, and silts with faint contorting layers, possible ice lenses over bedrock	3

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A23	Cl	Landslide deposits	Hummocky, unconsolidated deposits most common along the Susitna River and its major tributaries	Silty gravels, silty sands and silts; possible crude contorted layers	1, 2, 3
A24	Fpa-c	Abandoned flood plain deposits	Flat to gently sloping abandoned flood plain surfaces generally with silt cover over riverbed materials; adjacent to active flood plain	Silt and sandy silt finely layered over sands and gravels; frequent ice lenses	3
A25	Ht	Tailings	Flat to hummocky tailings deposited from gold dredging and coal mining	Unsorted, crudely layered fine to coarse-grained deposits	3
A26	C+Elu / Nsw	Colluvium and loess over weathered bedrock	Fluvially carved weathered bedrock ridges mantled with colluvium and loess found between Fairbanks and Nenana	Silts, sands, and angular to subrounded blocks of bedrock over bedrock (Birch Creek Schist)	3
A27	Fss	Silty retransported deposits	Fluvial and colluvial retransported silt (loess) accumulations in the foot slope areas on the low hills between Nenana and Fairbanks	Sandy silt; massive to finely laminated, with some organics and ice-rich layers	3
A28	Elu	Eolian loess	Thick mantle covering the weathered bedrock hills north of the Tanana River	Angular sandy silt, massive or layered, well sorted	3

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A29	Es	Eolian sand	Well-sorted, clean sand forming low dunes overlying cover and riverbed deposits of the Totatlanika Fan	Eolian sorted and layered sand and silt, sand	1, 3
A30	C	Colluvial deposits	Predominantly found at the base of steeper bedrock slopes as coalescing cones and fans and rock glacier	Angular, frost-cracked blocks of rock, some silt and sand	1, 2
A31	Ff-r	Alluvial fan channel sediments	Low to medium gradient sandy channel deposits of the Totatlanika Fan; elevated by natural levees; often abandoned	Gravels, sands, and gravelly sands, layered and well sorted to well graded	3
A32	O/Gfo	Organic deposits over outwash	Low-lying, organic covered, flat to gentle outwash plains	Organic material overlying rounded and striated cobbles, gravel and sand, crudely sorted and layered	1
A33	O/Fd	Organics over deltaic deposits	Low-lying, organic-covered, surface of deltaic deposits laid down where the Susitna River entered the proglacial lake occupying Cook Inlet	Organics overlying sorted and layered sands and silts	1
A34	Fd	Fluvial delta deposit	Flat to gentle surfaces of deltair deposits formed where the Susitna River entered the Naptowne age proglacial lake occupying Cook Inlet	Gravel and silt, generally sorted and layered	1

Table 2-1. Terrain Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Topography and Areal Distribution	Soil Stratigraphy	Linear Feature Association
A35	Cs/Scw	Solifluction deposits over bedrock	Smooth to lobate and striped flows of thawed (over frozen) residual soil, colluvium, and till over weathered sedimentary conglomerate of the Nenana Gravel Formation	Gravels, sands, and silts with faint, contorted layers; possible ice layers over bedrock	3
A36	Cs-f/Ctb-f	Solifluction deposits (frozen) over basal till (frozen)	Smooth to lobate, steplike topography on gentle slopes above the proglacial lake level, west of Tsusena Creek	Unsorted gravels, sands, and silts with thin ice layers, contorted soil layering	2
A37	Cs-f/Gta	Solifluction deposits (frozen) over ablation till	Smooth to lobate and hummocky topography along Deadman Creek	Silty, sandy gravel and silty, gravelly sands showing contorted layering	2
A38	Cs-f/Bxu	Solifluction deposits (frozen) over bedrock	Smooth to lobate, steplike topography on the flanks of some mountains, north and south of the Devil Canyon area	Mixed gravels, sands, and silts with thin ice layers and faint, contorting soil layering over bedrock	2

Later in this report, cultural resource site data are presented in conjunction with Terrain Units. In Chapter 4, an initial table of known sites is presented which contains several variables, including Terrain Units. Chapter 5 subsequently presents the predictive model for site location, which includes site types and periods of occupation and how they relate to Terrain Units. Finally, in Chapter 6, the 160-acre Research Units and Sample Units are presented in tables showing the amount (in acres) of each Terrain Unit represented.

2.2.4. Climate[1]

The Linear Features associated with this project extend from a Transitional climatic zone located south of the Alaska Range into a Continental climatic zone to the north. In general, the Transitional zone has a wetter and more temperate climate, while the Continental zone climate is characterized by extremes in daily and seasonal temperatures (hotter summers, colder winters) and less precipitation [Joint Federal/State Land Use Planning Commission (JFSLUPC) 1973].

In the Lower Susitna basin, temperature extremes over a 50-year period have ranged from 103°F to -93°F. The temperatures in the Anchorage area are moderated by Cook Inlet. Temperature extremes at Willow since 1963 have been 90°F to -56°F. Temperature extremes in the middle Susitna area are typically 95°F to -58°F, with average southwest or northeast winds of 22 mph and extremes of 120 mph. Broad Pass temperature extremes are 107°F and -68°F, with high winds of 80 mph over the past 50 years (Commonwealth 1982). Temperature extremes at McKinley Park range from 90°F to -52°F. Average precipitation is 15 inches per year,

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[1]These data have been extracted from Plaskett (1977), Commonwealth Associates, Inc. (1982), and the 1984 Susitna Hydroelectric Project DEIS.

which falls mainly in June through September but includes an average annual snowfall of 75.7 inches (Plaskett 1977).

The limited, but deep, canyons bisecting the Alaska Range and foothills are funnels where winds reach record speeds. Healy has recorded speeds well in excess of 100 mph, with anticipated extremes of 160 mph for Healy and 190 mph for Nenana Gorge over a 50-year period. Prevailing winds are from the southeast, except during the summer, when they are from the northwest.

Average annual temperatures at Tanana, north of the Alaska Range, range from 58°F to -38°F, with extremes of over 94°F and below -50°F. Annual average precipitation is just under 13 inches, with over half falling between June and September (Streten 1969, 1975).

2.3 Botanical Resources/Vegetative Units

In 1980 and 1981, an intensive Plant Ecology Studies Project in the impoundment area as well as along the Linear Features was carried out by the University of Alaska Agricultural Experiment Station (McKendrick et al. 1982). Using the vegetation classification system of Viereck and Dyrness (1980), vegetation of the entire area was mapped at 1:250,000 and for specific project areas at scales of 1:24,000 to 1:63,360. Upon completion of the maps, field checking, which included reconnaissance surveys and more intensive sample areas, was conducted. Vegetation/habitat types were described on the basis of species composition and community structure. Cover of plant species in vegetation layers was based either on height of vegetation or diameter at breast height (dbh) of larger woody species. The layers are described thus:

(1) The ground layer consisted of all herbaceous species and all woody species less than 0.5 m tall;

(2) The shrub layer consisted of woody species taller than 0.5 m but less than 2.5 cm dbh;

(3) Understory vegetation was woody species between 2.5 cm and 10 cm dbh;

(4) Overstory vegetation consisted of species larger than 10 cm dbh (McKendrick et al. 1982:6).

The following general description of various portions of the study area from McKendrick et al. (1982:13-14, 30) best summarizes the vegetation and habitat types subsequently used by HRA for Vegetative Units.

"The upper Susitna River basin is located in the Pacific Mountain physiographic division in southcentral Alaska (JFSLUPCA 1973). The Susitna basin occurs within an ecoregion classified by Bailey (1976, 1978) as the Alaska Range Province of the Subarctic Division.

"The Susitna River system drains parts of the Alaska Range on the north and parts of the Talkeetna Mountains on the south. Many areas along the east-west portion of the river between the confluences of Portage Creek and the Oshetna River are steep and covered with conifer, deciduous, and mixed conifer and deciduous forests. Flat benches occur at the tops of these banks and usually contain low shrub or woodland conifer communities. Rising from these benches are low mountains covered by sedge-grass tundra and mat and cushion tundra.

"The southeastern portion of the study area between the Susitna River and Lake Louise is characterized by extensive flat areas covered with low shrubland and woodland conifer communities which, because of intergradations, are often intermixed and difficult to distinguish in the field or on aerial photographs. To the northeast, the area along the Susitna River between the

Maclaren River and the Denali Highway consists of woodland and open spruce stands. Farther east, low shrubland cover increases. The Clearwater Mountains north of the Denali Highway have extensive tundra vegetation. The flood plain of the Susitna River north of the Denali Highway has woodland spruce and willow stands, while the Alaska Range contains most of the permanent snow fields and glaciers in the study area.

"Steep portions and some adjacent areas along the east-west reaches of the river are considered to be in the closed spruce-hardwood forest type of Viereck and Little (1972), the moderately high mixed evergreen and deciduous forest map unit of Spetzman (1963), and the upland spruce hardwood forest by the JFSLUPCA (1973). Whichever classification one chooses, this type of vegetation is found mainly along rivers in the southcentral and interior regions of the state.

"The benches bordering the east-west portion of the river and the area around the Maclaren River are classified as moist tundra in all three of the previously mentioned references. This classification includes herbaceous meadows as well as shrub-dominated sites, both of which also occur around the Brooks Range, on the Seward Peninsula, and near the Kiliuck Mountains.

"The extensive flats in the lower Oshetna River and Lake Louise areas in the southeastern portion of the upper basin are considered open, low-growing spruce forests by Viereck and Little (1972), low mixed evergreen and deciduous forests by Spetzman (1963) and lowland spruce-hardwood forests by the JFSLUPCA (1973). Viereck and Little's (1972) description appears most appropriate since the area is covered primarily by spruce stands with treeless bogs.

"The vegetation along the lower mountains and the lower slopes of the higher mountains was classified as alpine tundra by

Viereck and Little (1972) and the JFSLUPCA (1973) and as barren and sparse dry tundra by Spetzman (1963). In the current study, some of these areas were mapped as rock while other areas were mapped as sedge-grass tundra or mat and cushion tundra. On the previous maps, rock was included in alpine tundra. Some areas which were mapped as rock do have some important pioneering species growing in crevices, but the plants provided negligible ground cover. Regardless of the mapping and classification system used, the habitat is common on mountains throughout the state.

"The downstream flood plain is a part of the Cook Inlet-Susitna Lowlands, a portion of the trough which forms a major bifurcation in the Pacific Mountain System (JFSLUPCA 1973). This region is generally flat, occurs below 150 m in elevation, and experiences a climate that is transitional between maritime and continental. The growing season is at least one month longer than in the upper basin. The vegetation of this region is considered closed spruce-hardwood forest by Viereck and Little (1972), moderately high mixed evergreen and deciduous forest or high evergreen spruce forest by Spetzman (1963) and upland spruce-hardwood or bottomland spruce-poplar forest by the JFSLUPCA (1973)" (McKendrick et al. 1982:13-14).

"The Healy-Fairbanks corridor passes through a dissected plateau in the southern section, the Tanana Flats in the middle, and the Chena Ridge on the north. Different vegetation/habitat types are associated with each of these three segments. The southern portion of the corridor characteristically has open spruce and open spruce/deciduous types along the ridges, with low shrub and sedge-grass occupying the flatter areas. The central segment is covered by a complex mosaic of wet vegetation types, open spruce, and low shrub. The gradations between types and many unmappable small patches of vegetation made it necessary to map much of this area as complexes. The Chena Ridge segment is predominantly covered by open and closed deciduous forest" (McKendrick et al. 1982:30).

The vegetation/habitat types sampled and estimated by percentages during the Plant Ecology Studies for all areas listed in Table 2-2 are summarized from McKendrick et al. (1982:Tables 4, 7, 8). The Upper Susitna basin coverage was broad enough to include the inundation area as well as the associated Linear Features. The Willow to Cook Inlet and Healy to Fairbanks transmission corridors' vegetation/habitat types coverage was presented separately.

Table 2-2

Hectares and Percentage of Total Areas Covered by Vegetation/Habitat Types in the Upper Susitna River Basin Above Gold Creek, the Willow to Cook Inlet Transmission Corridor, and the Healy to Fairbanks Transmission Corridor

Vegetation/Habitat Type	Hectares	Percentage of Total Area
Total Vegetation	1,841,804	88.18
Forest	768,500	36.80
Conifer	659,156	31.56
Woodland Spruce	192,660	9.22
Open Spruce	154,014	7.37
Closed Spruce	4,896	.23
Deciduous	29,147	1.40
Open Birch	984	.05
Closed Birch	3,961	.19
Open Balsam Poplar	100	.01
Closed Balsam Poplar	172	.01
Woodland Deciduous	993	.05
Open Deciduous	12,553	.60
Closed Deciduous	10,384	.50
Mixed	80,197	3.84
Open	23,387	1.12
Closed	15,968	.76

Table 2-2. Areas Covered by Vegetation/Habitat Types (continued)

Vegetation/Habitat Type	Hectares	Percentage of Total Area
Open Conifer/Deciduous	14,199	.68
Closed Conifer/Deciduous	15,268	.73
Woodland Conifer/Deciduous	961	.05
Open Spruce/Open Deciduous	948	.05
Open Spruce/Wet Sedge-Grass/ Open Deciduous	1,993	.10
Open Spruce/Low Shrub/ Wet Sedge-Grass/Open Deciduous	7,008	.34
Open Spruce/Low Shrub	465	.02
Tundra	408,215	19.54
Wet Sedge Grass	16,230	.78
(Mesic) Sedge Grass	184,358	8.83
Sedge Grass	277	.01
Sedge Shrub	566	.03
Herbaceous Alpine	807	.04
Mat and Cushion	65,001	3.11
Mat and Cushion/Sedge Grass	139,680	6.69
Sedge Grass/Mat and Cushion	1,296	.06
Shrubland	664,102	31.80
Tall Shrub	129,127	6.18
Closed Tall Shrub	92	<.01
Low Shrub	533,181	25.53
Birch	33,549	1.61
Willow	10,645	.51
Mixed	488,987	23.41
Willow Shrub	58	<.01
Low Shrub/Wet Sedge-Grass	1,736	.08
Agricultural Land	175	.01
Disturbed Land	812	.04
Unvegetated	246,871	11.82
Water	43,190	2.07
Lakes	26,369	1.26
Rivers	16,821	.81
Rock	113,712	5.44
Snow and Ice	89,841	4.30
Gravel	128	<.01
Total Area	2,088,675	100.00

The final vegetation/habitat type data were plotted on maps of 1:250,000, 1:63,360/1:63,000, and 1:24,000. As part of the initial research of available data at the Harza-Ebasco offices, copies of 1:63,360/1:63,000 maps for the entire study area were obtained (UAAES 1980a, 1980b, 1981). McKendrick et al. (1982) caution those who might use their maps by pointing out that rarely do vegetation/habitat types change abruptly. Therefore, boundaries presented are judgemental on the part of the cartographer.

Two problems were encountered in trying to use these maps. The first was that certain routing changes had been made, so that portions of the current Linear Features, such as the east side of the Nenana River north of Healy, did not have vegetation/habitation type coverage on the maps. The second was that the degree of detail, and hence, the large number of potential variables, was felt to be too unwieldy at this stage of model development. However, a solution to both of these problems was available through two sets of maps recently prepared by Harza-Ebasco. These are Vegetation and Wildlife Resources maps for the South and North Study Areas, which have a scale of 1:31,680 (Harza-Ebasco n.d.a, b). The numerous vegetation/habitat types identified by McKendrick and others (1982) were reduced to eight major types: Coniferous Forest, Deciduous Forest, Mixed Forest, Recent Burn/Logged Area, Dwarf Tree Scrub/Tall Shrub, Low Shrub, Wetland, and Developed/Water/Barren. However, the maps prepared by McKendrick and others (1982) were used for the Linear Features associated with the impoundment area, since they were the only ones available. HRA determined which of the finer plant communities were lumped together to form the major vegetation types (Vegetative Units) in the Harza-Ebasco maps, and the same system was applied to all areas. Vegetative Units are presented in Table 2-3 by number (C1-9), symbol, name, vegetation/habitat types within each unit, plant cover within each vegetation/ habitat type, and the Linear Feature(s) with which each unit is associated. Vegetative Units have been plotted on the full-size Linear Feature maps along with the Terrain Units (see Fig. 2-3).

Table 2-3

Vegetative Units Located Within the Linear Features

Unit Numbers	Unit Symbol	Unit Name	Vegetation/Habitat Types	General Plant Cover by Vegetation Layers*		Linear Feature Association**
C1	Dt	Dry tundra	Mat and cushion tundra, Sedgegrass tundra, Grassland	1) GROUND LAYER:		2, 3
				Lichens, unidentified		
				Cladonia spp.	Lichens	
				Empetrum nigrum	Crowberry	
				Ledum spp.	Labrador tea	
				Vaccinium uliginosum	Bog blueberry	
				Arctostaphylos spp.	Bearberry	
				Betula spp.	Dwarf birch	
				Polytrichun spp.	Hairy-cap moss	
				Salix spp.	Willow	
				Carex spp.	Sedge	
				Lycopodium spp.	Clubmoss	
				Equisetum spp.	Horsetail	
				Eriophorum spp.	Cottongrass	
				Calamagrostis purpurascens	Purple reedgrass	
				Deschampsia spp.	Hairgrass	
				Festuca spp.	Fescue	
				Phleum commutatum	Timothy	
				Juncus spp.	Rush	
				Luzula spp.	Woodrush	
				Salix spp.	Willow	
				Various wild flowers		
				Grasslands are dominated by Calamagrostis canadensis (Blue joint)		
C2	Wt/m	Wet tundra/ Marshland	Wet sedge grass, Wetland	2) SHRUB LAYER:		1, 2, 3
				Salix spp.	Willow	
				1) GROUND LAYER:		
				Mosses, unidentified		
				Sphagnum spp.	Sphagnum moss	
				Salix spp.	Willow	
				Calamagrostis canadensis	Blue joint	
				Carex spp.	Sedge	

*Actual presence/absence and percentages vary depending upon elevation, soil moisture, and density of upper layers.

**Linear Feature Association Key: 1 = South Intertie
2 = Road Access/Railroad Access
3 = North Intertie

Table 2-3. Vegetative Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Vegetation/Habitat Types	General Plant Cover by Vegetation Layers		Linear Feature Association
C3	Cf	Coniferous forest	Open black spruce,	4) OVERSTORY:		1, 2, 3
			Woodland black spruce	Picea glauca	White spruce	
			Open white spruce	Picea mariana	Black spruce	
			Woodland white spruce	Larix laricina	Larch (Tanana flats area only)	
			Closed spruce			
			Open spruce	3) UNDERSTORY:		
			Woodland spruce	Picea glauca	White spruce	
				Picea mariana	Black spruce	
				Alnus sinuata	Sitka alder	
				2) SHRUB LAYERS:		
				Picea glauca	White spruce	
				Picea mariana	Black spruce	
				Salix spp.	Willow	
				Alnus crispa	American green alder	
				Rose acicularis	Prickly rose	
				1) GROUND LAYER:		
				Cradonia spp.	Lichens	
				Mosses, unidentified		
				Feather mosses	Feather moss	
				Ptilium spp.	Moss	
				Empetrum sp.	Crowberry	
				Ledum spp.	Labrador tea	
				Vaccinium spp.	Blueberry and cranberry	
				Equisetum spp.	Horsetail	
				Linnaea sp.	Twin flower	
				Calamagrostis sp.	Blue joint	
				Rubus spp.	Nagoon and cloudberry	
				Carex spp.	Sedge	
				Salix spp.	Willow	
				Betula spp.	Birch	
				Rosa spp.	Prickly rose	
				Picea mariana	Black spruce	
C4	Df	Deciduous forest	Closed birch forest	4) OVERSTORY:		1, 2, 3
			Open birch forest	Betula papyrifera	Paper birch	
			Closed balsam poplar	Populus balsamifera	Balsam poplar	
			Open balsam poplar	Populus tremuloides	Trembling aspen	
			Closed aspen forest	Picea glauca	White spruce (less than 5%)	
			Closed deciduous			
			Open deciduous	3) UNDERSTORY:		
				Betula	Birch	
				Picea glauca	White spruce	
				Populus balsamifera	Balsam poplar	
				Populus tremuloides	Trembling aspen	

Table 2-3. Vegetative Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Vegetation/Habitat Types	General Plant Cover by Vegetation Layers		Linear Feature Association
C4 (continued)				2) SHRUB LAYER:		
				Betula papyrifera and glandulosa	Resin birch	
				Picea		
				Populus balsamifera	Balsam poplar	
				Populus tremuloides	Trembling aspen	
				1) GROUND LAYER:		
				Ptilium spp.	Moss	
				Polytrichum spp.	Moss	
				Empetrum sp.	Crowberry	
				Ledum spp.	Labrador tea	
				Vaccinium spp.	Blueberry and cranberry	
				Equisetum spp.	Horsetail	
				Cornus canadensis	Bunchberry	
				Calamagrostis sp.	Blue joint	
				Gymnocarpium dryopteris	Oak-fern	
				Mertensia paniculata	Tall bluebell	
				Spiria spp.	Spirea	
				Lycopodium spp.	Clubmoss	
				Viburnum edule	Highbush cranberry	
				Betula nana	Dwarf arctic birch	
				Picea glauca	White spruce	
				Populus balsamifera	Balsam poplar	
C5	Mf	Mixed forest	Closed mixed forest Open mixed forest Woodland mixed	Same species as C3 and C4 with generally even representation of conifers and deciduous trees with overstory and understory.		1, 2, 3
C6	Ls	Low shrub	Birch shrub Willow shrub Low shrub Herbaceous Sedge shrub tundra	2) SHRUB LAYER:		1, 2, 3
				Betula glandulosa	Resin birch	
				Salix planifolia	Diamondleaf willow	
				1) GROUND LAYER:		
				Mosses, unidentified		
				Feather mosses	Feather moss	
				Empetrum sp.	Crowberry	
				Ledum spp.	Labrador tea	
				Vaccinium spp.	Blueberry and cranberry	
				Carex aquatilis	Water sedge	
				Arctostaphylos rubra	Red-fruit bearberry	
				Betula glandulosa	Resin birch	
				Betula nana	Dward arctic birch	

Table 2-3. Vegetative Units Located Within the Linear Features (continued)

Unit Numbers	Unit Symbol	Unit Name	Vegetation/Habitat Types	General Plant Cover by Vegetation Layers		Linear Feature Association
C7	Dts/Ts	Dwarf tree shrub/ Tall shrub	Closed tall shrub Open tall shrub	4) OVERSTORY: Picea glauca 3) UNDERSTORY: Picea glauca Alnus sinuata 2) SHRUB LAYER: Alnus sinuata 1) GROUND LAYER: Calamagrostis canadensis Linnaea borealis Alnus sinuata	 White spruce White spruce Sitka alder Sitka alder Blue joint Twin flower Sitka alder	1, 2, 3
C8	Dev or D	Developed/ Water/Barren		Areas which have been developed, primarily around Anchorage and Fairbanks, where native vegetation has been extensively disturbed and introduced vegetation may even be present. Areas of water (lakes, rivers, streams) and barren ground have been included in this unit.		1, 3
C9	Rb/La	Recently burned/ Logged area		Areas which have been subjected to recent burning and/or logging. These areas are limited to the Healy area. It appears they would have been one of the categories of Deciduous forest areas with some adjacent areas of Dward tree shrub/Tall shrub.		3

As with Terrain Units, described above, cultural resource site data as related to Vegetative Units are presented in Chapters 4, 5, and 6 of this report. These chapters present known cultural resources with information regarding in which Vegetative Unit they are located; the extent of positive or negative correlations of site types and periods of occupation with Vegetative Units; and the proportional representation of Vegetative Units in the 160-acre Research and Sample Survey Units.

2.4 Wildlife Resources

Extensive studies of wildlife resources have been conducted in the Susitna River Basin since the mid- to late 1960s. Since the late 1970s, intensive baseline studies of waterfowl, fish, and game and non-game mammals have been conducted in association with the proposed Susitna Hydroelectric Project. Diverse wildlife species typical of southcentral Alaskan ecosystems are located within the project area. The reader is referred to the DEIS, the FERC Application, and baseline studies referenced there and in the attached bibliography for details on wildlife resources. Table 2-4 presents common wildlife species by habitat and season.

Many of the species presented in Table 2-4 were exploited aboriginally on at least a seasonal basis. In the following chapter, the second section presents ethnographic overviews for the study area which include information regarding subsistence resource exploitation and associated settlement patterns. Available data allow reconstruction of seasonal and annual patterns of settlement and subsistence oriented toward availability of selected environmental features and selected animal or plant species. Obviously, the native inhabitants would exploit a greater number of resources as they became available.

Table 2-4

Common Wildlife Species Present in or near the Linear Features

Scientific Name	Common Name	Habitat	Season[a]
Gavia immer	Common loon	Lakes	2
Cygnus buccinator	Trumpeter swan	Lakes	2
Anas platyrhynchos	Mallard	Lakes, rivers	1, 2, 3
Anas acuta	Pintail	Lakes	1, 2
Anas crecca carolinensis	Green-winged teal	Lakes	1, 2
Anas americana	American widgeon	Lakes	1, 2
Aythya marila	Greater scaup	Lakes	1, 3
Arythya affinis	Lesser scaup	Lakes	2
Bucephala ciangula	Common goldeneye	Lakes, rivers	1, 3
Bucephala albeola	Bufflehead	Lakes	3
Ciangula hyemalis	Oldsquaw	Lakes	1, 2
Histrionicus histrionicus	Harlequin duck	Rivers	1, 2(?)
Melanitta nigra	Black scoter	Lakes	1, 2(?)
Aquila chrysaetos	Golden eagle	Cliffs	1, 2(?)
Circus cyaneus	Marsh hawk	Meadows	1, 3
Canachites canadensis	Spruce grouse	Coniferous & Mixed forest	
Lagopus lagopus	Willow ptarmigan	Mountains & lowlands	1, 2, 4
Lagopus mutus	Rock ptarmigan	Mountains & lowlands	1, 2, 4
Pluvialis dominica	Amerian golden	Dwarf shrubs, mountains, & meadows	1, 2
Tringa flavipes	Lesser yellowlegs	Lakes, rivers, shoreline	1
Actitis macularia	Spotted sandpiper	Alluvial bars	1, 2(?)
Phalaropus lobatus	Northern phalarope	Wet meadows with ponds	1, 2
Capella gallinago	Common snipe	Wet meadows	1, 2(?)
Calidris minutilia	Least sandpiper	Wet & dwarf shrub meadows	1, 2
Stercorarius longicaudus	Long-tailed jaeger	Dwarf shrub, mountains, & meadows	1, 2
Larus canus	Mew gull	Lakes, rivers	1, 2
Sterna paradisea	Arctic tern	Lakes, lakeshores	1, 2
Corvus corax	Common raven	Riparian & upland cliffs	

[a]Seasons: 1 = spring; 2 = summer; 3 = fall; 4 = winter

Table 2-4. Common Wildlife Species Present in or near the Linear Features (continued)

Scientific Name	Common Name	Habitat	Season
Mergus merganser	Common merganser	Rivers	2
Mergus serrator	Red-breasted merganser	Rivers	2
Tringa solitaria	Solitary sandpiper	River's edge	1, 2(?)
Larus philadelphia	Bonaparte's gull	River's edge & sloughs	1, 2
Larus argentatus	Herring gull	Alluvial islands & along rivers	1, 2
Lampetra japonica	Arctic lamprey	Main rivers	1, 2
Lampetra tridentata	Pacific lamprey	Lower Susitna River area	
Coregonus nelsoni	Alaska whitefish	Streams	Spawning=3
Oncorhynchus gorbuscha	Pink salmon	Tributaries, some sloughs, & upriver passages	1, 2, Spawning=3
Oncorhynchus keta	Chum salmon	Main rivers, sloughs, & some tributaries & upriver passages	1, 2, Spawning=3
Oncorhynchus kisutch	Coho salmon	Tributary mouth & upriver passages, & main river sloughs	1, 2, Spawning=3 4
Oncorhynchus nerka	Sockeye salmon	Main river sloughs & a few tributaries & upriver passages	1, 2, Spawning=1,2
Oncorhynchus tshawytscha	Chinook salmon	Tributaries , upriver passages, main river sloughs	1, 3, 4, Spawning=1,2
Prosopium cylindraceum	Round whitefish	Mouth of tributaries, sloughs & shallow rivers & inshore for spawning	1, 2, 3
Salmo gairdneri	Rainbow trout	Tributary mouths, sloughs, & main rivers	2, 4
Salvelinus malma	Dolly Varden	Tributaries, main rivers, coastal streams & lakes	1, 3
Salvelinus namaycush	Lake trout		Pre- & post spawning in fall
Thymallus arcticus	Arctic grayling	Deep lakes, large rivers, & silt-laden glacier systems	1, 3, 4

Table 2-4. Common Wildlife Species Present in or near the Linear Features (continued)

Scientific Name	Common Name	Habitat	Season[a]
Thaleichthys pacificus	Eulachon	Riffle areas & offshore from cutbanks	1, 2
Catostomus catostomus	Longnose sucker	Main rivers & tributary system	1
Lota lota	Burbot	Main rivers, deeper sloughs, tributaries & shallow waters for spawning	2, 3, 4
Gasterosteus aculeatus	Threespine stickleback	Generally shallow areas & bays, deep water in winter	2, 4
Coregonus	Bering cisco	Main rivers	2, 3
Lepus americanus	Snowshoe hare	Lowland forest	
Spermophilus parryll	Arctic ground squirrel	Open tundra & shrubland	
Tamiasciurus hudsonicus	Red squirrel	Forest	
Castor canadensis	Beaver	Marshy regions, lakes, & slow-flowing streams	2=lakes & rivers above 2,000 ft.
Ondatra zibethica	Muskrat	Lakes & pond regions	2=lakes & rivers above 2,000 ft.
Erethizon dorsatum	Porcupine	Rolling hills & elevated sections of landscape	4=hibernation
Delphinapterus leucas	Beluga whale	Saltwater & saltwater mixed w/freshwater	
Vulpes fulva	Red fox	Rolling hills adjacent to mountains; water nearby; prefer higher elevations	
Canis latrans	Coyote	No data	
Canis lupus	Wolf	Low elevations	1
		Low elevations=denning areas	late 1, early 2
		High elevations	late 2, early 4
		Low elevations	late 4
Ursus americanus	Black bear	High spruce habitat near river	1 & early 2
		Tundra areas for berries & river for salmon	2
		High spruce habitat	3
		Steep terrain near main Susitna River	4

Table 3. Common Wildlife Species Present in or near the Linear Features (continued)

Scientific Name	Common Name	Habitat	Season[a]
Ursus arctos	Brown bear	Lowland forests	1
		Open tundra	Late 1, early 2
		Salmon rivers	2
		Open tundra uplands	3
		Tundra/shrub denning areas	4
Martes americana	Marten	Spruce forest, mixed forest & woodlands below 3,000 ft.	
Mustela erminea	Short-tailed weasel	Woodland white or black spruce, medium shrub types	
Mustela nivalis	Least weasel	All habitats, especially near rivers	
Mustela vison	Mink	Streams & lake tributary creeks below 1,200 m	
Gulo gulo	Wolverine	Mid-level elevations	1, 3
		High elevations	2
		Lowland elevations, spruce forests	4
Lutra canadensis	River otter	Upper basin, rivers, tributary creeks & lakes	
Alces alces	Moose	Range through all habitats & prefer woodland black spruce & willow forests	
		Riparian for calving	1
		Forested areas	2
		Flood plain area	3
		Riparian or lowland forest	4
Rangifer tarandus	Caribou	Open tundra & shrubland	
		River areas & flats for calving	1
		High ground	2
		River areas over 2,700 ft.	3
		Forested areas	4
Ovis dalli	Dall sheep	Upland areas	
		Mineral lick locations	1 & early 2
		Mountainous areas	2, 3
		South-facing hill slopes	4

3.0 CULTURAL RESOURCES DATA BASE

3.1 PREHISTORY OF THE STUDY REGION: CENTRAL AND SOUTHCENTRAL ALASKA

Glenn H. Bacon, Alaska Heritage Resource Group
Sally T. Greiser, Historical Research Associates

3.1.1 Introduction

John Cook (1975a) once characterized the culture history of interior Alaska in terms of three periods, "(1) historic or late prehistoric occupations, rather definitely Athapaskan in nature, (2) an older cultural stratum which may, or may not, be early or ancestral Athapaskan, and (3) a vaguely defined early period." Ten years later Cook is still substantially correct.

Reconstruction of the prehistory of the study area is accomplished primarily through analysis of abandoned or lost material culture. These analyses focus on surviving lithic artifacts, since organic artifacts perish readily from exposure to surface weathering and from burial in acidic soils. The natural forces which destroy organic artifacts also destroy other organics associated with archeological deposits, thus severely limiting opportunities for placing archeological assemblages in time through radiometric analysis. Attempts at comparative typological analysis are frustrated by relatively few artifact classes, some of which persist for millennia with apparently little stylistic change. Given these limitations, the current level of prehistoric detail for the region is low.

In contrast, the material cultures of ethnographically described people from interior Alaska are made up largely of organics such as bone, skins, and plant fiber (cf. McClellan 1975; McKennan 1959). If prehistoric cultures were equally dependent upon organics for manufacture of their material culture, this may explain why the lithic-dominated assemblages surviving from prehistoric times appear so impoverished. Few distinctive lithic artifact forms have been recovered to date from the central and southern interior regions of Alaska. The most common lithic forms, aside from debitage, include endscrapers, microblades and the cores from which they are derived, burinated flakes, various styles of projectile points, bifaces, notched pebbles, boulder chip scrapers (chi-thos), and unifacially chipped forms. Typological comparisons that form the basis for the myriad technological complexes defined for interior Alaska are generally limited to these few lithic artifact classes (Table 3-1).

Attempts at seriating combinations of lithic forms and styles over time and space have been frustrated by the paucity of dated assemblages and geologically stratified, multicomponent recovery loci. Thus, while the literature is full of attempts at organizing lithic data in time and space (eg. Bacon 1977; Dumond 1977; West 1981), none of these attempts is without significant problems. Historically, archeologists working with Alaskan lithic material have focused on analysis of two common components of lithic assemblages, microblade cores and projectile points (e.g., Campbell 1961:73). From the beginning, the attempt has been to produce a typology which would allow definition of prehistoric traditions, horizons, and phases (cf. Willey and Phillips 1958). Stylistic analysis of individual artifact classes has met with some success (eg. Anderson 1968b; Cook 1968), but assemblage analysis has still not produced concensus concerning which artifact classes are culturally associated with one another. In large part, this is because most known interior Alaskan sites are either surface or shallowly buried sites, the components of which are difficult to identify and date.

Table 3-1

Prehistoric Technologies of Alaska

Name	Associated Dating	Artifacts	Reference
Historic Athapaskan (Dixthada)	1000 B.P. to Present	Contracting-stemmed points, boulder-spall end scrapers, tabular bifaces, hammerstones, whetstones, copper implements, unilaterally barbed bone points	Rainey 1939
Minchumina Tradition	2,600 B.P. to 950 B.P.	Flake burins, microblades and cores, lanceolate points	Holmes 1986
Northern Archaic Tradition	6000 B.P. to 4400 B.P.	Side-notched and oblanceolate points, elongate and semi-lunar bifaces, large unifaces, notched pebbles, cobble choppers	Anderson 1968a
Northwest Microblade Tradition	7500 B.P. to 1650 B.P.	Boulder-spall scrapers, large blades, blade tools, microblades and cores, straight and round-based oblanceolate points, split pebble and bifacial choppers, notched pebbles	MacNeish 1964
Susitna Complex	ca. 9000 B.P.	Concave-based points on flakes, microblades, modified bifacial thinning flakes	Dixon et al. 1986
Athapaskan Tradition	12,000 B.P. to Present	Microblades and cores, transverse burins, side-notched and stemmed points, square and round-based oblanceolate points	Cook and McKennan 1970
Denali Tradition	12,000 B.P. to 1000 B.P.	Bifacial biconvex knives, microblades and cores, large blades and blade-like flakes, burins, end scrapers, worked flakes	Bacon and Holmes 1980
American Paleo-Arctic Tradition	13,000 B.P. to 6000 B.P.	Blades and blade cores, microblades and cores, blade tools, burins, discoidal bifaces	Anderson 1968a
Denali Complex	13,000 B.P. to 8000 B.P.	Microblades and cores, large blades and blade-like flakes, burins, bifacial biconvex knives, end scrapers, worked flakes	West 1967
Nenana Complex	pre-11,000 B.P.	Bifacial knives, lanceolate points, transverse scrapers	Hoffecker 1982
Amphitheater Mountain Complex	pre-13,000 B.P.	Bifaces, burins, large blades, boulder-spall scrapers, end scrapers, flake cores	West 1972
Chindadn Complex	11,000 B.P. to 10,000 B.P.	Subtriangular knives, small triangular points, basally thinned concave-based points	Cook 1969

3.1.2 Regional Context

The study area is composed of three parts: (1) a northern subarea, between the Alaska Range divide and the Tanana River; (2) a central subarea, including the Middle and Upper Susitna Basin; and (3) a southern subarea, which includes the lower Susitna Basin and Upper Cook Inlet (Fig. 3-1). The prehistory of the northern portion is the best known of the three subareas, but it, too, is poorly documented. The central subarea has recently received attention through a University of Alaska Museum research program, documenting the potential impact of a Susitna Hydroelectric Project on the region's cultural resources. The southern subarea, restricted to a portion of the southern Talkeetna Mountains, is the least known of the three subareas, prehistorically.

Various chronologies have been suggested for the region of central Alaska that includes the study area. The prehistoric archeology of central Alaska can be discussed within a framework which reflects major environmental characteristics of three post-glacial subperiods: (1) a Tundra period, ending circa 8000 years before present (B.P.); (2) an Early Taiga period, circa 8000 to 4500 B.P.; and (3) a Late Taiga period, circa 4,500 years ago to historic contact (Fig. 3-2).

As should be expected, examination of the archeological record shows less and less available data as we move back in time. Furthermore, what data are available for the Tundra period are extremely confusing, as the various interpretations presented below demonstrate. This confusion results from an inductive approach to a limited data base. Without a large scale framework for interpretation, the observed variety in the data base simply creates confusion. Interior Alaskan archeology would benefit from focusing future research directions on development of behavioral models based on generalizations of hunter-gatherer adaptations to prehistoric environments in the study area. Such

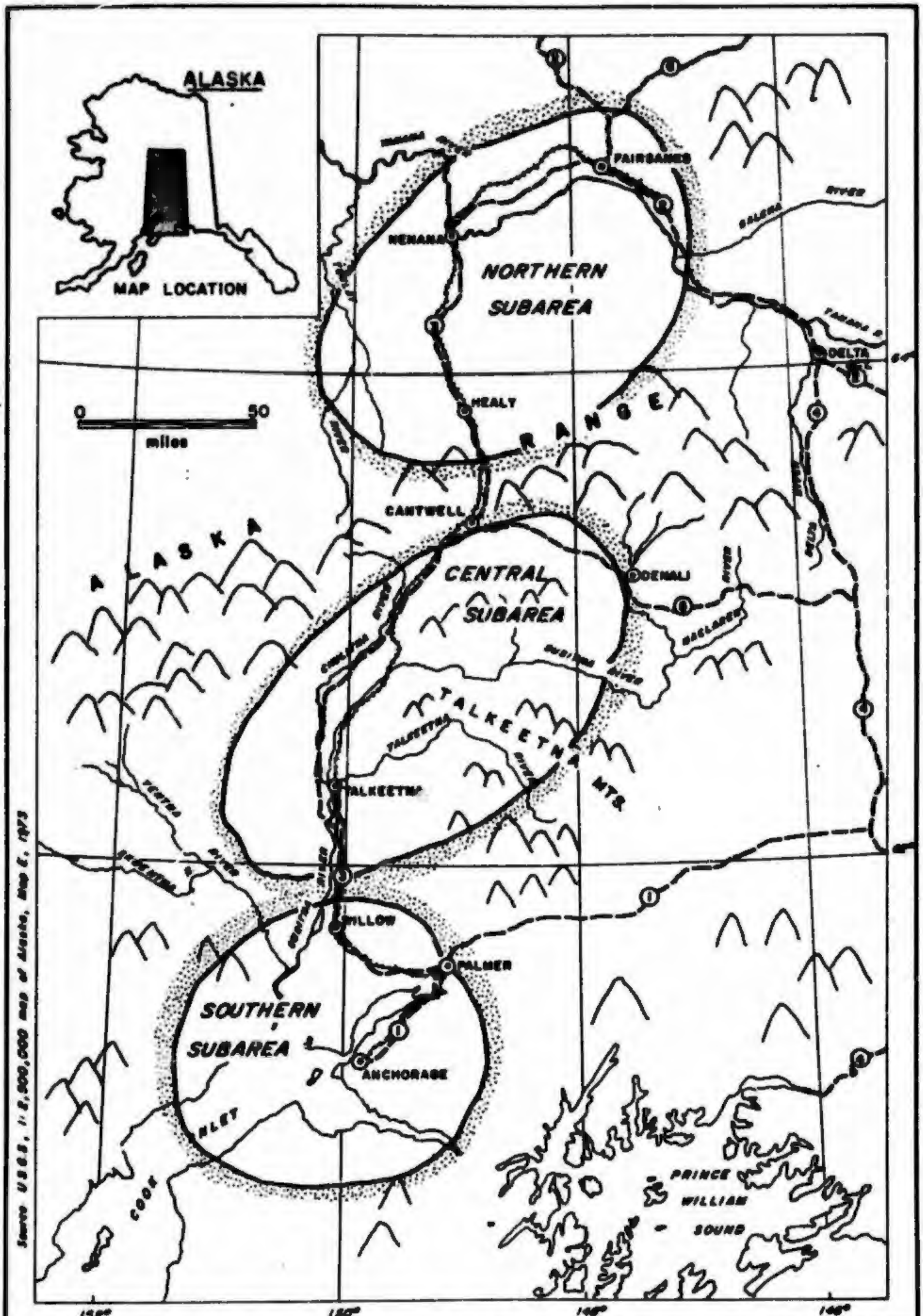


Figure 3-1. Map of the study area illustrating three subareas: northern, central, and southern.

