Chapter III: Affected Environment

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A. Introduction

1. How to Read This Chapter

This chapter contains background information about the physical, biological, and socioeconomic resources, resource uses, and programs that exist or occur on the Bureau of Land Management (BLM) lands managed by the Anchorage Field Office (AFO) in the Bristol Bay and Goodnews Bay regions. This information is provided to establish the environmental baseline for analysis of the direct, indirect, and cumulative effects analyses presented in Chapter IV. Chapter III is organized topically; the order in which topics are addressed is not intended to imply relative importance of the topic.

Section B discusses the affected environment for resources, Section C covers the affected environment for resource uses, Section D is dedicated to special designations, Section E provides background on the social and economic environment, and Section F presents the subsistence environment.

2. Critical and Non-critical Elements of the Human Environment

The Bureau of Land Management National Environmental Policy Act (NEPA) Handbook (H-1790-1) lists critical elements of the human environment and notes the need to consider these resources or values in all forms of analysis under NEPA, including environmental impact statements. The critical elements are drawn from legislation and Executive Orders. BLM has identified 14 critical elements of the human environment for consideration in every environmental document. There are 15 critical elements for discussion in Alaska. They are as follows:

1. Air Quality (The Clean Air Act of 1955, as amended)
2. Areas of Critical Environmental Concern (ACECs) [Federal Land Policy and Management Act (FLPMA) of 1976]
3. Cultural Resources (National Historic Preservation Act of 1966, as amended)
4. Environmental Justice [Executive Order (E.O.) 12898]
5. Farm Lands, Prime or Unique (Surface Mining Control and Reclamation Act of 1977)
6. Floodplains (E.O. 11988, as amended)
7. Invasive, Non-native Species (Lacey Act, as amended, Federal Noxious Weed Act of 1974, as amended; Endangered Species Act of 1973, as amended; and E.O. 13112, Invasive Species, 02/03/99)
8. Native American Religious Concerns (American Indian Religious Freedom Act of 1978)
9. Subsistence [Alaska National Interest Lands Conservation Act (ANILCA) of 1980]
10. Threatened or Endangered Species (Endangered Species Act of 1973, as amended)
11. Wastes, Hazardous or Solid (Resource Conservation and Recovery Act of 1976, and Comprehensive Environmental Response, Compensation, and Liability Act of 1980)
12. Water Quality, Surface & Ground (Clean Water Act of 1987; Safe Drinking Water Act Amendments of 1996; E.O. 12088 amended by E.O. 12580, and E.O. 12372)
13. Wetlands/Riparian Zones (E.O. 11990)
14. Wild and Scenic Rivers (Wild and Scenic Rivers Act of 1968, as amended)
15. Wilderness (FLPMA of 1976 and Wilderness Act of 1964)

All of the above but one is addressed in this environmental impact statement. The missing element is Farm Lands. There are no Farm Lands, Prime or Unique, within the planning area.

3. Geographic Scope

The Bay planning area consists of 23 million acres, of which approximately 2 million acres are managed by BLM. These lands include large blocks and a few scattered tracts of unencumbered BLM land and State- and Native-selected lands. BLM manages 1,163,604 acres of unencumbered land, 52,705 acres of subsurface estate, and 759,656 acres of State- and Native-selected lands. Table 1.1 provides BLM acreage information in the planning area. Selected lands will remain under the management of BLM until land conveyance is complete. BLM Alaska is also responsible for managing both surface and subsurface resources on BLM-managed public lands. For the purposes of the following discussion, the Bay planning area is addressed in terms of two sub-regions, the Bristol Bay area and the Goodnews Bay area.

The Bay planning area is approximately an hour away by air from Anchorage. The planning area extends over 250 miles east-west and 150 miles north-south with virtually no road system access to Bureau managed lands. Nearly all access is by specialized aircraft, small tundra-tire equipped planes, float planes, ski planes, helicopters, or watercraft. Commercial aircraft are used for travel to the communities in the planning area that are served by BLM's Anchorage Field Office (AFO).

Land ownership throughout Alaska continues to change as BLM transfers land from the Federal estate to the Native community and the State of Alaska. The Native community and the State of Alaska, under their respective entitlement statutes, have selected a considerable amount of the acreage in the planning area. BLM will continue to manage selected lands in accordance with statutory or regulatory guidance. Maps 3.1, 3.2, and 3.3 show unencumbered BLM lands in the planning area. They are the main focus of discussion in this chapter.

4. The Planning Process and Existing Management

a) The Planning Process and Public Participation

A Resource Management Plan (RMP) is the primary tool used by BLM to manage lands within BLM's jurisdiction. Resource management plans and planning decisions are the basis for every on-the-ground action BLM undertakes. They ensure that the public lands are managed and used in accordance with the intent of Congress and they provide a framework to ensure that land use plans and implementation decisions remain consistent with applicable laws, regulations, orders and policies. The planning process is also compliant with the provisions of the National Environmental Policy Act (NEPA). NEPA compliance affords the BLM and the public an opportunity to evaluate the environmental consequences of BLM's planning alternatives.

The planning process involves public participation. Public involvement "...means the opportunity for participation by affected citizens in ... planning ... including public meetings or hearings held at locations near the affected lands, or advisory mechanisms, or other such procedures as may be necessary to provide public comment in a particular instance" (FLPMA, Section 103(d)). Scoping is a collaborative public involvement process to identify planning issues to be addressed in the plan. Planning issues are disputes or controversies about existing and potential land and resource allocations, levels of resource use, production, and related management practices. Issues include resource use, development, and protection opportunities for consideration in the preparation of the RMP. Scoping also includes the introduction of preliminary planning criteria to the public for comment.