	Cultural Chronology	Period		Associated Technology
100 B.P.	Recent Historic	Recent Modern	Expansion of Taiga Forests	Copper implements, stemmed stone projectile points, flaked end scrapers, bounder chip tools
1000 B.P.	Athapaskan	Late Taiga		
2000 B.P.				Large bifacially chipped forms, microliths, large lanceolates
6000 B.P.		Early Taiga (shrub tundra dominates)		Side-notched projectile points, stone end scrapers, elongated stone bifaces, boulder chip scrapers, unifacially chipped forms, notched pebbles, stone axes, hammerstones, choppers
8000 B.P.	American Paleo-Arctic	Early Tundra (grassland tundra dominates)		Stone cores and microblades, burins, bifacial stone knives, stone end scrapers
14,000 B.P.	Early Sites?			

Figure 3-2. Cultural chronology, modified from Bacon et al. 1983:55.

models will provide a framework for interpretation of seasonal vs. cultural differences in toolkits and land use patterns, among other topics. Ultimately, such models may take years to refine to an acceptable degree, but their development should be a priority for Alaskan archeology.

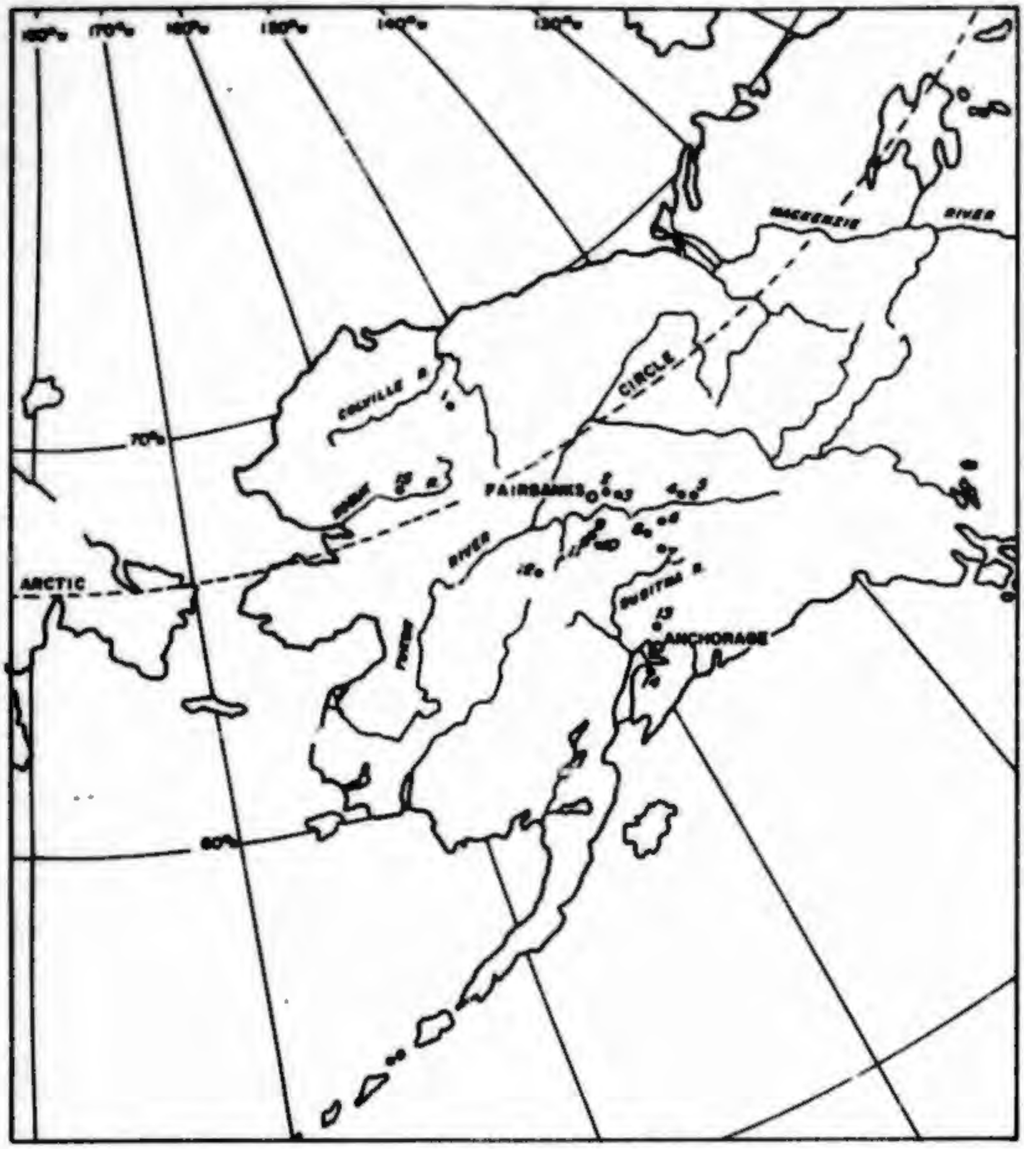
3.1.3 Northern Subarea

3.1.3.1 Tundra Period

The earliest known archeological sites in the northern subarea date to the 11th millennium before present. This period in Alaska is still poorly understood, but it likely represents a change in early post-glacial adaptations from steppe (grassland) to shrub tundra environment. This change in vegetative cover over large regions must have had dramatic consequences for local fauna and, thus, for early human adaptations (Stanley 1980:663-666). As noted, a number of complexes and traditions have been named that date to this period. Model refinement and substantially more data are needed before adequate assessment of these varieties and their significance can be made.

One of the first early Holocene technologies to be defined is the <u>Chindadn Complex</u>, recovered from the basal sediments at the Healy Lake Village site (Cook 1969) (Fig. 3-3). (A bone apetite date places this complex at between 11,000 and 10,000 B.P.) This small collection is characterized by subtriangular knives, small triangular projectile points, and basally thinned, concave-based points. While microblades are present, Morlan and Cinq-Mars (1982:373) have suggested that these are intrusive from later occupations at the site.

Since the excavation of the Chindadn Complex at Healy Lake in the late 1960s, a growing number of sites dating to the early 11th millennium B.P. have been reported from the northern slopes



SELECTED ARCHAEOLOGICAL SITE LOCATIONS IN INTERIOR ALASKA

0 175 350 525 700

miles

1. *Tuktu*
2. *Campus*
3. *Moose Creek Bluff*
4. *Healy Lake locality*
5. *Dixthada*
6. *Gerstle River*
7. *Tangle Lakes locality*
8. *Donnelly Ridge locality*
9. *Dry Creek*
10. *Carlo Creek*
11. *Teklanika River locality*
12. *Lake Minchumina*
13. *Long Lake locality, Ravine Lake*
14. *Beluga Point*
15. *Onion Portage*

Modified from *The Archaeology of Beringia*, by F. H. West (1981), inside cover

Figure 3-3.

of the Alaska Range. These include the Dry Creek site (Holmes 1974a; Powers and Hamilton 1978; Powers, Guthrie, and Hoffecker 1983; Thorson and Hamilton 1977), the Carlo Creek site (Bowers 1978), and the Moose Creek site (Hoffecker 1979, 1982). Other sites, such as FAI-091 (now known as the Owl Ridge site) and the Walker Creek site (Hoffecker 1979:15) are the subject of ongoing research. However, few of these data have been published (Peter Phippen, personal communication, 1985).

Recently, several investigators have remarked on the absence of microblades in the earliest components from these sites (eg. Anderson 1980:236; Hoffecker 1979:15; Morlan and Cinq-Mars 1982:372; Powers et. al. 1983:292). It is not yet clear whether this absence is a product of sampling bias or whether a non-microblade technology is truly present in the earliest recognized components in interior Alaska. To date, these early assemblages include elongate bifaces and retouched flakes from Component I at Carlo Creek (Bowers 1978); a projectile point from the Moose Creek site (Hoffecker 1982) and bifacial knives and projectile points, side scrapers, transverse scrapers, endscrapers, burins, flake tools, and cobble cores and tools from Component I at Dry Creek (Powers et. al 1983). Hoffecker has lumped these early archaeological assemblages from the north slopes of the Alaska Range under the rubric of the Nenana Complex, which he thinks may be either: (1) "a northern extension of the Paleo-Indian big game hunting tradition", or (2) ancestral to the Paleo-Indians (1979:21).

A large number of assemblages from interior Alaska have been interpreted as technologically related to material from Dyuktai Cave on the Aldan River in Siberia (Mochanov 1973). Frederick Hadleigh West was among the first to argue for technological relationships between interior Alaskan archeological sites and those being reported from Siberia. West (1967) proposed that four known interior Alaskan assemblages, two from north of the Alaska Range and two from south of the Alaska Range, were representative of an archeological culture which he termed the Denali Complex.

The Denali Complex type assemblages were recovered from the Campus, Teklanika East, Teklanika West, and Donnelly Ridge sites. The Denali Complex was defined as several lithic artifact forms found in association with one another, including bifacial biconvex knives, endscrapers, large blades and blade-like flakes, prepared cores, core tablets and microblades, burins and burin spalls, and worked flakes. West excludes the side-notched and lanceolate projectile point forms recovered from the two Teklanika sites and the Campus site, which he considered to be intrusive (West 1967:371). On the basis of morphological comparisons with other assemblages from Alaska, Canada, and Siberia, West concluded that the Denali Complex assemblages date between 13,000 and 8000 B.P. (West 1967:378).

Both West (1981) and Dumond (1977, 1982) have considered the Denali Complex as a regional variant of an American Paleo-Arctic Tradition, a term coined by Douglas Anderson to describe two archeological components found in northwestern Alaska, which he believes result from a "long period of isolated regional development" and which he believes date to the period from approximately 13,000 to 6000 B.P. (Anderson 1968a:29). Artifactual elements of the American Paleo-Arctic Tradition include discoidal bifaces, blades and unifacial tools on blades, microblades, prepared blade and campus-type microblade cores, and burins.

West has argued that the locations of many Denali Complex sites suggest a primary dependence upon caribou. His reasoning takes into account that many of the sites are located on the shores of lakes, which are, in turn, located in the vicinity of one of interior Alaska's major caribou herds (the Nelchina herd), and that interior Alaska ethnographies are filled with accounts of caribou hunted by chasing them into water, where they were more easily killed. Recently, West (1981) has considered the possible association between Denali peoples and interior Alaska bison herds.

Various researchers disagree with West's proposed Denali Complex. In 1970, Cook and McKennan reported Denali Complex materials younger than 3,000 years old at the Healy Lake Village site. To further question the dates of the Denali Complex, Mobley (1984) points out that none of the radiocarbon dates for the Campus site (one of the type sites for the complex) is older than about 3,500 years.

This disparity led Dumond (1977:52) to conclude that:

> . . . the so-called Denali complex probably represents not one but two cultural entities: the first, of the Paleo-arctic tradition, dating from as early as 8000 B.C.; the second, an aspect of the Northern Archaic tradition. . . .

West (1975a) reviewed the Tangle Lakes data and conceded that Denali-derived technology extends later in time than the Denali Complex. Other researchers (Bacon 1977; Holmes 1974b) argue for a long-lived Denali Tradition. Holmes and Bacon (1982) discuss the Denali Tradition as a reflection of cultural conservatism, possibly associated with continuation of a bison-hunting tradition.

One of the first attempts to integrate the bulk of interior Alaska archeological sites was Cook's (1969) Athapaskan Tradition. Based in part on a radiocarbon chronology, the Athapaskan Tradition is thought to begin around 11,000 B.P. and to extend upward in time to the ethnohistoric period (Cook 1969). Results of excavation at the Healy Lake Village site led Cook and McKennan (1970b) to define a four-phase sequence of the Athapaskan Tradition, preceded by the Chindadn Complex of an unrelated tradition. This sequence is as follows:

Level*	Garden Site	Village Site	Dates
Sod	Athapaskan	Athapaskan	AD 680-1050
1	Campus (Denali)	Proto-Athapaskan	est. 2500 BC
2	Campus & Tuktu	Campus	est. 4500 BC
3	Campus & Tuktu	Campus & Tuktu	7000 BC
4	Campus & Tuktu	Quartzite horizon	
5	Tuktu & Quartzite	Quartzite horizon	
6-10	----------------	Chindadn	est. 8000 BC or older

*Note: Levels are 2-in., arbitrary excavation units and are sequenced from top to bottom. Thus, level #1 represents the top 2 in. of the section (Cook n.d., 1970; McKennan and Cook 1968).

Critics of the Athapaskan Tradition, as defined archeologically, point to the shallowness of the Healy Lake sites and question the assumed spatial association for artifacts and between artifacts and dated samples. The stratigraphically lowest artifact assemblage, the so-called Chindadn Complex, is significantly different from the components that comprise the Athapaskan Tradition. Specifically, this lowest component lacks good evidence of the production of microblades and prepared cores.

At this time, the Tundra Period in interior Alaska is characterized by a potential early cultural tradition with a technology dominated by bifaces and lacking microblades. This tradition may be related to the Paleo-Indian Tradition defined in the American High Plains (Sellards 1952; Wormington 1957). Later Tundra Period components are characterized by a core-blade technology as opposed to the earlier, bifacial core technology. Microblades and burins are common tool forms in this component.

3.1.3.2 Early Taiga Period

Forests began postglacial invasion of eastern interior Alaska perhaps as early as 10,000 years ago and, by 6,000 years ago, spruce forest was present near the Onion Portage archeological site in western interior Alaska (Anderson 1971). During this period, a series of boreal adaptations was evident across North America. Many of these adaptations were expressed in technologies characterized, in part, by side-notched projectile points. This new and distinctive stone tool assemblage appears in archeological sites in the southern Yukon Territory of Canada (Workman 1978a) and spread along the Brooks Range into northwest Alaska by 6000 B.P. Anderson (1968a, 1968b) defined the Northern Archaic Tradition by the presence of:

(1) projectile point forms which changed through time from deeply side-notched to high-shouldered, oblanceolate forms;

(2) large, elongate bifaces which are replaced by smaller, semi-lunar bifaces;

(3) large, semi-lunar bifaces;

(4) endscrapers which exhibit a greater number of retouched edges through time and a shift in raw material from chert to obsidian;

(5) large, straight-edged unifaces;

(6) occasional slate items;

(7) notched pebbles which change from an elongate form, often with more than one notch on a side, to a less elongage form, seldom with more than one notch on one side; and

(8) for the early Northern Archaic, cobble choppers with unifacially prepared edges.

According to Anderson's classification, Northern Archaic sites lack a microtool technology. However, this definition is based on the Onion Portage site, not on a large sample of contemporaneous site assemblages.

Over a period of several millennia, stone tools similar to those of the Northern Archaic Tradition appeared in the southern interior of Alaska and the Tanana Valley (Plaskett and Bacon 1981:6). The uniformity of the Northern Archaic materials and the directional orientation of the sites through time suggest that this Tradition represents an actual migration of new peoples into Alaska (Workman 1978a:426).

In a summary of North Star Borough prehistory, in reference to the Northern Archaic Tradition, Plaskett and Bacon (1981:7) wrote:

> The most enigmatic aspect of the late Northern Archaic Period in Interior Alaska is the appearance of microcore and microblade components at several sites. Later period sites include the upper levels at the Healy Lake Village and Garden Sites, the University of Alaska Campus Site, the lower or pre-midden materials at the Dixthada Site, the two components at the Yardang Site, and the upper component at Site XMH-246 on the Gerstle River.

A primary question concerning the Northern Archaic Period in interior Alaska is whether or not this co-occurrence of coreblade and bifacial core technologies represent a single cultural tradition or whether their co-occurrence is the result of mixing of components, cultural complexes, or traditions.

As the effects of the Thermal Maximum began to diminish, interior Alaska likely felt the slight retreat of forest margins.

More importantly, conditions for the slight expansion of shrub-tundra might have improved. This is a particularly interesting point when considering the margins of the Susitna River basin, since much of that area is presently near tree line. We will come back to this point below in the discussion of the middle subarea prehistory. It is this hypothesized change in forest characteristics that divides the Taiga times into early and late periods.

3.1.3.3 Late Taiga Period

On the western coast and northern interior of Alaska, the transition period between early and late Taiga periods saw the development of the Arctic Small Tool Tradition (Giddings 1954; Irving 1954, 1957), with its emphasis on a microlithic technology. Concurrently, in the western interior regions of Alaska, sites occur which have assemblages similar to Northern Archaic Tradition sites. Artifact types from these Boreal Choris sites (Bacon 1977) include large, lanceolate and large, bifacially flaked projectile point forms, but lack microtools. The areal extent of Boreal Choris sites is unknown, although Boreal Choris may be evident as far east as Lake Minchumina.

On the basis of excavations at Lake Minchumina, which lies north of the Alaska Range and generally northwest of the project area, Charles Holmes (1974b, 1977, 1982, 1984) has defined the Minchumina Tradition, which he describes as "a local variant with crossties to the Northern Archaic Tradition and the Norton Tradition." The three phases that make up this tradition are linked by the presence of flaked burins, microblade technology, and lanceolate point forms (Holmes 1984:iv). A combination of obsidian hydration analysis, radiocarbon dating, and comparative typological analysis has led Holmes to conclude that the Minchumina Tradition dates from 2600-1000 years B.P. The Minchumina Tradition may express itself in the central project subarea.

Characteristic tool types of the Northern Archaic Tradition, notably large side-notched points, appear to have persisted in central Alaska until about 1,000 years ago, as did microblades. Subsequent archeological components contain tools of a technological complex similar to that of historic Athapaskan populations. The category of "large side-notched points" requires additional comment. Holmes has suggested that early side-notched points are larger than later types, and that these early forms may be associated with darts (spear throwers) and later forms with arrows (bow and arrow complex). After a superficial study of a few collections, Bacon noted asymmetry of many of the larger specimens. Such asymmetry may indicate that the large forms are not "points" at all, but end-hafted knives. These specimens should be studied microscopically for indications of use-wear. Circumstantial evidence supports the hypothesis in that, while both sizes (assuming bimodality) commonly occur in spatial clusters, smaller point forms are commonly associated with hearths, while the larger form rarely (if ever) are. This suggests the possibility of association with a different set of activities (e.g., butchering vs. weapon repair). In short, noted size differences, if they exist, may have either functional and/or temporal implications.

As discussed previously, Cook (1969) suggests that an Athapaskan Tradition began around 11,000 years ago and continued through the ethnohistoric period. According to this theory, the current Athabaskan-speaking people found within the study area today represent direct descendants of long-established prehistoric populations. Other researchers (Borden 1975; Dumond 1969, 1974; Carlson 1979) have suggested that the spread of Athapaskan groups is represented archeologically by the <u>Northwest Microblade Tradition</u> (MacNeish 1964). According to this theory, the Northwest Microblade Tradition, present in Beringia since the Late Pleistocene, had spread throughout large parts of Alaska and northwest Canada by 6,000 years ago.

Linguistic data indicate that proto-Athapaskan, dating to at least 3,500 years ago, developed as an interior rather than coastal language (Krauss and Golla 1981). Krauss and Golla (1981:68) suggest that the "homeland" of this language is "eastern interior Alaska, the upper drainage of the Yukon River, and southern British Columbia, or some part of this area," and that the earliest directions of Athapaskan expansion probably included moving westward farther into Alaska. This movement is believed to have occurred prior to 1,500 years ago.

Only four late prehistoric sites in the Tanana and Upper Tanana Athapaskan region have been extensively excavated, although over 200 sites have been reported (Shinkwin 1977:42). These sites are the Dixthada site near Mansfield Lake (Shinkwin 1975; Rainey 1939, 1940, 1953), the Village and Garden sites at Healy Lake (Cook 1969), and the Nenana River Gorge site in the foothills of the Alaska Range near Healy (Plaskett 1977) (see Fig. 3-3).

The Dixthada site yielded Athapaskan material culture including contracting stemmed points, flaked end and boulder spall scrapers, tabular bifaces, hammerstones, whetstones, copper implements, and unilaterally barbed bone points exhibiting a ladder design decorative element (Shinkwin 1975:156). This technology is distinct from that of the earlier Northern Archaic Tradition and the Denali Complex. Flaked stone tools, including microcores and microblades recovered by Rainey from the Dixthada site, are now known to belong to an older component of the site (Cook 1972; Shinkwin 1975). Since no site has been found which documents a transition from the earlier core and microblade technology to the later technology associated with Athapaskan-speakers, some researchers (e.g., Bacon 1977; Bacon and Holmes 1980; Shinkwin 1975) interpret the archeological record as indicating the replacement of an earlier core and microblade technology by a later Athapaskan technology at about 1,000 years ago.

An important research question is whether the lack of technological continuity between early and late prehistoric times in the Tanana Valley is reflective of population replacement. Some answers may come from excavation and analysis of such known Athapaskan sites as the Salchaket Village site, which is reported to have historic and prehistoric components (Yarborough 1975:14), Wood River Buttes (Andrews 1977:401), and the Chena site (Andrews 1977:401).

3.1.4 Central Subarea[1]

Prehistory of the central subarea has yet to be clearly documented. Research by University of Alaska archeologists has addressed the problem of artifact chronology in the Upper Susitna River basin through analysis of several tephra (wind-deposited volcanic ash) units found in the Susitna River region. These tephra units appear to be regionally recognizable and divide the Holocene sedimentary record into distinct sedimentary units, providing a series of time stratigraphic markers for the relative dating of archeological deposits found in the region (Dixon et al. 1985:Chapter 8; Gillispie 1985a). While unpublished radiometric and tephra data seem to allow definition of detailed time-stratigraphic relationships between archeological deposits (Dilley 1985), published data (Dixon et al. 1985:Table 8.1) are somewhat more problematic. Of 83 published radiocarbon dates associated with tephra in stratigraphic contexts, 23 of the dates are directy associated with artifacts. The other dates bracket archeological components or individual tephra units. These radiometric dates and their associated stratigraphic units are summarized in Table 3-2.

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[1]The central subarea discussion is less structured than the northern area discussion because of the general absence of a reliable chronology for the central subarea.

Table 3-2
Radiometric Dates and Associated Stratigraphic Units

Stratigraphic Unit	Radiometric Date (at 1 standard deviation)	
Above Devil Tephra	Range of 15 dates:	Modern to 2070±60 (Beta 9899)
	10 accepted dates:	Modern to 1800±55 (DIC 2284)
Devil Tephra	1380±155 (DIC 2246)	
Below Devil Tephra, no Watana Tephra present	2310±220 (DIC 1877), rejected	
Above Watana Tephra, no Devil Tephra present	2340±145 (DIC 1903), rejected 2940±110 (Beta 19780), rejected	
Below Devil Tephra, above Watana Tephra	Range of 4 dates: 1240±60 (Beta 10785) to 1880±50 (Beta 9892), all accepted	
Watana Tephra	Range of 5 dates: 835±180 (Beta 10784) to 5200±70 (Beta 10781), all rejected	
Below Watana Tephra, above Oshetna Tephra	Range of 28 dates: 1730±120 (Beta 7689) to 6490±370 (Beta 7694); 16 of these dates are associated with paleosol	
	23 accepted dates:	2690±70 (Beta 7301) to 5130±140 (Beta 7302)
Below Oshetna Tephra	Range of 7 dates:	1260±80 (Beta 7848) to 9140±100 (Beta 10783)
	3 accepted dates:	5900±135 (Beta 10786) to 7240±110 (Beta 7306)

Out of the 83 dates used to generate the above table, 20 were either from archeological contexts without associated tephras, or from wood, peat, or bone collected from stratigraphic profiles investigated to gain chronological knowledge of glacial geology. Of the 63 dates from archeological context, or pond or bag core samples, 22 were considered unacceptable by the investigators. Dates were rejected on the basis of: (1) unclear provenience; (2) the nature of the soil or sediments was difficult to rectify with the tephra sequence; (3) the sample was too small to give a reliable date; (4) the source material was redeposited or disturbed; or (5) the date was run on a bulk organic sample. Only the Devil Tephra is directly dated; however, this date falls within the bracketing dates both above and below. Although the Watana and Oshetna Tephras either have not been directly dated or dates have been rejected, the bracketing dates from above and below each indicate that the tephras were deposited sometime during a several hundred year time span. It appears that the Susitna tephras can be used for relative chronological placement of archeological deposits stratigraphically above or below.

Another problem with emerging regional cultural chronologies is linked to underlying assumptions made by researchers. Some researchers (e.g., Dixon et al. 1980; Dixon et al. 1984) routinely use the presence of side-notched points to assign archeological assemblages to the Northern Archaic Tradition and the presence of Campus-type microblade cores to assign assemblages to the American Paleo-Arctic Tradition. This may be reasonable if the two artifact classes are linked exclusively with the two named traditions <u>and</u> if no obvious alternative explanations are present. That is, one has to believe that side-notched points and microblade cores are never produced by the same culture at any given point in time. However, as various other investigators point out (e.g., Campbell 1961; Cook 1969; Holmes 1984), side-notched points and microblades can be found together. For some, this spatial association between side-notched points and microblades is the artificial product of a depositional environment which produces deflated strata in shallow archeological sites and undated components. For others, the spatial association is the product of cultural patterning, and the two artifact classes are the product of the same archeological culture.

No matter which side is correct, there is enough circumstantial evidence for either side that neither side should be ignored.

For the Tundra Period, based on excavations at the Jay Creek Ridge site (TLM-128), Dixon and his colleagues (1984:3-349) have defined a "new diagnostic artifact assemblage for the interior of Alaska." For purposes of this discussion, this assemblage is termed the Susitna Complex. This complex is not formally named, but "the most distinctive characteristic of this assemblage is bifacial edge-retouched, concave-based projectile points, exhibiting basal edge grinding, which have been manufactured on thin flakes," and "additional artifacts associated with this assemblage include modified bifacial thinning flakes and a microblade industry." Of several radiometric dates available for this complex, the earliest date to about 9000 B.P. (Dixon et al. 1984:3-348). It remains unclear whether the Jay Creek Ridge occupation is another variant of the American Paleo-Arctic Tradition or a representative of an as yet unnamed co-tradition. Another possible candidate for inclusion in the American Paleo-Arctic Tradition is the Tuff Creek North site (TLM-027), which is thought to date to early Holocene times, and which is associated with an assemblage that contains "blocky" cores, blades and microblades (some of which are retouched), and lithic debitage (Dixon et al. 1982:7-10).

Within Cook's (1969) sequence at Healy Lake, the Tuktu component contains both microblades and side-notched points. This component may represent a co-occurrence of technologies characteristic of the late Tundra ((American Paleo-Arctic) and the early Taiga (Northern Archaic) periods. The presence of both microblades and side-notched points later in the Healy Lake sequence is not inconsistent with results from a recent analysis of several sites (Gillispie 1985b) which has led to definition of the following sequence for interior Alaska, including the northern and middle subareas of the study area:

(1) 7,500 to 5,500 years ago -- early notched biface plus microblade assemblages;

(2) 6,700 to 4,000 years ago -- middle Holocene notched biface assemblages without microblade technology;

(3) 4,000 to 2,550 years ago -- absence of notched bifaces in middle Holocene assemblages; and

(4) 2,550 to 750 years ago -- late Holocene Interior notched biface assemblages with microblade technology.

Several sites located south of the Alaska Range may be related to the Northern Archaic Tradition. These include sites in the Upper Susitna River basin (Dixon et al. 1984), the undated Ratekin site (Skarland and Keim 1958), and numerous sites in the vicinity of Tangle Lakes (West 1981). Association of these sites and the Northern Archaic Tradition is made primarily by the presence of side-notched projectile points, a hallmark artifact class of this tradition. However, as noted above, early and late components in the Healy Lake sequence are reported to contain both side-notched points and microblades, but associated artifact classes appear more closely aligned technologically with the Denali Complex than with the Northern Archaic Tradition. Because the annual reports from the on-going Susitna investigations indicate that microblades and side-notched points both occur in early and late Holocene geologic contexts (Dixon et al. 1984:3-42, 3-70, 3-82, 3-320), no separation of these classes in time or space is clearly evident. Cultural chronologies based on the newly emerging Susitna data must be examined carefully. Several sites found there have been assigned to cultural-chronological units on the basis of stratigraphic position and associated radiocarbon dates alone (e.g., Dixon et al. 1984:3-253). The foregoing discussion attempts to point out the tentative and confusing nature of the data base and the need for caution in development of subarea chronologies.

Elsewhere in the central subarea, few prehistoric sites are known, and few of these date to early prehistoric times. Recent overviews of the Middle and Lower Susitna River drainage, including watershed areas between the Talkeetna Mountains and the Alaska Range, prepared for the U.S. Department of Agriculture, Soil Conservation Service, revealed a general paucity of known prehistoric sites (Bacon et al. 1982a, b, c). A recent archeological survey of a power transmission corridor between Willow and Healy resulted in discovery of 17 sites. Thirteen of these are presumed to date to prehistoric times (Bacon et al. 1983). Small artifact assemblages revealed through limited site testing include microblades, side-notched projectile points (not found in microblade sites), bifaces, scrapers, and lithic debitage. None of these sites have been radiometrically dated, but are presumed to date to Holocene times on the basis of geological setting.

Workman (1977) has surveyed the Copper River drainage and examined existing archeological evidence for Ahtna cultural roots (see Ethnohistory section, 3.2, for discussion of Ahtna). Primarily on the basis of evidence from two sites, GUL077 and MS23-0, he concludes that Ahtna prehistory can be traced back to the early second millenium A.D. These sites reflect a settlement pattern of winter hunting camps and summer fishing stations similar to that of the historic Ahtna. Workman enumerates similarities in material culture between historic and prehistoric sites. Although the attempt to extend ethnographic and linguistically ethnic boundaries back into prehistory should be done with caution (Krause 1972; Shinkwin 1975; Workman 1977), data strongly support affixing an Athapaskan label to sites dating as early as A.D. 1000 in the area. Sites dating to the previous millenium are distinctly different and do not appear to be part of the Athapaskan Tradition (Shinkwin 1975; Workman 1977).

To date, other than the Susitna Complex, nothing has emerged from the central subarea which appears inconsistent with chronologies developed for the northern subarea. Yet, at this point when data are so incomplete, it seems premature and unnecessary to impose external chronologies on the Upper Susitna basin.

3.1.5 Southern Subarea

The prehistory of the southern subarea is even more poorly documented than that of the central subarea. The greatest known concentration of material is being reported from undated archeological contexts in the vicinity of Bonnie, Ravine, and Long Lakes in the southern Talkeetna Mountains (Bacon 1975b, 1978; West 1975a). Long Lake core and blade materials have a published radiocarbon date of around 6,500 years B.P. (West 1975a:Fig. 1), but more recent visits to the site have indicated that this date may be associated with an assemblage dominated by bifaces and lacking a core and blade technology. Therefore, sites such as the Beluga Point site (Reger 1977, 1981), located along the northern shore of Turnagain Arm, that have been compared to Long Lake, use an inappropriate measure for the time depth of core and blade technology for this region. Indeed, the occurrence of core and blade technology at both of these sites may be coincidental. For example, it is possible that the core and blade components at Beluga Point are related to the Ocean Bay I phase of the Koniag Tradition (Clark 1979), while the similar technology at Long Lake may be, as West and Bacon believe, more closely related to the Denali Complex in the Alaskan interior.

While Fladmark (1979) and others have commented on the possibility of Late Pleistocene coastal migrations, no archeological sites that date to these times have been discovered. Later Holocene components of the Beluga Point site (II, IIIa, and IIIb) appear closely aligned with the Kachemak Bay sequence (de Laguna 1975; Workman 1978b), centered much further to the south on the Kenai Peninsula. Little other evidence is presently known which documents human occupation in the southern portion of the study area during early and middle prehistoric times. However, recent, limited field investigations (Bacon et al. 1982a, b) and a wealth of Dena'ina (Tanaina) place name (Bacon et al. 1982a, b; Kari 1982) and ethnohistorical data (Fall 1981) provide ample evidence that this region was heavily utilized by aboriginal populations in the late prehistoric period.

3.1.6 Synthesis

Considering the diverse biases with which various investigators have approached interior Alaska archeological data, surprising agreement has been reached by those who have offered interior Alaska cultural chronologies for review (Fig. 3-4). Most investigators familiar with the region agree that the earliest dated evidence for human occupation places this event somewhere in the neighborhood of 11,000 years ago for interior Alaska north of the Alaskan Range and slightly later for areas further south.

Early Holocene cultures, which may represent an early adaptation to postglacial conditions, utilized a core and blade technology, which may or may not have been preceded by a non-core and blade technology. Beginning about the time of early forestation of central Alaska in the mid-Holocene, side-notched projectile point forms can be found in archeological assemblages. These are sometimes found in association with microblade technologies. At about 1,000 years ago, microblade technologies disappear and are replaced by assemblages that can be traced directly to historic period Athapaskan cultures.

It is evident that current archeological investigation reports from the Upper Susitna basin have looked northward for comparative cultural-chronological frameworks. This is due in no small measure to the lack of comparative material from more southerly regions. Currently available archeological data are so

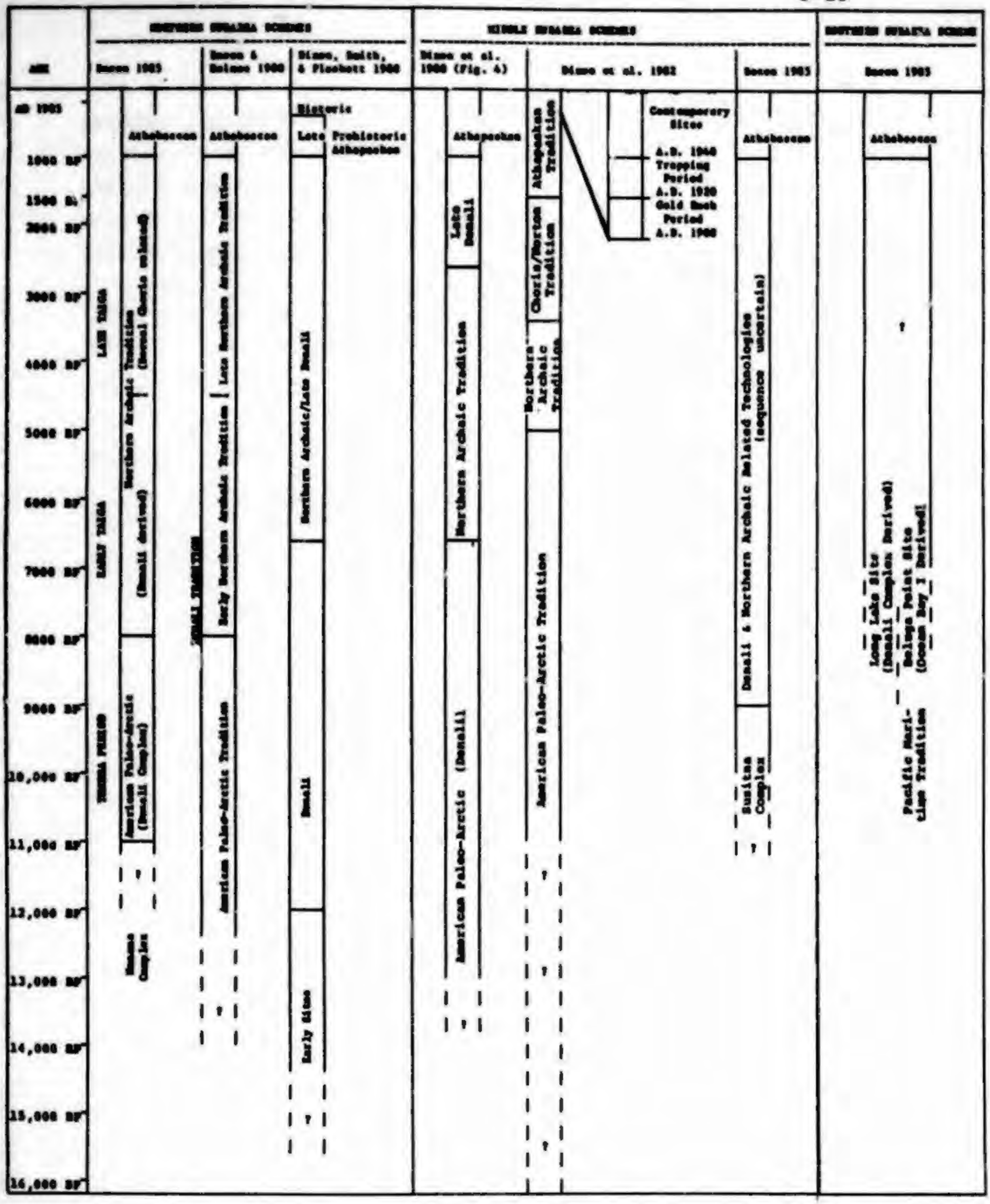

Figure 3-4. Speculative cultural chronologies for the south-central interior of Alaska.

geographically discontinuous that one must go as far south as the mid-Kenai Peninsula to find a south-central chronology that is relatively complete (Reger 1981). Even there, large data gaps still exist. Aside from the Pacific Maritime Traditions of the Alaskan Pacific coastal areas, little prehistory is known for southern south-central Alaska. When more information becomes available, we can reasonably expect the Upper Susitna basin to reflect the culture histories of areas immediately to the north and to the south.

Because southern south-central Alaskan prehistory is as yet undocumented, we must proceed with caution when formulating cultural historical frameworks for the Upper Susitna basin. Just as core and blade technologies near Cook Inlet have at least two potential sources, these same sources may apply to the Upper Susitna basin.

3.2 ETHNOGRAPHY

Janene M. Caywood
Historical Research Associates

3.2.1 Introduction

The current project area encompasses parts of the territories of three Athapaskan-speaking groups: the Tanaina (Dena'ina), the Ahtna, and the Tanana, as they existed at the time of European contact (Fig. 3-5). These three groups are identified on the basis of linguistic similarities and, to some degree, geographical distribution. For example, the Tanana speak three distinct but related languages and live within the drainage basin of the Tanana River (McKennan 1981). Each of the three groups identified above consisted of a continuum of bands distributed across a sometimes broad geographical area, who spoke similar languages and/or dialects. However, a local band at either end of the continuum may have had more in common, in terms of economic strategies, etc., with adjacent bands from a different language group than with spatially separate bands from their own group. Even the degree to which adjacent groups were able to communicate with each other depended more upon familiarity and competence with the language of their neighbors than with a common linguistic heritage.

The concept of a larger socio-political unit above the band level, such as the tribe, was lacking in all of the above-named groups at the time of white contact. "What have sometimes been called tribes were . . . simply spatially localized groups, distinguished for the most part by relatively slight cultural

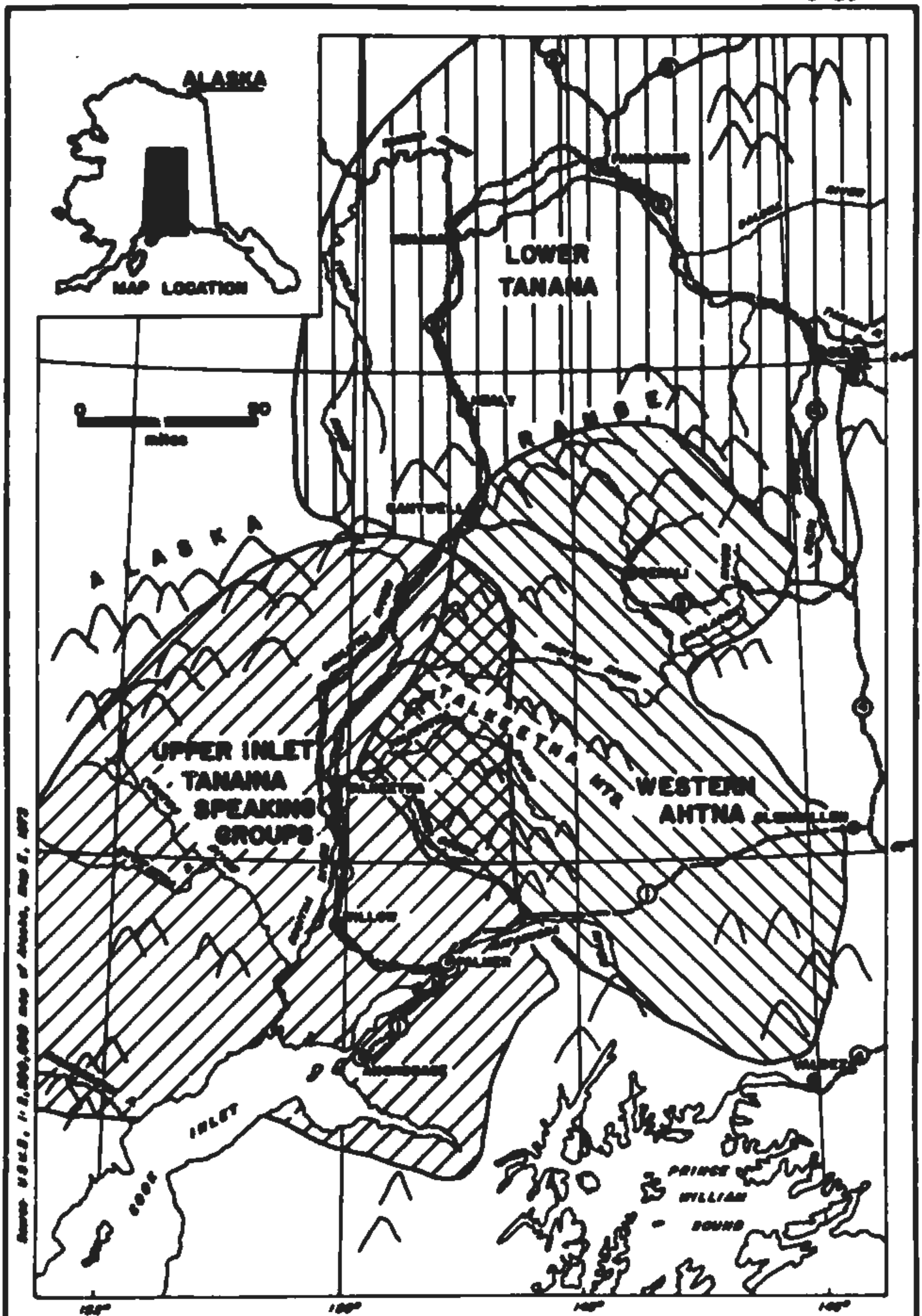

Figure 3-5. Approximate distribution of Tanaina, Ahtna, and Tanana groups over the project area.

differences" (Van Stone 1974:8). Tanaina, Ahtna, and Tanana economics were oriented around hunting and gathering activities and, thus, conform to the generalized Athapaskan pattern as discussed by Van Stone (1974) and others. However, within the range of each group's territory, differences in resource availability and distribution created concomitant differences in resource exploitation, scheduling, and associated settlement patterns.

Intra-group differences in economic orientation are perhaps most clearly seen among the Tanaina, who were distributed along the west side of the Kenai Peninsula, up the Susitna River drainage, and from the west side of Cook Inlet into the Alaskan interior to the headwaters of some of the major tributaries of the Kuskokwim River (Townsend 1981). Tanaina people living along or near the lower Cook Inlet had access to and exploited a wider variety of sea mammals than were available to people living adjacent to the upper Cook Inlet near the mouth of the Susitna and Turnagain Arm (Van Stone 1974). Similarly, Tanaina who traditionally occupied the upper reaches of the Susitna River were oriented more around the exploitation of the annual salmon runs and hunting of large land mammals. The availability and/or seasonality of subsistence resources directly influenced the degree to which individual bands could remain in one area at any given season, and created variations in settlement patterns exhibited within a group of people (i.e., Tanaina, Ahtna, or Tanana).

One of the results of differences in resource availability and the interaction of small, contiguous bands was the development of an extensive prehistoric trade system that may have included items from the Chuckchi Peninsula of Siberia, the Alaskan interior, and the Pacific Coast of Alaska. Townsend (1981) says of the Tanaina that special fairs were held for the express purpose of trade, and that native "rich men" with trading partners were considered important individuals. Items of trade included native copper from the Copper River drainage, dentalium shells from the Pacific Coast, caribou and other furs from interior land mammals, sea mammal products, porcupine quills, and also slaves (Townsend 1981:627).

The period of elaboration of trade networks has not been identified. However, evidence indicates that a widespread system had developed by the late prehistoric era. Plaskett (1977) found trade items at the Nenana River Gorge site, located on the Nenana River (an area occupied by the Lower Tanana in the 18th century). This site yielded two radiocarbon dates of A.D. 1490$\pm$115 and A.D. 1690$\pm$75, and produced artifacts that originated from both north and south of the Alaska Range. "Items that represent trade include obsidian, copper, chalcedony, a red-purple chert, and pottery" (Plaskett 1977:1810).

The well-developed trade system that existed at the time of European contact provided a network for the adoption of non-native trade goods and the incorporation of native Alaskans into the economy of the fur trade. The degree to which native Athapaskans' life systems changed after contact depended upon their role in the fur-trading system (i.e., trappers or middle men), and differential acceptance of a wide variety of technological innovations introduced or advocated by whites (i.e., the fish wheel, dog teams, etc.).

The following section will give a summary of the environment, economic and subsistence patterns, and material culture of the Tanaina, Ahtna, and Tanana, both before and after European contact. Since each of these groups is subdivided into several smaller linguistic and geographical units, only those units directly applicable to the study area will be discussed. Specifically, these are the Upper Inlet Tanaina, the Western Ahtna, and the Lower Tanana. Kari and Kari (1985) have identified regional bands within the Upper Inlet Tanaina, Western Ahtna, and Lower Tanana. Also, they have provided a description of the seasonal round of these bands and a list of place names derived from interviews with native informants. This information was incorporated into this chapter and is available as a separate report in Appendix B.

In general, the three subgroups identified above conform to the general Athapaskan cultural pattern. That is, people were organized in small, local bands and followed a scheduled cycle of seasonal transhumance, in order to exploit a wide variety of resources.

3.2.2 Tanaina (Dena'ina)

The Tanaina are an Athapaskan-speaking group who, at the time of European contact, occupied the area around Cook Inlet and adjacent regions to the north and west. This area offers great diversity in terms of terrain and weather. The Knik Arm area consists of "grassy meadows and shelving flat land . . . between the Arm and the Chugach Mountains, while the valleys and streams flowing from the northwest offer opportunities for pleasant settlements" (Osgood 1976:18). The climate of Knik Arm is not as severe as interior areas such as the Susitna River basin, since it is tempered to some degree by Pacific weather systems. The Susitna River itself is a heavily channeled stream that generally carries a heavy load of silt, since many of its tributaries are glacially fed. The Alaska Range separates the Susitna drainage from the Alaskan plateau to the north, and the drainage system of the Yukon River. The Alaska Range served as an effective barrier to frequent contact between human groups located on either side.

Both Kari (1975) and Townsend (1981) divide Tanaina speakers into four dialects, with corresponding geographic boundaries: Upper Inlet, Outer Inlet, Iliamna, and Inland. Townsend (1981) divides the Tanaina into three "societies:" the Susitna, Inland, and Kenai societies. According to Townsend (1981:624), these "societal divisions reflect differences in marriage patterns, socio-cultural elements, degree of interaction, and proximity." The society pertinent to this project is the Susitna society, which included people occupying the drainage basin of the Susitna River as far north as the headwaters of the Chulitna and Talkeetna Rivers; the east side of Upper Cook Inlet, including the area adjacent to Knik Arm and Turnagain Arm; and the west side of Cook Inlet as far south as Tuxedni Bay and inland to the Alaska Range (Townsend 1981:625). (The southwestern part of the Susitna society area is not directly applicable to this project.) With the exception of several groups below Nikolai Creek who spoke the Outer Inlet dialect, all of the local groups included by Townsend in the Susitna society spoke the Upper Inlet dialect (Townsend 1981:625).

Townsend points out that, within any of the three Tanaina societies, Susitna, Interior, or Kenai, differential distribution of resources caused differences in emphasis on and scheduling of particular resources, and ultimately influenced the degree of cultural elaboration and societal complexity attained by a local band. Despite such variations in economic orientation, a "high degree of interaction" among contiguous local bands served to preserve the "Susitna society" as a unit (Townsend 1981:624).

James Kari (1977a) and Fall (1981) divide the Tanaina who speak the Upper Inlet dialect into three regional bands: the Susitna River Basin, the Knik Arm, and the Tyonek area. The combined territories of these three subgroups correspond in general to Townsend's Susitna society. Only two of Kari's subgroups, the Susitna River Basin group and the Knik Arm group, are pertinent to this study. The territory of the Susitna River Basin Tanaina, as defined by J. Kari (1977a), runs from the mouth of the Susitna

River to the foothills of the Talkeetna Mountains, including the drainage of the Yentna River. The Knik Arm Tanaina were found along the Knik and Matanuska Rivers, and their territory included the Chugach and Talkeetna Mountains.

As stated above, differential distribution of resources throughout the area occupied by the Susitna society (or Upper Inlet speaking people) caused differences in resource scheduling. Fall (1981) identifies three settlement and subsistence patterns used by the Upper Inlet Tanaina during the 19th century (Fig. 3-6):

(1) the coastal pattern, consisting of two subgroups, (a) the Lower Susitna River basin and (b) the Tyonek area [the latter is not applicable to this study];

(2) the interior pattern of the Tanaina found in the upper reaches of the Susitna River drainage; and

(3) the Knik Arm pattern.

People of the Lower Susitna River basin, a subgroup of the Coastal pattern, spent the fall, winter, and early spring months in "winter" villages, the locations of which were determined by the presence of a reliable supply of fuel and water and close proximity of rivers or trail systems that could be used as transportation corridors. These villages tended to be located in areas that provided a good vantage point for spotting game and enemy parties, such as bluffs overlooking major streams. Also, winter camps tended to be located close to summer fishing areas (Kari and Kari, Appendix B).

The coming of spring necessitated movement of the local band to the head of Cook Inlet, often near the mouths of major rivers such as the Susitna. Migrant waterfowl and beaver were hunted initially, followed by seals and Beluga whales in June. Candle

SEASONS	WINTER Early Middle Late	SPRING Early Middle Late	SUMMER Early Middle Late	FALL Early Middle Late
Settlement	Winter villages ------------> Overlooks near rivers or trails with reliable fuel and water	Temporary settlements of local bands (trading expeditions by interior groups ------------>	Fish camps (near winter villages) --->	Temporary hunting camps Winter villages
Subsistence	Stored and dried foods, moose, bear and freshwater fish ---->	Migratory water fowl and beaver Seals, beluga, candle fish, Indian potatoes	Salmon ------>	Freshwater fish, beaver, moose, caribou at low elevations Bear, mountain sheep, ground squirrel, marmot at high elevations Stored and dried foods, moose, bear, freshwater fish
Habitat	Forested areas along Susitna River or main tributaries --->	Cook Inlet and mouths of major rivers ---->	Flood plain/ terraces of main Susitna, clear-water tributaries	Mountains and interior lakes Forested areas along Susitna River or main tributaries

Figure 3-6. Generalized Upper Inlet Tanaina annual settlement and subsistence cycle.

fish and a root known as "Indian potatoes" (Hedysarum alpinum) supplemented the diet during this season.

The beginning of the salmon runs in June required relocation of the band to fish camps along the major clear water tributaries of the Susitna. Salmon camps were occupied for most of the summer, until it was time to leave for the fall hunting trips into the mountains and to interior lakes. These trips were undertaken by men only or by entire families, depending upon the distances traveled, the longer trips requiring the cooperation of all band members (Townsend 1981:627). A variety of resources were harvested at this time of year, including freshwater fish (pike and grayling), beaver, and moose in the lower elevation lake environments, and bear, mountain sheep, ground squirrel, and marmot at higher elevations. Men usually hunted the larger game, while women snared the smaller mammals. The band returned to the winter villages at the completion of the fall hunts, and subsisted on stored, dried foods, supplemented by moose and bear which were hunted throughout the winter in areas adjacent to the village. Freshwater fish were also caught throughout the winter (Fall 1981).

The people of Knik Arm had a subsistence strategy similar to the Lower Susitna River basin people. However, they were required to travel farther to exploit the initial runs of king salmon that occur in June. King salmon runs do not extend to the tributaries of Knik Arm, so people were required to travel to the lower end of the Arm to set up their salmon camps. After the king salmon runs ended, people moved to tributaries of Knik Arm to exploit the runs of other species of salmon. The Chugach and Talkeetna Mountains were the focus of the fall hunts, when sheep, bear, ground squirrel, marmot, and caribou were harvested. The Knik Arm people used fences to trap or snare caribou. Like the people of the Lower Susitna River basin, inhabitants of Knik Arm returned to their winter villages at the close of the fall hunts, where they subsisted on stored food supplemented by fresh game and fish until the beginning of the spring fishing season (Kari and Kari, Appendix B).

The orientation of local bands living in the Upper Susitna River basin was concentrated on fish and mammal resources available in the interior. Coastal and salt water products were received through trade with Lower Susitna River basin people, but people from the upper river did not participate in procurement of such products. Trading expeditions to the mouth of the Susitna for saltwater products and salmon fishing began in the spring, the latter taking place on the major tributaries of the Susitna River. Early runs of king salmon were especially important to upper river bands, providing the first available resource that could be taken in large quantities. The fall hunt required the movement of families to the lower slopes of the Alaska Range and the Talkeetna Mountains for caribou, mountain sheep, bear, ground squirrel, and marmot. Winter found the local bands back in their winter camps located along the tributaries of the Susitna. Winter subsistence activities included moose and bear hunting and fishing through the ice of fresh water lakes (Kari and Kari, Appendix B).

As with many other Native American groups, the first extended contact that the Tanaina had with whites was with fur traders. At the time of contact, Upper Inlet-speaking (Susitna society) people had a well-developed network of inter- and intragroup trade. After introduction of the fur trade, the Tanaina integrated trapping for trade furs into the aboriginal trade system. Trapping for furs was included in the traditional hunts of fall and early spring and, therefore, did not alter extensively the aboriginal seasonal round of subsistence activities (Townsend 1981:627).

One change that did occur was an elaboration of the importance of "rich men" -- those individuals who were active in the native trade before the fur trade and who had established trading partners. Russian traders fostered the involvement of these men in the fur trade by extending them more credit than the average trapper. The "rich men" profited by the possession of large quantities of high-prestige trade goods such as dentalium shells and beads, and worked to sustain their place in the fur trade economy. Because of their elevated prestige, the "rich men" were able to attract relatives to join their households and to work for them in fur-trading activities. This pattern continued until the decline of the fur trade in the late 1800s (Townsend 1981: 627).

At the time of white contact, the Tanaina exhibited a complex inventory of material goods and manufacturing techniques. A wide variety of materials were used in weapon, implement, and clothing manufacture, including native copper, bone, stone, antler, plant fibers, wood, and animal products such as tanned skins, sinew, and hide cords. The following is a summary of material culture as described by Osgood (1976).

Hunting large game was primarily the responsibility of men, and required specialized implements, including harpoons, spears, bow and arrow, knives, snares, and a variety of traps. Harpoons with detachable, compound heads of bone and stone, sometimes used with attached bladders or floats designed to tire a wounded animal, were used for marine mammals. A short, thrusting spear was used to dispatch wounded animals as they neared boats. Large, bone-tipped spears were used to kill both black and grizzly bears. The spear thrower or atlatl was known to people in Upper Cook Inlet, but was not used by people in the Susitna River basin. Two kinds of bows were made by the Tanaina, one of Athapaskan design and another similar to the type used by the southern Eskimo. A variety of different arrow points were used, depending upon the animal or bird being hunted. Arrow points were made from stone, copper, bone, antler, and later from iron received through trade with Europeans. Small birds and mammals were killed with blunt-tipped arrows. Sinew line was used to make a variety of snares for mammals and birds. Women, as well as men, snared small animals and birds. Large and small animals also were caught in deadfalls and pitfalls. The design of these traps depended upon the behavior and size of the desired animal. A type of slingshot made with a single piece of skin was also used by the Tanaina.

Fishing technology included the construction of weirs across streams, fish traps, spears, and dip nets. Both men and women might dip fish from weirs, but the women's primary role was preparation of the fish for drying. Any lashing required for structures or implements to be used in the water was done with cord made from vegetable fiber (split spruce roots), since this did not stretch when wet. The fish traps consisted of barriers that impeded upstream progress. The fish generally could not find their way around the barrier and were then removed from the water with dip nets. Long, cylindrical basket trap "cages" made of alder poles, about 10 feet long, were also placed in the water at the opening of weirs. Fish swimming into the trap from the downstream opening were removed through a small hole in the top of the basket. The baskets for dip nets were made of netted spruce root. Fish were also taken individually with a "leister" or three-pronged thrusting spear with a bone point. Fish hooks made from antler and bone, and used with a line, were also used, especially during the winter while fishing through the ice.

Warfare was predominantly the realm of men and required weapons and armor. The most common weapon was a one-piece antler club with a protrusion formed by an antler tine, at right angle to the handle. A stone point was affixed to the end of the protrusion and the entire piece was soaked in oil to increase its weight. A type of armor was made by lashing together vertically positioned birch rods. A kind of shield, about the size of a club, was swung in front of an individual in order to knock down arrows from assailants.

Bone, stone, and hammered copper knives were used by men for a variety of tasks. Adzes, chisels, and awls were used to manufacture other implements or for construction. Adzes were made of stone or copper and used to cut trees or for cutting through ice in the winter. Awls were made by hafting beaver or porcupine teeth in bone or wood handles, and were used in the manufacture of wooden containers.

Some women's responsibilities that required specialized skills and/or technology included basketry, clothing manufacture, and preparation of hides and fish for drying. Baskets were made from spruce root fiber by coiling and weaving techniques. The size of these baskets varied and they were used for cooking, as storage containers, and as drinking cups. Both mats and some types of clothing were made by weaving. Woven grass mats were used as door covers and laid on the floor. Blankets or cloaks of woven rabbit skin strips were also made. Most clothing was made of tanned skins, either with the hair left on or removed. Garments with the hair left on were used in the winter for extra warmth. Skins were sewn with sinew threads, using bone needles and small bone awls. Clothing was decorated with porcupine quill embroidery, bits of fur and, later, with beads. The "everyday" implement used by women was the "semi-ovaloid" knife with a stone blade, hafted lengthwise in a wood handle. This knife was used for splitting fish and a variety of everyday tasks.

The Tanaina built several different types of structures. Winter camp dwellings were rectangular, semi-subterranean structures, sometimes as large as 40x30 feet. Sweathouses were attached to and entered through the main structure. A village may have included four or five such structures, occupied by several related nuclear families. According to Osgood (1976), the main structures at the summer fishing camps served as both dwellings and smokehouses, and consisted of a bent pole framework covered with birch bark strips. Townsend (1901) says that the primary structures at fish camps were small, sod and log structures built on the ground surface and separate from the sweathouses. Caches were built both above and below ground in winter villages, at the summer fish camps, and wherever else they might be needed, such as along trails, trap lines, etc. Fish drying racks also were built in the summer camps. A variety of temporary shelters were built by individuals or families on hunting trips. Semi-spheroid lodges built of strips of birch bark laid over bent poles, lean-tos, and skin tipis were used, as well as shelters made of alder brush in the areas above the timberline.

Travel during the winter was benefitted by the use of snowshoes constructed of birch wood with rawhide webbing. During the summer, people travelled via major waterways in birch bark canoes and moose skin boats. The traditional Eskimo kayak and umiak were also used by the Tanaina. However, it is not known how long the Tanaina had been using these before white contact.

At the time of white contact, the religion of the Tanaina consisted of a complex system of interaction between the "real" or everyday world of individuals, the world of "spirits" or ghosts, and the power of inanimate objects which were relatively greater or lesser than that of human beings. "The religion of the Tanaina is a respectful consciousness of the activity of an animated semivisible world which exists as a shadow of their own physical environment" (Osgood 1976:169).

Shamans served as mediators between the everyday world and the world of spirits (Osgood 1976:177). Evil spirits could possess an individual and cause sickness or death. Cures could be affected by shamans, using a special wooden mask and a small, carved wooden ball that was sent magically to the ailing person to locate the sickness (Townsend 1981:634). Shamanism continued as an important aspect of Tanaina life even after their conversion to Christianity in the mid-1800s (Townsend 1981:634).

The character of Tanaina religion did not lend itself to the observation of ritual or ceremony at specialized, identifiable localities. For example, a person became a shaman simply through experiencing a dream.

Disposal of the dead by the Tanaina was through cremation. Their complex belief system, in which spirits or ghosts of the dead often played a malevolant role, necessitated the disposal of the body in a prescribed manner, as well as the completion of a period of mourning and the holding of a "potlatch" in honor of the dead. The body of the deceased was clothed in special garments and placed in the funeral pyre along with a few of his or her personal belongings. Any bones and ashes that remained after burning were collected together and a fence built around the place of cremation to keep out animals (Osgood 1976:166). A bag containing the essential traveling equipment of the deceased was hung from a pole erected at the place of cremation. Cremation generally took place within 2-3 miles of the settlement, but not directly within it (Osgood 1976:166). After their conversion to Christianity, the Tanaina buried their dead. Small houses were built over the graves, or fences were built around them (Townsend 1981:634). Offerings were placed inside the grave houses or directly on top of the grave.

3.2.3 Ahtna

The Ahtna occupied the drainage basin of the Copper River. Their territory was bounded on the north by the Alaska Range from the Mentasta Mountains to Denali National Park and Preserve, on the east by the Wrangell Mountains, and to the south by the delta area of the Copper River. The northwestern edge of their territory was shared with the Upper Inlet Tanaina and the Lower Tanana Indians. However, contact with the Tanaina was much more frequent than with the Tanana, who were separated from the Ahtna by the Alaska Range (de Laguna and McClellan 1981:641).

The Upper Copper River valley has a climate similar to that of the Upper Susitna River basin. It has a Continental weather pattern with extreme variations in seasonal temperatures. The lower part of the valley, near the Chugach Mountains, is warmer, more humid, and wetter than the upper valley due to its proximity to the moderating weather systems of the Pacific Ocean (de Laguna and McClellan 1981:641).

The Ahtna are divided into three subgroups, Lower Ahtna, Middle and Western Ahtna, and Upper Ahtna, with corresponding differences in dialects and geographic distributions. The subgroup pertinent to the project area is the Western Ahtna. These people, along with the Middle and Lower Ahtna, all spoke a single dialect. The language of the Western Ahtna shows many similarities to the language of the Upper Inlet Tanaina (J. Kari 1977a), and may indicate intense inter-group contact and cooperation. Indeed, the Ahtna as a whole regarded the Tanaina as friends and relatives (de Laguna and McClellan 1981:642).

Relatively little is known of the subsistence patterns of the Ahtna in general, and the Western Ahtna specifically. De Laguna and McClellan (1981) indicate that each local group, made up of from one to nine extended family units, had its own resource territory, including a part of the Copper River or a major tributary for fishing, and a portion of land removed from the main river that included "small streams, lakes, marshes, forests, open uplands, and mountain regions" (1981:646). As with the Tanaina, slight differences in resource distribution created differences in resource scheduling (Fig. 3-7).

During the spring and summer, bands were located at good fishing areas along the Copper River or its tributaries (de Laguna and McClellan 1981). The species of fish sought depended upon the territory being exploited. Only two of the three regional bands recognized by Kari and Kari (Appendix B) for the Western Ahtna had direct access to salmon. The Talkeetna band (occupying the Talkeetna and Chulitna River drainages) and the Tyone band (occupying portions of the Susitna, Gulkana, and Tyone Rivers, Lake Louise, and Susitna and Tyone Lakes) both could obtain salmon within their resource territories. However, the Cantwell-Denali band, who utilized the Upper Susitna and Upper Nenana Rivers, did not have direct access to salmon. Instead, local bands in this region concentrated on harvesting whitefish during the spring and summer. Racks for drying fish and pits for fermenting fish also were used at the spring and summer camps. Plant resources were also collected in the spring, and continued to be available during summer and early fall.

After spring and summer fishing, the local bands moved to upland areas to hunt caribou and other large game, such as mountain sheep. Kari and Kari (Appendix B) say that the Cantwell-Denali band harvested caribou year-round, in the summer at the front of the glacier at the head of the Susitna River, and in August and September in lowland areas. Caribou fences with snares and corrals were used, and animals were killed from canoes as they swam across lowland lakes in the fall. Sheep and ground squirrels also were hunted by the Cantwell-Denali bands in the fall.

SEASONS	WINTER	SPRING	SUMMER	FALL
Settlement	Temporary camps (Western Ahtna) -----> Villages (Lower and Upper Ahtna) -------->	Fishing camps ---------------------------------->		Temporary hunting camps
Subsistence	Numerous animal and fish species -------->	Salmon on main rivers ------------------------> White fish on Upper Susitna and Upper Nenana Rivers --------------------> Various plants ------------------------------->	Caribou (Western Ahtna)	Mountain sheep, caribou and other large game
Habitat	Forested areas near available water ----->	High points near main views or their tributaries --------------------------->	Foot of glaciers for caribou ------------>	Upland areas for sheep and ground squirrels Lowland areas, especially near lakes, for caribou --------->

Figure 3-7. Generalized Ahtna annual settlement and subsistence cycle.

Probably all of the Western Ahtna returned to lower elevations in the fall of the year. However, the length of time during which people could remain in any given location is unknown. A present-day informant interviewed by Kari and Kari (Appendix B) indicated that groups in the Talkeetna region were never able to stay in permanent winter settlements, but were required to move continually from one subsistence camp to another. Winter subsistence probably depended upon the harvesting of many different animal and fish species. De Laguna and McClellan (1981) identify winter villages as one of three settlement types of the Ahtna as a whole. However, these camps and their associated semi-subterranean houses may not have been used by the Western Ahtna.

Ahtna material culture and technology is similar to that of the Tanaina and other Athapaskan groups. The exception is the absence of implements used in the harvesting of saltwater resources. A variety of stone, bone, antler, and copper hunting weapons were manufactured. Fishing technologies were similar to those discussed for the Tanaina, involving the construction of weirs and traps and the use of dip nets. Clothing styles and methods of construction were essentially the same as those of the Tanaina and many other Athapaskan groups.

As noted above, it is not known whether or not the Western Ahtna constructed large, semi-subterranean winter houses in permanent villages. In other areas of Ahtna territory, these winter villages consisted of a maximum of nine large, multifamily houses, either grouped together or scattered over an area of several miles (de Laguna and McClellan 1981:644). The winter houses consisted of a large, rectangular room with partitioned sleeping cubicles along the sides. A central fire hearth was used for cooking and also for heating rocks to be used in the sweathouse, a separate but attached room off the back of the dwelling opposite the door. De Laguna and McClellan (1981:645) say that every living site had a sweathouse, pit, and tree or platform caches, and additional, small enclosures for menstruants or parturients set at a distance from other structures. Western Ahtna informants indicate that, to their knowledge, they never used semi-subterranean houses (Kari and Kari, Appendix B). They used canvas tents late in the Historic Period. These probably replaced skin-covered winter lodges and summer lean-tos of the early Historic Period. In both winter and summer camps, the Western Ahtna had skin-covered (later blanket-covered), dome-shaped sweathouses.

Another type of house, built of logs chinked with moss and with shed-type roofs, was built in winter camps and by families on hunting trips. Temporary shelters used by families on the move were double lean-tos constructed with brush for walls and bark roofs and sides. Simple brush shelters were used by individual hunters. Bent pole frames covered with hides, which generally belonged to wealthy men (de Laguna and McClellan 1981:645), also served as temporary shelters.

Three types of caches also are known to have been used by the Western Ahtna (Kari and Kari, Appendix B). Two types of pole caches, one above-ground and one on the ground, were built. These were the only type used at fish camps, as they allowed circulation and prevented rotting. The third type was made with rocks, from rockslides above the timberline, for temporary caching of meat. The layers of meat were separated by layers of brush, apparently to allow circulation. Large rocks then were palced on top, to keep out predators.

One difference between the Ahtna and the Tanaina was that the Ahtna were restricted primarily to foot travel. Travel via waterways in the Ahtna territory was limited due to dangerous currents. Water craft were of two types. Large, skin boats capable of holding up to 30 paddlers were used on the rivers to carry heavy loads, and for trading trips to the coast. A small, one-man canoe made of birch or spruce bark was used in quiet water for hunting. Snowshoes were used in the winter, and loads were carried on 6-foot-long sleds with runners turned up at both ends, and pulled by hand.

The religious and burial practices of the Ahtna were similar to those of the Tanaina. Shamans played a prominent role in society, interceeding for individuals, between the "real" and "spirit" world. Like the Tanaina, the Ahtna cremated their dead. The ashes of the deceased sometimes were kept by his or her descendants, or were buried in a birch bark container (de Laguna and McClellan 1981:658-659). Exceptions to this practice involved shamans, who were always buried (de Laguna and McClellan 1981:661).

By the mid-1800s, the Russians had introduced the Christian faith and also the practice of burial in a plank-lined box. Graves were marked by a cross and surrounded by a fence. Small houses were built over the graves to contain some of the personal possessions of the deceased (de Laguna and McClellan 1981:659).

3.2.4 Lower Tanana

The term "Tanana" refers to the native Athapaskans who inhabited the drainage basin of the Tanana River, a major tributary of the Yukon River. "Lower Tanana" is a subcategory of Tanana speakers and is used by McKennan (1981) to identify those bands of Tanana Athapaskans who spoke one of three Lower Tanana dialects and who occupied the drainage basin of the Tanana River from the Goodpaster River downstream to the mouths of the Tolovana and Kantishna Rivers. Lower Tanana speakers may formerly have occupied an area farther west, to the junction of the Tanana and Yukon Rivers. However, by the time of white contact, Koyukon-speaking peoples occupied this area and were apparently moving gradually up the Tanana River (McKennan 1981). The remainder of the Tanana River drainage was populated with people speaking two languages related to Lower Tanana: Tanacross and Upper Tanana. The three main languages of the Tanana and the dialectic differences within each language correspond to the geographic distribution of bands.

The Tanana River drainage system forms part of the Alaska Plateau and is bounded by natural physical barriers: the Alaska Range and the Wrangell Mountains to the south, and to the north by the mountains of the Yukon-Tanana uplands from the head of the Tolovana River east to Mount Harper at the head of Healy River (McKennan 1981:565). The eastern distributional boundary of the Tanana-speaking peoples, as it existed at the time of European contact, is not known.

The Tanana River drainage has a climate similar to the rest of interior Alaska. The moderating effects of the Pacific air currents are blocked by the 10-12,000 ft. high peaks of the Alaska Range. Consequently, winter and summer temperatures are extreme, from as low as -70°F in winter to as high as 90°F during the summer months. Precipitation throughout the year averages only about 12 inches, but there is much standing water in some localities due to the presence of permafrost (McKennan 1981:564). About half of the rain falls during the summer, with July and August being the wettest months. Snow generally covers the ground between October and May (de Laguna 1947).

Several major tributaries feed the Tanana River below the Goodpaster River. Delta Creek, Little Delta River, the Wood, Nenana, and Kantishna Rivers all enter the Tanana from the south. These are all glacially fed, channeled streams with heavy silt loads, as is the Tanana itself. The major tributaries that enter the Tanana from the north, the Salcha, Chena, and Tolovana Rivers, are generally clear of silt (McKennan 1981:563).

A wide variety of mammal, bird, and fish species were available to the people occupying the Lower Tanana River area. Caribou herds were most abundant above the timberline, as they followed their seasonal migration routes across the tundra. At the time of European contact, moose were plentiful in the area; however, there is some evidence that may indicate that moose are fairly new arrivals to interior Alaska. In any event, for at least the past 100-150 years, moose have been available at lower elevations and in the river bottoms, where browse is available. Mountain sheep, marmot, and ground squirrel, as well as marten (the latter sought for their pelts), were found in the higher mountains. The varying hare and the porcupine were sought for food, and the latter provided quills for decorative embroidery. Additional fur bearers include red fox, lynx, wolverine, beaver, mink, otter, and muskrat. Bears (black and grizzly) were hunted for both meat and hides. However, bear hunting does not appear to have been of major economic importance (McKennan 1981:565).

Migrant waterfowl were available seasonally, and resident populations of ptarmigan and ruffed and sharptail grouse were also exploited. Salmon was perhaps the most important fish resource to the Lower Tanana. Seasonal spawning runs progressed only as far up the Tánana as the Goodpaster River, the approximate boundary between Lower Tanana and Tanacross subgroups. Spawning took place in all of the clear water tributaries of the Tanana below the Goodpaster, where aboriginal fishing activities were concentrated. Whitefish, grayling, northern pike, sucker, and ling were also harvested from freshwater lakes and streams.

Effective exploitation of the food and fur-bearing species identified above required seasonal movement from place to place (Fig. 3-8). McKennan (1981) indicates that reliable ethnographic data are available only for the area above the Goodpaster River. However, the model of subsistence activity scheduling that he

SEASONS	WINTER			SPRING			SUMMER			FALL		
	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late	Early	Middle	Late
Settlement	Semi-permanent hunting camps ------->			Temporary camps ------->		Fish camps ------------------->			Temporary hunting camps	Semi-permanent hunting camps ------->		
Subsistence	Caribou ------------->			Moose, muskrat, beaver and caribou		Salmon and other freshwater fish, berries, roots, ducks, and other birds after salmon run ----------------->			Sheep, marten, marmot, ground squirrels in mountains	Caribou ------------->		
Habitat	Uplands near near timberline ----->			Lowlands near fish camps -->		Clearwater tributaries and lakes ----------->			Streams Mountains	Uplands near timberline		

Figure 3-8. Generalized Lower Tanana annual settlement and subsistence cycle.

proposes is probably applicable to bands throughout the entire Tanana River drainage system. According to McKennan (1981), the fall caribou hunt was of primary importance to local band subsistence. The southward-migrating caribou were dispatched in a variety of ways, but the large hunts usually involved the use of caribou fences to snare animals or to herd them into an enclosure, where they could be speared or shot with bow and arrow. If successful, the fall hunt could produce enough meat to support an entire band (consisting of from one to ten extended families) through the winter. The winter camps for a local band were generally located close to the caribou fences in the uplands. Maintenance of fences was the collective responsibility of the local bands using them.

The coming of spring required the movement of people to areas nearer the main river. A variety of animals were hunted in the lowlands, including moose, muskrat, beaver, and caribou, the latter moving once again to the area above the timberline. By late spring and early summer, the salmon began their spawning runs and were the focus of collective fishing efforts. Large weirs were constructed on clear water rivers and streams near lake outlets. The fish were taken in cylindrical traps and from dip nets suspended from the weirs, and also by individuals with dip nets fishing from canoes in the main river. The arrival of several runs of salmon allowed the Lower Tanana to remain in their fishing camps for a longer period of time than bands located above the Goodpaster River, who did not have direct access to salmon.

After the salmon runs had ended, local bands subsisted on dried salmon and supplemented their diets with vegetable foods and ducks and other birds until the late summer. At this time, hunting trips were made to the mountains, where the men would hunt big horn sheep, using fences and snares, and the women would snare marmots and ground squirrels. All three of these animals were procured for their meat and skins. Fall brought the members of the local band back to the vicinity of the caribou fences (McKennan 1981:565-566).

During pre-contact times, most of the subsistence strategies identified above were carried out on the level of the local band. McKennan (1981) states that, although individual families might participate in some subsistence activities by themselves, the cooperation of the local band as a unit was required for most major subsistence activities. However, bands were probably not static groupings of families.

> The bands were of such small size that periodic famines, warfare and later, diseases introduced by whites could easily reduce them to a point where they were no longer viable. The survivors would be forced to join another and larger band or starve. On the other hand under optimum conditions some bands no doubt increased to a size where they were forced to split into smaller units and seek new territory (McKennan 1981:566).

Although the Tanana did not think of themselves as a single socio-political unit, McKennan (1981:562) describes the Lower Tanana as a "regional band" or a group of smaller bands united through marriage and common interests, such as a similar pattern of seasonal resource exploitation.

The incorporation of the Tanana into the fur trade system brought about changes in technology, resource scheduling, and settlement patterns. Before the late 1800s, Tanana contact with European fur traders had taken place primarily through intermediaries and by annual trips to the mouth of the Tanana River, where they dealt directly with Russian and British traders. However, the penetration of whites into the Tanana River drainage and the establishment of fur trading posts increased the desire to obtain furs which could then be exchanged for European trade goods.

The adoption of the dog sled for traction by Tanana natives was encouraged by fur traders. The use of a team and sled allowed an individual to greatly increase the area of exploitation of his trap line. However, keeping sled dogs created the need for a reliable source of dog food -- dried fish. An increase in the market for dried fish extended the time spent fishing, and the introduction of the fish wheel by whites changed fishing locales from the clear water tributaries to the heavily silted main channels of the Tanana River. The economic emphasis gradually switched from the collective level of the band to the individual endeavors of the nuclear family. Settlement began to be clustered around trading posts and the traditional seasonal, nomadic movements decreased.

The material culture and technological systems of the Tanana were similar to other Alaskan Athapaskan-speaking groups. A wide variety of materials and skills were used to fashion tools, weapons, and structures, varieties of which usually depended upon the availability of raw materials. As stated earlier, caribou were hunted by constructing large fences near timber line, that were either lined with snares or built so as to funnel the animals into a corral. Spears and bows and arrows made of birch were then used to kill the individual animals. Arrow points for killing large game were made of bone, antler, or hammered native copper, and later, iron or steel. Blunted arrows were used for killing birds. A variety of snares and deadfalls also were used to take small mammals and birds.

Fishing activities required a complex technological system involving the construction of weirs, and the production of cylindrical fish traps and dip nets. "Leisters," three-pronged spears, were also used to spear fish. Pits near fish camps were excavated to ferment fish.

Women were usually responsible for cleaning and drying the fish, and used a "semi-lunate" stone knife for this purpose.

Birch bark containers, laced with plant fiber, were made by women, who also were responsible for preparation of hides and clothing manufacture.

McKennan (1981:571) identified three types of structures built by the Tanana. Winter camp houses consisted of a domed lodge constructed of bent poles covered with tanned skins. Summer fish camp dwellings consisted of bark-covered huts. Dome-shaped sweathouses were constructed separately at both winter and summer camps. The double lean-to, usually housing two nuclear families, was used in transitory hunting camps.

Recent informant interviews by Priscilla Kari (Kari and Kari, Appendix B) provide information on several additional structures built and used by the Lower Tanana. Smokehouses were constructed for drying both fish and meat. They also built log caches on poles, as well as long-lined, subterranean, cubical caches up to 6 ft. on a side. The final structure was a platform built on poles in low, open areas, to be used as observation areas for game.

Like the Tanaina and the Ahtna, the Tanana used snowshoes for winter travel as well as tobaggans and double-ended sleds. During aboriginal times, these sleds were pulled by hand. Summer travel was along waterways, using small, partially decked, birch bark canoes, and a large, skin-covered boat for transporting heavy loads downstream.

Like the Tanaina and the Ahtna, the religion of the Tanana centered around shamanism. Shamans were "believed to possess special spiritual power . . . secured by means of dreams" (McKennan 1981:374). Tanana burial practices were also similar to those of the Tanaina and Ahtna. Cremation was used before white contact. Personal belongings of the deceased were often burned with the body, or sometimes given away. However, with the first white influence, burial replaced cremation and a small house was built over the grave (McKennan 1981:572).

3.2.5 Conclusion

From the foregoing discussion, the similarity of settlement patterns, resource use scheduling, technology, and material culture of the various Athapaskan groups in the study area is apparent. Individual band adaptations reflect the intimate relationship between hunting-gathering groups and their environments. Many of the environmental distinctions that affected local Athapaskan cultural patterns presumably affected earlier occupants as well.

3.3 HISTORIC OVERVIEW

Daniel P. Gallacher
Historical Research Associates

3.3.1 Early Exploration and Russian Control, 1741-1867

In 1741, 13 years after Vitus Bering first discovered a passage separating Asia from North America, he and Alexei Chirikov captained two vessels on an exploratory voyage eastward from the eastern coast of Russia. The two commanders lost contact during a storm, and Chirikov sailed southeast along the southeastern coast of Alaska. Bering proceeded in a more easterly direction to the southern coast of Alaska, where he saw and named Mount St. Elias. Chirikov returned to Russia in October 1741, but Bering's ship capsized on the return trip, killing the commander and many of his crew. The survivors, including Georg Wilhelm Stellen, a noted German physician and naturalist, constructed a smaller boat out of the wreckage of their craft and arrived safely in their home port in August 1742. Stellen carried with him a number of sea otter skins and, upon his return, prepared detailed reports of the abundant animal life on the Aleutian Islands and along the southern coast of Alaska.

Although ill-fated, Bering's voyage and the information obtained by Stellen stimulated interest among Russian fur traders in the fur resources of Alaska. However, according to Ivan Petroff, Russian fur-trading activity in Alaska prior to 1800 was limited to the Aleutian and Kurila Islands. The number of firms involved in this trade multiplied rapidly after Bering's discovery, and "every Siberian merchant who had a few thousand rubles at his command sought to associate himself with a few others; in order to fit out a miserable craft or two and engage in the same business" (Petroff 1900:175). Petroff indicated that there were over 60 firms competing for the Alaskan trade, and that their unjust treatment of the native population created problems for later fur-trading operations.

By the late 1780s, although there still were a number of small, independent traders, the Shelikof Company and the Lebedev-Lastochkin Company were the leading competitors for dominance of the lucrative trade. The rivalry between the two firms and the independent traders continued until the late 1790s, and at times resulted in violent confrontation. Finally, in 1799, the Russian Government issued a 20-year imperial charter to the privately owned Russian American Company (formerly the Shelikof Company). This company not only controlled the fur trade in Alaska until the United States purchased the territory in 1867, but it was the representative of Russian sovereignty in the region until that date (Brooks 1906). From a number of fortified trading posts, located on the coast or on coastal islands, the Russian American Company traded with the natives for furs or outfitted small, company-staffed, trapping parties. Between 1799 and 1820, the returns from this trade were encouraging, and Emperor Alexander I granted the company a second 20-year charter in 1820.

In addition to their trading activities, company officials attempted to transform the natives into farmers and stockmen and to thereby ensure a stable food supply. The company purchased cattle herds from Spanish-held California and supplied the natives with seeds and farming implements. The experiment in civilization met limited success. The natives were indifferent to the requirements of crop production, and feared the large stock animals. Company officials soon abandoned their efforts and were forced again to rely on imported foodstuffs.