BLM has documented the results of scoping in a formal scoping report that was made available to the public in fall 2005. The issues and actions defined during the scoping process have been analyzed and have guided the organization of Chapter III with the following goals in mind:

- Identify the relevant physical, biological, social and economic resources.
- Review available resource information.
- Establish an environmental baseline.
- Conduct a past/present effects analysis.

b) Existing Management

The Southwest Planning Area Management Framework Plan (1981) covers only the Goodnews Block.

The Land Use Plan Amendment for Wildland Fire and Fuels Management (2004, 2005) is applicable to all BLM-managed lands within the planning area.

B. Resources

1. Geography and Climate

a) Physiographic Regions

The boundaries of the Bay planning area include a varied landscape that includes portions of the Aleutian Range of mountains and two other mountain ranges, five major lake and river systems, and both coastal and interior environments. Within the area are a variety of pristine ecosystems. The planning area is part of two physiographic or geographic regions, the Pacific mountain system and the central upland and lowland region (Wahrhaftig 1965). Within this same area, a number of ecoregions have been identified. Ecoregions are based on perceived patterns of a combination of causal and integrative factors including land use, land surface form, potential natural vegetation, and soils (Gallant 1996). They are:

- Interior Forested Lowlands and Uplands
- Ahklun and Kilbuck Mountains
- Subarctic Coastal Plain
- Bristol Bay-Nushagak Lowlands
- Alaska Peninsula Mountains
- Alaska Range

b) Environmental Change

Climate trends over the last three decades have shown considerable warming (USDA 2004; UAF 1999; AMAP 1997). This has already led to major changes in the environment and in Alaska's ecosystems. Alaska has experienced the largest regional warming of any state in the U.S., with a rise in average temperature of about five degrees Fahrenheit since the 1960s and eight degrees Fahrenheit in winter (UAF 1999). This has led to extensive melting of glaciers, thawing of permafrost and reduction of sea ice (UAF 1999).

Alaska's warming is part of a larger warming trend throughout the Arctic. The warming has been accompanied by increases in precipitation of roughly 30% between 1968 and 1990 in some areas. Other areas have experienced drying (UAF 1999; McClenahan 2006, Pers. Comm.). Projections suggest that the strong warming trend will continue, particularly warming during the winter months (UAF 1999). Some anticipated changes in weather patterns include intensification of the Aleutian low-pressure system, which may shift slightly southward. Alaska would then continue to grow wetter, with annual precipitation increases of 20-25% in the north and northwest, but little change from present conditions in the southeast. Winters are anticipated to be wetter in the east and drier in the west, with summers being drier in southeast Alaska and wetter elsewhere. Winter soil moisture changes with precipitation, but summer increased evaporation from a warmed climate exceeds any projected increases in precipitation, and soils are dry everywhere (UAF 1999).

Tree growth in the boreal forest depends on temperature and precipitation. Boreal forests may be at risk from climate change associated with regional warming. Potential impacts may include decreases in effective moisture sufficient for forest growth, tree mortality from insect and disease outbreaks, probability of an increase in wildland fires, changes caused by permafrost thawing and invasion of trees, shrubs and other plant species that are acclimated to the new conditions (USDA 2004; UAF 1999).

Regional environmental changes are observed to be impacting the entire Bay planning area, including coastal areas. The reduced sea ice along Alaska's coasts and rising sea level are rapidly eroding the coastal soil. Some of these locations contain archaeological and paleoontological sites (UAF 1999).

Coastal wetlands are being affected by rising sea level and increased storm surges as salt water and beach gravel are being moved inland (UAF 1999). These are natural processes, but should be monitored on BLM-managed lands for effects on a wide variety of resources.

The following impacts have been observed in Alaska in recent years:

- The warmer, drier climate has caused forest problems such as increased tree mortality, fire frequency and insect outbreaks (USDA 2004; Juday 1996; Fleming and Volney 1995).
- Spruce bark beetle outbreaks in Alaska have recently become one of the most widespread infestations observed to date, surpassed recently in Alaska by the aspen leaf miner and the birch leaf miner (USDA 2004). Such infestations of bark beetle have been observed in the forests near Iliamna and those around Dillingham and Aleknagik in the Bay planning area.
- A warmer climate has lengthened the growing season and growing degree days by 20% (UAF 1999).
- Boreal forests are expanding north at the rate of 60 miles for each two degrees Fahrenheit increase (UAF 1999).
- Shrubs and trees are expanding into arctic tundra (Starfield and Chapin 1996; UAF 1999).
- Vegetation communities are being converted to communities with taller, denser vegetation (Starfield and Chapin 1996; Rupp et al. 2000a; Rupp et al. 2000b).
- Concerns about invasion of non-native plants are increasing statewide.

The following effects are anticipated should the current trend continue:

- There is an ever increasing risk of wildland fires in areas that to date have seen few fires (USDA 2004; UAF 1999).
- One projection (Rupp et al. 2000a), for example, shows a 200% increase in the total area burned per decade, leading to a deciduous forest-dominated landscape on the Seward Peninsula, presently dominated by tundra vegetation.
- Burning of the vegetative cover may increase the risk of soil erosion.
- Changes in temperature and precipitation will affect coastal forest hydrology and salmon spawning streams important to subsistence, commercial and sport fisheries (UAF 1999).
- Hydrologic changes in forested watersheds include warmer stream temperatures and lower summer flow from low elevation streams, higher flow from higher elevation streams (already being reported from the New Koliganek region)(BLM 2005b; UAF 1999).
- There are likely to be changes in the range of vertebrate animals and changes in productivity of aquatic ecosystems (UAF 1999). As the boreal forest intrudes further north at the expense of tundra and shrub communities, there will be changes in habitats and the distribution and density of a number of wildlife species on land (UAF 1999).
- Long-term effects might include general treeline advance in elevation as well as latitude; colonization of formerly glaciated lands; and transition of tree species and ecotypes (UAF 1999).
- Regional environmental warming is affecting areas traditionally underlain by permafrost, melting frost wedges, changing drainage patterns, and drying up small lakes and wetland complexes within the Bay planning area. (UAF 1999)
- The nature and composition of soils in this region probably will be affected over time by these changes should the warming trend continue (Birkeland 1999).
- With so much melting of glaciers and permafrost, mechanisms such as slump, soil creep, and mass wasting (i.e. avalanches) can become more active (UAF 1999; McClenahan 2004).