The Russian American Company also encouraged religious and educational training. This effort increased after 1820, and the company sponsored construction of a number of churches, chapels, and schools for the benefit of the natives, as well as for their employees. Many of the structures built during this period are still extant (Petroff 1900).

Despite the attempts to establish a more permanent presence in their Alaskan colonies, evidenced by the introduction of agriculture and the fostering of religious and educational training, the Russian American Company remained primarily interested in exploiting the area's fur wealth. Attempts were made to explore new areas, yet the Russian presence in Alaska was almost exclusively limited to the fur-rich Aleutian Islands, the coastal region, and the offshore islands. There are few documented attempts of Russian exploration of the interior. A Russian explorer named Malakof ascended the Susitna River in 1834, but returned home with little information concerning the region. In 1842-1843, Lieutenant Alexiev Zagoskin followed the Yukon River, keeping extensive notes on the native population and the fur resources during his reconnaissance of the river and its tributaries. His survey prompted the Russian American Company to pursue the exploration of the region (Brooks 1906).

Expeditions by England and the United States between 1840 and the late 1860s provided additional information about interior Alaska. Most of these surveys traversed the country along and north of the Yukon River. One of the most celebrated expeditions began in 1865, when Robert Kennicott led a party of men on a survey of the Yukon in an attempt to locate a route for a proposed telegraph line to be built by the Western Union Telegraph Company through British Columbia and Alaska, across the Bering Strait and Siberia, to Europe. Although Kennicott died at Nulato, Alaska, in 1866, his associates completed the survey and, in turn, provided additional knowledge of the terrain and the resources of the Lower Yukon and its tributaries.

3.3.2 The American Presence in Alaska, 1867

Although the United States expressed an interest in purchasing Alaska as early as 1854, it was not until 1856, at the end of the Crimean War, that Russia seriously considered the American proposition. The war prompted Czarist Russia to re-evaluate its world colonial possessions. Alaska, for a variety of political and economic reasons, was viewed by the Russians as a potential liability, despite the documented wealth of minerals and furs. In addition, American acquisition of Alaska appeared to threaten Russia less than acquisition by a more formidable world power such as Great Britain. Despite considerable support for the proposed sale, many influential Russian officials considered the divestiture premature. Thus, for over 10 years, Alaska remained a Russian colony.

Finally, on March 30, 1867, a treaty negotiated between U.S. Secretary of State William Seward, and Baron Stoeckl, the Russian foreign office minister, for the purchase of Alaska was submitted for ratification to the U.S. Senate. On April 9, 1867, the Senate approved the treaty, but anti-expansionist members of the House of Representatives, led by Cadwallader C. Washburn of Wisconsin and Benjamin Butler of Massachusetts, waged a stubborn and often vicious battle against the necessary appropriations bill. Congress finally granted approval for the purchase of Alaska on July 14, 1868 (Luthin 1937).

With the acquisition of Alaska, the United States obtained a vast and virtually unexplored wilderness. The once-lucrative fur resources had been largely depleted by the trapping activities of the Russian American Company and the Hudson Bay Company along the coast and the Yukon River. The mineral resources, although documented, had been virtually ignored by the Russians and the English, to avoid conflicting with their lucrative fur-trading activities. Thus, exploration of the uncharted interior, mineral development, and the establishment of the requisite transportation network characterized the history of Alaska Territory after 1867.

The U.S. Government was reluctant to fund extensive exploration of the interior and chose instead to concentrate official surveys of the coast of Alaska. There were, however, several interior expeditions, funded primarily by the Department of the Army, designed to gain a better understanding of the geography and native inhabitants for defensive purposes. Virtually all of the interior explorations conducted prior to the late 1890s were concentrated along the Yukon and Copper Rivers and their tributaries, north and east of the study area (Reed 1966).

There were few documented incursions into the study area prior to the 1890s. One exception was the establishment of a small trading center known as Susitna Station, on the Susitna River north of Cook Inlet. The Alaska Commercial Company, a large, privately owned fur trading company, started the post in the mid 1870s. The small post was the company's northernmost trading center in the Cook Inlet region and served the few native inhabitants along the Susitna and Yentna Rivers. The trading station also provided supplies to the few miners who attempted to ascend the Susitna prior to the 1890s (Cole 1983).

The discovery of gold at Turnagain Arm on the Kenai Peninsula in 1895 prompted the first well-documented incursion into the Susitna River drainage. In 1896, William Dickey and Allen Monks ascended the river, hoping to find gold on or along its tributaries. After reaching Susitna Station, the two men constructed small boats and rowed and portaged as far north as Portage Creek. Dickey and Monks were unsuccessful in their prospecting, but they provided information about the previously unexplored region (Cole 1983).

The same year that Dickey and Monks prospected the upper Susitna River, miners discovered gold on the Klondike River, northeast of the study area in Canadian Territory. By 1897, there was an influx of miners into the region that was unparalleled in the history of the area. The silver panic of 1893 had devastated the hard-rock mining industry in the mountainous regions of the continental United States, and the Klondike strike provided new hope and incentive for dedicated miners. Utilizing every available means and route of transportation, men surged into Dawson City and other camps along the Klondike. They were soon followed by businessmen and farmers, who envisioned that, from the new-found wealth of the gold fields, they could and would prosper (Carlson 1946).

The Klondike strike awakened the U.S. Government to the possibilities of extensive mineral wealth in Alaska Territory. As stated above, Government funding for exploring the territory since its acquisition had been limited and had been devoted almost entirely to coastal surveys. In 1895, the U.S. Geological Survey (USGS) allocated a small amount of money for exploration of the interior. The gold strikes on the Kenai Peninsula and on the Klondike in 1896 resulted in increased funding for exploration of all major interior drainages.

J.E. Spurr led the first major scientific expedition into parts of the study area in 1898. Spurr and his five assistants arrived at Tyonek in April and, after procuring supplies, they started up the Susitna River. By late May, had they reached the American Commercial Company's post at Susitna Station, where they replenished their provisions and attempted to hire a native guide. The Indians at the post refused Spurr's offers, claiming that the river was impassable because of the rapid current. Spurr continued up the Susitna to the mouth of the Yentna River, which he followed to the Skwentna River. He ascended the

Skwentna, located and crossed Portage Pass through the Alaska Range, and descended into the Yukon River valley (Cole 1983).

The USGS also sent survey parties into the Copper River and other major drainages in 1898. The Copper River survey was funded and conducted jointly with the Department of the Army. Two separate parties, one led by Captain E.F. Glenn and W.C. Mendenhall, and the other by Captain W.R. Abercrombie, entered the region from different directions during the early summer of 1898. Glenn followed the Matanuska Valley from Cook Inlet, and crossed the Alaska Range into the Delta River Valley.' Glenn and Mendenhall descended the Delta River to the Tanana River, carefully noting the geology of the region. Abercrombie, F.L. Schrader of the USGS, and their men entered the Copper River from Valdez, following the "prospectors' trail" over Valdez Glacier. Schrader, like his counterpart Abercrombie, noted the geologic formations along the lower Copper River.

During the same summer, G.H. Eldridge and Robert Muldrow ascended the Susitna River to the Jack River and crossed overland to the Nenana (known then as the Cantwell) River. Eldridge and Muldrow endured extreme hardship during their survey, primarily during the trip up the Susitna when they were forced to literally drag their canoes because they were unable to row against the swift current (Reed 1966).

The following year (1899), one of the most famous and comprehensive surveys of Alaska was conducted. The expedition was privately financed by Edward H. Harriman and included many of the leading scientists, engineers, and humanists in America. Harriman's party, initially intended as a pleasure cruise for his family and several friends, totaled 14 family members, 25 scientists, and 65 crew members and support staff. For over two months, the members of the Harriman Expedition remained in Alaska, devoting most of their time to surveying the coastal region, but taking numerous short trips into the interior. The knowledge gained by this privately funded "pleasure cruise" greatly increased America's understanding of the vast resources of Alaska (Reed 1966).

The most thorough survey of the Susitna River was undertaken in 1902. On May 7, Dr. Alfred H. Brooks and seven men departed Tyonek on a journey that covered over 800 miles and took over 5 months to complete. The party ascended the Susitna River, discovered and crossed Rainy Pass through the Alaska Range, and descended the Kuskokwim River. They then turned to the northeast and followed the Alaska Range, camping on August 4 below Mount McKinley. Brooks surveyed the Yanert Fork of the Nenana River, followed the Nenana to the Tanana, and then turned northwest, arriving in Rampart on the Yukon River in mid-September. Although Brooks and his men suffered extreme hardships during their journey and daily risked their lives, they provided the scientific world with invaluable data on the topography, geography, and geology of this little-known region (Reed 1966).

Mapping and surveying the interior of Alaska by members of the War Department and the USGS coincided with the advancement of the mining frontier from the Yukon River valley into the study area along the Nenana, Tanana, and Susitna Rivers and their tributaries. While the scientific expeditions left little evidence of their passing, the thousands of miners and attendant support groups established settlements, some ephemeral and others that became permanent, thriving communities.

Gold initially was discovered on the Tanana River in the early 1870s, but these early prospectors did not develop the strike. Over 20 years later, in 1898, prospectors aboard two small steamships ascended the Tanana River and established a winter camp on the Chena River, a tributary of the Tanana. While prospecting, they discovered traces of gold in the river gravels, but the miners were not equipped to develop the richer placer deposits, which were covered by a deep layer of gravel and dirt. According to I.M. Prindle, who surveyed the Fairbanks District between 1903 and 1909, the results of this prospecting venture were typical of mining in the region in the late 1890s and early 1900s. These men often:

> had only small supplies of food. They were obliged to travel rapidly. They had few opportunities to more than glimpse the country traversed and fewer still to prospect with sufficient thoroughness, especially in valleys where the depths to bedrock in most places far exceeded the depths obtaining in other regions. . . . So, apart from sporadic trips by miners from the Forty-mile and Birch Creek regions or from the temporary halts of those who traveled down the Tanana, this rich region was neglected (Prindle 1913:86).

However, the Fairbanks region was not neglected for long.

In 1901, a small trading station was established on a slough of the Tanana River. The station, named Fairbanks, supplied the few miners in the region. In July 1902, Felix Pedro discovered gold on a small stream 12 miles from Fairbanks. The Pedro Creek strike was quickly followed by strikes on Fairbanks and Cleary Creeks. News of the discoveries spread quickly to the mining camps along the Yukon River in Alaska and Canada and, during the winter of 1902-1903, thousands of miners rushed into the area.

The overburden covering the placer gold discouraged many of the new prospectors and many had left the area by the end of 1903. Those who remained began uncovering richer placers under the thick, frozen overburden. To extract these richer placers, the miners needed more sophisticated mining equipment than the pan and rocker system used to mine placer deposits on the Yukon. Thus, the miners in the Fairbanks region had to import more elaborate machinery, including steam prods to thaw the frozen ground and power hoisting equipment to remove the earth. This posed problems for the Fairbanks miners, since existing transportation systems were sorely inadequate. The necessary equipment could be brought by steamboat up the Tanana River, but there were only small pack trails from the river to the placer camps. Miners worked to widen the trails from the small communities of Fairbanks and Chena (also on the Tanana River) to accommodate the wagons required to carry the heavy and cumbersome hoisting machinery.

In 1904, Falcon Joslin, a Fairbanks attorney who envisioned great profit from providing dependable transportation, incorporated the Tanana Valley Railroad (TVRR). The construction of the narrow-gauge line was funded by businessmen from New York and Chicago. Construction began in 1905 at Chena and, the first year, tracks were laid from Chena to Pedro Creek, with a 4.7-mile spur line to Fairbanks. In 1907, construction crews extended the line to Chatanika (Koenig 1954).

The TVRR facilitated the development of the mining industry in the Fairbanks District and it also contributed to the early and rapid growth of both Fairbanks and Chena. Initially, the headquarters for the TVRR were located at Chena, with terminal grounds at Chena Junction, Fairbanks, and Gilmore. Yet, by 1910, Chena had begun to lose the battle with Fairbanks as the premier supply point for miners in the Fairbanks District. In 1907, there were over 400 people in Chena, but by 1915, only 50 remained. The Chena business district in 1907 included several hotels and restaurants, a bakery, and other thriving businesses but, in 1915, only one general store remained. The TVRR moved their headquarters to Fairbanks and many of the residential and commercial buildings were either torn down or moved to Fairbanks or to small mining camps in the nearby hills (Koenig 1954).

The town of Fairbanks grew quickly after its initial beginning in 1901 as a trading station. By 1904, there were reportedly over 5,000 people living in the city. However, this population was transient and fluctuated with the success or failure of the nearby mines. Nonetheless, Fairbanks became the regional center for suppliers as well as for entertainment. Accommodations were often impossible to obtain, but the same was not true of liquor and fine food. Fairbanks was a mining boom town reminiscent of similar communities in Montana, California, Colorado, and other mining areas in the continental United States (Koenig 1954).

For the first five years of the mining boom near Fairbanks, the TVRR was a great success. Joslin boasted that the TVRR would soon extend their line to Nome and Circle City. However, by 1910, when the placer deposits that prompted the initial boom were depleted, the TVRR began a rapid financial decline. News in 1914 of the impending construction of a Government-sponsored railroad boosted the hopes of the TVRR stockholders. In 1917, the Government leased and then purchased the entire rolling stock of the TVRR (Koenig 1954).

The success and prosperity of the TVRR was intimately tied to mineral production. The same was true for the city of Fairbanks. The city supported a population of over 5,000 by 1906-1907, but the 1920 census, reflected a decline to less than 1,200 (Koenig 1954).

Gold strikes prompted settlement in other regions of the study area, yet none were as important as the ones that occurred near Fairbanks. In 1905, prospectors discovered placer deposits in the Cache Creek, Peters Creek, and Lake Creek basins, tributaries of the Yentna River. Although lone prospectors accounted for the bulk of the production in the Yentna Mining District, the Cache Creek Mining Company, organized in 1908, was influential in advertising the potential of the area. The company owned over 3,000 acres of mining claims along Cache Creek and imported hydraulic equipment and constructed several miles of ditches to provide water for the hydraulic mining that was necessary to extract the buried placer gold (Cole 1983).

The small community of McDougall, originally a trading post, became the primary supply point for the mining camps in the Yentna District. Supplies reached McDougall from Susitna Station by riverboat during the summer and dog sled during the winter. However, after the completion of the Alaska Railroad (ARR) in 1923, miners found it cheaper and less difficult to transport supplies from Talkeetna, a station on the ARR, than to utilize the stores at McDougall (Cole 1983). The town of McDougall quickly declined in importance.

Another equally productive mining region located near the study area was the Willow Creek District. Prospectors first discovered placer deposits in the early 1900s on several small tributaries of Willow Creek, including Craigie Creek and Archangel Creek. By 1909, the placer deposits had been exhausted, but the Willow Creek Mines, Inc., opened several lode mines in the above-named drainages. On Craigie Creek, the Lucky Shot and War Baby Mines proved to be the most productive. The company constructed a stamp mill, amalgamation tables, and utilized the cyanide process to remove gold from the crushed ore. The Fern Gold Leasing Company operated a lode mine near the head of Archangel Creek, while other, smaller mines were operated by the Bralaska Mining Company. In 1936, the USGS reported that the Willow Creek District was the second leading producer of gold ore in Alaska (Smith 1936).

All of the mining districts in the study area underwent radical changes in mining techniques after the initial placer deposits were discovered. From the initial pan and rocker method of extraction, miners soon began using hydraulics to extract free-milling gold from stream banks and hillsides suspected of containing paying deposits. Both the pan and rocker and hydraulic mining methods were relatively inexpensive. However, when and if gold ore veins were discovered, the small, independent miner usually was unable to provide the necessary capital to develop the lode. Thus, he either sold his claim to a larger company or sold shares in the claim to obtain the funds necessary to successfully conduct a lode-mining operation. The types of equipment necessary included power drills, hauling and crushing equipment, and processing facilities. Most of the lode mines in the study area were limited in size until after the construction of the Alaska Railroad, because it was prohibitively expensive to transport heavy lode-mining equipment into remote regions.

Prior to the construction of the ARR, miners and settlers in the study area relied on an extensive network of overland trails. Also, during the winter, the rivers in the study area, including the Susitna and Yentna, were frozen and provided a natural thoroughfare for overland transportation. Although the remains of the trails system, which were maintained by the Alaska Road Commission (ARC), are still visible and used even today, the majority of the trails have long been abandoned and have become overgrown.

The most famous and undoubtedly the longest trail in the study area was the Iditarod, first surveyed by the ARC in 1907-1908. Construction of the trail began in 1910, when the ARC sent eight men and six dog teams out to locate and construct a winter trail from Nome to Iditarod and thence to Seward. The portion of the trail within the study area begins near Susitna Station and follows the Susitna River north to the Yentna. It then proceeds northwest to Rainy Pass across the Alaska Range and into the Kuskokwim River valley. The trail was used heavily between 1911 and the early 1920s, but an alternate route into the Kuskokwim valley was pioneered in 1924, which obviated the need for commercial use of the Iditarod Trail (Cole 1983).

At set intervals, the Iditarod and most other trails were marked with tripods built of wooden spruce poles. The tripods were tall enough to be visible after heavy snowfalls and enabled winter travelers to avoid the danger of wandering from the trail in hazardous winter weather. The ARC also provided small roadhouses, usually at 20-mile intervals. The roadhouses could be used by anyone traveling the trail, and some were staffed by employees of the ARC. Accommodations varied from 50¢ to $1 for a bed and an additional fee for boarding dog teams. Within the study area, there were several roadhouses, including those at Susitna Station, Lakeview, and Alexander. The roadhouses, like most of the trails, were abandoned during the 1920s when alternate, and safer, means of transportation became available (Cole 1983).

3.3.3 Trapping

Russia's interest in the fur resources of Alaska prompted their initial colonization and encouraged their presence in the territory for over 100 years. When the United States purchased Alaska Territory in 1867, the population of fur-bearing animalson the coastal lands and offshore islands had dropped dramatically, due to extensive trapping. However, the fur resources of the interior remained relatively stable, despite the presence of a trading station on the Yukon River established by the Hudson's Bay Company in 1857.

It was not until after the mining boom of the late 1890s and early 1900s that the fur resources of interior Alaska were exploited extensively. With the influx of miners, the extent and availability of beaver, muskrat, otter, and other fur-bearing animals became well known. Moreover, the miners often trapped animals to supplement their income from mining.

During the early 1920s, the market price for fox and other furs increased dramatically. Several individuals in the study area established fur farms and capitalized on this change in the market. One traveler through the study area during this period commented that:

> In returning down the Yentna to Susitna Station, I found very little activity except for trappers and fur farmers, who were located on an average every six miles or so along the river bank. . . . The white men seemed to be ambitious and energetic, building trails, cabins and doing other work in readiness for the trapping season. . . . As far as I could ascertain, there appeared to be no activity in prospecting or mining; probably the high prices paid for fur during the recent years made trapping more profitable (Cole 1983:94).

The high price for furs was short-lived and, after 1930, the number of fur farms declined. Yet today, trapping and raising fur-bearing animals is an important part of the economy of southeastern Alaska.

3.3.4 Agriculture

Agricultural settlement in the study area began with the mining boom of the late 1890s and early 1900s. Farmers and stockmen followed the miners and mining companies into the mineral-rich Tanana Valley in order to provide food products to the rapidly growing mining population. Until the construction of the Alaska Railroad, the agricultural sector of the study area flourished, despite the limited growing season. After the Alaska Railroad was constructed, however, farmers found it increasingly difficult to compete with products imported from Seattle and other areas in the states.

3.3.5 The Alaska Railroad

The roads and trails maintained by the ARC in the early 1900s offered a relatively primitive means of transportation. Maintenance costs were expensive and bridges across creeks and rivers frequently were destroyed during spring runoff. The leading businessmen in and near the study area realized that a more dependable type of transportation route was essential. During the first 15 years of the 20th century, they lobbied Congress for funds either to construct or to provide incentives for the private construction of a major railroad. Congress was reluctant to grant financial guarantees or large land grants similar to those granted to the major railroads in the continental United States, such as the Union Pacific and the Northern Pacific. Yet, Congress realized that, because of Alaska's remoteness and inaccessibility, it was essential to provide a dependable means of transportation for the Territory in order to ensure continued growth and to assure the extraction of the precious metals that, by the early 1910s, were becoming increasingly important to the American build-up for World War I.

In 1912, after continued urging by private interest and the Governor of Alaska Territory, Congress agreed to establish a commission to study the transportation problems in Alaska Territory. President William Howard Taft appointed J.J. Morrow of the U.S. Corps of Engineers as chairman, and Alfred H. Brooks, USGS geologist, as vice-chairman. The commission reported in 1913 that, to ensure the continued growth of the mineral industry in Alaska and to encourage agricultural production, the U.S. Government should begin construction of two railroads immediately. The commission suggested that one route should use the existing tracks of the Copper River and Northwestern Railroad, "from Cordova to Chitina, and extending on to Fairbanks," and that the second railroad should extend from Seward, around Cook Inlet, to the Iditarod River. The commission also suggested the rates that should be charged for use of the rail line. President Taft submitted the Morrow Commission's report to Congress in February 1913. In an accompanying report, Taft "emphasized his opposition to Government operation but acquiesced in Government ownership" (Fitch 1967:44).

On March 12, 1914, Congress passed what became the Alaska Railroad's organic act. The act authorized the President to locate, construct, and operate a railroad in the Territory of Alaska. On May 2, 1914, President Woodrow Wilson ordered Secretary of the Interior Franklin K. Lane to begin surveys for the location of the railroad. Wilson also appointed the Alaska Engineering Commission to oversee the construction work. During the summer of 1914, crews conducted surveys along the two routes suggested by the Morrow Commission. The AEC submitted the results of their survey to the President in February 1915, and it was left to President Wilson to decide which of the two routes should be utilized for construction of the railroad. On April 10, 1915, Wilson selected the present route of the ARR, that generally follows the Susitna River, crosses the Alaska Range, and terminates in Fairbanks. He ordered the Secretary of the Interior to begin construction on the ARR immediately.

The AEC selected a site at the head of Cook Inlet as the headquarters for construction of the Alaska Railroad. Construction crews began arriving at the newly named settlement of Anchorage by the end of April 1915, and construction began immediately. The AEC moved their headquarters from Seward to Anchorage in 1917. The act of March 12, 1914, enabled the AEC to utilize all "machinery, equipment, instruments, material, and other property of any sort whatsoever" that had been used to construct the Panama Canal (Fitch 1967). The surplus equipment from the Panama Canal construction activity began arriving in the summer of 1915, and included steamshovels, derricks, locomotives, flatcars, shop machinery, and railroad equipment.

The construction of the ARR was a massive undertaking that took over eight years to complete. The topography and climate contributed to the extensive length of time for completion of the railroad. Transportation of construction materials was impossible in most areas during the summer months because of the boggy conditions along the Susitna River valley. During the winter, when most of the region was frozen, construction materials were transported by horse and sled to construction camps in advance of the rail line. The severe winter weather prevented construction activity during approximately seven months out of the year, except for the placement of bridge supports, which had to be completed when the ground was frozen in order to sink the pylons to the proper depth. Construction crews waited until the ground was frozen and then used steam points to thaw only the ground in the area where the pylon would be sunk. Then, the earth was removed and the concrete pylon was set in place. Construction of the railroad required millions of board-feet of lumber and hundreds of thousands of railroad ties that often had to be shipped in from Seattle, Washington. Also, because of boggy conditions along the Susitna River, the AEC had to import virtually all of the fill dirt and gravel used to build the railroad bed. As fast as the tracks were laid, trains were used to bring more equipment and materials for further construction.

In addition to the topographic and climatic conditions that retarded construction of the railroad, the United States involvement in World War I posed a problem of manpower for the AEC. In 1917, there were approximately 4,500 men working on the railroad. The following year, that number had dropped to less than 2,500. In 1917, 103 miles of track were laid by the AEC, compared to 54 miles of track in 1918 and 68 miles in 1919.

In June 1919, the original $35 million congressional appropriation for construction of the railroad was exhausted. Congress appropriated $17 million in October 1919, but additional appropriations were required before final completion. The total cost expended for construction of the Alaska Railroad was approximately $65 million. On July 15, 1923, President Warren G. Harding, in a ceremony across the Susitna River from the town of Nenana, drove the final spike, completing construction of the ARR. Within two years after construction was completed, several Congressmen began a movement to force the abandonment of the railroad because of what they viewed as the exorbitant cost of maintenance and operation. Criticism of the operation of the ARR continued into the 1930s. In part, the criticism was justified because, until the mid-1930s, the ARR never generated enough revenue to satisfy the operation and maintenance costs. However, in 1936, under the direction of Colonel Otto F. Ohlson, the railroad returned a net profit of over $76,000. Since that year, the ARR has not run a deficit.

The construction of the ARR provided the first dependable transportation route from the coastal waters of southern Alaska to the interior, mineral-rich valleys. There were numerous, small, privately owned railroads that were able to connect with the ARR and, in effect, extend the ARR lines (Fitch 1967). With the construction of the ARR, the Alaska Road Commission began abandoning a number of winter trails throughout the study area. Whereas, prior to the construction of the railroad, Susitna Station had been the most important supply point for the Susitna River valley, the town of Talkeetna assumed that role after construction was completed in 1923. Also, a number of small communities were established during the construction period, as either construction camps or railroad stations. Some of the small communities include Healy, Kashwitna, Curry, Chulitna, Honolulu, Clear, Browne, and Nenana. Many of these camps continue to support a small population.

Although construction of the ARR provided a dependable means of transportation for previously inaccessible areas, there remained in the 1920s thousands of miles of land in Alaska Territory that could not be reached by dependable transportation. With the advent of the airplane in the late 1920s, these areas were provided with dependable, if infrequent, transportation by air. The ARC assumed responsibility for construction and maintenance of airfields in Alaska. In most cases, the airstrips constructed by the ARC usually were located on abandoned riverbeds. Thus, they were normally suited only for emergency landings. However, "bush pilots" became an essential part of the transportation network throughout Alaska Territory in the 1920s and 1930s, and remain so today.

3.3.6 Summary

Historic sites within the study area derive primarily from the 1890s and post-1900s. The explorers who surveyed the area before and after 1900 left little physical evidence of their passing. The development of the mining frontier and the establishment of the requisite support facilities, including the major roads and trails and the Alaska Railroad, were the major events that transpired after 1900 in the region. The preponderance of historic sites are the remnants of these events and often can provide information that illuminates the process of historic development.

4.0 CULTURAL RESOURCE DATA BASE ANALYSIS

Historical Research Associates Staff
Alaska Heritage Resource Group Staff

4.1 Introduction

An extensive review of published literature and limited circulation manuscripts, plus a review of site files housed at AHRS by staff personnel at HRA and AHRG, has led to the accumulation of data for 476 prehistoric, ethnohistoric, and historic cases, either components or loci, at 398 sites. A total of 269 of those sites were recorded during the 5-year Susitna Hydroelectric Project inundation area cultural resource survey, conducted by the University of Alaska Museum (Dixon et al. 1981, 1982, 1983, 1984, 1985). HRA was supplied with final copies of reports from the first four years of the survey, and draft copies of Chapter 8 (Analysis and Synthesis of Project Data) and Appendix D (Historic and Archeological Sites Documented as Part of the Cultural Resources Survey) of the UAM 1985 report by Harza-Ebasco. In addition, HRA compiled data on 18 sites recorded along the Anchorage-Fairbanks Intertie (Bacon et al. 1983). AHRG supplied written summaries plus USGS map locations for 111 sites on and near the proposed Linear Features, located through a search of the AHRS files (Appendix A). These data were then reformatted by HRA staff to be compatible with all other data (Table 4-1).

Table 4-1

Recorded Cultural Resource Sites Within and Adjacent to the Linear Features

AHRS Site Number[a]	Terrain Unit A[b]	Terrain Unit B[c]	Vegetative Unit[b]	Site Size (m^2)	Distance to Water (m)	Site Type[c]	Period of Occupation[c]
ANC0140	A18	B21	C08	20	804	22	1
ANC0210	A21	B19	C08	2000	2000	21	1
ANC0420	A09	B17	C08	2000	400	21	1
ANC0430	A09	B17	C08	2000	360	21	1
ANC0440	A18	B21	C08	2000	800	21	1
ANC0600	A09	B17	C05	100	20	5	3
ANC0610	A09	B17	C05	44257	10	5	3
ANC0760	A09	B17	C04	100	400	21	1
ANC0990	A09	B17	C04	400	0	23	1
ANC2510	A21	B19	C08	3050	800	21	1
ANC2640	A21	B19	C05	150	850	21	1
ANC2650	A21	B19	C05	200	740	21	1
ANC2660	A09	B17	C04	100	90	21	1
FAI0070	A03	B05	C02	4	400	1	0
FAI0100	A16	B24	C03	200	2500	24	1
FAI0110	A09	B17	C05	200	40	26	1
FAI0140	A24	B17	C07	250	20	24	1
FAI0160	A24	B17	C05	200	40	24	1
FAI0220	A25	B28	C08	500	200	27	1
FAI0280	A26	B03	C07	0	800	40	0
FAI0610	A25	B28	C04	400	500	27	1
FAI0620	A27	B16	C03	200	40	24	1
FAI0640	A24	B17	C06	150	50	24	1
FAI0680	A18	B21	C06	150	850	24	1
FAI0690	A09	B17	C08	170	40	24	1
FAI0700	A09	B17	C07	180	20	24	1
FAI0890	A09	B17	C06	4725	0	23	1
FAI0900	A09	B17	C07	400	500	24	1
FAI0940	A03	B01	C06	4	300	1	3

[a]Alaska Heritage Resources Survey (AHRS) site numbers are based on the three-letter abbreviation of the 1:250,000 USGS map on which they are located, and the specific number assigned to that site.

[b]Definitions of these variables are presented in Chapter 2

[c]Definitions of these variables are presented below.

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
FAI0960	A03	B01	C02	75	300	1	0
FAI0980	A09	B17	C07	300	5	23	1
FAI1060	A03	B05	C02	25	900	1	0
FAI1120	A19	B21	C05	4	700	1	0
FAI1210	A29	B01	C02	25	850	3	0
FAI1220	A29	B01	C02	25	700	3	0
FAI1230	A29	B01	C02	25	700	3	0
FAI1240	A29	B01	C02	4	600	3	0
FAI1250	A29	B01	C02	25	650	1	0
FAI1260	A29	B01	C02	25	700	1	0
FAI1270	A16	B20	C07	25	400	1	0
FAI1340	A25	B28	C04	400	2000	27	1
FAI1410	A19	B21	C06	6	90	1	0
FAI142A	A19	B21	C06	80	175	1	0
FAI142B	A19	B21	C06	80	1700	1	0
FAI1430	A19	B21	C06	4	1100	1	0
FAI1440	A19	B21	C06	10	1000	1	0
FAI1450	A19	B21	C06	4	995	1	0
FAI1460	A19	B21	C06	15	1000	1	0
FAI1690	A09	B17	C06	300	100	22	1
FAI2020	A09	B17	C05	329	40	27	1
FAI2130	A15	B10	C04	100	800	1	0
FAI2140	A16	B01	C03	1	400	1	0
FAI2210	A25	B28	C08	250	100	21	1
FAI2220	A25	B28	C05	100	10	27	1
FAI2240	A25	B28	C04	2500	20	27	1
FAI2250	A02	B17	C07	300	30	21	1
FAI2260	A28	B21	C07	300	100	21	1
FAI2280	A25	B28	C04	200	40	27	1
FAI2300	A09	B17	C05	300	46	21	1
FAI2310	A25	B28	C08	400	100	21	1
FAI2320	A25	B28	C08	100	150	21	1
FAI2330	A25	B28	C08	150	100	21	1
FAI2340	A25	B28	C08	300	100	21	1
HEA0050	A19	B16	C06	400	20	3	11
HEA0050	A19	B16	C06	400	20	3	9
HEA0060	A09	B17	C06	0	804	40	0
HEA0070	A16	B01	C05	1	1000	7	0
HEA0080	A19	B21	C05	0	800	40	0
HEA0090	A22	B09	C05	0	700	40	0
HEA0120	A10	B01	C05	0	200	1	0

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
HEA0140	A20	B20	C03	0	90	40	0
HEA0180	A10	B16	C06	225	50	3	0
HEA0190	A10	B16	C06	325	40	3	0
HEA0200	A21	B19	C06	0	19	1	3
HEA0250	A21	B19	C06	0	1000	1	0
HEA0260	A18	B21	C06	0	100	1	0
HEA0270	A22	B04	C03	0	400	1	0
HEA0300	A21	B19	C06	0	400	1	0
HEA0320	A18	B21	C06	0	1500	40	0
HEA0330	A16	B01	C06	4	400	7	0
HEA0340	A19	B21	C06	4	800	40	0
HEA0350	A16	B01	C05	100	800	3	5
HEA0360	A19	B21	C04	25	800	40	0
HEA0370	A19	B21	C05	25	90	40	0
HEA0380	A19	B16	C05	200	400	1	5
HEA0380	A19	B16	C05	200	100	1	11
HEA0510	A18	B21	C05	200	800	24	1
HEA0620	A23	B23	C03	150	70	40	0
HEA0750	A18	B21	C05	200	300	24	1
HEA0760	A20	B20	C05	300	40	25	1
HEA0770	A20	B20	C03	250	60	25	1
HEA0780	A18	B21	C04	800	400	26	1
HEA0790	A20	B20	C06	465	20	25	1
HEA0800	A18	B21	C05	250	800	24	1
HEA0810	A10	B16	C05	166	0	23	1
HEA0820	A09	B17	C05	400	25	24	1
HEA0830	A02	B18	C05	164	0	23	1
HEA0840	A20	B20	C05	55	0	23	1
HEA0910	A10	B16	C05	240,000	500	28	1
HEA1090	A20	B20	C06	200	90	40	0
HEA1370	A16	B16	C05	200	400	3	11
HEA1380	A19	B21	C06	10	800	1	0
HEA1390	A19	B21	C06	10	200	1	0
HEA1400	A19	B21	C06	78	20	1	0
HEA1410	A19	B21	C05	40	50	1	0
HEA142A	A19	B21	C05	10	800	10	0
HEA142B	A19	B21	C05	15	800	1	0
HEA1740	A05	B10	C02	2000	200	1	0
HEA175A	A08	B06	C06	4150	150	1	0
HEA175B	A08	B01	C06	850	50	1	0
HEA176A	A04	B08	C06	300	100	1	0
HEA176B	A04	B08	C06	4	100	1	0

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
HEA177A	A03	B19	C06	2	100	1	0
HEA177B	A03	B19	C06	5	100	1	0
HEA1780	A03	B19	C06	18	50	1	0
HEA1790	A03	B21	C07	1	300	7	0
HEA1800	A05	B10	C06	1003	120	1	0
HEA1810	A11	B07	C06	34	30	1	5
HEA1820	A04	B08	C06	16	100	1	0
HEA1830	A05	B10	C06	1	110	7	0
HEA1840	A05	B25	C06	1	10	1	0
HEA1850	A07	B01	C06	1	160	1	0
HEA1860	A07	B10	C06	600	250	1	0
HEA1880	A16	B03	C03	500	100	27	1
HEA1900	A21	B19	C05	5	700	7	0
HEA1950	A03	B19	C03	25	1600	1	0
HEA1960	A03	B17	C03	1	110	7	0
HEA1970	A05	B20	C03	1	100	1	0
HEA1980	A05	B13	C03	100	50	.	0
HEA1990	A05	B13	C03	1	1000	7	0
HEA2000	A05	B10	C03	25	1500	1	0
HEA2010	A05	B10	C03	100	1500	1	0
HEA2020	A05	B01	C03	100	1200	1	0
HEA203A	A05	B16	C01	25	100	1	0
HEA203B	A05	B16	C01	25	100	1	0
HEA2040	A05	B10	C01	100	600	1	0
HEA2050	A05	B10	C01	100	800	1	0
HEA2060	A05	B17	C03	100	100	21	1
HEA2070	A05	B17	C03	100	100	21	1
HEA2100	A09	B17	C06	400	50	1	0
HEA2110	A09	B17	C07	20	200	1	0
HEA2250	A05	B17	C01	4000	1000	1	0
HEA2260	A06	B07	C01	4500	1600	1	0
TAL0040	A09	B17	C05	14478	50	24	1
TAL0050	A03	B19	C03	300	800	26	1
TAL0110	A05	B01	C01	10500	200	31	1
TLM0010	A20	B22	C03	250	750	24	1
TLM0050	A09	B17	C05	200	800	21	1
TLM0060	A02	B18	C05	1000	0	23	1
TLM0070	A01	B26	C06	0	1	3	9
TLM0070	A01	B26	C06	0	1	3	0
TLM0070	A01	B26	C06	0	1	3	3

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM0090	A02	B18	C03	0	10	40	3
TLM0150	A03	B08	C03	1	10	1	0
TLM0160	A03	B08	C03	79	200	3	0
TLM0170	A04	B08	C03	6	122	1	0
TLM0180	A05	B01	C06	171	800	1	3
TLM0180	A05	B01	C06	171	800	1	5
TLM0200	A07	B24	C05	1	10	29	1
TLM021A	A08	B27	C06	200	112	1	0
TLM021B	A08	B06	C06	25	150	1	11
TLM021C	A08	B06	C01	8	150	1	0
TLM0220	A09	B24	C03	57	3	3	3
TLM0220	A09	B24	C03	57	3	3	3
TLM0220	A09	B24	C03	57	3	3	3
TLM0230	A09	B16	C05	90	443	21	1
TLM0240	A10	B27	C05	8	300	1	0
TLM0250	A08	B27	C03	140	300	1	0
TLM0260	A09	B17	C07	75	46	1	3
TLM027A	A09	B10	C03	105	100	1	11
TLM027B	A09	B10	C03	105	100	1	5
TLM027C	A09	B10	C03	105	100	1	3
TLM028A	A11	B07	C03	4	30	1	0
TLM028B	A11	B03	C03	1	30	1	0
TLM0290	A09	B17	C03	31	30	3	9
TLM030A	A10	B16	C03	2571	46	3	9
TLM030B	A10	B16	C03	2561	46	3	3
TLM0310	A12	B05	C06	1	274	8	0
TLM0320	A12	B05	C06	54	274	1	0
TLM0330	A09	B17	C05	4	30	8	0
TLM0340	A13	B01	C03	6	30	1	0
TLM0350	A06	B17	C05	42	30	1	0
TLM0360	A12	B10	C06	1	335	1	0
TLM0370	A12	B03	C01	1	396	1	0
TLM0380	A06	B21	C06	63	61	3	5
TLM039A	A03	B10	C06	75	20	1	11
TLM039B	A03	B10	C06	75	20	1	3
TLM040A	A03	B20	C06	144	20	7	11
TLM040B	A03	B20	C06	144	20	1	5
TLM040C	A03	B20	C06	144	20	1	3
TLM0410	A08	B10	C03	1	183	7	0
TLM042A	A06	B21	C03	65	46	40	0
TLM042B	A06	B21	C03	91	50	3	0

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM0430	A09	B17	C06	40	23	3	3
TLM0440	A12	B10	C03	7000	400	3	0
TLM045A	A12	B10	C01	1050	200	1	0
TLM045B	A12	B11	C01	200	200	1	0
TLM0460	A12	B10	C06	4400	150	3	0
TLM0470	A07	B04	C06	30	30	1	0
TLM0480	A03	B10	C03	50	30	3	3
TLM0480	A03	B10	C03	50	30	3	7
TLM0490	A06	B06	C06	1	50	1	0
TLM0500	A02	B18	C03	51	4	3	3
TLM0500	A02	B18	C03	51	4	3	5
TLM0510	A03	B12	C06	1	40	1	0
TLM0520	A03	B08	C06	8000	100	1	3
TLM053A	A03	B21	C06	48	500	1	0
TLM053B	A03	B21	C06	1	560	1	0
TLM0540	A04	B08	C03	4	30	1	3
TLM0550	A03	B10	C03	8	400	1	3
TLM0560	A09	B17	C03	225	16	21	1
TLM0570	A03	B10	C06	30	60	1	0
TLM0580	A09	B17	C03	4	60	1	3
TLM0590	A08	B08	C03	41	250	5	3
TLM0600	A04	B08	C03	15	150	1	0
TLM061A	A04	B08	C03	21	300	3	11
TLM061B	A04	B08	C03	21	300	3	3
TLM0620	A09	B17	C03	384	120	3	3
TLM0620	A09	B17	C03	384	120	1	0
TLM0630	A09	B08	C03	15	65	2	5
TLM064A	A08	B10	C03	4	300	1	0
TLM064B	A08	B10	C03	9	350	1	3
TLM065A	A02	B18	C03	524	30	3	3
TLM065B	A08	B10	C03	4	30	3	3
TLM065C	A08	B10	C03	24	30	3	3
TLM0660	A07	B03	C01	300	70	1	0
TLM0670	A07	B10	C03	2625	180	1	0
TLM0680	A08	B13	C06	1350	100	1	0
TLM0690	A14	B14	C06	225	50	3	3
TLM0690	A14	B14	C06	225	50	3	9
TLM0690	A14	B14	C06	225	50	3	0
TLM0700	A08	B13	C06	16	70	1	0
TLM0710	A09	B17	C06	960	16	21	1
TLM0720	A02	B03	C03	28	31	5	3