2. Air Quality

Air is a ubiquitous resource vital to most life on earth. Air resources consist of the gaseous atmosphere. The air resources within the Bay planning area are constantly changing as winds and climatic systems move air masses across the globe.

The Air Resources Program oversees this resource according to Federal and State laws. A primary function of the Air Resources Program is to evaluate proposed actions on jurisdictional Federal lands according to the National Environmental Policy Act. There are no specific BLM-AK goals and objectives, other than compliance with Federal and State laws.

The management/enforcement of the air quality standards falls within the jurisdiction of the U.S. Environmental Protection Agency (EPA), which has the primary responsibilities under the Federal Clean Air Act (CAA). The EPA has transferred a number of responsibilities to the states and in most cases, to regional air quality management districts. The Alaska Department of Environmental Conservation, Division of Air Quality, has responsibility for air quality in Alaska. These responsibilities include monitoring, permitting, enforcement, and issuing air advisories for hazardous health conditions when necessary.

To identify an area by its air quality, all geographic areas in the state are designated by the Federal administrator as "attainment," "nonattainment," or "unclassifiable." An area is designated "attainment" for a particular contaminant if its air quality meets the ambient air quality standard for that contaminant. If there is insufficient information to classify an area as attainment or nonattainment for a particular contaminant, the area is designated "unclassifiable" for that contaminant. The Bay planning area has been designated unclassifiable/attainment. For air quality monitoring purposes, Alaska has been divided into four "air quality regions." The Bay planning area falls within the South Central Alaska Intrastate Air Quality Control Region.

The air resources within the planning area are generally considered pristine or of very good quality, except during summer when wildland fires may increase the airborne particulates. This resource may be affected by other natural and human-related activities locally, regionally, or globally. Natural conditions can temporarily degrade air quality. Ash and gases from volcanic eruptions and wind blown glacial till or sand can also degrade air quality. Most of this region is very sparsely populated. Impacts to human inhabitants are generally localized and temporary.

Increasing population and development can stress air resources due to increased emissions from aircraft and vehicle internal combustion engines, burning of wood and fossil fuels, and industrial facilities that emit a broad spectrum of chemical by-products into the air. Portions of this region may continue to experience population growth and a corresponding increase in commercial, residential, and industrial development, which will exert increased demands on the regional air resources.

Primary stressors or sources of air pollution that may degrade local air resources more often will not come from BLM lands, but from surrounding lands within the Bay planning area, based on current and projected land use patterns. Except for issues of smoke from wildland or prescribed fires, wind-blown dust from infrastructure development (for example, dust from newly developed roads with heavy traffic running at high speeds) and airborne contaminant dispersion and deposition (for example, from new or existing mining operations) there are no other known current public issues regarding air quality within the Bay planning area. The State of Alaska Department of Environmental Conservation monitors these activities for air quality violations.

a) Smoke Management

The Alaska Department of Environmental Conservation (ADEC) is responsible for declaring air episodes and for issuing air quality advisories, as appropriate, during periods of poor air quality or inadequate dispersion conditions. ADEC is a member of the Alaska Wildland Fire Coordinating Group. During periods of wildland fire activity, the Multi-Agency Coordinating Group, a sub-group of the Alaska Wildland Fire Coordinating Group, addresses air quality and smoke management issues. As ADEC develops its State Implementation Plan for regional haze, changes may be necessary to address additional fire tracking and emission management needs based upon policies and guidelines developed by the Western Regional Air Partnership. Under State law, all agencies, corporations, and individuals that burn 40 or more acres of land require written approval from ADEC prior to burning. The Enhanced Smoke Management Plan being developed by ADEC will outline the process and items that must be addressed by land management agencies to help ensure that prescribed fire activities minimize smoke and air quality problems. The Enhanced Smoke Management Plan will also address elements required by the EPA regulations: 40 CFR Parts 50 and 51 Treatment of Date Influenced by Exceptional Events.

b) Critical Thresholds

During the NEPA process, air resources are evaluated for impacts. According to the Clean Air Act, each Federal agency must demonstrate that decisions or actions comply with applicable air quality requirements. Non-compliance with the Clean Air Act is a critical threshold that could stop a proposed action. State air quality regulations may also be considered a threshold. If a proposed action is expected to degrade air quality, additional information or further study may be required to quantify the amount of degradation (amount of pollutants released), to analyze the impact the action would have on the air resource (including impacts on human and ecological populations), and to evaluate the action's compliance with Federal and State regulations.

3. Soil resources

The Soil Resources Program is responsible for the protection, restoration, and enhancement of soils on BLM-managed lands. Inventory and monitoring are the typical means used to assess the condition of the resource.

a) Soils Inventory

Except for three soils studies and a number of archaeologically-related soils investigations, no detailed soil resource inventories are known to have been done in the Bay planning area, and none have taken place on BLM-managed lands. However, soils in the Bay planning area have been surveyed on a very broad scale (USDA SCS 1979) (Maps 3.4 and 3.5). This survey is best used for general land use planning and as a guide to areas for a specific purpose. Map units are very large and lacking in detail. Alaska has been divided into fifteen major land resource areas. The Bay area is comprised of portions of the Alaska Peninsula, the Kuskokwim Highlands, and the Western Alaska Coastal Plains and Deltas.

Intensive soil surveys have been done on limited areas, most notably in the Nondalton area (Hinton and Neubauer 1966), the King Salmon-Naknek area (Furbush and Wiedenfeld 1970), and the Dillingham area (Rieger 1965). A brief summary of the major soil associations (USDA SCS 1979) in the Bay planning area (based on soils maps 3.5 and 3.6) are as follows:

(1) Inceptisols (Map 3.4)

Sixty-four percent of the Bay planning area soils are Inceptisols. An Inceptisol is a type of soil in which there has been only relatively minor modification of the parent material by soil-forming processes. There has been enough modification to be able to tell an Inceptisol from an Entisol, but not intense enough to form the kinds of soil horizons (soil layers) that are required for classification in other soil orders. Generally, poorly drained soils with permafrost are considered to be Inceptisols even though they have no diagnostic horizon other than an epipedon. Most soils in Alaska are Inceptisols (USDA SCS 1979:35).

(2) Spodosols (Map 3.4)

Nineteen percent of Bay planning area soils are Spodosols. In Spodosols, organic carbon, aluminum, and in most places, iron, have been leached by percolating water from the upper part of the soil and deposited or precipitated at greater depth to form a spodic horizon. Most Spodosols in Alaska have a surface mat of organic litter, which is at least partially decomposed and a gray mineral horizon (an albic horizon) above the spodic horizon. Spodosols are dominant on uplands in areas with high precipitation, where moisture in excess of that required by the natural vegetation moves completely through the soil. Except in very coarse material and in special situations in tundra areas, Spodosols in Alaska normally occur only where mean annual precipitation exceeds 15 inches. Spodosols are most common in forested areas, but a few occur in western Alaska tundra areas (USDA SCS 1979:46).

(3) Histosols (Map 3.4)

Only 2% of lands within the Bay planning area contain soils known as Histosols, which are made up completely or in large part of organic material. The organic material accumulates under wet conditions, in depressions or other low areas that are nearly always inundated, on slopes affected by seepage, or as a blanket on rolling hills in areas of very high rainfall. Examples of this type of soils can be found at Brooks Lake in Katmai National Park (USDA SCS 1979:30).

(4) Entisols (Map 3.4)

Only 1% of soils within the Bay planning area are classified as Entisols. In Entisols there is little or no evidence of change as a result of soil-forming processes; most of them have few diagnostic horizons. Wet mineral soils are classified as Entisols. In Alaska, Entisols occur most commonly on flood plains and outwash plains which receive new deposits of sediment at frequent intervals, on uplands adjacent to major rivers where new material blown from the river beds is deposited, in other young material, such as recently exposed glacial moraines, and in very cold or very steep areas where vegetation is sparse, where soils are unstable, or where parent material is exceptionally resistant to chemical weathering (USDA SCS 1979:15).

(5) Rough Mountainous Land (Map 3.4)

Fourteen percent of the Bay planning area consists of Rough Mountainous Land (RM1) and Cinder Land (CL). Rough mountainous land is made up of steep rocky slopes, ice fields, and glaciers. Some slopes in the mountains support sparse shrubby vegetation, but most are barren. Thins soils occur in the vegetated areas on lower slopes and in valleys, but almost all are stony and shallow over bedrock or bouldery deposits (USDA SCS 1979:150-151).

Cinder lands can be found on the Alaska Peninsula and on the western Alaska coastal plains and deltas. Areas of fresh volcanic ash and cinder flows occur on slopes of active volcanoes on the Alaska Peninsula. These areas have little or no vegetation except for willows and grasses in deeply incised drainageways, such as the Valley of Ten Thousand Smokes in Katmai National Park. The loose ash is highly subject to disturbance by wind. Because of the instability of the volcanic material and the possibility of future depositions, they are poor sites for roads or buildings. The paucity of vegetation

restricts their value for most wildlife (USDA SCS 1979:56). These areas are unsuitable for agriculture, forestry or building construction. A more detailed breakdown of specific soil types is provided in Map 3.5.

Table 3.1. Soils Found in Bay Planning Area Unencumbered BLM Lands: Suitability and Limitations for Selected Uses

Planning Block, Unencumbered BLM Land	Soil Associations Present	NRCS Suitability and Limitations for Selected Uses (SCS (NRCS) 1979)
Klutuk Creek Block	IA13, IQ2	Unsuitable for livestock grazing; moderate to very severe drawbacks for locating roads, constructing low buildings, slight to very severe drawbacks for recreation and off-road trafficability. Unsuited for commercial forestry. Some areas (IA13) suitable for crops, all areas suitable for caribou.
Iliamna (West) Block	IA7, IA4, IA9, HY5, HY4	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou; primarily valuable for natural water storage and wildlife habitat.
Iliamna (East) Block Chekok Creek Chulitna River	RM1, IA7, SO7 SO7, RM1	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Poor to unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou.
Alagnak Block	IQ2, IA4, IA9	Unsuitable for crops, domestic cattle and sheep grazing; severe to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Unsuited for commercial forestry. Suited for caribou and other wildlife habitat.
Kvichak Block	RM1, IQ2, IA4, HY5, IA7	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Poor to unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; suitable for caribou.
Koggiling Creek Block	IQ2, IA3	Unsuitable for crops, slight to very severe drawbacks for locating roads, constructing low buildings, recreation and off-road trafficability. Unsuited for commercial forestry. Fair to unsuitable for domestic livestock grazing; good for caribou.
Yellow Creek Block	EF1, IA13, IQ2, IA3	Exceptionally high quality of habitat for a large variety of wildlife. Unsuitable for livestock grazing; moderate to very severe drawbacks for locating roads, constructing low buildings, slight to very severe drawbacks for recreation and off-road trafficability. Unsuited for commercial forestry. Some areas suitable for crops.
Goodnews Block	IU1, IU2, IU3, IQ6	Fair to unsuited for crops, poor to unsuited for grazing domestic cattle and sheep; moderate to very severe drawbacks for locating roads, constructing low buildings, recreation, and off-road trafficability. Generally unsuited for commercial forestry. Generally good for caribou.