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM0730	A09	B17	C03	9	300	1	0
TLM0740	A06	B17	C06	10	50	1	5
TLM0750	A06	B06	C03	8	200	1	3
TLM076A	A06	B08	C06	45	400	1	0
TLM076B	A06	B08	C06	1	375	1	0
TLM076C	A06	B08	C06	1	360	1	0
TLM077A	A10	B16	C03	46	30	3	5
TLM077B	A10	B16	C03	46	30	3	3
TLM0780	A04	B08	C03	39	8	1	5
TLM078C	A04	B08	C03	39	8	1	3
TLM0790	A09	B17	C03	2100	800	21	1
TLM0800	A07	B17	C03	36	20	21	1
TLM0810	A04	B08	C06	4	40	1	0
TLM082A	A03	B19	C01	1	100	1	0
TLM082B	A03	B19	C01	13	90	1	0
TLM0830	A04	B08	C06	4	7	1	0
TLM0840	A04	B08	C03	12	5	1	3
TLM0850	A04	B08	C03	4	150	1	0
TLM0860	A04	B08	C03	7	10	1	0
TLM0870	A04	B08	C03	28	70	1	3
TLM0880	A11	B07	C03	4	90	1	3
TLM0890	A07	B01	C06	375	64	3	3
TLM0900	A07	B02	C06	3	92	1	0
TLM091A	A07	B01	C06	1	122	1	0
TLM091B	A07	B01	C06	1	130	1	0
TLM0920	A07	B01	C06	1	75	1	0
TLM0930	A07	B10	C06	30	60	1	0
TLM0940	A04	B08	C03	20	46	1	3
TLM0950	A04	B08	C03	8	400	1	0
TLM0960	A03	B27	C03	4	563	1	3
TLM097A	A03	B10	C03	185	400	3	9
TLM097B	A03	B10	C03	185	400	3	5
TLM097C	A03	B10	C03	185	400	3	3
TLM0980	A04	B08	C03	1	40	1	0
TLM099A	A07	B10	C06	10	84	1	0
TLM099B	A07	B10	C06	16	80	1	0
TLM100A	A03	B26	C06	4200	20	3	3
TLM100B	A03	B26	C06	63	150	3	3
TLM1010	A14	B21	C01	8	75	1	0
TLM1020	A07	B01	C03	8	60	1	3
TLM1030	A14	B21	C01	14	90	1	0

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM1040	A14	B09	C03	24	36	3	3
TLM1050	A03	B12	C06	150	100	1	3
TLM1060	A11	B15	C06	4	402	7	0
TLM1070	A03	B16	C06	84	350	1	0
TLM1080	A03	B16	C01	270	100	1	0
TLM1090	A03	B16	C01	13	15	1	0
TLM1100	A03	B01	C01	52	20	1	0
TLM1110	A03	B25	C01	4	20	40	3
TLM1120	A05	B01	C01	15	15	8	0
TLM1130	A03	B16	C06	5	100	1	0
TLM1140	A03	B16	C01	17	200	1	0
TLM1150	A09	B01	C01	4	400	7	0
TLM1160	A12	B10	C06	1	400	8	0
TLM1170	A04	B08	C06	200	40	1	0
TLM1180	A05	B10	C05	1	40	1	0
TLM1190	A08	B01	C03	44	643	1	0
TLM1200	A08	B06	C03	9	724	1	0
TLM1210	A08	B01	C03	1	150	3	0
TLM1220	A08	B22	C03	3	160	7	0
TLM1230	A08	B22	C06	75	500	5	3
TLM1240	A08	B22	C03	2250	200	1	0
TLM1250	A08	B06	C03	1	150	1	0
TLM1260	A14	B08	C03	17	700	3	0
TLM1270	A08	B10	C03	3	321	1	0
TLM128A	A08	B05	C03	600	805	3	11
TLM128B	A08	B05	C03	600	805	1	3
TLM129A	A08	B10	C03	150	200	1	3
TLM129B	A08	B10	C03	4	175	1	3
TLM130A	A08	B10	C03	12	100	3	5
TLM130B	A08	B10	C03	12	100	3	3
TLM1310	A08	B10	C03	1	60	7	0
TLM1320	A08	B08	C03	1	40	7	0
TLM1330	A08	B08	C03	1	20	7	0
TLM1340	A03	B01	C05	2	400	1	0
TLM1350	A03	B01	C05	32	450	1	0
TLM1360	A06	B10	C03	6	150	3	5
TLM1370	A04	B08	C03	4	804	1	0
TLM1380	A04	B08	C06	1	500	7	0
TLM1390	A07	B01	C06	1	700	1	3
TLM1400	A08	B01	C06	800	250	1	3
TLM1410	A04	B08	C06	25	100	1	3
TLM1420	A04	B08	C06	1	150	3	5

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM143A	A04	B08	C06	844	150	3	9
TLM143B	A04	B08	C06	844	150	3	5
TLM143C	A04	B08	C06	844	150	3	3
TLM1440	A03	B10	C03	288	300	1	9
TLM1450	A08	B01	C05	12	400	1	0
TLM1460	A08	B09	C06	1	60	7	0
TLM1470	A08	B16	C06	1	175	7	0
TLM1480	A08	B21	C06	1	100	1	3
TLM1490	A03	B08	C06	1	65	1	5
TLM1500	A03	B08	C06	1	150	1	3
TLM1510	A03	B08	C06	1	6	3	3
TLM1520	A03	B08	C06	1	50	7	0
TLM1530	A04	B08	C06	16	100	1	3
TLM1540	A03	B08	C06	400	75	1	3
TLM1550	A10	B16	C06	16	50	1	0
TLM1590	A08	B10	C06	1	150	1	5
TLM1600	A03	B10	C06	1	100	1	0
TLM1640	A03	B01	C06	1	90	1	5
TLM1650	A05	B10	C05	16	400	1	3
TLM1660	A05	B10	C05	37	600	1	0
TLM1670	A05	B10	C05	4	400	7	0
TLM1680	A10	B16	C06	1	100	7	0
TLM1690	A03	B06	C03	45	800	1	5
TLM1690	A03	B06	C03	45	800	3	9
TLM1700	A03	B08	C06	20	70	1	0
TLM171A	A08	B08	C03	9	250	1	5
TLM171B	A08	B08	C03	9	250	1	3
TLM1720	A07	B02	C06	4	500	1	0
TLM173A	A13	B10	C03	4	50	1	0
TLM173B	A13	B10	C03	28	50	1	3
TLM173B	A13	B10	C03	28	50	3	5
TLM173C	A13	B16	C03	16	50	1	0
TLM1740	A03	B08	C06	9	250	1	0
TLM1750	A03	B10	C03	34	100	3	3
TLM1750	A03	B10	C03	34	100	3	0
TLM1760	A03	B06	C06	4	90	1	0
TLM1770	A14	B20	C06	4	400	40	0
TLM1780	A02	B18	C03	150	12	21	1
TLM1790	A08	B02	C06	6	400	1	0
TLM1800	A04	B08	C03	42	300	1	11
TLM1800	A04	B08	C03	42	300	1	0
TLM1810	A03	B11	C06	1	200	7	5

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM1820	A09	B17	C06	4	50	1	0
TLM1830	A04	B01	C03	1	250	1	0
TLM184A	A08	B10	C03	93	300	3	5
TLM184A	A08	B10	C03	93	300	3	9
TLM184B	A08	B10	C03	93	300	3	3
TLM1850	A11	B01	C06	100	800	1	0
TLM1860	A08	B10	C06	35	30	1	3
TLM1870	A09	B10	C03	16	20	1	3
TLM1880	A03	B10	C06	4	20	1	3
TLM1890	A11	B10	C06	300	150	1	3
TLM1900	A04	B08	C06	12	402	1	5
TLM1910	A03	B01	C06	1	100	7	0
TLM1920	A03	B21	C06	1	700	7	0
TLM1930	A03	B03	C06	4	20	1	0
TLM1940	A04	B08	C03	9	95	1	0
TLM1950	A08	B01	C03	1	30	1	0
TLM1960	413	B23	C04	4	7	40	0
TLM1970	A03	B03	C06	1	45	7	0
TLM1980	A06	B21	C06	1	50	7	0
TLM1990	A14	B08	C03	46	100	3	3
TLM1990	A14	B08	C03	46	100	1	7
TLM2000	A09	B09	C03	4	150	7	0
TLM2010	A04	B08	C03	43	16	1	3
TLM2020	A09	B17	C03	4	147	7	5
TLM2030	A09	B10	C06	40	58	1	3
TLM2040	A13	B16	C03	4900	50	21	1
TLM2050	A14	B10	C01	1	40	7	0
TLM2060	A02	B17	C06	15	150	7	3
TLM207A	A06	B01	C03	35	200	1	11
TLM207B	A06	B01	C03	35	200	1	3
TLM208A	A03	B10	C01	4200	400	1	0
TLM208B	A03	B12	C06	6	800	1	0
TLM208C	A03	B27	C06	5	400	1	0
TLM2090	A05	B10	C03	24	400	1	3
TLM2100	A05	B10	C03	8	150	1	3
TLM2110	A05	B10	C03	4	90	1	3
TLM2120	A09	B18	C06	96	7	21	1
TLM2130	A05	B21	C03	4	20	7	5
TLM214A	A05	B21	C06	4	900	1	0
TLM214B	A05	B21	C06	12	900	1	3
TLM2150	A08	B10	C03	52	500	5	3
TLM2160	A08	B10	C03	27	60	3	5

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM217A	A03	B01	C03	22	400	3	5
TLM217B	A03	B01	C03	22	400	3	3
TLM218A	A08	B10	C06	12	300	1	0
TLM218B	A08	B10	C06	1	275	1	5
TLM2190	A08	B21	C06	20	60	1	0
TLM220A	A03	B09	C03	145	400	3	3
TLM220B	A03	B09	C03	145	400	1	5
TLM2210	A08	B08	C03	28	150	3	[illegible]
TLM222A	A08	B21	C03	87	15	3	[illegible]
TLM222B	A08	B21	C06	531	250	3	[illegible]
TLM222C	A08	B08	C06	4	300	3	[illegible]
TLM222D	A08	B10	C06	36	250	3	3
TLM222E	A08	B21	C06	4	250	40	3
TLM2230	A08	B12	C03	40	150	3	3
TLM2240	A08	B10	C03	16	400	1	3
TLM225A	A08	B10	C03	31	75	3	5
TLM225B	A08	B10	C03	31	75	3	3
TLM226A	A06	B08	C05	58	15	3	5
TLM226A	A06	B08	C05	58	15	3	3
TLM226B	A04	B09	C05	32	250	3	3
TLM226C	A04	B08	C05	16	250	3	5
TLM226D	A04	B08	C05	16	250	3	3
TLM226E	A04	B08	C05	32	250	3	3
TLM226F	A04	B08	C05	16	75	7	0
TLM2270	A06	B10	C03	4	30	1	3
TLM2280	A14	B10	C06	4	5	1	5
TLM2290	A09	B08	C04	24	100	3	5
TLM230A	A09	B17	C04	66	175	1	5
TLM230B	A09	B17	C04	66	175	10	3
TLM2310	A08	B01	C03	19	50	3	3
TLM2320	A09	B17	C03	439	75	3	[illegible]
TLM2330	A09	B17	C03	4	30	40	[illegible]
TLM234A	A07	B02	C05	104	100	3	[illegible]
TLM234B	A07	B02	C05	56	125	3	[illegible]
TLM235A	A08	B02	C03	12	200	1	[illegible]
TLM235B	A08	B01	C03	26	150	1	[illegible]
TLM235C	A08	B02	C03	33	100	40	3
TLM2360	A08	B01	C05	30	300	1	3
TLM2370	A08	B16	C03	4	10	7	3
TLM2380	A10	B16	C03	26	5	40	3
TLM2390	A10	B16	C03	12	50	1	0
TLM2400	A10	B16	C03	314	20	3	3

Table 4-1. Recorded Cultural Resource Sites Within and Adjacent to the Linear Features (continued)

AHRS Site Number	Terrain Unit A	Terrain Unit B	Vegetative Unit	Site Size (m^2)	Distance to Water (m)	Site Type	Period of Occupation
TLM2410	A10	B16	C03	4	100	1	0
TLM2420	A09	B17	C03	49	75	3	3
TLM2430	A06	B01	C03	4	150	1	0
TLM2440	A08	B01	C03	4	200	40	3
TLM2450	A04	B08	C06	1	200	1	0
TLM246A	A07	B01	C05	4	100	40	5
TLM246B	A07	B01	C05	4	100	1	3
TLM2470	A02	B17	C05	592	90	3	3
TLM2480	A07	B16	C05	25	10	27	1
TLM2490	A09	B17	C03	24	10	3	3
TLM2500	A02	B18	C06	2	6	3	3
TLM2510	A13	B10	C03	17	100	3	0
TLM2520	A07	B16	C04	25	10	3	3
TLM2530	A07	B16	C04	4	10	3	3
TLM2560	A10	B18	C03	6	80	3	3
TLM2570	A14	B21	C05	4	100	5	3
TLM2580	A10	B16	C05	12	8	40	3
TLM2590	A02	B18	C05	123	10	1	3
TY00030	A03	B19	C05	2000	30	15	1
TY00060	A03	B19	C05	3	90	7	0
TY00140	A09	B17	C03	700	800	5	3
TY00170	A02	B18	C05	800	90	21	1
TY00240	A09	B17	C04	375	50	15	3
TY00250	A02	B18	C05	300	800	26	1
TY00260	A09	B17	C05	450	0	23	1
TY00270	A09	B17	C05	250	0	23	1
TY00280	A03	B19	C03	300	800	26	1
TY00290	A03	B19	C03	250	1000	26	1
TY00310	A03	B19	C03	450	0	23	1
TY00340	A09	B17	C03	1500	20	15	3
TY00350	A18	B21	C04	800	25	5	3
TY00370	A03	B19	C05	60	40	21	1

4.2 Methodology

Our objective in researching the existing cultural resource data base was to gather site-specific information regarding environmental data, site size, distance to water, site function, and period of occupation. As discussed later in Chapter 5, due to the uneven quality of recorded information, bivariate rather than multivariate factor analysis would be used on the computerized data. Therefore, seven key variables were selected to be recorded for each site. By limiting the number of variables, the resulting factors and the subsequent model would be as clear and concise as possible. The methodology for recording these variables is discussed below.

The first variable we sought for each site was the topographic association. The Terrain Units and Terrain Unit maps, as discussed in Chapter 2 and Table 2-1, were the ideal units for describing the UAM and most other sites and the best documents for use in illustrating the topographic information. Therefore, UAM sites were easily transferred from a set of limited circulation, 1"=1 mile (1:63,360) maps prepared by UAM to inundation area Terrain Unit maps. Transfer of AHRG site locations from USGS maps to the Terrain Unit maps was also straightforward. These data were then recorded and coded as Terrain Unit A.

On the basis of site narrative and site form review, a second variable was selected. This variable was labelled Terrain Unit B, and consisted of on-site observations by site recorders. We refer to these as intuitive Terrain Units, since they were rarely defined and represent localized observations (Table 4-2). This variable was most useful if questions arose as to site location among one of two or more adjacent Terrain or Vegetative Units. Because these observations were made using very localized information, Terrain Unit B could not be reconstructed on Linear Feature maps and, therefore, was not used in the predictive model development.

Table 4-2
Terrain Unit 2: Intuitive Terrain Units

Terrain Unit No.	Description
B1	Ridge
B2	Bench on ridge
B3	Slope on ridge
B4	Bedrock ridge
B5	Plateau on ridge
B6	Knoll on ridge
B7	Esker
B8	Kame
B9	Kame slope
B10	Knoll
B11	Knoll slope
B12	Bench on knoll
B13	Knoll on moraine
B14	Knoll on bedrock
B15	Knoll on esker
B16	Alluvial terrace
B17	Flood plain terrace
B18	Flood plain
B19	Moraine
B20	Bedrock outcrop-bench
B21	Plain (Glacio-lacustrine)
B22	Low ridge on lacustrine plain
B23	Erosional slump
B24	River confluence
B25	Lakeshore
B26	Lake outlet
B27	End of ridge
B28	Tailings

The third variable recorded was Vegetative Unit. These were also presented and discussed in Chapter 2, and defined in Table 2-3. Again, based on locational data from the UAM reports and the USGS maps supplied by AHRG, this information was easily plotted on Linear Feature and inundation area general vegetation maps, and then data recorded as Variable C on computer sheets.

Site size, the fourth variable, was recorded for each site on the basis of surface or subsurface units recorded by the investigators. Only documented size was recorded, rather than maximum potential size based upon the topographic feature on which a site was located. Several sites recorded in the AHRS files did not have size indicated. In such cases, this variable was coded as zero.

Distance to water, the fifth variable, was generally easy to obtain from the UAM site narratives or by using accompanying maps. With the AHRS sites plotted on USGS maps, distance to water was also easily recorded.

Site type classification, the sixth variable, was based on the series of definitions presented below. Site descriptions were reviewed for key items such as presence or absence of features, types of features present, and types of tools or tool assemblages present. For multicomponent sites, it was possible that site function might be different for each level or locus; thus, each of these cases was coded on a separate line.

Period of occupation, based primarily on the cultural chronology presented by the UAM, was the final variable recorded. We opted for this chronology because the majority of available data is coded from UAM sites. As discussed in Chapter 3, the culture history of the study area is extremely confusing, at least as it is generally expressed in the literature. As stated, classification of cultural tradition on the basis of presence of microblades or side-notched points is an oversimplification and probable misrepresentation of complex data. However, our application of this chronology through Phase II field work may serve as a test of its value.

For a number of sites, more than one period of occupation was documented. Each component was coded as a separate case where all information might be identical except for the period of occupation. Placement of sites within the chronology was done on the basis of diagnostic artifacts, radiocarbon dates, or, for a large number of the UAM sites, presence of one or more dated, visually distinct ash lenses. Finally, Chapter 8 of the UAM 1985 Final Report presents a summary discussion of occupation through time, with summary tables of chronological classification of sites, which also was checked for usable information.

To extract data from the AHRS files, AHRG began by plotting the Linear Features on USGS 15' quadrangle maps. Because AHRS uses a latitude and longitude coordinate system, AHRG defined broad corridors of latitude or longitude to include the Linear Features (see Appendix A, attachment A). Using a computer printout of AHRS files, all sites within the defined corridors were plotted on the USGS maps. The assumption was that AHRS coordinates were accurate, but the plotting indicated that errors existed, such as railroad-related features having coordinates a mile or more from the railroad.

There were, however, several cross-checks for this potential source of error, including reference to the original source of documentation cited in AHRS and USGS maps (1:250,000 series) on which Division of Geological and Geophysical Survey (DGGS) personnel have plotted AHRS inventory listings (with an eye toward correcting obvious locational errata). Certain isolated sites reported in AHRS may have fallen through the "safety net" due to inherent errors in their locational descriptions, but these should be very few.

An additional problem with the AHRS inventory was that references are cited only by author and dates, with no description of the title, place of publication, or depository for manuscript sources. Locating some of the more obscure manuscripts proved to be quite difficult. In some cases, these hard-to-find references, once found, turned out to be a personal communication with no specific site information (Cook 1975b), or very brief narratives lacking most usable data such as site size (Holmes 1975a).

Despite the AHRS inventory's inherent problems, AHRG researchers feel confident that all prehistoric sites that have been reported in the area are listed and source documentation is identified. Much less confidence is placed on the reliability of the AHRS inventory in identifying historic sites, basically because historic sites have seldom been treated consistently in cultural resource inventory projects. In addition, most historic sites listed in the AHRS files have been taken directly from Orth's 1967 Dictionary of Alaska Place Names, which generally has little or no usable detail, and no ground truthing has been undertaken to check locational or site integrity information.

4.3 Review of Data Sources

As mentioned above, the UAM reports (Dixon et al. 1981, 1982, 1983, 1984, 1985) were the source of the majority of available data for developing the current predictive model. Data needed to code all variables were presented either in the site narratives or in project area maps. Once the drafts of Chapter 8 and Appendix D for the 1985 report were received, the early reports generally were not used. In conversations with E. James Dixon and George Smith, co-investigators of the UAM project, it was learned that some revisions of earlier site narratives had been made in preparing the 1985 Final Report. Chapter 8 and Appendix A lack concise summaries of variables such as formal Terrain Units, Vegetative Units, and distance to water, although intuitive Terrain Units are summarized (Dixon et al. 1985:Table 8.18, Environmental Setting), as are periods of occupation (Dixon et al. 1985:Tables 8.19-8.23).

Data presented in Appendix C of the Intertie Report (Bacon et al. 1983) were easily coded into our format. Although site size was specified on site forms, additional interpretation of site data would have been enhanced with the presentation of individual site maps for all sites.

As mentioned previously, the information from the AHRS site files was variable in quality. Part of this variability is probably due to the way original investigators recorded sites and submitted information to AHRS or DGGS. However, there are reports available for individual sites such as Carlo Creek (Bowers 1980) and Dry Creek (Powers et al. 1983) which present in detail information for the variables we were recording. Finally, it should be mentioned that several cultural resource survey reports (Plaskett 1976; Reger 1980, 1983) also present usable site information in narrative form or in appended site forms.

4.4 Site Type Definitions

4.4.1 Prehistoric/Ethnohistoric Sites

Types of sites are discussed in terms of maintenance vs. extractive tasks (Binford and Binford 1966:291-292). Maintenance tasks pertain to the fulfillment of nutritional and technological requirements of the group, whereas extractive tasks involve the direct exploitation of environmental resources. Both categories represent aspects of primary goal fulfillment (Jochim 1976).

It has been suggested (Binford and Binford 1966:292) that maintenance activities occur at base camps "selected principally in terms of space and shelter regulations of the residence group." These base camps compare to Jochim's (1976) immediate settlement locations, to which he added water, fuel, and a view as determinants.

Extractive tasks, on the other hand, involve work groups rather than the entire band and the locations are determined by "the distributions of resources within a territory" (Binford and

Binford 1966:291). The sites of these extractive tasks conform to general resource exploitation locations, as presented by Jochim.

Recorded sites in or near the study area, as well as sites referenced in the ethnographic literature, have been categorized according to the major activity represented, based on known or anticipated cultural material and/or features. As can be seen from the discussion of site types presented below, there is not yet sufficient data in the ethnographic and archeological literature to fully define each site type. Also, there is some overlap of activities from one type of site to another. The site types presented represent an anticipated range, although not all of these types have been documented archeologically.

4.4.1.1 Long Term Occupations

For purposes of this study, long term occupations or villages are defined as locations at which both maintenance and extractive tasks took place. Distinguishing characteristics of villages are the size and variety of activities represented. The degree of variability depends on whether the site was used for more than a single season, and/or over a period of years.

Ethnographic information from the three Athapaskan groups living within the study area indicates that the locations of village sites, as well as kinds of activities distinguishable in an archeological context, will depend upon the economic orientation of the local band occupying a specific area. Although it is recognized that ethnographic data should not be used as a model for the entire prehistoric period, the following discussion concerning likely archeological remains from long term occupation sites is probably applicable to at least the last 1,000 years.

Archeological remains associated with winter villages in Tanaina territory may consist of house pits -- the remains of large, semi-subterranean, log structures with attached sweathouses. These sites also may have the remains of separate storage structures or cache pits. Winter villages tended to be located on the major tributaries of the Susitna River or on the main river itself, sometimes along the edge of a bluff or in a hidden, defensive position, and always adjacent to a good fuel source. Post-contact villages contained smaller houses built above-ground, but still made of logs with sides blanketed with earth. Post-contact sweathouses were built separate from the main dwelling. A variety of storage structures and caches also may be found in post-contact winter villages.

Winter subsistence consisted of dried and stored products, supplemented by freshly killed game (bear, moose, porcupine, beaver) and fish. A wide variety of tools used for hunting, butchering, and processing fresh foods may be expected to occur in winter village sites. Activities such as hide preparation, and clothing and implement manufacture (i.e., showshoes) also should be represented in archeological assemblages from such sites.

Spring and summer fish camps may be considered long term occupation sites, in that groups of people spent a good part of their subsistence year at specific localities, and returned to the same locations year after year. Fish camps were located on clearwater tributaries of the major rivers, often near lake inlets. Among the Tanaina, fish camp houses were smaller than winter dwellings. These houses may have been of two types: bent pole structures covered with bark strips (Osgood 1976) or small, above-ground, log and sod dwellings (Townsend 1981). Separate sweathouses, cache pits, storage platforms, and drying racks also were located at fish camps.

Activities represented in the archeological record at such sites would be more restricted than at winter villages. Here, the primary activity was catching and processing of fish. Specialized tools, implements, and structures (i.e., weirs, basket traps, dip nets, drying racks) would not generally preserve well. Implements such as "ulu" knives, used for splitting fish, and fish spearheads would be more likely to be found in these sites. Secondary subsistence activities that may be represented would be gathering and processing of vegetable foods and other products, and maintenance or repair of tools and clothing.

Within the territory of the Lower Tanana, winter villages may contain the remains of domed structures, made by laying tanned hides over bent pole frames anchored in the ground. Also, separate sweathouses, storage structures, and cache pits may occur. Tanana winter villages tended to be located in upland areas, near the timberline and the location of caribou fences. Villages sites were selected for their proximity to water and fuel sources, as well as trails and other travel corridors. Like the Tanaina, winter subsistence was based upon dried food sources supplemented with fresh foods. The range of activities represented in the archeological record for Tanana winter villages would be similar to those from the Tanaina area.

In the spring, the Tanana moved from their upland camps to the lowlands, to hunt a variety of mammals and birds. With the beginning of the spring salmon runs, fish camps were established on clearwater tributaries of the Tanana River near lake outlets, where they remained for most of the summer. Summer dwellings were bark-covered huts, with separate, bent pole sweathouses. Drying racks, and storage pits and structures also would be found at these camps. The activities and artifacts represented at Tanana fishing camps would be similar to those discussed for the Tanaina.

4.4.1.2 Short Term Occupations

Short term occupations or campsite/temporary habitation sites are also localities where activities focus on maintenance tas<. The variety of activities are either less intensively carried out or fewer in number than at the village sites. These short term occupations are more likely than village sites to be associated with a particular extractive activity in the general area. Furthermore, these sites should show a seasonal rather than year-round use pattern.

The Upper Inlet Tanaina, the Lower Tanana, and the Western Ahtna all used short term occupation sies during different phases of their seasonal round. This is especially true of the Western Ahtna, who were thought to be more nomadic than either of the other two groups, due to a lack of reliable, concentrated resources. In Western Ahtna territory, short term occupation sites may include the remains of log and sod houses, double lean-tos made of brush with bark roofs and sides, and dome-shaped sweathouses made of poles or saplings covered with hides (de Laguna and McClellan 1981:645). Activities represented in the archeological record would depend upon the resource being exploited. Weapons for killing animals or fish and processing implements as well as evidence of manufacture and/or repair of tools may all be found at short term occupation sites. Faunal remains recovered from such sites would probably be restricted in species composition, reflecting specific procurement activities.

The temporary dwellings of the Tanaina included semi-spheroid, bent pole lodges covered with birch berk strips; lean-tos; skin tipis; and alder brush shelters -- the latter built in areas above the timber line (Osgood 1976; Townsend 1981). The double lean-to made with poles was used by the Tanana in transitory hunting camps (McKennan 1981). Sweathouses would not be found in temporary camps. However, depending upon the duration and purpose of the stay, the remains of cache pits or elevated storage structures may be located. The types of activities and biotic remains represented archeologically would be similar to those discussed for the Ahtna. It should be noted that natural shelters, such as caves, probably would have been used by most aboriginal groups for short term habitation sites.

4.4.1.3 Large Mammal Kill and Processing Sites

Kill and processing sites generally refer to locations where more than one or two large mammals have been dispatched and/or subsequently butchered. Generally, aggregation of species due to topographic constrictions (i.e., narrow valleys) or other natural causes is needed in order to conduct large kills. The tendency of species such as caribou to gather at certain times of year or to follow a consistent route of travel is very conducive to conducting mass kills. With caribou-sized mammals, killing and processing of carcasses can be carried out at the same location if the numbers of killed animals is not too great. Processing would include skinning and dividing the carcasses into easily transported meat packages and other usable items. If large numbers are involved, a secondary processing site for boning and drying meat, sinew removal, and initial cleaning and drying of hides may be selected to avoid attracting carnivores and insects. Generally, these activities are extractive in nature. However, certain maintenance tasks such as tool resharpening, tool replacement, and food preparation would be performed to meet immediate needs.

Features associated with kills would include natural or contrived traps or constrictions. Natural traps would include box canyons or cliffs. However, constrictions along regular migration routes, or even lakes, could be used as effectively as traps. Contrived traps would be fences and canals, such as used in caribou hunting (Osgood 1976; McKennan 1981; de Laguna and McClellan 1981). Caribou fences in the study area were constructed near tree lines and consisted of logs lashed to standing trees, or free-standing fences which would leave little evidence after they decomposed. The primary evidence would have to be a layer of bone at the site of the kill.

Cultural materials at kill and processing sites would include projectile points, knives or bifacial butchering tools, scraping tools, and possibly hammerstones and anvil stones for bone marrow and grease extraction and preparation.

4.4.1.4 Lithic Material Sites

The range of site types included under this heading includes lithic quarry or procurement sites, lithic workshops or chipping stations, and generalized lithic scatters.

Lithic quarry or procurement sites are located at or adjacent to lithic raw material sources such as rock outcrops or redeposited lenses of gravel or cobbles. Tasks include the extraction of raw material from its matrix and the initial tool manufacturing stages (i.e., preparation of blanks and preforms). These sites generally contain unused or tested and discarded pieces of raw material; large amounts of primary reduction debris; some fragmented cores or bifaces broken during early stages of manufacture; manufacturing tools such as hammerstones; and possibly digging paraphernalia such as antlers.

A lithic workshop or chipping station, located further from the source than a procurement site, contains lithic manufacturing debris, including primary and/or secondary reduction debris, biface blanks, cores, broken or rejected tools, and manufacturing tools such as hammerstones. Worn or resharpened tools are generally not present. Lithic workshops are considered to be extractive in nature because of their task-specific nature and, generally, their location near a lithic raw material source. The major difference between a lithic workshop and a lithic procurement site is that no source material is present at the workshop.

A site containing limited amounts of lithic debris and no diagnostic tools is categorized as a lithic scatter. Such sites may represent limited tool manufacture and/or maintenance, or they may represent more complex activities from which functionally diagnostic tools have been carefully removed and curated.

4.4.1.5 Isolates

Isolates are cultural resources that are limited in content and have no contextual information through which to evaluate their place in the prehistory or history of the area, other than intrinsically. Strictly speaking, an isolate is a single item which may have been lost or discarded and is not associated with any other cultural material.

4.4.1.6 Cache Pit Sites

Cache pits were used by the Athapaskan inhabitants of the study area for short term storage of meat, fish, or other items. Another kind of pit, which may resemble a cache pit, is a pit dug at or near fish camps in which fish were placed for fermentation. These pits were located along trail systems and adjacent to trap lines, as well as in occupation sites.

4.4.1.7 Cairns

Cairns are simply piles of rocks. Antiquity and integrity of cairns are assessed on the basis of whether or not they are sodded-in or lichen-covered. Cairns served a variety of purposes prehistorically. Reflecting this variety, some cairns have cultural debris or other features associated, whereas others are isolated occurrences. Cairns are presumed to have served as markers for trails, campsites, and burials. Within camps, cairns may have served functional purposes such as marking a meat cache or a storage pit. Cairns may have been erected to commemorate an important place or event. Finally, alignments of cairns might have been used to form drive lines in association with kill sites. Drive lines generally begin where herd gathering can take place, and gradually narrow as destination is approached. The destination is either a topographic break or some form of impoundment.

4.4.1.8 Burials

The ethnographic record indicates that the Athapaskan groups in the study area cremated their dead. This practice usually took place outside of the village or camp. However, sometimes the structure in which a person died was burned along with the body (de Laguna and McClellan 1981). Generally, these cremation sites were marked in some manner, such as with a small fence or pole, and the ashes and remaining bones of the dead were either collected and buried or kept by relatives of the deceased.

Disposal of the dead by earlier prehistoric peoples may include both inhumation and cremation. At this point, no associations can be made between different cultural periods and specific practices, beyond the Protohistoric Period practice of cremation by Athapaskan groups.

4.4.1.9 Pictographs

Pictographs have been found in the Tanana River valley (Giddings 1941:69) as well as the Lower Cook Inlet (Osgood 1976:118). The Tanana River valley pictographs consist of anthropomorphic figures from 4 to 25 inches in height, drawn with red pigment. Some of the smaller human figures are contained within a double-ended boat. The figures were painted on a smooth, slightly underhung, rock face 20 feet high and 50 feet long, on a bluff above the confluence of Moose Creek and a slough of the Tanana River, 18 miles east of Fairbanks (Giddings 1941:69). The pictographs reported by Osgood (1976) include a school of fish, a man shooting a bow, a fox, a sea lion, and a beluga whale. All are drawn in miniature (1 inch to 1.5 inches) with red pigment. The figures are located on the walls of a shallow rockshelter on Bear Island in Bear Cove, Kachemak Bay, in the lower part of Cook Inlet (Osgood 1976:118). The origin of the pictographs in both areas is undetermined. They may have been made by Athapaskan groups; by earlier, non-Athapaskan resident populations; or by people who used the area infrequently (i.e., the Eskimo).

4.4.2 Historic Site Types

4.4.2.1 Individual Buildings or Structures

The most likely isolated historic structures to have been built in the study area are the shelter cabins which were established by the Alaka Road Commission at approximately 20-mile intervals along winter trails. They were usually 12x14-ft., one-story structures. Most of the available information indicates that there are very few remaining. Most were abandoned in the 1920s, and the lack of maintenance, coupled with the effects of the severe climatic conditions, have probably reduced most of the cabins to foundation remains or collapsed structures. However, remains of this site type still could be located in the study area.

Log cabins built by individual trappers and/or miners also may occur. These structures might be located along a trap line used through the trapping season or adjacent to mineral claims a person or persons might have. Some miners trapped in the winter; thus, cabins might have two functions. Actual identification of trapping locations may not be possible, and use of a cabin for trapping purposes might only be concluded if information regarding the occupant still exists.

4.4.2.2 Railroad-related Sites

In addition to the Alaska Railroad bed, there are several related site types, which include railroad bridges, station stops, the remains of construction camps abandoned after completion of the railroad in 1923, and tunnels.

4.4.2.3 Trail Systems

The Iditarod Trail is the foremost historic winter trail in the study area. However, other trails that branched off of the Iditarod could be located during the field survey.

4.4.2.4 Historic Communities

Most of the historic communities located within the study area are related to the construction of The Alaska Railroad. Other communities were related to gold-mining activity in the Fairbanks region, including Ester and the suburbs of Fairbanks, and coal mining in the Healy and Lignite Creek area.

4.4.2.5 Mining Sites

There are a number of mining sites that could be located within the study area. Most of these sites will be located near Fairbanks, in the vicinity of Ester. The types of sites consist of residential and commercial structures; dredging operations; lode-mining operations; and attendant facilities such as stamp mills, cyanide and arsenic processing plants, and various types of mining equipment.

4.4.2.6 Aviation Sites

The current USGS topographic maps of the study area indicate the presence of a number of private landing strips along the Susitna River that serve outlying districts. It is not possible to determine exactly when these landing strips were constructed, but the use of airplanes as a primary means of transportation began in the late 1920s. The earliest of these sites could be of historic importance.

4.5 Summary of Data Base

As mentioned, a total c. 476 cases representing 398 sites were recorded from southcentral Alaska, on or near the Linear Features or within comparable environmental settings. The data recorded for the seven variables described above have been subjected to factor analysis, as discussed below. These data, which are presented in raw form in Table 4-1, can be summarized as follows (Table 4-3). Detailed discussion and interpretation of these data are presented in the next two chapters.

Table 4-3
Summary Site Data According to Subdivisions of Variables Recorded from Site Descriptions
($\bar{n}$ = number of cases)

Terrain Unit A	$\bar{n}$	Terrain Unit B	$\bar{n}$	Vegetative Unit C	$\bar{n}$	Site Size m^2	$\bar{n}$	Distance to Water m	$\bar{n}$
A1	3	B1	51	C1	25	0	24	0	9
A2	15	B2	7	C2	10	1	57	1	3
A3	78	B3	8	C3	173	2	3	-	-
A4	40	B4	2	C4	18	3	4	3	3
A5	31	B5	6	C5	71	4	49	4	2
A6	19	B6	10	C6	155	5	4	5	4
A7	25	B7	4	C7	11	6	7	6	2
A8	67	B8	65	C8	13	7	1	7	3
A9	60	B9	7	C9	0	8	8	8	3
A10	19	B10	78			9	7	-	-

Table 4-3. Summary Site Data According to Subdivisions of Variables Recorded from Site Descriptions (continued)

Terrain Unit A	$\bar{n}$	Terrain Unit B	$\bar{n}$	Vegetative Units	Site Size m^2	$\bar{n}$	Distance to Water m	$\bar{n}$
A11	7	B11	2		10	6	10	13
A12	9	B12	4		12-20	41	12-20	34
A13	8	B13	4		21-30	35	21-30	26
A14	13	B14	3		31-40	22	31-40	18
A15	1	B15	1		41-50	18	41-50	33
A16	8	B16	37		51-60	13	51-60	10
A17	0	B17	59		61-70	4	61-70	9
A18	10	B18	13		71-80	10	71-80	10
A19	22	B19	21		81-90	3	81-90	16
A20	7	B20	12		91-100	20	91-100	49
A21	8	B21	48		101-150	17	101-150	36
A22	2	B22	4		151-200	24	151-200	28
A23	1	B23	2		201-300	27	201-300	37
A24	3	B24	5		301-400	16	301-400	41
A25	11	B25	2		401-500	6	401-500	12
A26	1	B26	5		500-1000	17	500-1,000	64
A27	1	B27	5		1001-2000	10	1,000-2,500	11
A28	1	B28	11		2001-10,000	17		
A29	6				10,000-240,000	4		
A30-38	0							
Total:	476		476	476		476		476

Table 4-3. Summary Site Data According to Subdivisions of Variables Recorded from Site Descriptions (continued)

Computer Code	Description: Protohistoric/Historic	Number of Cases
1	Chipping station/lithic scatter	223
2	Kill site/processing site	1
3	Campsite/temporary habitation	99
5	Cache pit	9
7	Isolated stone tool or flake	34
8	Rock alignment/cairn	4
10	Burial	2
15	Village	3
21	Historic building/structure	30
22	Monument/cemetery	2
23	Railroad bridge	10
24	Railroad station	15
25	Railroad tunnel	3
26	Tower	6
27	Mining camp and operation	9
28	Trail	1
29	Inscription	1
31	Recent military activity	1
40	Disturbed beyond recognition	23
	Total	476

Table 4-3. Summary Site Data According to Subdivisions of Variables Recorded from Site Descriptions (continued)

Computer Code	Description: Cultural Chronology	Number of Cases
1	Historic Period	78
3	Athapaskan Period	122
5	Late Denali Complex	40
6	Arctic Small Tool Tradition	2
7	Northern Archaic Tradition	10
9	American Paleo-Arctic Tradition	11
0	Unknown	213

	Total	476

4.6 Unrecorded Ethnohistoric and Historic Sites

As part of the research conducted for cultural resources along or adjacent to the Linear Features, HRA staff and ethnograpic consultants identified localities of sites or potential sites. These sites show up in the ethnographic or historic literature and manuscripts as locations of activities or structures which have not yet been formally recorded. In our research, there were no comparable cases for prehistoric sites. Therefore, the following discussion will detail sources reviewed and present results of the research.

4.6.1 Potential Ethnohistoric Sites

The recent ethnographic literature for the study area was researched to locate potential ethnohistoric sites; definite but unrecorded ethnohistoric sites; and resource use areas which might contain physical remains of the native users. The sources used include the Tanaina and Ahtna place names lists (Kari and Kari 1982; Kari and Kari, Appendix B; J. Kari 1983) and three reports presented in the 1983 USDA Susitna River Basin Study (Bacon et al. 1982a, 1982b; Reger 1978).

The following data regarding ethnographic sites is keyed to the Linear Feature maps (Fig. 2-3). Available descriptions and general locations from J. Kari (in Bacon et al. 1983) are also provided. These should be considered as site leads until they are more fully recorded. These sites have the potential of also being prehistoric; however, location of prehistoric components at the village sites and association of prehistoric sites with the trails are needed to confirm this.

(1) Ethnographic Site 1 (E-1) -- Red Shirt Lake Villages. Kari states, "At least three separate villages were located on Red Shirt Lake: one at the outlet, one on Lynx Creek, and one at the head of the lake" (Bacon et al. 1983:25). The area was used intensively early in the Historic Period on a seasonal basis because of the abundant lake trout and salmon runs from July to November. Fish traps were set along the lake and it is reported that houses extended continuously to Cow Lake, 1 mile to the south.

(2) E-2 -- Outlet of Cow Lake Village. Many house pits are located at this early Historic Tanaina village, but it was smaller than Red Shirt Lake village. All the houses are reputed to have been located along the east side of Cow Lake outlet stream.

(3) E-3 -- Upper Fish Creek. Kari states, "This is the Red Shirt Lake outlet stream to Flat Horn Lake. Many fish are reported to be in this creek, and Indian houses used to be all along it" (Bacon et al. 1983:24).

(4) E-4 -- Trail along a low ridge from Flat Horn Lake to Cow Land and on to Susitna Station. The ridge

parallels a creek that flows into the north end of Flat Horn Lake. The trail system continued on to Red Shirt Lake from Cow Lake. The ridge, which is only 3-4 feet high and approximately 200 yards wide, may be an esker.