b) Soils Overview

The soil resources within the planning area are generally considered pristine or unaltered by human activity, except in areas adjacent to villages and urban areas. This resource may be affected by natural forces such as wind and water erosion and from human activities such as road building and mining. A primary function of the Soil Resources Program is to evaluate proposed actions on jurisdictional Federal lands according to the National Environmental Policy Act. For all authorized activities in the area, required operating procedures and stipulations mitigate potential sources of soil degradation.

c) Permafrost

A dominant factor in defining soils is the presence or absence of permafrost. Permafrost is defined as soil, sand, grave, or bedrock that has remained below 32 degrees Fahrenheit for two or more years (Muller 1945). Intermittent throughout the planning area, permafrost can exist as massive ice wedges and lenses in poorly drained soils or as a relatively dry matrix in well-drained gravel or bedrock. During the short arctic summer, these soils thaw, forming a shallow unfrozen zone termed the active layer. Permafrost forms a confining barrier that prevents infiltration of surface water and keeps the active layer of soils saturated. Permafrost also provides the structural integrity to hillsides and stream channel banks. Map 3.6 shows the distribution of permafrost in the planning area.

As permafrost is an integral component of the soils in the planning area, any surface disturbance that removes the overlying vegetation can initiate melting of ice-rich permafrost and result in surface subsidence (termed thermokarsting), drastically altering the surface topography, hydrological regime, and temperature of the underlying soils. As permafrost begins to thaw near the surface, it warms to greater depths, forming thaw ponds, gullies, and beaded streams. The hydrologic and thermal regime of the soil is the primary factor controlling the vegetation. These changes to the thermal regime of the soil initiate a long process of recovery with perhaps 20 to 50 years of cumulative impacts (Hinzman et al. 2000).

Soils and glacial residues in the Bay planning area contain isolated masses of intermittent permafrost. In the Bristol Bay Coastal Plain, permafrost underlies nearly all areas except the southern part of the plain. It is deep or absent in sand dunes and natural levees along streams, except in the case where tall grasses and deep sod exist (USDA SCS 1979). The region is undergoing a warming and drying trend that probably has affected the locations and depth of permafrost as well as the seasonal freeze-up of surface soils. Because no in-depth soil surveys have been accomplished for BLM lands in the Bay planning area, it is not known how future activities, for example, attempts to build ice roads to haul equipment and gravel for carrying out oil and gas exploration activities, will affect vegetation and soils (Map 3.6).

d) Soils Demand Analysis and Forecast

Soil is an important resource in the proposed planning area, as it supports habitat important to the abundant wildlife present in the Bay planning area, promotes stream bank stability and habitat important to the myriad anadromous and freshwater fish that inhabit the region. Subsistence, commercial, and recreational uses of the land are all related directly or indirectly in some way to soil use.

At the present time, the activities that demand the most from the soil in the Bay planning area are subsistence and recreational in nature, particularly the use of all-terrain vehicles. Marked winter trails between villages have the potential to become summer four-wheeler trails. A trail from Kokhanok to Katmai National Preserve that crosses BLM lands, used by four-wheelers, has created some erosion problems. Another 4-wheeler trail has been created from a lodge on the Alagnak River in Katmai National Preserve to Sugarloaf Mountain, with access across BLM lands. It has not yet been investigated by BLM staff. A trail that follows the Goodnews River and crosses BLM lands should be monitored for its soil impacts.

Two types of soil degradation can occur with any human activity. The first is introduction of hazardous materials, e.g., a fuel spill. The second is other types of pollution, e.g., erosion and silting.

Currently there are no timber harvests occurring on BLM lands in the Bay planning area, and none are anticipated.

Soils have a role to play in wetlands, which are lands transitional between terrestrial and aquatic systems, and are generally described as lands where water saturation is the dominant factor in determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface (Cowardin 1979).

Soil resources have a role in the social and cultural aspects of rural Alaskans. The resource indirectly affects and is used for subsistence and personal use. In the past, a fine blue clay often found adjacent to the rivers in the planning area (i.e. upper Naknek River at Lake Camp) was used historically and prehistorically in the region to make bisque-fired pottery lamps and bowls (McClenahan 1994).

e) Critical Thresholds

Physical soil characteristics that may limit the degree to which reclamation may take place include sandy soils, clayey soils, soils with large coarse fragments, including glacial rubble, a shallow depth to parent material, soils with low organic matter content, and hydric soils with a shallow depth to groundwater (McClenahan 2006, Pers. Comm.).

4. Water Resources

BLM-managed lands within the Bay planning area contain many hydrologic features that contribute to the area's diverse water resources. Maps 3.1, 3.2, and 3.3 depict the major water bodies in the planning area. Major watersheds throughout the United States are assigned a name and an 8-digit hydrologic unit code (HUC). Nine major watersheds are incorporated within the boundary of the Bay planning area. These watersheds are the Naknek (19030204); Lake Clark (19030205); Upper Nushagak River (19030301); Mulchatna River (19030302); Lower Nushgak River (19030303); Wood River (19030304); Togiak (19030305); Lake Iliamna (19030306); and Kuskokwim Delta (19030502). These watersheds are composed of a complex network of streams, wetlands, and lakes that combine to support wildlife, plants, and a multitude of human activities.

The unencumbered BLM lands within the Bristol Bay region are dominated by four major watersheds: the Kvichak River, the Alagnak River, the Naknek River, and the Nushagak River drainages. The Kvichak River flows from Lake Iliamna to Kvichak Bay in a west-southwest direction. Major tributaries include the Alagnak River, Ole Creek, Levelock Creek, Ben Courtney Creek, and Kaskanak Creek (Map 1.1; Photos 3.1, 3.3, and 3.6).

The Alagnak River is located to the south of the Kvichak River, and drains into it just above Cape Horn, immediately before the Kvichak empties into Kvichak Bay. It originates from upland streams that feed into Kukaklek and Nonvianuk Lakes, located near the northwestern corner of Katmai National Park and Preserve.

The Nushagak River begins in the Nushagak Hills and flows generally southward to tidewater at the head of Nushagak Bay. The valley floor of the Nushagak River slopes in a southward direction and is dotted with hundreds of small lakes. Large tributaries of the Nushagak include the Nuyakuk, Wood, Snake, and Igushik rivers. Tides affect the Nushagak as far upstream as the Keefer Cutoff, approximately 43 miles above the mouth of the river, where the Iowithla River flows into the Nushagak on its west side. Tidal waters, though having maxima of only 19 and 21 feet, respectively, at Clarks Point and Dillingham, pile up in the narrow waterways of the lower parts of the Wood and Nushagak Rivers and raise the water levels

upstream several feet higher. The tidal currents are strong, the ebb being the stronger because of the current from the Nushagak and Wood Rivers (Mertie 1938). Other tributaries flowing into the Nushagak from the west include Koggiling Creek, Lower Klutuk Creek, the Mulchatna River, and Cranberry Creek. Tributaries entering the Nushagak from the east above the Iowithla include Koklong Creek, Upper Klutuk Creek, and Napatoli Creek.

The Naknek River is the Southeasternmost major river in the planning area. Its headwaters are in the western mountains of the Aleutian Range. It flows westward from Naknek Lake and empties into Bristol Bay. The communities of King Salmon, Naknek, and South Naknek are located on its banks. BLM lands in this vicinity are all either State- or Native-selected and are not expected to remain in Federal ownership.

Unencumbered BLM lands within the Goodnews region of the planning area are located within watersheds dominated by the mainstem, Middle Fork, and South Fork of the Goodnews River, Indian River, and Arolik River. Smaller flowing waterbodies include Jacksmith Creek and Cripple Creek.

The Middle Fork, South Fork, and mainstem of the Goodnews River begin in the Ahklun Mountains and flow in a southwesterly direction. These waterbodies converge near the village of Goodnews Bay before emptying into Kuskokwim Bay via Goodnews Bay. The mainstem of the Goodnews River begins within the Togiak Wilderness area and intersects various tributaries, including Wattamise Creek, Granite Creek, and Barnum Creek. The headwaters of the Middle Fork of the Goodnews River are located within the Togiak National Wildlife Refuge. The South Fork of the Goodnews River begins in the Togiak National Wildlife Refuge, intersects Tivyagak Creek, and is located predominately on unencumbered BLM land.

The Indian River drainage consists of Indian River and the North Fork and South Fork of Indian River. The North Fork of Indian River begins just east of Kiugtlugtulit Mountain and intersects Nautilis Creek before converging within the saltmarsh flatlands of the mainstem of the Indian River. The headwaters of the South Fork of the Indian River are located on the west end of Explorer Mountain. Each of these rivers flows east to west and empties into Kuskokwim Bay via Carter Bay.

The Arolik drainage consists of the East and South Fork of the Arolik River. The headwaters of the South Fork of Arolik River are located on the east side of Tatlignagpeke Mountain and flow north before intersecting the mainstem of the Arolik River within the Togiak National Wildlife Refuge. The East Fork of the Arolik River begins south of Chingekigtlik Mountain and flows northwest into Arolik Lake before converging with the South Fork, eventually emptying into Kuskokwim Bay, south of Quinhagak village.

Cripple Creek flows from its headwaters at Cot Mountain east to Kuskokwim Bay, a journey of approximately 30 miles almost entirely across unencumbered BLM land.

Jacksmith Creek begins on unencumbered BLM land at Mitlak Mountain, flows southwest before doglegging northwest across coastal saltmarshes into the Togiak National Wildlife Refuge, then into Kuskokwim Bay via Jacksmith Bay.

Subsistence, commercial, and recreational uses are all related in some way to water use. National Weather Service data suggest the variable annual precipitation amounts throughout the region range from 25-120 inches (Map 3.7). Generally, it is believed that the surface water in these watersheds is of good quality. There are no waterbodies on BLM-managed lands within the planning area that are classified as impaired by the State of Alaska (Clean Water Act, section 303d).

Minimal water quality information is available on most waterbodies in the planning area. Most preliminary water quality samples on BLM-managed lands were gathered in conjunction with fisheries, wildlife, and riparian studies in the Goodnews Bay and Bristol Bay areas. Water quality constituents for these studies included pH, total dissolved solids, total alkalinity, and temperature. Most of this data is unpublished except BLM Open File Report 107, which identifies variability in the total alkalinity of tundra ponds on

BLM-managed land n the Kvichak River area (Seppi, 2006). For all authorized activities in the area, adherence to State water quality standards is a minimally required stipulation of the authorization.

No streams are monitored for water quantity within the planning area by BLM. The USGS has established stations to conduct water quantity and quality monitoring within the planning area. Though some stations have been discontinued, other stations have been established. The USGS maintains information concerning historical and currently running stations[1]. The USGS has also collected information concerning ground water resources within the planning area, including the Lower Nushagak River, Lake Clark, and Kuskokwim Delta watersheds[1]. No ground water data has been collected on BLM-managed lands within the Bay planning area.