(5) E-5 -- Low ridge extending from Cow Lake south to the Little Susitna River. This is an area where the Susitna River Athapaskans historically gathered birch bark in the spring. In the fall, it was a reliable source area for game, particularly bear. This ridge also is part of an intersecting trail system between Susitna Station and Knik Arm and the Red Shirt-Cow Lakes trail. Based on the description of this ridge, it may represent another esker.

(6) E-6 -- Polly Creek Trail. This ethnohistoric trail runs from the Susitna River to Red Shirt or Nancy Lakes. In the 1940s and 1950s, Billy Pete extensively trapped the area, which had an abundance of beaver.

Sites E-1 through E-5 are located on or near the Susitna Transmission Line, on Plate G-33 of the Linear Features maps (Fig. 2-3). Site E-6 is on Plate G-34 of the Linear Features maps.

4.6.2 Potential Historic Sites

HRA utilized a number of research materials to locate unrecorded historic sites within the study area. Initially, HRA researchers conducted an extensive literature search to locate primary and secondary research materials that would indicate the presence of historic sites. These included, but were not limited to, the following:

(1) U.S. Geological Survey Bulletins, Professional Papers, water supply papers, and cartographic materials;

(2) previously prepared historic surveys of areas adjacent to the study area;

(3) historic cartographic materials; and

(4) manuscripts and narratives documenting the historic development within and adjacent to the study area.

These resources provided a broad framework for an understanding of the types of historic resources that still might be visible in the study area. However, because of the inexact locational information for historic sites on existing historic maps, these are considered to be potential sites, to be watched for by cultural resource survey crews in the general vicinity.

After reviewing the research materials, HRA historians studied aerial photographs of the proposed hydroelectric project provided by Harza-Ebasco. Most of the aerial photographs are from the 1980s, with only two of the Healy area from 1949. The review of the aerial photographs was coordinated with the existing project maps and, whenever structures of any type were located within the centerline and right-of-way, they were added to the project maps and identified with a preliminary historic site number. While some recent structures, such as mobile homes, were easily eliminated, the aerial photographs did not allow full screening of recent structures. The results of this review cannot be considered to be conclusive. However, it can provide a framework for the actual field survey for historic resources along the project corridor.

Plate G-30

(1) Historic Site 1 (H-1) is an L-shaped structure approximately the SE¼ NW¼ of Section 20, T14N R2W, about ½ mile south of the railroad tracks.

(2) H-2 is located in the NW¼ NE¼ of Section 23, T14N R3W. It appears to be a covered, round, storage facility, probably an oil storage facility or possibly a treatment plant for sewage.

(3) H-3 is located in the NW¼ NW¼ NE¼ of Section 23, T14N R3W. The transmission line parallels what appears to be an existing right-of-way for a pipeline. The right-of-way has been cleared to a certain extent in most areas, and heads to the west to Knik Arm.

(4) H-4 is located at the point where the proposed line meets Knik Arm. There appears to be a facility associated with the gas pipeline.

Plate G-31

(5) H-5 consists of several cabins on the northwest shore of Lost Lake. It was not possible to determine exactly how many cabins there are due to incomplete maps for the area.

Plate G-32

The line enters G-32 at a point in almost the exact middle of the S½ of Section 28, T15N R4W, and extends through Sections 29 and 19. There are apparently no historic sites or structures visible. There is, however, a landing strip for a small airfield that is located in Sections 33 and 29, T14N R4W.

(6) In approximately the SW¼ SE¼ and SE¼ SW¼ of Section 4, T15N R5W, H-6 appears to be two structures. They are not very visible on the aerial photographs, but are located near an old stream bed of the Susitna River. If they are historic sites, the closest one is approx. ½ mile west of the centerline of the project.

Plate G-3.

(7) H-7 appears to be some type of structure, located approximately 3/4 mile north-northwest of the northwest shore of Yohn Lake.

Plate G-34

(8) H-8 appears to be some type of foundation or dwelling remains, in a clearing in the SW¼ NE¼ of Section 7, located along a tractor trail noted on the topographic map.

(9) In the NW¼ SW¼ of Section 6, H-9 appears to be some structures along a small, abandoned bed of the Susitna River.

(10) H-10 appears to be a structure in a small clearing about 100 yards from one of the meanders of the Susitna River, in the NW¼ NE¼ of Section 21, T19N R5W. It is located near the centerline on the western edge of the Delta Islands. There appear to be three structures at this location.

(11) H-11 is a number of structures that are part of the community of Willow, in T19N R4W, Sections 4, 5, 6, 7, 8, and 9. They are located approximately 1-2 miles from the centerline, depending on how far north they are.

Plate G-35

(12) H-12 is a number of cabins, located in Sections 30 and 31 of T20N R4W, and the E½ of Section 26. It is impossible to determine exactly how old they are. They may be just summer cabins or a small suburb of Willow. Along the main road, or one of the primary roads, into Willow from the northwest, south of the cabins designated as H-12, are a number of structures on either side of the road. Some of them look to be businesses, with cars outside.

Plates G-45 and G-46

(13) H-13 is the community of Healy. Again, like Willow, Healy will be densely populated in the community and in areas nearby, which includes Secs. 18, 19, 20, 21, 28, 29, and 30 in T12S R7W. There are a number of potential sites (H14-18), including the community and outlying suburbs. The plotting begins north of Healy and extends to Brown's Trailer Court. There are a number of structures northwest of Healy. In the NE¼ NW¼ Sec. 11, T11S R8W, is H-14; and in the SW¼ SW¼ Sec. 2, are H-15 and H-16. In the NW¼ SW¼ Sec. 1 is H-17, and in the SE¼ SW¼ is H-18, almost directly on the North Transmission Line centerline. Northeast of those structures, at what appears to be the railroad siding called Lignite, is H-20, in T11S R8W. On the topographic map or Plate G-46, there is a designation for a landing strip at this location. There are also a number of other structures.

(14) H-19 is southeast of H-20, and includes a tramway across the Nenana River. This tramway crosses the river to the east and connects with a road that goes up

into the hillside east of the Nenana River to what appears to be a strip-mining operation. H-19 probably would include the tipple and associated structures. Minerals from the strip mine across the river are transported on the tramway to deposit in a large pile by the side of the river. H-19 and H-20 are approximately 3/4 to 1 mile east of the centerline of the proposed transmission line.

(15) H-21 consists of approximately 12 structures, in T11S R8W, NW¼.

(16) H-22 consists of several structures along an access road to the railroad, in T10S R8W, Sec. 33, NE¼ SE¼. They are probably related to the railroad.

(17) H-23 consists of are a number of structure near a railroad bridge across the Nenana River. They are probably railroad associated, and are located either on the NE¼ NE¼ Sec. 33 or SE¼ SE¼ Sec. 28.

H-24 is located in the SW¼ NW¼ SW¼ Sec. 27 and consists of some structures located along an access road from the railroad that heads to the east.

H-25 is in either the NE¼ SE¼ Sec. 28 or the NW¼ SW¼ Sec. 27, and consists of several structures along the railroad that are, again, probably associated with the railroad.

Plate G-47

(18) H-26 and H-27 are a number of structures located in T9S R8W, SE¼ SE¼ Sec. 21, on the banks of the Nenana River. There appear to be about 8-9 structures in the bend of the Nenana, on the centerline of the proposed transmission line. Directly north of H-26 and H-27, the powerline crosses the Nenana River and then the Alaska Railroad.

(19) H-28 is located in T9S R8W, NW¼ Sec. 7, approximately 1 mile from the centerline. The Nenana River is between the centerline and the site. It appears to be a currently utilized gravel pit with several structures located at a bend in the George Parks Highway.

(20) H-29 is a rest area designated on Plate G-47 in T9S R9W, SE¼ SE¼ SE¼ Sec. 14. On the aerial photograph, there appears to be one structure, located approximately 1 mile from the proposed centerline.

(21) H-30 is some type of siding of the Alaska Railroad and some buildings, located in T9S R9W, NW¼ Sec. 12. It appears to be only one building on the aerial photo, but on Plate G-47, there appear to be several other structures. There is also a name, "Browne," which would probably be Browne Siding on the Alaska Railroad.

(22) H-31 appears to be several structures located along the stream in T8S R8W, SW¼ NW¼ Sec. 13 and SE¼ NE¼ Sec. 14. It is not certain that they are structures, but they are located in clearings along the stream and there could be foundation remains.

(23) H-32 is in T8S R7W, on the banks of a lake in the SW¼ NW¼ Sec. 7, approximately 1½ mile from the centerline

of the transmission line. There could be more than one structure at different locations around the lake. There appears to be a float plane or boat-docking facility on the west side of the lake. This could be the site of several summer homes or a guiding or fishing venture.

(24) H-33 is in T7S R8W, NW¼ Sec. 23, and is labeled "Radio Tower" on the topographic map. It is located approximately 1¼-1½ miles west of the centerline.

Plate G-51

(25) H-34 is located in T1S R3W, on the line between the NE¼ and SE¼ of Sec. 29.

(26) H-35 is in T1S R2W, NW¼ NE¼ and NE¼ NW¼ Sec. 18, and in portions of the SE¼ SE¼ and SW¼ SE¼ of Sec. 7. There are a number of what appear to be residential structures on the outskirts of the town of Ester.

(26) H-35 is also in Sec. 18, T1S R2W, and consists of more structures further back into the forest and almost directly on the centerline of the project in the NE¼ of Sec. 18.

(27) H-37 is located in T1S R2W, in the SE¼ Sec. 8, SW¼ Sec. 9, and portions of the NE¼ Sec. 17. This appears to be a dredging operation southeast of the town of Ester.

(28) H-38 is located in T1S R2W, and is basically a continuation of H-37. There are residential structures and what appear to be businesses located along a highway through and east of the town of Ester. Again, these appear to be residential structures associated with the mining operations at Ester.

5.0 PREDICTIVE MODEL

Dr. Thomas A. Foor
Consultant

T. Weber Greiser
Historical Research Associates

5.1 Previous Predictive Models

Most archeological studies which are concerned with predicting the presence or absence of cultural values involve the analysis of complex and interacting variables that are difficult to isolate and study individually (Jochim 1976; Butzer 1971; Leith 1973; Issac 1972; Judge and Dawson 1972; Judge 1973; Wood 1978). This recognizes anthropology's largely intuitive belief that the archeological record reflects a site selection decision process that is multivariate and multicausal for prehistoric hunter-gatherers. Previous researchers in southcentral interior Alaska (Bacon et al. 1983; Dixon et al. 1980) have proposed intuitive site location models considering such factors as topography and resource availability.

In 1980, Dixon and others described four "locations that may have been useful for resource exploitation" (Dixon et al. 1980:41). These included overlooks or high points in the topography; terraces adjacent to lakes or streams where multiple resources such as fish, aquatic mammals, and water fowl could be exploited; terraces adjacent to abandoned or former water bodies, for the same reasons; and natural topographic constrictions where migratory land mammals would be concentrated. Data from studies of modern faunal behavior, ethnographic sources, previously recorded sites, and "other pertinent data" were used to develop the locational model (Dixon et al. 1980:41).

As part of the multi-year cultural resource survey of the proposed Susitna Hydroelectric Project inundation area, the University of Alaska Museum (UAM) developed a predictive model for site location (Dixon et al. 1981, 1982, 1983, 1984). As part of their research strategy, UAM archeologists stated that:

> An analysis of the data derived from the literature search focusing on site locales has established that archeological sites occur in a non-random pattern in relation to associated physical, topographic, and ecological features. . . . (Dixon et al. 1982:2).

During the following three years, UAM archeologists specified a number of environmental variables which they believed to influence aboriginal site selection patterns. In 1981, overlooks, lake margins and active or abandoned stream and river margins were presented as the topographic/environmental features where sites from all time periods are likely to occur. In the next annual report (Dixon et al. 1982), natural constrictions were added to complete the suite of major variables associated with or influencing archeological site locations. They noted that, where two or more of the natural features co-occurred, site density or probability of site reuse increased. As a result of later field work, one final natural feature was added: mineral licks (Dixon et al. 1984), the only noted feature not discernable on a topographic map. The locations of salt-enriched outcrops can be determined indirectly through determination of Dall sheep distribution. In the study area, Dall sheep are the primary users of licks for natural mineral salts, and the period of intensive use is spring and early summer (Tankersly 1984).

The report of the 1983 field season (Dixon et al. 1984) also identified areas of little or no cultural resource site potential and areas that were not testable using available methods. These areas with little or no potential for finding sites include steep canyon walls, areas of standing water, and exposed gravel bars. These areas were not selected as survey locales, except in cases where they were scheduled for immediate impact from project related activities "as a means of documenting their low archeological potential" (Dixon et al. 1984:2-2).

Another attempt at predictive modelling is reported in the Anchorage-Fairbanks Transmission Intertie Cultural Resources Survey report (Bacon et al. 1983). The model is general and essentally regional in scope, but is based on earlier, area-specific, efforts in which attempts were made to correlate site potential and microenvironments over time. The more general approach allowed for incorporation of ethnographic data, increasing its usefulness. Using modern environmental resource distribution data, in conjunction with known Athapaskan subsistence patterns, Bacon and colleagues specified the types of sites expected and delimited areas most likely to contain the highest density of archeological sites, including the following:

1. Fishing sites along those rivers flowing to the Pacific. These sites occur ethnographically most commonly nearer the confluences of rivers -- particularly at confluences which join clear and muddy watered rivers.

2. Spawning sites in clear water tributaries to the Susitna River.

3. Areas through which large mammals would be naturally funneled as they moved from wintering to summering grounds. Such areas will include numerous lookout and ambush sites such as small points of topographic prominence.

4. Areas near the shores of lakes and ponds. These areas commonly provided fuel and water for camps. Fishes such as trout and grayling are also common as are small furbearers.

5. Areas near the margins of swampy lowlands. These areas support large numbers of small furbearers as well as seasonally large numbers of migratory waterfowl.

6. Areas near tree line at higher elevations provide necessary wood for fuel and construction of winter

> houses. They also provide access to nearby alpine tundra areas which sometimes supported caribou (Bacon et al. 1983:74).

In addition to this model of where site density should be highest, the authors briefly discussed the types of sites which can be expected to occur in the area. Prehistoric and historic occupations of the area are interpreted as primarily transitory, and exploitative of particular resources for relatively short periods of time. They predicted the presence of overnight camps or semi-permanent village sites and sites associated with food procurement, social interaction, and religion. Finally, the authors noted that the presence and visibility of the cultural resources would have been affected by natural and cultural processes which might have either destroyed sites or covered them so extensively that relocation would be extremely difficult.

A recent approach, labeled the Geometric or Dimensional Reduction Technique (Thorson et al. 1983), uses additional archeological and geomorphic data from interior Alaska to identify points of high site probability. The points are defined by the "intersection of two linear units, three planar surfaces, or by places of change in character along a linear unit" (Thorson et al. 1984:13).

> Examples of survey points that result from the intersection of two linear units include the mouths of streams and rivers into lakes and oceans, the junctions of tributaries and major rivers, the corner of an exposed terrace, the intersection of an animal migration path with another line such as a river valley, and the drainage divide region between two streams. A known stratigraphic target on a line formed by bluff intersections also represents a point focus for survey. Recognition of sedimentological indicators of paleoshorelines or river channels along an exposed stratigraphic unit may also represent a point focus for survey.
>
> Essentially zero dimensional survey points can also be commonly recognized as variations along a

> linear unit in a planar surface. Examples include prominent changes in river gradient, shallow spots across rivers, valley constrictions, ridge crests and edges of ridges, small bays along straight coast, the ends of peninsulas, and zones of no offset or mineral licks along recent fault escarpments. Such interpretations can easily be made for modern geographic settings. Although more difficult to recognize for paleogeographic settings, they are especially important if the probability for old sites is high.
>
> During pre-survey planning, survey points can be identified on planar surfaces independent of intersections of linear units. Examples include small lakes, topographic prominences, caves, outcrops of rock suitable for tool making, and isolated mineral licks. Any anomalous topographic or lithologic feature on an otherwise expansive surface should be a focus for survey. (Thorson et al. 1984:14-15).

Of the above-cited reports, only the latter attempted to test their models. In the other cases, the predictive statements were simply presented, generally not to be discussed again.

5.2 Statistical Methods

As previous researchers have demonstrated, development of a testable site location model which is able to isolate complex and interacting variables for study is no easy task. The Linear Features project is no different in this regard, and the methods discussed here directly address the problem of how testable hypotheses will be developed regarding prehistoric, ethnographic, and historic Alaskan settlement.

A careful review of the literature that reports the results of surveys in and around the area of interest indicates that survey boundaries have not always been precisely stated and that there is an absence of quantifiable geographical information for those surveyed areas that did not contain sites. Unfortunately, the lack of such information makes it difficult to accurately estimate site density within identifiable environments or microenvironments. It also limits the use of such data for sampling questions and testing hypotheses like "Area A should have a higher density of campsites than Area B." Because one aspect of our research problem is to develop testable hypotheses about settlement patterns in various periods of Alaskan prehistory and history, yet because density data are unavailable, we have chosen to examine as many facets as possible and to sort out, a posteriori, the major factors.

We began our data collection by using information from relevant survey reports (as specified in Chapter 4 above) and maps to measure and code each reported site for characteristics pertaining to topography, geomorphology and soils; vegetation; distance from water; site size; site function; and period(s) of occupation. The resulting data matrix was then entered into a computer data file where it is available for analysis.

Factor analysis is used to analyze the quantitative relationships among the several variables that are used to describe each site. Examples of data appropriate for factor analysis abound in archeology and the use of this method has provided fruitful returns in past archeological investigations (Binford and Binford 1966; Binford 1972; Rowlett and Pollnac 1971; Glover 1969; Hill 1968).

Factor analysis provides one of the most powerful tools for the quantitative analysis of multivariate problems. One of its most attractive features is that it is appropriate for those situations such as this where the relative worth of one of a number of possible settlement-related variables is difficult to assess beforehand.

In addition, factor analysis can be used to describe the ways in which a set of regions (each one defined by a different geographical variable) may vary. When several sites show basically the same pattern of variation, we intuitively suspect that some of the variables are redundant or associated and that a more basic pattern lies beneath; the "factor" is an approximation of that "basic pattern" (Berry 1960; Thompson et al. 1962).

The results of the factor analysis are interpreted with respect to the Alaskan ethnographic record as well as previously proposed archeological settlement theories for the region. This information will be used to support our predictions about the relationships between the settlements, location strategies, and mobility patterns between the prehistoric and ethnohistoric Alaskan hunter-gatherers, as well as the historic period developers and settlers.

Data from the field survey will be used to test two hypothetical models generated through this analysis, which predict the presence or absence of cultural values in the project area:

(1) The first predictive settlement model is derived from previous archeological work, the factor analysis, and the ethnographic and historic records.

(2) The second is a model which is analogous to the null hypothesis used in inferential statistics. The model specifies a hypothetical settlement pattern with environmental uniformity -- a random site distribution when considered across the relevant geographic variables.

According to the hypothesis of environmental uniformity, the prehistoric, ethnographic, and historic Alaskan groups would be expected to have spread out into all geographic areas, achieving a random distribution at a given density. The alternative is, of course, that there are preferred geographic settings for particular activities. Therefore, we would expect that higher densities of sites used for a certain kind of activity will be found in specific geographic settings.

The research problem of comparing our two predictive models for cultural values against the results of field survey is a common one in the analysis of geographical data. It falls under the general heading of "the distribution of point (site) density" (Davis 1973). Several advantages are gained by using the point density approach in conjunction with standard-sized sampling units. By specifying 160-acre quadrants that, as a whole, will reflect the range of variations within the survey area, we will be able to measure how close we have come to meeting our goal of a homogeneous, adequate, and unbiased sample of cultural values. The standard-sized sampling units and well-controlled information on geographical characteristics permit a wide range of inferential statistics for comparing the site frequencies obtained during the survey with the expected frequencies.

The Binomial sampling distribution (Link and Brown 1973), the Poisson sampling distribution (Davis 1973), and the Chi-squared ($\underline{X}^2$) test for independence (Cochran 1952) are used to test the effectiveness of the predictive model against the information collected during the survey. These tools, and others, will be used when appropriate. These methods will be used to provide answers to questions such as: "Are campsites randomly situated with respect to vegetation?" or "Are the locations of campsites and flaked stone tool work areas associated?"

Our choice of measurement scales will be determined by the requirements of the problem at hand. For example, one problem we are interested in solving relates to the frequency of distribution of sites within our sampling quadrants. The most parsimonious approach to this problem is to consider the variable as a discontinuous quantity, i.e., it can only assume integral values (whole numbers) and not fractions of integers. Because we have designed our survey with a large number of sampling units, the counts can be summarized as integers, placed in numerical order, and then grouped into frequency classes. Each class is marked by integers, and the number of values that fall into a class is the class frequency. Therefore, the frequency simply records the number of sampling units which contain the same number of sites. Because we have designed the survey with a large number of sampling units, the counts can be summarized in a frequency distribution and treated with statistical tests, such as the positive binomial or Poisson series. The scale of measurement and the treatment of this data are much different than how we would, for example, approach problems involving the description of association between ordinal scales. Such a problem is presented in this document, where we are interested in knowing whether the rank of an environmental zone on one sale measuring proportion of area within the study area can be predicted from its rank on a scale measuring proportion of area within a selected sample area. This question is more fruitfully addressed, not with the approach we would use with the frequency distribution, but with the use of ordinal scales and some appropriate statistic that describes association between two ordinal scales. As a matter of practice, our significance level will be specified at alpha = .01, which means we are willing to risk rejecting our null hypothesis when in reality it is true 1% of the time.

5.3 Site Types and Environmental Unit Associations

The results of the non-metric factor analysis (Coombs 1964; Coombs and Kao 1955) were examined with an eye cast towards factors that might measure differences in topographic and vegetation settings for different kinds of site types. The question asked is whether there are vegetation and topographic units that can be used to predict the presence or absence of a particular site type. Such an association can be demonstrated for many of the sites and site types considered here. Following is a summary of the interpretations, arranged according to site type defined in Chapter 4, for those site types that have apparent patterning.

Table 5-1
Site Types and Strong Positive or Negative Environmental Unit Associations

Site Type	Association	Terrain Unit	Vegetative Unit
1	Strong Positive	A3, 4, 5, 6, 7, 11, 19	C1, 6
	Strong Negative	A1, 2, 9, 10, 18, 20, 24, 25	C4, 5, 8
3	Strong Positive	A1, 2, 8, 10, 14, 29	C2, 3
	Strong Negative	A5, 18, 25	C1, 5, 6, 7, 8
7	Strong Positive	A3, 8	--
21	Strong Positive	A2, 9, 21, 25	C5, 7, 8
	Strong Negative	A3, 4, 8	C1, 3, 6
23	Strong Positive	A9	C5
	Strong Negative	--	C3, 6
24	Strong Positive	A9, 18, 24	C5, 7
	Strong Negative	--	C3, 6
25	Strong Positive	A20	--
27	Strong Positive	A25	C4, 5
	Strong Negative	--	C6
40	Strong Positive	A16, 19	--
	Strong Negative	A3, 4	--

If there was no patterning, then those sites can either be expected to be evenly distributed across all units or the sample is too small to generalize to the population at this time. When neither strong positive or negative patterns were determined, these cases were dropped from the sample treatment and, thus, sample counts do not always equal the total number of cases.

5.3.1 Site Type 1 - Chipping Station/Lithic Scatters

Terrain Unit Associations

Of the 223 occurrences of this site type, 131 or 59% have strong, positive associations with 7 particular Terrain Units. These Terrain Units within which high proportions of prehistoric chipping stations/lithic scatters are documented and can be expected to cluster are:

- A3 Ablation till;
- A4 Kame deposits;
- A5 Ablation till over unweathered bedrock;
- A6 Frozen basal till;
- A7 Colluvium over bedrock and bedrock exposures;
- A11 Esker deposits; and
- A19 Solifluction deposits over outwash deposits.

Twenty of the 223 cases of Site Type 1 (9%) have strong, negative correlations with 8 Terrain Units. These Terrain Units in which the factor analysis suggests that low proportions of sites of this type are found include:

- A1 Organic deposits;
- A2 Flood plain deposits;
- A9 Terraces;
- A10 Granular alluvial fans;
- A18 Outwash deposits;
- A20 Colluvium over bedrock and bedrock exposures (Birch Creek Formation);
- A24 Abandoned flood plain deposits; and
- A25 Tailings.

Of the 223 chipping station/lithic scatters, 151 (68%) are addressed in this model of Terrain Unit associations; Terrain Unit associations were undeterminable for the remaining 32%. Of these 151 cases with patterned relationships to Terrain Units, 131, or 87%, occur in the 7 units with the strongest, positive associations. In the same seven Terrain Units with the highest proportion of Site Type 1, the total number of cases, in the overall sample of 476, is 222, or 47%. [To avoid confusion, the reader should be aware of the coincidence that the total number of Site Type 1 occurrences (i.e., 223) is the same as the total number of cases in well-represented units.] Chipping station/lithic scatters comprise 59% (131/222) of the total cases in these 7 Terrain Units strongly associated with this site type.

In the eight Terrain Units that contain a low proportion of this site type, the total number of cases in the overall sample of 476 is 126, or 27%. Chipping stations/lithic scatters comprise only 16% of the 126 cases ($\underline{\bar{n}}$=20). Further, these 20 cases represent only 13% of the total chipping station/lithic scatters found in the 15 Terrain Units with either positive or negative associations.

Table 5-2 presents the information discussed above in a 2x2 contingency table; the chi-squared ($\underline{\bar{x}}^2$) value for this table is 59.15 (less than a 1 in 1000 chance). A value this size for 1 degree of freedom is extremely rare and suggests that there is a strong association between the two groups of Terrain Units disclosed by the factor analysis and the occurrence of chipping station/lithic scatters. The first group has a strong positive correlation, while the second group has a strong negative correlation with this particular site type.

Table 5-2
Prehistoric Chipping Station/Lithic Scatters by Terrain Unit

Terrain Unit	Chipping Station/ Lithic Scatter	All Other Site Types	Total
A3, A4, A5, A6, A7, A11, A19	131	91	222
A1, A2, A9, A10, A18, A20, A24, A25	20	106	126
Total	151	197	348

Vegetative Unit Associations

In regard to Vegetative Units, chipping station/lithic scatters cluster in high proportions in Dry tundra and Low shrub units. Fifty-three percent (119/223) were located in these two units. Of the 223 chipping station/lithic scatters, 138 (62%) are addressed in this model of Vegetative Unit associations. Of these 138 cases with patterned relationships, 86% were located in the two units with the strongest positive associations.

In the two Vegetative Units with the highest frequency of Site Type 1, the total number of cases in the overall sample of 476 is 180, or 38%. Site Type 1 comprises 66% (119/180) of the total number of cases in these two units. Areas where such sites are shown to cluster in somewhat lower proportions include the Coniferous forest and the Dwarf tree scrub-Tall shrub units. A total of 187 cases were reported in these units and 79 (42%) of those are chipping station/lithic scatters. Ninety-one percent (198/218) of the Site Type 1 cases which demonstrated some correlation (either positive or negative) with Vegetative Units have strong or moderately strong associations with one of four Vegetation Units.

The factor analysis suggests that the Deciduous forest, Mixed forest, and Developed units are those in which chipping station/lithic scatters constitute a low proportion of the total site type composition. An analysis of the component frequencies reveals that only 20 out of the 111 components reported in these units (18%) are classed as chipping station/lithic scatters and that those 20 are only 9% of the total chipping station/lithic scatter site type.

Table 5-3 presents the results of the above-listed analysis in a 2x3 contingency table. The χ^2 statistic for this table is 60.59, indicating that the clustering tendency revealed by the factor analysis is supported by the information from the previous surveys. A value as large as this with 2 degrees of freedom is an extremely rare event if there was no association between the vegetative units and the distribution of chipping station/lithic scatters. The fact that 89% of the documented chipping station/lithic scatter sites in the study population are located in the first two groups of vegetative units in the table indicates another strong positive correlation.

Discussion

In reviewing the topographic descriptions of the Terrain Units containing high to moderate proportions of chipping station/lithic scatter components, 10 of the 12 have slight to pronounced topographic relief. The topography includes dunes, hummocky terrain, lower canyon walls, hills, ridges, and scarps. In a draft of Chapter 8 for the 1985 Susitna Hydroelectric Project cultural resource report (Dixon et al. 1985), 70% of all recorded sites were classified as being located in overlook settings. Overlooks are areas of higher topographic relief with good views of the surrounding area. It appears, then, that we may have the statistical basis for stating that overlooks are preferred site settings. It is possible that the UAM survey may

Table 5-3
Prehistoric Chipping Station/Lithic Scatters by Vegetative Unit

Vegetative Units	Chipping Station/ Lithic Scatters	All Other Site Types	Total
Dry tundra-Low shrub (C1, C6)	119	61	180
Coniferous forest, Dwarf tree scrub/Tall shrub (C3, C7)	79	105	184
Deciduous forest, Mixed forest, Developed (C4, C5, C8)	19	83	102
Total	217	249	466

have had biases toward overlook settings. If that is true, then there should be a significant difference in our field findings. Vegetative Units C1, C6, and C7 also have a nearly 50% or greater correlation with the Terrain Units with topographic relief.

A second factor for some Terrain Units having high to moderate proportions of Site Type 1 is that the units are transitional between lowland and upland areas. Units A5, A6, and A14 are defined as transitional. Archeological research has demonstrated that transitional environmental zones have been more heavily exploited or occupied by prehistoric human populations because of the proximity of resources from the various adjacent areas.

Terrain Unit 8 does not appear to fall into either of the previous explanations. Unit 8, Lacustrine sediments (from glacial lakes) over basal till, is located in lowlands between Stephan Lake and Watana Creek, upstream past the Tyone River. The proximity to these features plus the proximity to caribou calving grounds may explain the above average number of chipping station/lithic scatters.

The Terrain Units where few occurrences of Site Type 1 have been recorded and few can be expected to occur are units that contain low topographic relief, areas of disturbance, or areas likely to be subject to disturbance. However, Terrain Unit 9, Terraces, contains 13 chipping station/lithic scatter cases out of 67 total cases in these units. While this represents 19% of the total cases within the unit, it accounts for less than 6% of Site Type 1. Further research may increase the representation of this site type in this unit, especially since previous investigators have specified terraces as likely locations for sites. Finally, Terrain Unit 20, Colluvium over Birch Creek Formation bedrock, appears to have a strong negative correlation with Site Type 1, even though similar units, A7 and A16, have strong to moderate correlations. The pattern here is unclear and certainly warrants further data collection.

As mentioned above, Vegetative Units C1, C6, and C7 appear to have a better than even correlation with Terrain Units marked by topographic relief. The Vegetative Units with low proportions of Site Type 1 are those where surface visibility may be quite limited or where destruction of cultural resource sites may have occurred. The moderate relationship of Coniferous forest (C3) to Site Type 1 is not clear, especially in light of the low proportion units which include Deciduous and Mixed forest.

5.3.2 Site Type 3 - Campsite/Temporary Habitation

Terrain Unit Associations

Of the 99 occurrences of Site Type 3, 46 or 46% have strong positive associations with 6 Terrain Units. The factor analytic solution suggests that Terrain Units where campsite/temporary habitation components appear to cluster are:

- A1 Organic deposits;
- A2 Flood plain deposits;
- A8 Lacustrine sediments over ablation till;
- A10 Granular alluvial fan;
- A14 Frozen basal till over bedrock; and
- A29 Eolian sand.

Three Terrain Units had a total absence of Site Type 3. These Terrain Units, where a low proportion of campsite/temporary habitations are expected, are:

- A5 Ablation till over unweathered bedrock;
- A18 Outwash deposits; and
- A25 Tailings.

In the six Terrain Units with the predicted high proportion of Site Type 3, the total number of cases in the overall sample of 476 is 121, or 25%. Campsite/temporary habitation cases comprise 38% (46/121) of the total cases in these units with strong, positive associations.

Table 5-4 is a 2x2 contingency table which cross-classifies Site Type 3 cases found with respect to the two above-listed groups of Terrain Units. The $\bar{\underline{x}}^2$ statistic for this table is 22.27 for 2 degrees of freedom. A value this large suggests that proportions of this site type are not evenly distributed over the terrain classes and the factor analytic groups are good predictors of the occurrence of campsite/temporary habitations.

Table 5-4
Prehistoric Campsite/Temporary Habitations by Terrain Unit

Terrain Unit	Campsite/ Temporary Habitation	All Other Site Types	Total
A1, A2, A8, A10, A14, A29	46	75	121
A5, A18, A25	0	46	52
Total	46	121	173

<u>Vegetative Unit Associations</u>

In regard to Vegetative Units, campsite/temporary habitations cluster in high proportions within the Wet tundra and Coniferous forest units. Approximately 61% of Site Type 3 cases are found in these two units. Furthermore, 33% of all cases recorded in the Wet tundra and Coniferous forest units were of this type.

Campsite/temporary habitations constitute a low proportion of the components found in the Dry tundra, Mixed forest, Low shrub, Dwarf tree scrub/Tall shrub and Developed units. Only 13% of the cases classified in these zones are thought to be of this site function.

Table 5-5 is a 2x2 contingency table which presents the distribution of cases with respect to the two groups of Vegetative Units discussed above. The distributional difference in proportions between the two groups of Vegetative Units manifests itself in a significant χ^2 value of 26.19 for 1 degree of freedom, which strongly suggests a non-random association of the two Vegetative Unit groups and this site type.

Table 5-5
Prehistoric Campsite/Temporary Habitations by Vegetative Unit

Vegetative Unit	Campsite/ Temporary Habitation	All Other Site Types	Total
Wet Tundra Coniferous Forest (C2, C3)	60	123	183
Dry Tundra, Mixed Forest, Low Shrub, Dwarf Tree Scrub/Tall shrub, Developed (C1, C5, C6, C7, C8)	36	247	283
Total	96	370	466

Discussion

Nearly half (5 of 11) of the Terrain Units with high to moderate proportions of campsite/temporary habitation cases have slight to pronounced topographic relief. As with Site Type 1, microenvironments within these units may provide sufficient elevation for overlook locations. Three of the 11 units are defined as transitional and, again, prehistoric people occupying those areas could exploit multiple resources from a single location.

Three Terrain Units with high to moderate proportions of Site Type 3 are currently or were formerly adjacent to lakes and/or rivers and larger tributaries. These units (A8, A2, and A9) fit into the pattern identified by previous investigators of sites near active or abandoned lake, stream, and river margins. This association also may indicate that these environments are more conducive to camps or to short term habitation rather than to the more transitory activities represented by Site Type 1. There is also a moderately strong correlation between Vegetative

Unit C3, Coniferous forest, with units A2, A8, and A9. Nearly 42% of all cases and 34% of Site Type 3 cases recorded in C3 are from these three Terrain Units.

The low proportion associations are probably most significant for Vegetative Units C1, C7, and C8, since no components were located in those units, while the expected value is between 3 and 5. While site destruction due to development may be a problem in C8, lack of preservation due to natural processes may be more of a factor in Dry tundra (C1) and Dwarf tree-shrub/Tall shrub (C7). Vegetative Units C5 and C6 had fewer cases than expected. In the Mixed forest (C5), site visibility may be a problem, while in the Low shrub, the problem may be lack of site preservation.

5.3.3 Site Type 7 - Isolated Stone Tool or Flake

Terrain Unit Associations

The factor analysis suggests that the Terrain Units which will have a higher proportion of prehistoric "isolates" include Ablation till (A3) and Lacustrine sediments (of glacial origin) over ablation till (A8). Further examination of the data reveals that, while 31% of the cases in our total sample (145/476) are found in these areas, 50% of the isolates (17/34) are found in these areas. The other half show no patterning across the remaining units.

A $\underline{\bar{x}}^2$ statistic for the counts presented in Table 5-6 was calculated to be 5.64. A value of this size for 1 degree of freedom is likely to arise only 1.5 times out of 100 if there is no association or predictability between terrain and the occurrence of this site type. Hence, we conclude that there is a difference in the proportion of sites of this type falling into Units A3 and A8, when considered across the groups of Terrain Units derived from the factor analysis.

Table 5-6
Isolated Lithic Material by Terrain Unit

Terrain Unit	Isolate Lithic Material	All Other Site Types	Total
A3, A8	17	128	145
All other Terrain Units	17	314	331
Total	34	442	476

Discussion

The correlation of isolates with hummocky terrain in A3 and lake/river/stream margins in A8 is strongly influenced by the high to moderate proportions of Sites Types 1 and 3 in these units. Apparently, in units with higher proportions of chipping station/lithic scatters and campsite/temporary habitation sites, higher proportions of of isolated lithic material can be expected to occur.

5.3.4 Site Type 21 - Historic Buildings/Structures

Terrain Unit Associations

Of the 30 recorded historic buildings/structures, 22, or 73%, have strong to moderate, positive associations with one of four Terrain Units:

A2 Flood plain deposits;
A9 Terrace;
A21 Glacial till; and
A25 Tailings.

The total number of cases in these four units is 92, with Site Type 21 representing 24%, whereas this site type represents only 6% of the cases in the total sample (30/476). The non-metric factor analysis also suggests that cases classified as historic buildings/structures show strong, negative correlations with these units:

A3 Ablation till;

A4 Kame deposits; and

A8 Lacustrine sediments over ablation till.

Only one of the 185 sites reported in these areas is classified as a historic building/structure.

Table 5-7 is a 2x2 contingency table which cross-classifies Site Type 21 cases found with respect to the two noted groups of Terrain Units. The $\underline{X}^2$ statistic for this table is 41.07 for 1 degree of freedom. The high value strongly suggests that Historic Buildings/Structures are not evenly distributed across the landscape.

Table 5-7
Historic Buildings/Structures by Terrain Units

Terrain Unit	Historic Buildings/ Structures	All Other Site Types	Total
A2, A9, A21, A25	22	70	92
A3, A4, A8	1	184	185
Total	23	254	277

<u>Vegetative Unit Associations</u>

Of the 28 historic buildings/structures with strong positive or negative associations with Vegetative Units, 19 (61%) are found in high proportions within Mixed forest, Dwarf tree scrub, and Tall shrub units. In addition, 19 of 95 (20%) total cases in the three units are Site Type 21.

Historic buildings/structures make up a low proportion of the cases found in Dry tundra, Coniferous forest, and Low shrub Vegetative Units. The nine cases found in those units represent only 2.5% of the total cases found there.

Table 5-8 is a 2x2 contingency table presenting the distribution of cases in respect to the Vegetative Units discussed above. The χ^2 value for this table is 38.87 for 1 degree of freedom, meaning that there is a less than 1 in 1,000 chance of the value arising if there is no strong association.

Table 5-8
Historic Buildings/Structures by Vegetative Units

Vegetative Unit	Historic Buildings/ Structures	All Other Site Types	Total
Mixed forest, Dwarf tree scrub/Tall shrub, Developed (C5, C7, C8)	19	76	95
Dry tundra, Coniferous forest, Low shrub (C1, C3, C6)	9	344	353
Total	28	420	448

Discussion

The two major historic themes along most of the Linear Features study area are the Alaska Railroad and mining. The railroad was constructed in areas that were well drained or that could be easily built up, and in level or gently sloping terrain. Apparently, Flood plain deposits, Terraces, and Glacial till units contained some of the best terrain for routing the railroad. Mining, on the other hand, although not similarly limited to specific terrain, always leaves its mark in the form of Tailings (five cases are recorded in the Tailings Unit). Although not specifically described for sites in this category, it is assumed that the association of Historic Buildings/Structures is primarily with the railroad or with mining. Hence, we have the strong Terrain Unit associations.

As discussed below, there are strong positive associations of Dwarf tree scrub/Tall shrub with the Alaska Railroad, possibly Mixed forest with mining, and both activities with Developed areas. The strong negative association with Dry tundra and Low shrub may be due to their location in higher elevations, where historic activities did not take place. The negative association with Coniferous forest and Site Type 21 may be due to the location of that Vegetative Unit in low-lying, very moist areas.

5.3.5 Site Type 23 - Railroad Bridges

Terrain Unit Associations

Of the 10 railroad bridges in the sample, 5 (50%) occur in the Terrace Terrain Unit. A total of 60 cases are reported in the Terrace unit, with 8% of these cases classified as railroad bridges. All other topographic areas contain 416 components, of which 5 are classed as railroad bridges. The $\tilde{\underline{x}}^2$ statistic for the counts presented in Table 5-9 is 9.73 with 1 degree of freedom, suggesting that the proportional distribution of railroad bridge sites across the Terrain Units is not equal.

Table 5-9
Railroad Bridges by Terrain Unit

Terrain Unit	Railroad Bridge	All Other Site Types	Total
A9	5	55	60
All other Terrain Units	5	411	416
Total	10	466	476

Vegetative Unit Associations

The results of the factor analysis suggest that areas classified as Mixed forest would contain a greater proportion of sites classified as railroad bridges than other Vegetative Units. The analysis further suggests that Coniferous forest and Low shrub units were areas in which railroad bridges were not likely to cluster. Table 5-10 presents the results of cross-classifying site type by these Vegetative Units. The $\bar{\underline{x}}^2$ value for this table is 14.49 for 1 degree of freedom, indicating that the two factor analytic derived groups of Vegetative Units are not identical in their proportion of railroad bridge sites. For the three Vegetative Units, 75% of the reported railroad bridges fall into the Mixed forest unit. Further examination reveals that less than 1% of the total cases reported in the Coniferous forest and Low shrub units are Railroad Bridge sites, significantly less than expected.