Current management practice under the Southwest Planning Area (SPA) Management Framework Plan (MFP), section W-2.1, for the Goodnews block only, identifies the need to "Perfect legal water rights to the water resources on public lands in support of Bureau programs, and in compliance with the Alaska Water Use Act" and to "Protect existing water rights of the U.S." Section W-3.1 of the SPA MFP advocates wetland and flooplain identification."

Water resources play a significant role in the social and cultural aspects of rural Alaskans' lives. The resource is used extensively for subsistence and personal use. Within the planning area, major programs that can generate point or non-point water quality problems are mineral development, recreation, forest management, hydroelectric development, and wildland fire.

a) Mineral Development

Table 3.2 shows active (pre-ANSCA) mining claims on BLM-managed lands within the planning area. Currently, there is only one active mining operation within the planning area. Hanson Industries maintains a block of mining claims near Platinum. This placer mine operation has used a bucket-line dredge since 1937 to extract mineral deposits along the Salmon River. After decades of mining, there have been considerable changes to the hydrological characteristics of the Salmon River basin. Tailings composed of porous gravel and cobble-sized material as high as 50 feet now occupy areas once filled with fine particulate material necessary to support proper river functions. During periods of low flow, the Salmon River becomes a discontinuous river in sections where the tailing porosity is too great to support the surface flow of the river. This discontinuity of river flow at times prevents access to anadromous fish spawning habitat. There are no active coal or oil and gas leases within the Bay planning area.

Table 3.2. Lode and Placer Properties on BLM-managed Land with Active Mining Claims and/or APMAs Located in the Bay Planning Area

Deposit name	ARDF/AMIS no.	Land status	Mining claims	APMA no. (2005)	Deposit type
GOODNEWS BAY/SNOW GULCH AREA					
Arolic River	GO036/101-016	Native-selected	State	A052798	Placer
ILIAMNA/KVICHAK AREA					
Iliamna Project, D block	None	BLM/State-selected	State		Lode
Iliamna Project, H block	None	BLM/State-selected	Federal & State		Lode
LSS	None	BLM/State-selected	State		Lode
PLATINUM AREA					
Salmon River	HG012/123-004	Native-selected	Federal	A055585	Placer

[1] Information pertaining to USGS surface and ground water data collection efforts can be found at: http://waterdata.usgs.gov/ak/nwis

b) Recreation

The primary regulated recreational activities in the planning area are guided hunting, sport fishing, and float trips. These activities have the potential to impact water resources. Though State of Alaska regulations (18 AAC 72.020 and AS 46.03.800-810) prohibit the disposal of human waste within close proximity of waterbodies, the public's dumping of garbage and human waste near rivers and streams and the effects such activities have on water quality were cause for concern during scoping. It is not known whether such activities occur near the rivers and streams that flow through unencumbered BLM lands in the planning area.

Recreation within the planning area covers a wide range of activities including OHV use, camping, raft and canoe float trips, and sightseeing. Many of these activities include shoreline use resulting in minor disturbance of vegetation, erosion and increased water turbidity. Should OHV use increase, the effects on water quality may become more widespread.

c) Fire Management

The potential for wildfire exists in areas of dense spruce forests. Wildland fires can greatly alter the hydrologic characteristics of stream basins, by removing the tree canopy, undergrowth, organic litter, shallow roots, and obstructions and by creating water-repellent soil conditions. As a result, severe flooding and fire-related erosion often follow fire damage, particularly when intense rain falls over small steep watersheds soon after a wildfire that has burned both the soil and canopy. The risk of fire-flood events drops considerably after only a few years as new vegetation is reestablished and the soil infiltration is increased by wetting, frost action, and animal activity.

Erosion from fire is further aggravated by the use of mechanized fire equipment on ice-rich, fine-grained, permafrost soil. Complete removal of all of the vegetation and organic material during fireline construction causes much deeper permafrost melting than occurs in adjacent burned areas. Runoff channels and deep gulleys frequently form, and siltation can result.

d) Forest Products

Currently, there are no timber harvests occurring on BLM lands in the planning area and none are anticipated.

5. Vegetation

This section describes the occurrence and current vegetation classes derived from satellite imagery within the planning area. Alaska Earth Cover Classification divides major vegetation types into categories derived from satellite imagery and verified by site visits to improve the accuracy of the categories. There are few detailed plant inventories for the planning area. Forestry and wildland fire management as they relate to vegetation are addressed in separate sections.

a) Alaska Earth Cover Classification

Vegetation on most of the BLM lands of the planning area was mapped on a broad scale using satellite imagery. Four joint USDI BLM/ FWS-Ducks Unlimited, Inc. projects: Kvichak Earth Cover Classification (2002), Goodnews Bay Earth Cover Classification (2003), Naknek Military Operations Area Earth Cover Classification (2001), and Iliamna Earth Cover Classification (1994) provide a baseline inventory of vegetative cover classifications. This mapping generalizes vegetation and therefore is best utilized for general land use planning and as a guide to areas for further analysis. More intensive studies have been done for limited areas, including the Goodnews Bay region and the Ahklun Mountains (Lipkin 1994,

Parker 2004), and the northwestern Alaska Peninsula (Batten and Parker 2004). Since the Earth Cover Classification covers most of the BLM lands covered in this plan, these classifications are used to define the vegetation within the plan boundaries.

The classification scheme consists of 10 major categories and 27 subcategories. A classification decision tree and written descriptions were developed in support of the classification. The classification was based primarily on Level III of the Viereck (and others) classification of 1992.

Classes that could not reliably be discerned from satellite imagery were merged into a more general class. Because of the importance of lichen for site characterization and wildlife forage, and because the presence of lichen can be detected by satellite imagery, shrub and forested classes with and without a component of lichen are distinguished.