Table 5-10
Railroad Bridges by Vegetative Unit

Vegetative Unit	Railroad Bridge	All Other Site Types	Total
Mixed forest (C5)	6	65	71
Coniferous forest (C3) Low shrub (C6)	2	326	328
Total	8	391	399

Discussion

The most preferred route for the Alaska Railroad, as noted, appears to have included terraces. Because of the association of terraces in general with current or former rivers or streams, the necessity for bridges is obvious wherever the water body, tributaries, or old channels were crossed. The strong association between Mixed forest and railroad bridges may be more related to the association of Terrace and Mixed forest units. Over 20% of all cases recorded in the Terrace unit are located in Mixed forest, which is greater than the expected frequency of 16%. Regarding the low proportion units, Low shrub appears to be significantly under-represented in the Terrace units; however, Coniferous forest was recorded at the expected level. One possible explanation for the strong negative relationship with Coniferous forest is that this unit tends to be associated with low-lying, moist areas.

5.3.6 Site Type 24 - Railroad Stations

Terrain Unit Associations

Of the 15 railroad stations in the sample, 12 (80%) occur in one of three Terrain Units:

- A9 Terraces;
- A18 Outwash deposits; and
- A24 Abandoned flood plain deposits.

A total of 73 cases were recorded in these Terrain Units, with the 12 railroad stations comprising 16.4%.

Those Terrain Units which were rated as having a low proportion of station sites are Ablation till (A3) and Lacustrine sediments over basal till (A8). No stations were recorded in these two units out of a total of 159 cases, a lower-than-expected value. The $\bar{x}^2$ value for Table 5-11 is 24.14 with 1 degree of freedom, suggesting a significant, non-random distribution of railroad stations.

Table 5-11
Railroad Stations by Terrain Units

Terrain Unit	Railroad Stations	All Other Site Types	Total
A9, A18, A24	12	61	73
All other Terrain Units	3	400	403
Total	15	461	476

Vegetative Unit Associations

The factor analysis rated the Mixed forest and Dwarf tree scrub/Tall shrub areas as Vegetative Units in which railroad station sites were likely to cluster. Coniferous forest and Low shrub areas were rated as units where low proportions of such components would be found. Of the total 410 cases reported in these areas, 14 (3.4%) were classified as railroad stations. A total of 82 cases were found in the areas rated as good predictors for the presence of railroad stations, and 60% of the cases (9/15) were found in those areas. Coniferous forest and Low shrub units contained 328 components, only 5 (1.5%) of which were classified as railroad stations (Table 5-12). The $\bar{x}^2$ value for Table 5-10 is 15.02 for 1 degree of freedom, indicating that the areas are distinct for all practical purposes. There is a difference in the proportion of railroad stations to all cases when considered across the two above-listed groups of vegetation zones.

Table 5-12
Railroad Station by Vegetative Unit

Vegetative Unit	Railroad Station	All Other Site Types	Total
Mixed forest, Dwarf tree scrub/Tall shrub (C5, C7)	9	73	82
Coniferous forest (C3) Low shrub (C6)	5	323	328
Total	14	396	410

<u>Discussion</u>

Because the Alaska Railroad was located in level to gently sloping areas, there is a strong correlation between railroad stations and Terrain Units A9, A18, and A24. All three Terrain Units are flat to gently sloping and all are ideal locations for a railroad. In respect to the units with low proportions, Ablation till is hummocky and Lacustrine sediments over basal till units are low-lying terrain located a considerable distance from the railroad.

The relationship between railroad stations and Vegetative Units is quite similar to the pattern described for railroad bridges. The main difference is the addition of Dwarf tree scrub/Tall shrub (C7) into the high proportion category. Four of the 15 railroad stations (24%) occur in this unit. The association may not be fortuitous, but may be a result of the presence of the railroad. Railroad stations are initially constructed at predetermined distances to ensure an adequate fuel supply for the locomotives.

5.3.7 Site Type 25 - Railroad Tunnels

Three railroad tunnels were reported in the area of interest. All three were found in areas classified as Colluvium over bedrock and bedrock exposures (A20). No association between vegetation zone and this site type was found. Railroad tunnels were constructed along the route of the rail line when the rock outcrop in question would support tunneling and when avoidance would be prohibitively expensive.

5.3.8 Site Type 27 - Historic Mining Camps and Operations

Terrain Unit Associations

Nine historic mining camps were recorded in the study area. Not surprisingly, six of the nine were reported in topographic units classified as Tailings (A25), while only five other cases were reported in this Terrain Unit. A total of 465 cases were found in all other units and only 3 of these cases were classified as mining camps. The $\underline{x}^2$ statistic for these data is 144.78 with 1 degree of freedom, indicating an unusually strong association.

Vegetative Unit Associations

Factor analysis suggested that mining camp components would be found in higher proportions in Vegetative Units classified as Deciduous forest (C4) or Mixed forest (C5). They also should be found in lower proportions in areas classified as Low shrub (C6). Further analysis of actual frequencies discloses that none of the 155 sites reported in the Low shrub areas are classified as mining camps. Seven of the 89 sites found in the Deciduous forest and Mixed forest areas are classified as mining camps, with 4 of the 9 mining camps reported among the 18 total cases found in the Deciduous forest areas.

Discussion

Mining camps were usually located at or near the "discovery claim," if the claim proved viable. The result of the mining activity would obviously be tailings and the extent of tailings deposits would depend upon the extent of the auriferous deposits. The relationship of mining camps to the high-proportion Vegetative Units may be related to the well-drained gravels which may support Deciduous and/or Mixed forests. Hence, it is proposed that the relationship is between Terrain and Vegetative Units, not site type and Vegetative Units.

5.3.9 Site Type 40 - Disturbed Sites

Results of the factor analysis suggest that 28 unclassified cases tend to cluster in areas classified as Colluvium over bedrock and bedrock exposures of Nenana Gravel Formation (A16), and Solifluction deposits over outwash deposits (A19). Areas in which they are found in lower proportions than expected include Terrain Units classified as Ablation till (A3) and Kame deposits (A4). One-quarter (9/36) of the total cases reported in the first two units (A16 and A19) are unclassifiable as to site function and only one out of the 118 total cases recorded in the latter two Terrain Units (A3 and A4) are unclassifiable. The χ^2 statistic for these counts is 22.67, with 1 degree of freedom, indicating a non-random distribution.

The initial interpretation of the above data is that natural processes are more active in units A16 and A19 than in A3 and A4, and, thus have subjected prehistoric sites to greater disturbance. It is interesting to note, however, that Terrain Units A16 and A19 contained sufficient numbers of intact chipping station/lithic scatters to be high and moderate predictors of their presence.

5.4 Cultural Chronology and Environmental Unit Associations

The factor analysis results also disclosed potential relationships among chronology, Terrain Units, and Vegetative Units. As with site types, there are strong positive and negative associations between periods of occupation and environmental units. Following is a summary of interpretations arranged according to chronological class for those periods with apparent patterning (Table 5-13). The chronological periods used below are those established and defined in Chapter 4.

Table 5-13
Chronological Periods and Strong Positive or Negative Environmental Unit Associations

Chronological Period	Associations	Terrain Unit	Vegetative Unit
Historic	Strong Positive	A9, 18, 20, 21, 24, 25	C4, 5, 7, 8
	Strong Negative	A3, 4, 6, 8, 14, 19	C1, 3, 6
Athapaskan	Strong Positive	A2, 8	C3
	Strong Negative	A12, 16, 19, 20, 25	C1, 2, 8
Unknown	Strong Positive	A5, 12, 19, 29	C1, 2, 6
	Strong Negative	A2, 9, 18, 25	C3, 4, 5, 8

5.4.1 Historic Period

Terrain Unit Associations

The factor analysis suggests that historic period cases have positive correlations with the following Terrain Units:

A9 Terrace;

A18 Outwash deposits;

A20 Colluvium over Birch Creek Formation bedrock and bedrock exposures;

A21 Glacial till;

A24 Abandoned flood plain deposits; and

A25 Tailings.

Of the 78 cases classified as historic period sites, 54 (69%) occur in these six Terrain Units. Of the 99 total cases in these Terrain Units, 55% are historic.

The Terrain Units which are expected to have a low proportion of such sites are:

A3 Ablation till;

A4 Kame deposits;

A6 Basal till;

A8 Lacustrine sediments over ablation till;

A14 Frozen basal till over bedrock; and

A19 Solifluction deposits over outwash deposits.

Of the 78 cases classified as historic, only 6 (8%) occur in these six units. These six represent only 2.5% of the total cases found in these units.

Table 5-14 cross-classifies the distribution of historic sites and Terrain Units. A $\underline{\bar{x}}^2$ value of 126.28 for 1 degree of freedom is highly significant. The results suggest that historic sites are not randomly distributed across the landscape.

Table 5-14
Historic Sites by Terrain Unit

Terrain Unit	Historic Sites	Other Cultural Period Sites	Total
A9, A18, A20, A21, A24, A25	54	45	99
A3, A4, A6, A8, A14, A19	6	233	239
Total	60	278	338

Vegetative Unit Associations

The factor analysis suggests that the Deciduous forest (C4), Mixed forest (C5), Dwarf tree scrub/Tall shrub (C7), and Developed areas (C8) have higher proportions of historic period cases than expected, whereas Dry tundra (C1), Coniferous forest (C3), and Low shrub (C6) units have lower proportions of such sites than expected. An analysis of the 480 cases found in these 7 units supports this result (Table 5-15).

Table 5-15
Historic Sites by Vegetative Unit

Vegetative Unit	Historic Sites	All Other Site Types	Total
C4, C5, C7, C8	55	58	113
C1, C3, C6	23	330	353
Total	78	388	466

Seventy percent of the historic period cases are found in the four units judged to have a high proportion of such sites and

47% of the total cases from those units are historic. Only 7% of the cases found in the Dry tundra (C1), Coniferous forest (C3), or Low shrub (C6) units are historic, representing 29% of the total historic cases found. The $\bar{x}^2$ statistic for these correlations is 106.15 at 1 degree of freedom, which is very significant.

Discussion

As discussed under site type distribution, the two major historic themes represented by recorded sites are The Alaska Railroad and mining. The railroad route was selected to cross level to gently sloping terrain, such as Terraces, Outwash deposits, Glacial till, and Abandoned flood plain deposits. Railroad tunnels were constructed through bedrock when that became an impediment for routing. The Tailings obviously would have a strong association with the historic mining.

The vegetative associations also duplicate those with high and low proportions of the various historic site types. Deciduous forests had the strongest association with mining camps, and this may reflect the better-drained gravel and gold-bearing deposits. The location of historic sites on terraces which have high proportions of Mixed forest generally explains the Historic sites/Mixed forest relationships. Developed areas are those areas with historic or more recent sites; thus, the relationship should be strong. The vegetation of the Dwarf tree scrub/Tall shrub areas is believed to be a direct result of historic development, as well. This is especially obvious in areas that were cleared for timber for railroad construction and to provide fuel for trains. The Dry tundra and Low shrub units tend to be in areas of greater topograhic relief, where we anticipate fewer of the known types of historic sites. The low proportion of historic sites in the Coniferous forest unit is thought to be due to these units being in marshy, low areas.

5.4.2 Athapaskan Period

Terrain Unit Associations

The factor analysis suggests that the Lacustrine sediments over ablation till (A8) and Flood plain deposit (A2) Terrain Units have a high proportion of Athapaskan period cases. Of the 122 cases classified as Athapaskan period sites, 36 (30%) occur in these two Terrain Units. Of the 80 total cases found in the units, 45% are classified as Athapaskan.

Unweathered consolidated bedrock (A12), Colluvium over bedrock and bedrock exposures (A7), Solifluction deposits over outwash deposits (A19), and Tailings (A25) are units in which low proportions of these cases will be found. Of the 122 cases of Athapaskan sites, none occur in these four Terrain Units.

Table 5-16 cross-classifies the distribution of Athapaskan sites and Terrain Units as identified through the factor analysis. A total of 136 cases were found in the above-discused units. Athapaskan period sites comprise 45% of the total cases reported in the units believed to have a high proportion of sites are from this period. None of the sites in the low proportion are assigned to the Athapaskan period. A $\underline{\overline{x}}^2$ value of 32.51 at 1 degree of freedom is significant. The results suggest that Athapaskan period sites are not randomly distributed across the landscape.

Table 5-16
Athapaskan Sites by Terrain Unit

Terrain Unit	Athapaskan Sites	Other Cultural Period Sites	Total
A2, A8	36	44	80
A12, A16, A19, A20, A25	0	57	57
Total	36	101	137

Vegetative Unit Associations

The factor analysis suggests that areas of Coniferous forest (C3) have a relatively high proportion of cases dating to the Athapaskan period, and that a low proportion of such sites occur in the Dry tundra (C1), Wet tundra (C2), and Developed (C8) Vegetative Units. An analysis of the distribution of Athapaskan period sites over these units supports this interpretation.

Table 5-17
Athapaskan Sites by Vegetative Unit

Vegetative Unit	Athapaskan Sites	Other Sites	Total
C3	67	106	173
C1, C2, C8	1	47	48
Total	68	153	221

A total of 68 Athapaskan period sites are reported in the 4 above-mentioned zones. A total of 67 (98%) of them were found in the Coniferous forest unit. Only 1 of the 49 components reported in the Dry tundra, Wet tundra, and Developed units is from this period. The $\bar{x}^2$ statistic of 22.00 at 1 degree of freedom indicates that this is definitely a non-random association.

Discussion

The strong association of Athapaskan period sites with Terrain Units A8 and A2 is probably due to the pattern of resource exploitation practiced by the Athapaskans. Many of the primary food resources in their diet throughout the year are located in rivers or streams and the nearby lands. Therefore, sites located for exploiting these resources would likely be located in the adjacent flood plain. The association with the lacustrine deposits probably has to do with the fact that these units are primarily located in lowlands between Stephan Lake and Watana Creek, upstream past the Tyone River, which was apparently heavily exploited by Athna groups. It will be interesting to see if this latter pattern holds true outside of the inundation area.

The Terrain Units where proportions are low would either be areas not preferred by Athapaskans, associated with other activities (such as tailings) or where cultural remains would not be well preserved. The explanation for the high proportion of Athapaskan sites in the Coniferous forest unit is at least partially explained by the fact that nearly two-thirds of the recorded cases of Coniferous forest (C3) occur in Terrain Unit A8, and nearly half of the cases in Flood plain deposits are C3. The low proportion of Athapaskan sites in certain Vegetative Units appears to correlate somewhat with the low proportion Terrain Unit categories. The correlation between the Developed Vegetative Unit (C8) and Tailings (A25) is much greater than expected (50% as opposed to 2.9%). The low proportion of Athapaskan sites in Dry and Wet tundra correlates with a general absence of sites in these units.

5.4.3 Unknown Chronological Period

Terrain Unit Associations

Terrain Units within which sites with an unknown chronological affiliation are expected to cluster are:

- A5 Ablation till over unweathered bedrock;
- A12 Unweathered consolidated bedrock;
- A19 Solifluction deposits over outwash deposits;
- A29 Eolian sand.

Of the 69 undated cases, 80% occur in these four Terrain Units. Of the 70 total cases found in these units, 79% are undated.

Terrain Units in which undated sites are expected in low proportions are:

- A2 Flood plain deposits;
- A9 Terrace;
- A18 Outwash deposits; and
- A25 Tailings.

Of the 69 undated cases, 14 (20%) occur in these four units. These 14 represent 14% of the total cases found in these units.

Table 5-18 cross-classifies the distribution of undated sites and Terrain Units. Further analysis of frequencies of occurrence discloses that 70 components are reported in areas thought to have a high proportion of this site type. A total of 55 or 79% of those components are classified as Unknown for chronological period. A total of 69 chronologically Unknown components were reported in the areas of interest. A total of 55 of those 69 (80%) are reported in the areas thought to have a high proportion.

Table 5-18
Undated Sites by Terrain Unit

Terrain Unit	Dated	Undated	Total
A5, A12, A19, A29	54	14	68
A2, A9, A18, A25	11	83	94
Total	65	97	162

A total of 101 components were found in the areas predicted to have a low proportion of undated components. Only 14 of those components are undated. Further, only 20% of the undated components are found in these areas. A χ^2 value of 72.50 at 1 degree of freedom suggests that the relationship is definitely non-random.

Vegetative Unit Associations

Sites which cannot be confidently classified into one class or another cluster within the Dry tundra (C1), Wet tundra (C2), and Low shrub (C6) Vegetative Units and are found in lower proportions in the Coniferous forest (C3), Deciduous forest (C4), Mixed forest (C5), and Developed (C8) units. Table 5-19 cross-classifies components by chronological period and the above-mentioned Vegetative Units.

Table 5-19
Undated Sites by Vegetative Units

	Undated	Dated	Total
C1, C2, C6	126	64	190
C3, C4, C5, C8	83	192	275
Total	209	256	465

A total of 192 sites were reported in the Dry tundra, Wet tundra, or Low shrub units, 66% of which are placed in the Unknown category. A total of 285 sites were reported in the units believed, on the basis of the factor analytic results, to have a relatively low proportion of cases with an unknown chronological affiliation. Only 32% of those 285 are placed in the Unknown category. The $\underline{x}^2$ value for this table is 57.84 for 1 degree of freedom. This value indicates that the two factor analytic derived groups of Vegetative Units definitely do not contain random distributions of sites in the Unknown chronological period.

Discussion

It is interesting to note that high proportions of sites classified chronologically as Unknown are located in Terrain Units A12 and A19, which had low proportions of historic and Athapaskan period sites, and vice-versa. While the other two Terrain Units, A5 and A29, did not correlate strongly with the other chronological periods, they did fit into an overall pattern of units subject to natural disturbance or unfit for human occupation. Terrain Unit A12, Unweathered consolidated bedrock, includes cliffs along the Susitna River canyon.

Basically, the same pattern of site location by chronological period applies to Vegetative Units. The areas with high proportions of undated cases are those likely to be used briefly, and such transitory sites are not likely to contain diagnostic materials.

6.0 RESEARCH DESIGN FOR FIELD TESTING THE MODEL

T. Weber Greiser and Sally T. Greiser
Historical Research Associates

6.1 Background for Sample Selecting

In our proposal, we recommended the use of weighted, simple random sampling within each environmental unit because of the limited amount of data available regarding internal variation within the sampling population. Our recommendation, prior to data analysis, was to weight environmental units according to the total number of located "points" or archeological cases within each unit. This recommendation was modified due to insufficient case density information for the study area. Too few data were available regarding site density by type or period of occupation, within any specified geographical unit, to allow weighting by case density. Our modified approach was to weight environmental units for sample selection by their proportionate representation within the population.

The quadrant method is proposed, where the area to be sampled is subdivided into squares and an effort is made to count or collect all the sites found within each of a selected number of these units. When the quadrants are well chosen, the total number of sites in the area can be closely estimated. The number of sampling units to be chosen was influenced by the work of plant ecologists and geographers, who indicate that the sampling unit should be large enough so that several sites will occur in each quadrant. It is not necessary or even desirable that each quadrant include a representative assemblage of all the site types of the area. It is much better as a sampling operation that the sampling quadrants be small and widely scattered, each with only a random and not complete representation of the sites. If the quadrants comprise a good sample of the area, the sites from all units combined will be a good sample of the cultural values even though the sites of any single quadrant are not.

A review of literature indicates that no reliable density estimates are available for the study area as a whole. As a solution to this problem, we chose to investigate minimal areas by using "nested plots" of one-half-mile, or 160-acre squares. During analysis, this allows for each half-mile quadrant to be subdivided and analyzed to determine optional sampling unit size for the area of interest (Fig. 6-1). The half-mile unit is selected because of the half-mile corridor width.

In the sample selection process, we have two primary goals. The first is to select as representative and, therefore, statistically valid sample as possible. The second is to adequately sample all the subpopulations in the universe to ensure the collection of necessary data for management needs. To accomplish this, we designed a plan to draw independent samples of half-mile units, in relative proportion to the size of environmental units or subpopulations. Furthermore, by using "nested plots," we can readily increase our total number of sampling units as the data indicate.

The question of how large a sample to take from a population for making a test is often asked by cultural resource managers. This question can be answered, provided the manager can first answer these two questions: (1) How great a difference in sample averages do you wish to detect?; and (2) How much variability is present in the population? If numerical values are available for answering these questions with a reasonable degree of accuracy, then the appropriate sample size can be determined.

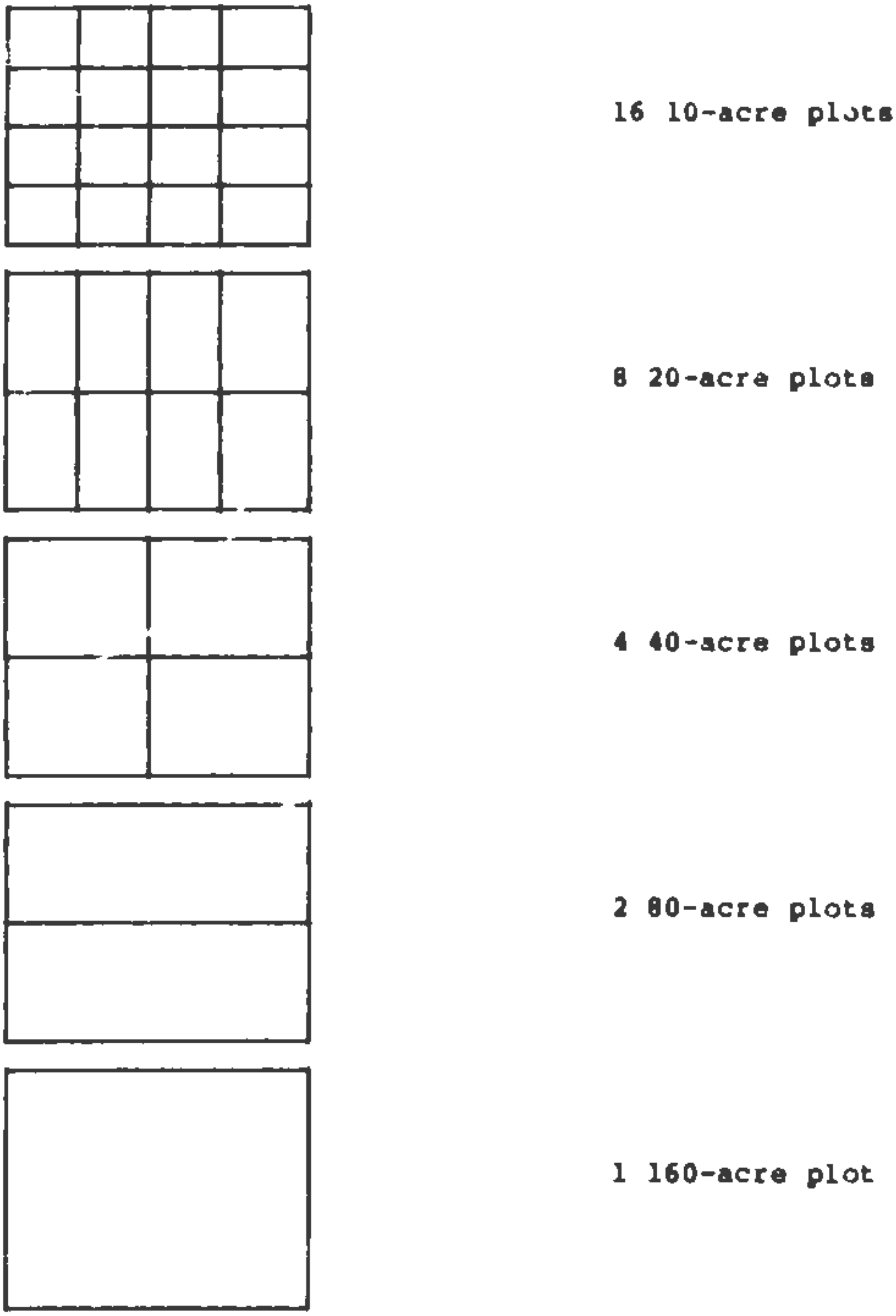

Figure 6-1. Design for "nested plots' sampling strategy.

For southcentral interior Alaska, data remain too limited to answer these questions with any degree of confidence. We chose a 20% sample size as being adequate to address the question of site distribution in the study area. Twenty percent is a generally accepted figure for an adequate sample with a population of this size, i.e., $\underline{n}$=552. The 552 quadrants that are plotted on Figure 2-2 were derived by dividing the 276 miles of the project area into equal-sized, 160-acre quadrants (Table 6-1).

We recognize that ground conditions and accessibility may inhibit adequate study of all selected sample units. Accordingly, the ultimate sampling fraction may be reduced to no less than 15%.

This sample size should be sufficient for all but the most rare site types, to provide useful estimates for site type values during subsequent cultural resource investigations. We will use the field survey results to derive estimates for each type of site identified. We will address the question, "How large a sample would be necessary to be sure, for all practical purposes, to include at least one quadrant with each particular site type?"

It must be kept in mind that sampling will allow testing of predictions concerning only sites which are detectable through standard archeological survey techniques. Because of this effective filter, it is not clear whether the pattern of "identified" sites will represent a true picture of the pattern of "all" sites. This is a fundamental problem associated with testing of predictive models.

Key to Table 6-1

Unit No.	Unit Symbol	Unit Name
		Terrain Units
A1	= O	Organic materials
A2	= Fp	Flood plain deposits
A3	= Gta	Ablation till
A4	= GFk	Kame deposits
A5	= $\frac{\text{Gta}}{\text{Bxu}}$	Ablation till over unweathered bedrock
A6	= Gtb-f	Basal till (frozen)
A7	= $\frac{\text{C}}{\text{Bxu}}$ +Bxu	Colluvium over bedrock and bedrock exposure
A8	= $\frac{\text{L}}{\text{Gtb-f}}$	Lacustrine deposits over basal till
A9	= Fpt	Terrace
A10	= Ffg	Granular alluvial fan
A11	= GFe	Esker deposits
A12	= Bxu	Unweathered, consolidated bedrock
A13	= $\frac{\text{Cs-f}}{\text{Fpt}}$	Solifluction deposits (frozen) over terrace sediments
A14	= $\frac{\text{Gtb-f}}{\text{Bxu}}$	Frozen basal till over bedrock
A15	= $\frac{\text{Ff-c+O}}{\text{Ff}}$	Fan cover deposits and organics over fan river bed deposits
A16	= $\frac{\text{C}}{\text{Bcw}}$ +Bcw	Colluvium over bedrock and bedrock exposure
A17	= Mt	Marine tidal deposits
A18	= GFo	Outwash deposits
A19	= $\frac{\text{Cs}}{\text{GFo}}$	Solifluction deposits over outwash
A20	= $\frac{\text{C}}{\text{Nwu}}$ +Nwu	Colluvium over bedrock and bedrock exposure
A21	= Gto	Glacial till
A22	= $\frac{\text{Cs}}{\text{Nw}}$	Solifluction deposits over weathered bedrock
A23	= Cl	Landslide deposits
A24	= Fpa-c	Abandoned flood plain deposits
A25	= Mt	Tailings
A26	= $\frac{\text{C+Elu}}{\text{Nw}}$	Colluvium and loess over weathered bedrock
A27	= Fss	Silty retransported deposits
A28	= Elu	Eolian loess
A29	= Es	Eolian sand
A30	= C	Colluvial deposits
A31	= Ff-r	Alluvial fan channel sediments
A32	= $\frac{\text{O}}{\text{GFo}}$	Organic deposits over outwash
A33	= $\frac{\text{O}}{\text{Fd}}$	Organics over deltaic deposits
A34	= Fd	Fluvial delta deposit
A35	= $\frac{\text{Cs}}{\text{Bcw}}$	Solifluction deposits over bedrock
A36	= $\frac{\text{Cs-f}}{\text{Gtb-f}}$	Solifluction deposits (frozen) over basal till (frozen)
A37	= $\frac{\text{Cs-f}}{\text{Gta}}$	Solifluction deposits (frozen) over ablation till
A38	= $\frac{\text{Cs-f}}{\text{Bxu}}$	Solifluction deposits (frozen) over bedrock
A39	= not used at this time	
A40	= not used at this time	
		Vegetative Units
C1	= Dt	Dry tundra
C2	= Wt/m	Wet tundra/marshland
C3	= Cf	Coniferous forest
C4	= Df	Deciduous forest
C5	= Mf	Mixed forest
C6	= Ls	Low shrub
C7	= Dts/Ts	Dwarf tree shrub/Tall shrub
C8	= Dev; D	Developed; Water/barren
C9	= Rb/La	Recently burned/logged area

Table 6-1

Research Units

Research Quadrant	TERRAIN UNITS A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
1									137									31									2			
2									80			30						17									33			
3*									143									17												
4									106									43									11			
5									66									81									15			
6									76									53									31			
7*									155									3									2			
8									59									19									82			
9									61	21								13									65			
10			1						71	60								3									17			
11			9						113	30																				
12										121								26									15			
13			6						32	122																				
14			16						37	76																	33			
15			16						26	76																	44			
16			25						97	25																	13			
17									92									56									12			
18									81									12			10						57			
19									108												32						20			
20									35	35								12			78									
21									52	32								30			6									
22									116	66																				
23									113	67																				
24									112	68																				
25									120												25									15
26*									17	101											28									16
27									45	20								21			76									
28									86									3			65									8
29									122									10			25									3
30									56									53			51									
31			25						12									116			4						3			
32*																		160												
33*																		160												
34*																		160												
35									25									110												25
36			14						4									92			36									16
37			4						96												27									33
38			120						36																					4
39*			160																											
40			160																											
41*			160																											
42			50					76		23																				5
43*									13												15									132
44									130												30									
45								20	25												115									
46*								86													76									
47								40	18												102									
48*			6					11	26												119									
49*									23								80				47									10
50								7	3												150									
Subtotal			780					236	2819	893		30					80	1329			1113						655			265

Table 6-1. Research Units (continued)

Research Quadrant	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
1															90			64	
2																		160	
3*																	144	16	
4																	144	16	
5																16		144	
6															80	80			
7*															72		72	16	
8															116	44			
9																		160	
10																160			
11															16	144			
12															19	125		16	
13															160				
14															158	2			
15															160				
16															160				
17														153	7				
18														160					
19														160					
20														160					
21														124			36		
22														55			105		
23														85			75		
24														160					
25														93			67		
26*														153				7	
27														98				62	
28														28			130	2	
29														13			147		
30														93	36		31		
31															20		140		
32*															160				
33*															160				
34*															160				
35															160				
36															160				
37														16	144				
38															160				
39*														47	113				
40												1		157	2				
41*												53			107				
42														125	35				
43*														160					
44														158	2				
45															160				
46*															160				
47												70			90				
48*												30			130				
49*												60			20			80	
50												6			154				
Subtotal												220		2200	3180	571	1089	740	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
51			152															3												5
52*	80		80																											
53	160																													
54	115		45																											
55			160																											
56*			160																											
57			160																											
58			160																											
59			160																											
60*			151															9												
61			144															16												
62																		160												
63																		160												
64																		160												
65*																		160												
66																		160												
67																		160												
68																		160												
69*																		160												
70																		127												
71																		113											8	
72																		7											31	
73																													9	
74*																														
75																		136												
76		83																77												
77			125						35																					
78			104																										23	
79	8		85																											
80	13		160																											
81			101																											
82			97																											
83																													6	
84																													27	
85			33																										15	
86*			130																											
87			106																											
88			76																											
89			42																											
90*			61																											
91*																													+45	
92*		15																											5	
93		24	37																											
94																													20	
95			2																										13	
96			45																											
97		41	35																											
98		3	26																											
99	2		50																											
100			30							10																				
Subtotal	378	166	2710						35	10								1756											230	5

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
51															30		37	25	
52*												80			1		79		
53												160							
54												115					45		
55												73					87		
56*												143			17				
57															160				
58															160				
59															160				
60*															160				
61															160				
62															160				
63															160				
64														75	85				
65*														160	13		7		
66														75			86		
67														157	1		2		
68													113	67					
69*													160						
70		33										40	112						
71		30										38	132						
72		102										150	1						
73		151										160							
74*		160										160							
75		36										160							
76												153						8	
77												37	123						
78		36										42	64		36				
79		67										81			79				
80		7										4			136				
81		30										45			111				
82		63										64			90				
83			145	9								160							
84			133									160							
85			112									145			15				
86*			22									84			76				
87			34									94			66				
88			84									137			23				
89			110									146			16				
90*			99									136			26				
91*				115											160				
92*			29	111								31			129				
93			90									95			65				
94			132									160							
95			145									153			7				
96			43	32								84			76				
97			31	82								31			129				
98			114	30											53		107		
99			100									134			6				
100			120									123			37				
Subtotal		751	1500	379								3600	705	493	2601		470	33	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
101			15																											
102*																														
103			36							5																				
104			66							47																				
105			82							16																				
106			65																											
107			9															10												
108		110																												
109		37																												
110		41																												
111		7																											2	
112																													11	
113*																														
114																														
115																														
116									10									10												
117		4							110									18					23							
118		35							102									11					9							
119	20								96									64												
120*	47								77									36												
121									76									84												
122		7							31									97												
123		80							60									30												
124	6	42							39									73												
125		162																10												
126		118																63												
127		81																79												
128		85																75												
129*		153																7												
130																														
131																														
132*																														
133																		160												
134	12																	148												
135	30									87						63														
136*	9															137														
137	157																		3											
138	142																		18											
139	79								6	5								70												
140*										156								4												
141	40								50	32								38												
142										12						8		160												
143*										100								60												
144																3		157												
145*																		160												
146*																		160												
147		33							12									95												
148		13								7						36		36	70											
149		6							128							4		22												
150		25							110							15		10												
Subtotal	542	1039	291						907	467						246		1890	91				32						13	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
101			145									160							
102*			160									160							
103			99									100				60			
104			49									126				34			
105			62									82				78			
106			95									87				73			
107			122	11												160			
108				50									11			149			
109				123									18			142			
110				119									115			45			
111			42	109									81			79			
112			86	63								79	76			5			
113*			160									160							
114			85	75								73	70		17				
115			75	85								78			82				
116				140								9			151				
117				5								104			56				
118				3								129			31				
119												113			47				
120*												131			29				
121												74			86				
122		25										44	62		54				
123													99		51			10	
124													104		56				
125													95		50			6	
126													109	49	2				
127													131	29					
128													160						
129*													160						
130			104	56								85	75						
131			156	4									1			159			
132*			160									160							
133														9	151				
134													128	32					
135															40	116		4	
136*					14										126	34			
137															35	100		25	
138															68	82		10	
139															70	65		25	
140*															156	4			
141															136	24			
142															118	42			
143*															3	157			
144															78	82			
145*															4	156			
146*															35	125			
147															100	60			
148															76	84			
149															35	125			
150															107	53			
Subtotal		25	1600	843	14							1956	1495	119	2059	2293		80	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
201*	84													15			145		
202	123																160		
203	96													58			102		
204	23															8	152		
205																149	11		
206	107															116	44		
207	114													61		22	77		
208	1													15		55	90		
209*																160			
210	52															160			
211	19															160			
212	2															160			
213*																160			
214																160			
215																160			
216																160			
217*																32	128		
218																	160		
219	10																160		
220	62																160		
221	35															2	158		
222*																108	52		
223																	160		
224a																92	68		
224b																7	153		
225*																87	73		
226	61															40	120		
227	41																160		
228	1																160		
229*	20																160		
230	71																160		
231*	60																160		
232	91																150	10	
233	68																160		
234	63																160		
235	50															29	131		
236																72	88		
237																85	75		
238																21	139		
239																95	65		
240																160			
241																160			
242													100			50		10	
243*													40				60	60	
244*													7				93	60	
245																	160		
246																	159	1	
247														112			48		
248														124			36		
249														37			123		
250														93			67		
Subtotal	1270												147	515		2670	4687	141	

Table 6-1. Research Units (continued)

	TERRAIN UNITS																													
Research Quadrant	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
151										8								152												
152*										136								36												
153										12						10		130												
154																120		32												
155																23		137												
156																11		160												
157																20		160												
158																33		127												
159										76						18		66												
160		5							6	53								96												
161																10		150												
162									19	60						7		96												
163*		46							30									75												
164		84							37	26								13												
165		40							120																					
166		30							148																					
167*									160																					
168*									160																					
169*									160																					
170	40								112																					
171*	5								155																					
172									99	29								32												
173									40	76								37												
174									120									40												
175									120									40												
176									93							30		37												
177									4							4		152												
178										21						9		130												
179									9	161						10														
180									10	96											56									
181									57	103																				
182										150						2														
183	18									19											123									
184																43					117									
185																121					30									
186																157					3									
187																150				1										
188*															16	166														
189															128	13							19							
190*															160															
191															92	60														
192															22	130														
193															131	29														
194	7														73	80														
195	31														129															
196															130															
197															157															
198	13														60															
199*	20														3															
200															150															
Subtotal	142	195							1669	980					1276	1269		1073		1	336		19							

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
151															75	85			
152*															128	32			
153															14	146			
154																160			
155																160			
156															3	157			
157																52	108		
158																20	140		
159																120	40		
160																145		15	
161																80	80		
162																94	66		
163*																77	63	20	
164																96	39	25	
165																	140	20	
166																	145	15	
167*																	160		
168*																	160		
169*																	160		
170														4			156		
171*														15			145		
172														33			127		
173														117			43		
174														40			120		
175														40			120		
176														37			123		
177														149			11		
178														140			20		
179														146			14		
180														103			3		54
181																	147		13
182																	160		
183																	160		
184													23	137					
185														160					
186														117	10		33		
187														10	145		5		
188*														35	125				
189															11		149		
190*															52		108		
191														15	6		139		
192														54			106		
193														85		28	47		
194														90			70		
195														118			42		
196	22																160		
197	3																160		
198	78																160		
199*	137																160		
200	2													96			64		
Subtotal	242												23	1761	509	1452	4053	95	67

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
201*															36															
202	21														16															
203															66															
204	22														115															
205	120														32															
206	53																													
207															46															
208															159															
209*															160															
210															160															
211															161															
212															158															
213*															160															
214															160															
215															160															
216	2														158															
217*															160															
218															160															
219															162															
220															98															
221															125															
222*															160															
223															160															
224a															160															
224b															160															
225*															160															
226															99															
227															119															
228															159															
229*															140															
230															80															
231*	48														52															
232	10														50															
233															92															
234															97															
235															102															
236		60													100															
237		93													67															
238		104													56															
239		25													135															
240	1														139									20						
241	51														9									100						
242		70																						90						
243*		160																												
244*		160																												
245	36	126																												
246	5	155																												
247	8	48								57																		47		
248																											26	136		
249																											126	34		
250																											84	76		
Subtotal	305	999								57					4712									210			236	293		

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
251																											28	132		
252																											32	120		
253*																											150	2		
254*	4																										151	5		
255*	1																										150			
256																											161	19		
257																											165	15		
258																											92	68		
259																											90	68		
260*																											158	2		
261																											160			
262																											85	75		
263																											53	107		
264																											56	106		
265																											45	115		
266																											113	47		
267																											36	126		
268*																											16	144		
269																											52	108		
270*																											148	12		
271																											67	93		
272																											97	63		
273																											96	64		
274																											68	92		
275																											117	43		
276																											129	31		
277																											133	27		
278																											134	26		
279																											138	22		
280																											128	32		
281																											47	113		
282*																											18	142		
283																											140	20		
284																											40	120		
285																											138	22		
286																											82	78		
287																											137	23		
288																											33	127		
289																											127	33		
290																											120	40		
291*																											9	151		
292																											61	99		
293																											138	22		
294																											70	90		
295																											97	63		
296*																											63	97		
297																											147	13		
298																											99	61		
299																											130	30		
300																											98	62		
Subtotal	5																										4821	3176		

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
251														160					
252														85			75		
253*														18			142		
254*														1			159		
255*																	160		
256																	160		
257																	160		
258															2		158		
259															15		145		
260*																	160		
261																	160		
262															10		150		
263															37		123		
264															96		64		
265															127		33		
266															17		143		
267															61		99		
268*															77		83		
269															33	3	124		
270*															135	11	14		
271															48	112			
272															35	125			
273																160			
274															85	75			
275															118	34		8	
276														4	22	134			
277														99		43	13	5	
278														18		11	131		
279														78			82		
280														8	34		118		
281															160				
282*															142		18		
283															20		140		
284															140		20		
285															20		140		
286															155		5		
287															115		45		
288															160				
289															120		40		
290															160				
291*															45		115		
292															160				
293															70		90		
294															67		93		
295															43		117		
296*															33		127		
297																	160		
298															43		117		
299															77		83		
300															83		77		
Subtotal														471	2765	708	4043	13	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
301																											136	36		
302																											145	15		
303*																											155	5		
304*																											156	4		
305																											150	18		
306																											40	120		
307*																										15		145		
308*																											26	136		
309																											90	70		
310																											113	67		
311																											85	95		
312																											117	63		
313																											118	62		
314																											85	75		
315*																											122	30		
316																											85	75		
317																											67	113		
318																									30		76	26		
319																									100		5	55		
320																									84		73	6		
321																									110			30		
322																									110			30		
323																									40		90	30		
324*																									23		137			
325*																									73		18	70		
326							28			132																				
327*						13				147																				
328							6			156																				
329		5					70			85																				
330		55					40																							
331*																														
332						30	62																							
333																														
334						90																								
335*						73																								
336						85	5																							
337							9																							
338		8				46			1																					
339			25			72								63																
340			120			40																								
341*			100																											
342			[illegible]			27																								
343		63	57			48																								
344			63			117																								
345			120			36																								
346*			144											15							1									
347			125											35																
348			109				34																							
349		36	119				5																							
350			110				30																							
Subtotal		167	1201			667	326		1	520				113							1				504	15	2049	1362		

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
301															40		112		
302													30				110		
303*															26		134		
304*															35		125		
305															9		151		
306															117		63		
307*													10		150				
308*													160						
309													157				3		
310													156				4		
311													146	6			40		
312													5	52			103		
313														102			50		
314														97			63		
315*														63			117		
316														40			120		
317														105			55		
318														5			155		
319														89			71		
320														160					
321														160					
322														160					
323														160					
324*														160					
325*														160					
326																160			
327*																160			
328											46					114			
329											65					95			
330						65					13					167			
331*						160					40					120			
332						78					60					100			
333																			
334						30										160			
335*						87										160			
336						70										160			
337						151					40					120			
338						105										160			
339																160			
340																160			
341*																160			
342																160			
343																160			
344																160			
345																160			
346*																160			
347											16					144			
348											99					61			
349											95					60		5	
350											141					15		4	
Subtotal						786					615		664	1499	385	3216	1672	9	

Table 6-1. Research Units (continued)

Research Quadrant	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
	TERRAIN UNITS																													
351			40								120																			
352			3								157																			
353		20	132																											
354	31		42			30	57																							
355*			80				80																							
356*							160																							
357*							160																							
358			40				112																							
359*			20		92		32																							
360					110																									
361			10		66																									
362					8																									
363					102				9																					
364*																														
365							29																							
366	2			35																										17
367	2			13			70																							
368	3	15	19	26			86														11									
369		6	36				54		32												4									
370			9						112																					
371									50																					
372*		5							130																					
373		12							77																					
374		26	3						75																					
375		17					65		13																					
376							6																							
377			8				3																							
378			7				20																							
379			8		80		12																							
380		1			102		69																							
381					92		60																							
382*					106		56																							
383	16		9		115		1																							19
384a			55		105																									
384b			135																											
385	15		59																											
386*			25						4																					
387									2																					
388*			26																											
389			2																											
390									60																					
391			2																											
392	27			45																										
393	8			91																										
394	57		3	66																										
395			96	11	30																									
396		17	128		15																									
397*			3	157																										
398		22	119		19																									
399		7	120		33																									
400		75	85																											
Subtotal	161	229	1360	444	1083	30	1136		560		277										15									36

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
351											136					24			
352											160								
353											113					47			
354											130					30			
355*											50					110			
356*																160			
357*																160			
358																160			
359*						8										160			
360		22				28						8				152			
361						84					7					153			
362						152					81					79			
363						49					26					133		1	
364*						160					141					19			
365						70	61				64					95		1	
366						64	42				87					72		1	
367							67				125					35			
368											76	82						2	
369						30					148	12							
370						30					139	21							
371						102					155	5							
372*						25					138	22							
373						71					76	84							
374						38					153	7							
375						65					155	5							
376						154					64	33				63			
377						149						84				76			
378						125						141				19			
379						60					15	4				141			
380						8					24	73				63			
381											40	19				101			
382*											36					116		8	
383																160			
384a																158		2	
384b							25									160			
385								80								154		6	
386*								131			24					136			
387								150			76					84			
388*								134			17					143			
389								150								160			
390								112								134		26	
391								150								160			
392								80								160			
393								61			29					131			
394								36								160			
395								15								160			
396											17					138		5	
397*																160			
398											50					102		8	
399																160			
400											7		59			88		6	
Subtotal		22				1499	195	1135			2579	602	59			4850		62	

Table 6-1. Research Units (continued)

Research Quadrat	Terrain Units																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
401			37		123																									
402	26	26	100																											
403	22		7		131																									
404*	3				157																									
405*					160																									
406	22				138																									
407	5		80		75																									
408*			142		18																									
409			160																											
410*			160																											
411	56		6		98																									
412	6		52		102																									
413	13				147																									
414			92		68																									
415			46		114																									
416		54	106																											
417		26	86					48																						
418	7							153																						
419								160																						
420	71							89																						
421	7							37						116																
422	28							2						130																
423	33							49						78																
424	1							149						10																
425*								160																						
426								160																						
427								160																						
428								160																						
429*								160																						
430	21							139																						
431	17							129						16																
432	13							65						82																
433							57	103																						
434																														
435							134	26																						
436							7	121			9							23												
437	6							77		77																				
438	46	11						102		1																				
439	16							111																						
440		33						127																						
441								69																						
442								96																						
443*								76																						
444*		36	7					55																						
445		21																												
446			95																											
447			138																											
448			66																											
449			87		73																									
450			78		82																									
Subtotal	417	207	1553		1486		198	2761		78	9			430				23												

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
401																160			
402													57			103			
403																160			
404*																159		1	
405*																160			
406																160			
407																160			
408*																160			
409																160			
410*																160			
411																160			
412																160			
413																160			
414																160			
415																160			
416																145		15	
417													84			71		5	
418													93			67			
419													93			67			
420																160			
421																160			
422																160			
423																160			
424																160			
425*															54	106			
426															88	72			
427															25	135			
428															89	71			
429*															15	145			
430															3	157			
431																160			
432																160			
433																160			
434																			
435																160			
436																160			
437																160			
438																158		2	
439						33					9					151			
440																157		3	
441							111				80					80			
442							66									159		1	
443*							86				1					159			
444*							66				104					56			
445							139				134					26			
446							65				160								
447							22				160								
448							94				160								
449											160								
450											160								
Subtotal						33	665				1128		327		274	6004		27	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
451*			140		11																									
452			36		1		125																							
453*						4	153					3																		
454						13	51					96																		
455		68					66			1		65																		
456		57	18			8	82					3																		
457		62				14	66			36		4																		
458		9	13							60				80																
459		19	118											23																
460			15				34					10		101																
461*		28	107									23		2																
462			11				35					114																		
463							112					48																		
464*			41									119																		
465			109				33					18																		
466			7				153																							
467							49							111																
468							81			23				56																
469*										4				156																
470							125							35																
471			49				63					48																		
472							125					35																		
473*							129					31																		
474							156					4																		
475							116					66																		
476							123					14		23																
477							80							100																
478							49							111																
479							98							62																
480*	14						4							162																
481	41						30							80																
482	11													169																
483	31													129																
484	42													118																
485*							4							156																
486*	115					8	37																							
487	66	14				12	60																							
488		35				125																								
489	2	11				147																								
490*		1				159																								
491	3					157																								
492	8					152																								
493	8					160			3																					
494						113			67																					
495						31			129																					
496						153			7																					
497						62			30	70																				
498		101				37				22																				
499*						160																								
500		53				73				36																				
Subtotal	341	428	663		12	1577	2225		214	217		861		1652																

Table 6-1. Research Units (continued)

Research	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
Quadrant	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
451*											160								
452											105						55		
453*											105						55		
454											103						57		
455											72						80		
456											4					6	150		
457											26					30	106		
458																4	156		
459																90	61		
460																83	77		
461*																165	15		
462																157	3		
463																160			
464*											5					155			
465													45			115			
466											11					149			
467											37					123			
468											42					109	9		
469*											62					27	71		
470											13					116	33		
471											96					66			
472											80					70			
473*											166					36			
474											103					57			
475												19				21	120		
476												4				37	119		
477											41					30	109		
478												3			73		86		
479												111			29		20		
480*															22		130		
481											80				9		63		
482															153		7		
483													26		6		120		
484															57		103		
485*														3	115		42		
486*											31			129					
487											18			142					
488														32	120				
489														12	140				
490*													19	1	160				
491													16		166				
492															160				
493															160				
494													9		151				
495													72		80				
496													3		157				
497													1	36	125				
498														36	86			40	
499*															60		91		
500													15	36	111			10	
Subtotal											1354	137	206	411	2131	1751	1960	50	

Table 6-1. Research Units (continued)

Research Quadrant	TERRAIN UNITS																													
	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
501		40				111																								
502		119				41																								
503		53				107																								
504		164				16																								
505		82				78																								
506*		160																												
507*		160																												
508						160																								
509		15				64								86																
510		13				71								76																
511			36			124																								
512*						160																								
513a							65							95																
513b		77												83																
514							131					29																		
515							160																							
516				87			30					36																		
517				64			96																							
518				72										80																
519*														160																
520							7							153																
521							131					13		16																
522*							157					3																		
523							94							66																
524							90							70																
525*			14			63	2			21				60																
526			9							23				128																
527			35	7										118																
528			97	27		10				19				7																
529	10		122				20																							
530	21		81		58																									
531			143		17																									
532			19		15							60																		
533			21									58																		
534			30																											
535			2																											
536*																														
537								42																						
538								79																						
539								130			30																			
540	2						58	100																						
541	60						36	84																						
542	75							85																						
543*								160																						
544			40					112																						
545			30					121																						
546	25							106						29																
547	3							77						80																
548								89						71																
549*								160																						
550		163																												
551		160																												
Subtotal	176	1192	696	257	90	1002	1094	1365		63	30	205		1304																

Table 6-1. Research Units (continued)

Research Quadrant	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
501													3		127			30	
502													3		90			67	
503															135			25	
504															100			60	
505															160				
506*															140			20	
507*															150			10	
508															160				
509															160				
510															160				
511														25	135				
512*															160				
513a													160						
513b											142						18		
514											14						146		
515											111					40	9		
516											116					44			
517											55					105			
518											84					76			
519*											26					95	39		
520											111					49			
521											46					114			
522*																160			
523																55	105		
524																	160		
525*																86	74		
526																57	103		
527																65	95		
528																42	118		
529											138						22		
530											160								
531											160								
532								50			160								
533								81			160								
534						130					126					34			
535						158					84					76			
536*						160					154					6			
537						118					4					156			
538						81										160			
539																160			
540																160			
541																160			
542																160			
543*																160			
544															4	55	101		
545																93	67		
546																160			
547																160			
548																160			
549*																160			
550															160				
551													20		140				
Subtotal						647		139			1051		186	25	1901	3008	1057	212	

Table 6-1. Research Units (continued)

Research Quadrant	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
1-50			300					236	2019	893		30			
51-100	378	166	2718						35	10					
101-150	562	1039	291						907	467					
151-200	142	195							1669	900					1276
201-250	385	999								57					4712
250-300	5														
301-350		167	1281			667	324		1	520				113	
351-400	161	229	1360	444	1003	30	1136		560		277				
401-450	417	207	1553		1406		190	2761		70	9			430	
451-500	341	430	663		12	3577	2225		214	217		661		1652	
501-551	176	1192	606	257	90	2002	1094	1365		63	30	205		1304	
TOTAL	2547	4632	9314	701	2671	3256	4975	4362	6205	3285	316	896	0	3579	5986
PERCENT	2.88	5.26	10.60	.79	3.02	3.68	5.62	4.91	7.01	3.71	.36	1.01	0	4.06	6.77

Research Quadrant	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
1-50		80	1329			1113						455			265
51-100			1756											230	5
101-150	246		1090	91				32						13	
151-200	1269		1073		1	336		19							
201-250									210			234	393		
250-300												4821	3174		
301-350						1				506	15	2049	1362		
351-400						15									36
401-450			23												
451-500															
501-551															
TOTAL	1515	80	6871	91	1	1465	0	51	210	506	15	7559	4809	263	306
PERCENT	1.71	.09	7.77	.10	.01	1.66	0	.05	.23	.67	.02	8.56	5.44	.27	.35

Research Quadrant	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40
1-50										
51-100		751	1580	379						
101-150		25	1600	863	14					
151-200	262									
201-250	1270									
251-300										
301-350						706				
351-400		22				1499	195	1135		
401-450						33	645			
451-500										
501-551						667		139		
TOTAL	1512	790	3180	1222	14	2965	840	1274	0	0
PERCENT	1.71	.90	3.59	1.38	.02	3.38	.92	1.47	0	0

Research Quadrant	C1	C2	C3	C4	C5	C6	C7	C8	C9
1-50		220		2200	3100	571	1009	760	
51-100		3600	705	493	2601		470	33	
101-150		1954	1495	119	2059	2293		80	
151-200			23	1741	569	1452	4053	95	67
201-250			367	515		2670	4607	341	
251-300				671	2765	700	4063	13	
301-350	615		666	1699	305	3216	1472	9	
351-400	2579	602	59			4050		62	
401-450	1120		327		276	6006		27	
451-500	1354	137	306	411	2131	1751	1960	50	
501-551	1051		106	25	1901	3000	1057	212	
TOTAL	7527	6521	3792	7474	16035	26611	18831	1462	67
PERCENT	8.52	7.38	4.29	8.46	18.16	30.13	21.32	1.66	.08

6.2 Sample Selection

After dividing up the project area into 552 equal-sized, 160-acre quadrants, a sample of 110, or 20% of the total number, was drawn (Table 6-2). The sample was drawn with a close eye cast on population specifications -- in other words, to insure that the kinds and quantities of cultural values observed during the survey do not differ from those predicted for the area because of incomplete sample specifications. For instance, our background research has provided us with reason to suspect that different kinds of sites are found in different Terrain and Vegetative Units. If survey information focused on one particular topographic region, we would not be able to summarize the range of cultural values found in the project area. Our approach to this problem was to select the 110 quadrants such that they would fairly represent the range of variation for both Terrain and Vegetative Units, while at the same time maintaining as complete coverage of the project area as possible. Such an approach makes the best use of data from the predictive models in recovering the full range of cultural values from the area of interest by providing assurance that some areas are not over- or under-represented in the sample.

In order to determine how well our sampling quadrants represented the kinds and quantities of environmental units in the project area, we first sought information about the correlation between the proportions of area for each Vegetative Unit in the sample quadrants and the proportions of areas in the project area's Vegetative Units (Table 6-3).

Key to Table 6-2

Unit No.	Unit Symbol	Unit Name
		Terrain Units
A1	= O	Organic materials
A2	= Fp	Flood plain deposits
A3	= Gta	Ablation till
A4	= GFk	Kame deposits
A5	= $\frac{\text{Gta}}{\text{Bxu}}$	Ablation till over unweathered bedrock
A6	= Gtb-f	Basal till (frozen)
A7	= $\frac{\text{C}}{\text{Bxu}}$ +Bxu	Colluvium over bedrock and bedrock exposure
A8	= $\frac{\text{L}}{\text{Gtb-f}}$	Lacustrine deposits over basal till
A9	= Fpt	Terrace
A10	= Ffg	Granular alluvial fan
A11	= GFe	Esker deposits
A12	= Bxu	Unweathered, consolidated bedrock
A13	= $\frac{\text{Cs-f}}{\text{Fpt}}$	Solifluction deposits (frozen) over terrace sediments
A14	= $\frac{\text{Gtb-f}}{\text{Bxu}}$	Frozen basal till over bedrock
A15	= $\frac{\text{Ff-c+O}}{\text{Ff}}$	Fan cover deposits and organics over fan river bed deposits
A16	= $\frac{\text{C}}{\text{Scv}}$ +Scv	Colluvium over bedrock and bedrock exposure
A17	= Mt	Marine tidal deposits
A18	= GFo	Outwash deposits
A19	= $\frac{\text{Cs}}{\text{GFo}}$	Solifluction deposits over outwash
A20	= $\frac{\text{C}}{\text{Nwu}}$ +Nwu	Colluvium over bedrock and bedrock exposure
A21	= Gto	Glacial till
A22	= $\frac{\text{Cs}}{\text{Nwv}}$	Solifluction deposits over weathered bedrock
A23	= Cl	Landslide deposits
A24	= Fpa-c	Abandoned flood plain deposits
A25	= Ht	Tailings
A26	= $\frac{\text{C+Elu}}{\text{Nwv}}$	Colluvium and loess over weathered bedrock
A27	= Fss	Silty retransported deposits
A28	= Elu	Eolian loess
A29	= Es	Eolian sand
A30	= C	Colluvial deposits
A31	= Ff-r	Alluvial fan channel sediments
A32	= $\frac{\text{O}}{\text{GFo}}$	Organic deposits over outwash
A33	= $\frac{\text{O}}{\text{Fd}}$	Organics over deltaic deposits
A34	= Fd	Fluvial delta deposit
A35	= $\frac{\text{Cs}}{\text{Scv}}$	Solifluction deposits over bedrock
A36	= $\frac{\text{Cs-f}}{\text{Gtb-f}}$	Solifluction deposits (frozen) over basal till (frozen)
A37	= $\frac{\text{Cs-f}}{\text{Gta}}$	Solifluction deposits (frozen) over ablation till
A38	= $\frac{\text{Cs-f}}{\text{Bxu}}$	Solifluction deposits (frozen) over bedrock
A39	= not used at this time	
A40	= not used at this time	
		Vegetative Units
C1	= Dt	Dry tundra
C2	= Wt/m	Wet tundra/marshland
C3	= Cf	Coniferous forest
C4	= Df	Deciduous forest
C5	= Mf	Mixed forest
C6	= Ls	Low shrub
C7	= Dts/Ts	Dwarf tree shrub/Tall shrub
C8	= Dev; D	Developed; Water/barren
C9	= Rb/La	Recently burned/logged area

Table 6-2

Sample Units

Sample Quadrant	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
															TERRAIN UNITS															
3*									163									17												
7*									155									3									2			
26*									17	101											28									16
32*																		160												
33*																		160												
34*																		160												
39*			160																											
41*			160																											
43*									13												15									132
46*								84													76									
48*			6					11	26												119									
49*									23								80				47									8
52*	80		80																											
56*			160																											
60*			151															9												
65*																		160												
69*																		160												
76*																														
86*			130																											
90*			61																											
91*																													65	
92*		15																											5	
102*																														
113*																														
120*	47								77									36												
129*		153																7												
132*																														
136*	9															137														
140*										156								6												
143*										100								40												
145*																		160												
146*																		160												
152*										124								36												
163*		46							39									75												
167*									160																					
168*									160																					
169*									160																					
171*	5								155																					
188*															16	166														
190*															160															
199*	20														3															
201*															76															
209*															160															
213*															160															
217*															160															
222*															160															
225*															160															
229*															160															
231*	48														52															
263*		160																												
Subtotal	209	374	916					95	1126	481					1263	303	80	1367			285						2		70	156

Table 6-2. Sample Units (continued)

Sample Quadrat	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
3*																	144	16	
7*															72		72	16	
26*														153				7	
32*															160				
33*															160				
36*															160				
39*														47	113				
41*												53			107				
43*														160					
46*															160				
48*												30			130				
49*												60			20			80	
52*												80			1		79		
56*												143			17				
60*															160				
65*														140	13		7		
6[illegible]*													160						
74*		160										160							
86*			22									84			76				
90*			99									136			26				
91*				115											160				
92*			29	111								31			129				
102*			160									160							
113*			160									160							
120*												131			29				
129*													160						
132*			160									160							
136*					14										126	34			
140*															156	4			
143*															3	157			
145*															4	156			
146*															35	125			
152*															128	32			
163*																77	63	20	
167*																	160		
168*																	160		
169*																	160		
171*														15			145		
188*														35	125				
190*															52		108		
199*	137																160		
201*	84													15			145		
209*																160			
213*																160			
217*																32	128		
222*																108	52		
225*																87	73		
229*	20																160		
231*	60																160		
243*													60				60	60	
Subtotal	301	160	630	226	14							1388	360	565	2320	1132	2036	199	

Table 6-2. Sample Units (continued)

Sample Quadrant	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
														TERRAIN UNITS																
244*		160																												
253*																											158	2		
254*	4																										151	5		
255*	1																										159			
260*																											158	2		
268*																											16	144		
270*																											168	12		
282*																											18	162		
291*																											9	151		
296*																											63	97		
303*																											155	5		
306*																											156	4		
307*																										15		165		
308*																											26	134		
315*																											122	30		
324*																									23		137			
325*																									72		18	70		
327*						13				147																				
331*																														
335*						73																								
341*			160																											
346*			144											15							1									
355*			80				40																							
356*							160																							
357*							160																							
359*			28		92		32																							
364*																														
372*		5							130																					
382*					106		56																							
386*			25						4																					
388*			36																											
397*			3	157																										
404*	3				157																									
405*					160																									
408*			142		18																									
410*			160																											
425*								160																						
429*								160																						
443*								76																						
444*		36	7					55																						
651*			149		11																									
653*						4	153					3																		
661*		28	107									23		2																
666*			41									119																		
669*										4				156																
673*							129					31																		
680*	16						4							142																
685*							4							136																
686*	115					8	37																							
690*		1				140																								
Subtotal	137	228	1072	157	564	257	813	449	136	151		176		471							1				95	15	1404	951		

Table 6-2. Sample Units (continued)

Sample Quadrant	TERRAIN UNITS (continued)										VEGETATIVE UNITS								
	A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	C1	C2	C3	C4	C5	C6	C7	C8	C9
244*													7				93	60	
253*														10			142		
254*														1			159		
255*																	160		
260*																	160		
266*															77		83		
270*															135	11	34		
282*															142		18		
291*															65		115		
296*															33		127		
303*															26		134		
304*															35		125		
307*													10		150				
308*													160						
315*														43			117		
324*														160					
325*														160					
327*																160			
331*						160					40					120			
335*						87										160			
341*																160			
346*																160			
353*											50					110			
356*																160			
357*																160			
359*						8										160			
364*						160					141					19			
372*						25					139	22							
382*											36					116		8	
386*								131			36					136			
388*								134			17					143			
397*																160			
404*																159		3	
405*																160			
408*																160			
410*																160			
425*															56	106			
429*															15	145			
443*							86				1					159			
444*							64				106					56			
451*											160								
453*											105						55		
461*																145	15		
466*											5					155			
469*											62					27	71		
473*											146					36			
480*															22		130		
485*														3	115		42		
486*											31			129					
490*													19	1	140				
Subtotal						440	150	265			1060	22	196	515	909	3301	1760	60	

Table 6-2. Sample Units (continued)

Sample Quadrant	TERRAIN UNITS A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
499*						160									
506*		160													
507*		160													
512*						160									
519*														160	
522*							157					3			
525*			14			63	2			21				60	
536*															
563*								160							
569*								160							
Subtotal		320	14			383	159	320		21		3		220	

Sample Quadrant	TERRAIN UNITS A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
499*															
506*															
507*															
512*															
519*															
522*															
525*															
536*															
563*															
569*															
Subtotal															

Sample Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
499*															69		91		
506*															140			20	
507*															150			10	
512*															160				
519*											26					95	39		
522*																160			
525*																86	76		
536*						160					154					6			
563*																160			
569*																160			
Subtotal						160					180				519	667	204	30	

Table 6-2. Sample Units (continued)

Sample Quadrant	TERRAIN UNITS A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15
3-263	209	376	916					95	1126	481					1265
264-400	137	228	1072	157	564	257	813	449	134	151		176		471	
400-569		328	14			383	159	320		21		3		220	
TOTAL	346	932	2002	157	564	640	972	864	1260	653	0	179	0	691	1265
PERCENT	2.0	5.2	11.4	0.9	3.1	3.6	5.5	4.9	7.2	3.7	0	1.0	0	3.9	7.1

Sample Quadrant	TERRAIN UNITS A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30
3-263	283	88	1367			285						2		50	156
264-400						1				95	15	1494	951		
400-569															
TOTAL	283	88	1367	0	0	286	0	0	0	95	15	1496	951	50	156
PERCENT	1.6	0.5	7.8	0	0	1.6	0	0	0	0.5	0.1	8.5	5.4	0.3	0.9

Sample Quadrant	TERRAIN UNITS (continued) A31	A32	A33	A34	A35	A36	A37	A38	A39	A40	VEGETATIVE UNITS C1	C2	C3	C4	C5	C6	C7	C8	C9
3-263	301	160	630	225	14							1388	360	565	2320	1132	2036	199	
264-400						440	150	265			1060	22	196	515	989	3301	1760	60	
400-569						160					180				519	667	204	30	
TOTAL	301	160	630	226	14	600	150	265	0	0	1240	1410	556	1080	3828	5100	4000	290	0
PERCENT	1.6	0.9	3.6	1.3	0.1	3.4	0.9	1.5	0	0	6.9	8.0	3.2	6.1	21.8	29.4	22.8	1.6	0

Table 6-3
Proportions of Vegetative Units in the Sample and Survey Areas

Vegetative Unit	Proportion of Acres in Sample	Proportion of Acres in Survey Area
C1	.07	.09
C2	.08	.07
C3	.03	.04
C4	.06	.08
C5	.22	.18
C6	.29	.30
C7	.23	.21
C8	.02	.02
C9	.00	<.01

The Spearman rank correlation coefficient was selected to measure the degree of association between the two series. The problem of association between ordinal scales can be viewed as a matter of guessing order. The problem here is the degree to which a vegetation unit's relative position or rank in one ordinal scale is predictable from its rank in another. In order to compute the Spearman coefficient between the two sets of proportions, it was necessary to rank them in two series. The ranks of the proportions given in Table 6-3 are shown in Table 6-4. Thus, for example, Table 6-2 shows that Vegetative Unit C6, Low shrub, which showed the highest proportion of acres in the project area, also showed the highest proportion of acres in the sample, and this was assigned a rank of 9 on both variables. The reader will observe that no Vegetative Unit's rank in one series was more than 2 ranks distant from its rank on the other series. For the acreage proportions in these nine units, the correlation between the sample and the project area ranks is $\underline{r}$=.99. This observed value exceeds the table value of .783 for nine observations and = .01. Thus, we conclude that there is association between our sample proportions and the study area proportions.

Table 6-4
Rank Proportions of Vegetative Units in the Sample and Survey Areas

Vegetative Unit	Rank Proportion of Acres in Sample	Rank Proportion of Acres in Project Area
C1	5	6
C2	6	4
C3	3	3
C4	4	5
C5	7	7
C6	9	9
C7	8	8
C8	2	2
C9	1	1

One alternative to this approach was to treat the percentage data as interval scales and calculate Pearson's coefficient of correlation to describe the degree and direction of linear association between the two sets of numbers. Pearson's coefficient also can be understood in terms of guesses, but it is distinct in terms of how guesses are made and how errors are tabulated. While association in nominal scales involves the notion of guessing class membership, and we have seen that in ordinal scales the problem is one of guessing order, when it comes to interval scales, association is a question of guessing scores or values on measures. Because the scores or values we are dealing with constitute a "closed series," that is, each series is constrained to add up to 1.00, and because of other measurement and sampling considerations, we felt the nonparametric statistical test best fit this particular problem. A Pearson's correlation coefficient for the same series was computed to see if there was any great discrepancy between the interval scale measure and the ordinal scale measure. The computed value of .99 for the Pearson's coefficient indicates a reasonable agreement with the Spearman coefficient value, which also is .99.

As part of our evaluation, we also wanted to know whether the data suggest an agreement between the proportion of acres for each Terrain Unit in the project area and the proportion of acres in each Terrain Unit in our sample (Table 6-5). We express this question by again asking whether a correlation exists between project area proportions and sample proportions as measured by ranks. The calculated test statistic r_s=.995, which is greater than the critical value of .47 for a=.01 and 31 ranks suggests a great deal of agreement between the project area proportions and the sample proportions.

6.3 Field Methods for Testing the Predictive Model

6.3.1 Field Logistics

Four pedestrian field crews of four persons each, each under the direct supervision of an experienced, graduate-level archeologist and under overall supervision of Glenn Bacon, Co-Investigator, will conduct the field reconnaissance. Notes regarding general daily activities, weather, ground cover, natural features, and other pertinent information will be kept by each crew. These notes will contain information not otherwise found in site forms. Such notes can be easily maintained by each crew on Sample Quadrant Records (Fig. 6-2) upon completion of each survey unit. These records allow for easier field review and later analysis of data.

6.3.2 Transect Intervals and Frequency of Subsurface Testing

Average case size is summarized by Terrain Unit, Vegetative Unit, Site Type, and Period of Occupation in Table 6-6. Twenty-one of the recorded cases did not have case size data; therefore, these have been deleted from this phase of analysis, leaving us with a population of 455. Overall, the average site size is 962

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Table 6-5
Rank Proportions of Terrain Units
in the Sample and Survey Areas

	Rank Proportion of Acres in Sample	Rank Proportion of Acres in Project Area
A1	16	16
A2	24	24
A3	31	31
A4	8	7
A5	17	17
A6	20	20
A7	26	26
A8	23	23
A9	27.5	28
A10	21	21
A12	10	10
A14	22	22
A15	27.5	27
A16	13	14.5
A17	4	3
A18	29	29
A21	14	13
A23	5	6
A26	2	1.5
A27	30	30
A28	25	25
A29	3	4
A30	7	5
A31	15	14.5
A32	9	8
A33	19	19
A34	11	11
A35	1	1.5
A36	18	18
A37	6	9
A38	12	12

CULTURAL RESOURCE SAMPLE QUADRANT RECORD

1. Sample Unit number: ____________________
2. Sample Unit legal description: ____________________
3. Date inventory in sample unit began: ____________________
4. Date inventory in sample unit finished: ____________________
5. Cultural resource sites found in sample unit: ____________________
   Field Site Number — Very Brief Description

6. Isolated artifacts found: ____________________
   Legal location — Very Brief Description

7. Number, location, and results of subsurface tests.

8. Directions for locating Sample Unit; landowner name (phone no.)

9. General comments on topography and environment of Sample Unit.

10. Percentage and/or acreage of environmental units.

12. "Testability" of unit (note % of permafrost, bedrock, or other inhibiting factor).

13. Names of crew members working in Sample Unit.

14. Other relevant information (i.e., visible cultural resources in adjacent units).

SECTION OF MAP SHOWING

SAMPLE UNIT

Figure 6-2. Sample Unit Record.

Table 6-6
Average Site Size by Terrain Unit, Vegetative Unit, Site Type, and Period of Occupation

Terrain Unit			Vegetative Unit			Site Type			Period of Occupation		
Unit No.	Average Site Size	No. of Sites	Unit No.	Average Site Size	No. of Sites	Unit No.	Average Site Size	No. of Sites	Unit No.	Average Site Size	No. of Sites
A2	250	12	C1	1,017	25	1	216	217	0	287	197
A3	299	78	C2	223	10	2	15	1	1	3,841	78
A4	90	40	C3	223	170	3	340	94	3	609	119
A5	605	31	C4	374	17	5	5,117	9	5	66	40
A6	265	19	C5	4,684	66	7	7	34	7	48	2
A7	171	25	C6	291	144	8	2,104	5	9	520	9
A8	191	67	C7	185	10	10	38	2	11	165	10
A9	1,361	59	C8	995	13	15	1,292	3			
A10	14,475	17				21	789	30			
A11	64	7				22	160	2			
A12	1,412	9				23	796	10			
A13	625	8				24	1,179	15			
A14	65	13				25	338	3			
A15	100	1				26	358	6			
A16	119	7				27	550	9			
A17	550	2				28	240,000	1			
A18	553	8				29	1	1			
A19	87	18				40	40	13			
A20	253	6									
A21	1,081	5									
A23	150	1									
A24	200	3									
A25	482	11									
A27	200	1									
A28	300	1									
A29	22	6									

sq. meters, but this includes 57 cases recorded as 1 m^2, the majority of which are isolates, plus 2 historic cases over 20,000 sq. meters in size. Therefore, a second computer run was made that elminated sites smaller than 2 m^2 and larger than 20,000 sq. meters. The average case size for this run is 387 sq. meters for 396 cases.

Analysis of variance was also run for Site Size by Terrain Unit, Vegetative Unit, Site Type, and Period of Occupation to determine if significant relationships were discernable. In only one case did this analysis show a statistically significant correlation. This correlation was between Site Size and Period of Occupation when the extremely large sites, all of which were historic, were included. However, the second run results indicated that the extremely large sites had overwhelmingly influenced the analysis. Generally, it can be concluded that significant correlations were not determined due to the small sample size and heterogeneous nature of the population under study. This is not to say, however, that indications of patterning do not exist.

Terrain Units A9, A10, A12 and A21 have the largest average site sizes (see Table 6-6). After removal of the largest and smallest sites from the population, only Terrain Units A12 and A21 continue to have average site sizes over 1,000 sq. m, with A9 dropping to 591 and A10 dropping to 390. It is interesting to note that Terraces (A9) and Glacial Till (A21) have high proportions of historic cases and moderate proportions of prehistoric camps and lithic scatters. Granular alluvial fans (A10) have high proportions of campsites. Unweathered consolidated bedrock (A12) was not found to have a strong relationship with particular site types or sites from any one time period.

Average site size of below 100 sq. meters characterizes Terrain Units A4, A11, A14, A19 and A29. Only one unit (A4) average increased to over 100 sq. meters after the second run, with the very small and very large cases removed. Esker deposits (A11) and Solifluction deposits over outwash deposits (A19) have high proportions of lithic scatters and moderate proportions of campsites. Frozen basal till over bedrock (A14) and Eolian sand (A29) have high proportions of campsites and moderate proportions of lithic scatters. These small sites will be the hardest to locate, especially if there is no surface visibility.

When Site Size is considered in terms of Vegetative Units (see Table 6-6), there are no units with a site size average of less than 185 sq. meters and the largest average exceeds 4,600 sq. meters. Again, after removing the extremely large and small sites from the sample, the smallest average site size for a unit increases to 195 sq. meters and the largest drops to 1,155 sq. meters.

Vegetative Units with the largest site size average are C1, C5, and C8. Dry tundra (C1) has high proportions of undated lithic scatters, while Mixed forest (C5) and Developed (C8) areas have high proportions of Historic Period sites. The smallest site size averages occur in Vegetative Units C7, C2, and C3. Dwarf tree scrub/Tall shrub (C7) has high proportions of historic sites and moderate proportions of lithic scatters. Wet tundra (C2) and Coniferous forest (C3) both have high proportions of campsites and moderate proportions of lithic scatters.

These aspects of the predictive model provide for planning the survey and testing strategy on a general level. That is, from these results we recognize a need for somewhat narrower survey transects in Terrain and Vegetative Units with small site size averages. However, for a more detailed level of planning and implementation, field observations which have evolved into intuitive models (see Chapter 5) are important.

Incorporating the above information, we propose using transect spacing between surveyors of 20 to 50 meters. The wider spacing will be used in areas of moderate to steep slopes where few sites would be located. Crew members will walk a zig-zag pattern to maximize coverage. For logistical reasons and to avoid the possibility of people getting lost, spacing will not exceed the distance at which people can maintain contact. Hence, 50 meters is a maximum, and may be too broad, spacing to be practical. The narrower spacing will be used when points such as the intersection of a tributary with a drainage are encountered, regardless of Terrain or Vegetative Unit.

6.3.3 Site Recording Procedures

All prehistoric sites will be recorded by the archeological crew. The archeological crew also will record historic sites, later to be reviewed by the Project Historians. The site recording procedures to be employed are designed to document, to the fullest extent possible, all observable cultural and related natural phenomena. For archeological surface sites, the crew members place pin flags by each flake or other cultural indicator to aid visually in determining the extent and density of cultural material. Crew members collect all diagnostic cultural materials. The location of all samples will be plotted on a sketch map of the site, in relation to a datum point established on-site by the crew.

Controlled subsurface shovel testing in areas of poor surface visibility or in areas lacking cutbanks will be implemented in a procedure similar to survey spacing. Tests will be placed every 20 to 50 meters along points of high site probability where surface visible cultural materials have not been located. These controlled shovel tests will be of variable dimensions depending on sediment character and depth, with removed backdirt screened through 1/4" mesh screen by 10-cm increments. Tests will be excavated through 30 to 50 cm of sterile deposits unless bedrock or permafrost are encountered. In the case of permafrost, attempts will be made to expose and thaw the sediments or return to the site if possible. Otherwise, a small bore core (2.5 cm) will be used for subsurface testing. Our goals in subsurface testing are:

(1) to determine the presence and depth of subsurface cultural deposits;

(2) to attempt to determine temporal placement;

(3) to enhance site boundary determinations.

Prehistoric sites encountered in cutbanks require different techniques from those described above. The exposed bank will be cleaned up for stratigraphic examination and recording.

After a site has been defined through surface or bank examination, the crew proceeds to record the site on approved forms, to include:

(1) assigning a temporary field number;

(2) locating the site on a 15-minute quadrangle map or aerial photograph and on the Linear Feature maps;

(3) measuring the site;

(4) specifying concentrations of cultural debris within the site, in addition to features;

(5) recording and coding environmental variables such as Terrain Unit, Vegetative Unit, habitat, local topography, aspect, soil type, view, exposure to wind, rank and order of nearest water, and elevation;

(6) photographing the site in both black-and-white and color film, including an overview shot as well as photos of individual features or concentrations where possible.

(7) sketching the site in relation to topographic features, including the location of subsurface tests and collected artifacts;

(8) when appropriate, carbon samples will be gathered for radiometric analysis.

Historic sites will be recorded in a manner similar to prehistoric sites. Black-and-white and color photographs will be taken of all standing structures in such a way as to show two elevations. Structural condition will be noted by the recording team. In addition, measurements will be made for each structure and feature.

7.0 SUMMARY AND FUTURE RESEARCH CONSIDERATIONS

Sally T. Greiser
Historical Research Associates

The primary goal of the Phase I research was to develop a model which could be used to predict the occurrence and density of cultural resource sites by type, age, and cultural affiliation, if possible, within defined environmental units along the Susitna Hydroelectric Project Linear Features corridors. This model, as presented here, promises to allow for prediction of site distribution by type. Age and cultural affiliation are much more difficult to determine, given the state of cultural chronological development in the study area. As discussed in Chapter 3, several competing chronologies exist, none of which are based on adequate data. A number of suggestions are presented here for future research aimed at the need for a reliable cultural chronology.

Important data categories for refinement of the cultural chronology include lithic assemblages and datable cultural and natural phenomena. For more recent sites, organic remains are plentiful which aid in cultural identification as well as subsistence reconstruction. Unfortunately, for the earlier periods, the variability in material classes is minimal.

Initially, researchers in the area must rethink and justify the basis on which sites are categorized by cultural complex or tradition. A pivotal issue in Alaskan prehistory is the presence or absence of tools and debris representative of a core and blade technology. For example, for sites thought to date between 5000 and 1500 years B.P., UAM archeologists use the presence of microblades to assign sites to the Late Denali Complex and the presence of side-notched points to assign sites to the Northern Archaic Tradition (Dixon et al. 1985). Whereas the case may be as simple and straightforward as this dichotomy appears, the co-occurrence of these two tool types at a number of sites (e.g., Healy Lake) calls us to look further prior to applying a potentially oversimplified scheme. The assumption in this classification scheme is that two cultural traditions are represented on the basis of one tool type per tradition. Although this may, in fact, be the case, thoughtful examination of multiple hypotheses must first be conducted.

A starting point for investigation of such key tool types is the question, "What is the meaning of the difference in technology represented by a core and blade vs. a bifacial reduction system?" The presence of the resultant tools at a site may reflect cultural, temporal, or economic factors. Apparently, little effort has been put toward systematic technological and use-wear analyses of these tool forms in an attempt to determine the source of variability. Even within the core and blade tradition, the source of variability is generally not considered and different core and blade types are used as temporal markers. This practice is common, although Anderson (1970) demonstrated the co-occurrence of four core and blade types at Akmak, from which he concluded that their variety was due to functional differences rather than temporal.

For sites lacking datable carbon, a few avenues are open for determining temporal position. The high frequency of obsidian at sites in the study area provides one avenue for improving the local chronology. In other areas where obsidian is common, establishment of a local hydration rate has proved valuable (e.g., see Davis 1972). In addition to providing an absolute dating method, trace element analysis of the available source materials can help researchers to identify patterns of exploitation which may be informative about particular cultures and their use of and access to the resource base.

Another promising dating source is tephra. UAM researchers have discussed four prehistoric tephra falls, occurring between 5,000 years ago and the beginning of the Christian era. More research is necessary to refine the local tephrochronology, which at this time appears to conflict with some of the radiocarbon results from dated cultural components. However, with refinement, this dating source should prove to be an important contribution toward refining the local chronology.

Although we recognize the importance and usefulness of regional cultural chronologies, this research focus in inherently static. The development of predictive models of hunter-gatherer behavior, based on reconstructed resources and constraints of the environment through time, can provide a process-oriented research framework out of which will eventually come a reasonable chronology. We recognize the limitations of the environmental data base for the Terminal Pleistocene and the first half of the Holocene, but are encouraged by the increasing number of researchers working in this area. For the last 6,000 years, with environmental resources and constraints constant on a macro-level, such modeling should not be too difficult. Of course, smaller-scale environmental phenomena, such as ash falls and ice flows, would need to be incorporated into the model.

Given a best possible reconstruction of environmental resources and constraints, resource use schedules and settlement patterns can be predicted for local groups depending upon their level of technology. A series of hypotheses can be proposed and tested through the implementation of well-thought-out survey and excavation designs. Ultimately, patterns of seasonal behavior will become more visible, as will land use patterns of different cultural traditions.

Through such a focus as is recommended here, basic questions of technology and subsistence can be evaluated in a framework that allows for model refinement. Eventually, not only will a sound cultural chronology emerge, but this framework will allow for a dynamic picture of prehistoric and early history lifeways to be developed.

With regard to the Susitna Linear Features Project, we hope to incorporate such a behavioral model as part of the interpretive scheme for Phase II data analysis. Much of the necessary data are presented in Chapters 2 and 3 and the authors have experience in developing such models for other regions (e.g., Greiser 1985). We believe that the behavioral model would provide the ideal framework for addressing the research questions posed in the Alaska Power Authority's "Cultural Resources: Research Priorities" workshop held in Anchorage in November 1984. Finally, we believe that this model provides for explaining, rather than merely describing, culture change.

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