A few classes from Level IV of the Viereck classification were mapped because of their identifiable satellite signature and their importance for wildlife management. These Level IV classes are tussock tundra, low shrub tussock tundra and low shrub willow/alder.

b) The Natural Vegetation Cover

Table 3.3 provides the Earth Cover Classes for vegetation for the areas that were covered in the planning area, and Table 3.4 gives the percentage of unencumbered BLM lands in the planning area in each land cover type. The vegetation in the Bay planning area is for the most part unimpacted by humans. Based on the studies cited above, the vegetation in the four vegetation study areas, Naknek, Kvichak, Iliamna, and Goodnews, comprises the following percentages of each general category (Maps 3.8 a-d, 3.9 a-d, 3.10 a-d, and 3.11 a-d).

Table 3.3. Earth Cover Classes for Vegetation in Portions of the Bay Planning Area

Vegetation Type	Needleleaf	Deciduous	Mixed	Tundra	Tussock/Wet Tundra
Study Region					
Naknek	21%	14%	5%	51%	3%
Kvichak	10%	14%	5%	40%	6%
Iliamna	2%	3%	1%	20%	47%

Table 3.4. Percentage of Planning Block in Major Land Cover Types Bay Planning Area Unencumbered BLM Lands

Planning Block	Forest	Clear Water	Grass/Forb	Riparian	Wetlands	Coastal Graminoid	Saltwater Estuary
Alagnak	19%	4%	32%	8%	33%	4%	0%
Goodnews	1%	5%	46%	22%	23%	3%	1%
Iliamna West	33%	7%	28%	14%	19%	0%	0%
Chulitna River	78%	1%	15%	3%	3%	0%	0%
Klutuk Creek**	15%	3%	47%	4%	32%	0%	0%
Koggiling Creek**	20%	10%	32%	8%	30%	0%	0%
Kvichak	20%	8%	35%	10%	26%	0%	0%
Yellow Creek	14%	10%	41%	5%	31%	0%	0%

**Portions of the western edges of these planning blocks were outside of the study area.

c) Wetlands, Herbaceous Tundra, and Forests in the Bay Planning Area

Land cover, together with data about food sources, water, shelter, and living space, is used by biologists to assess wildlife habitat. The existing classifications, discussed above, have been utilized to produce maps of wetlands (Maps 3.10a-d), grasslands (Maps 3.8a-d), forest landcover (Maps 3.9a-d), and lichens (Maps 3.11a-d). Exclusive of the Chulitna River block, between 19% and 33% of the land cover on BLM unencumbered lands in the planning area is wetland vegetation. Wetland vegetation decreases and forest vegetation increases in the planning blocks to the north and east in the Kvichak study area. Riparian vegetation is more prevalent in the Iliamna West block (14%) and the Goodnews block (22%).

d) Noxious and Invasive Plant Species in the Planning Area

The harmful effects of invasive non-native plants is a matter of some concern. In sufficient quantities invasive non-native plants can adversely affect forage, wilderness, wildlife habitat, visual quality, recreation opportunities, and land value. These plants are more prevalent near areas of human disturbance. It is BLM's responsibility to ensure that management actions do not increase the spread of invasive non-native plants. Prevention measures are considered where soil is disturbed on or adjacent to BLM-managed lands. One prevention measure is the use of weed free seed and mulch. Where practical, native species are used in any revegetation effort on BLM-managed lands.

e) Treatments

Vegetation manipulation by wildland fire, prescribed fire, or mechanical or manual treatments are forest management practices used to enhance sustained yield or reduce wildland fire risks.

6. Fish and Wildlife

a) Wildlife

BLM has responsibilities in the planning area for habitat management, and cooperatively manages habitat with the State of Alaska under a Master Memorandum of Understanding between the Alaska Department of Fish and Game and the Bureau of Land Management (1983) (Appendix G).

BLM manages wildlife habitat with an emphasis on habitat maintenance, enhancement and restoration.

Table 3.5 provides a list of mammal and amphibian species within the Bay planning area. Table 3.6 is a list of bird species known to occur in the Bay planning area, and Table 3.7 presents the variety of marine invertebrates that may be present in the coastal parts of the Bay planning area. Some of the mammals and many of the birds are migratory.

Table 3.5. Table of Amphibian and Mammal Species Present in the Bay Planning Area (ADF&G CPDB 2005, Foster 1991, Mountaineers 1994, Udvardy 1977, Whitaker 1980, Jacobsen 2004, USFWS 2005)

Common Name	Scientific Name	Common Name	Scientific Name
Amphibian		Wolverine	*Gulo gulo*
Wood Frog	*Rana sylvatica*	Masked Shrew	*Sorex cinereus*
Land Mammals		Dusky Shrew	*Sorex monticolus*
Large Land Mammals		Arctic Shrew	*Sorex arcticus*
Black Bear	*Ursus americanus*	Pygmy Shrew	*Microsorex boyi*
Brown Bear	*Ursus arctos*	Tundra Shrew	*Sorex tudrensis*
Caribou	*Rangifer tarandus*	Little Brown Bat	*Myotis lucifugus*
Moose	*Alces alces*	Hoary Marmot	*Marmota caligata*
Dall Sheep	*Ovis dalli*	Red Squirrel	*Tamiasciurus hudsonicus*
Small Land Mammals		Northern Red-Backed Vole	*Clethrionomys rutilus*
Beaver	*Castor Canadensis*	Meadow Vole	*Microtus pennsylvanicus*
Coyote	*Canis latrans*	Tundra Vole	*Microtus oeconomus*
Red Fox	*Vulpes vulpes*	Singing Vole	*Microtus gregalis*
Arctic Fox	*Alopex lagopus*	Brown Lemming	*Lemmus sibiricus*
Alaskan (Tundra) Hare	*Lepus othuss*	Northern Bog Lemming	*Synaptomys borealis*
Snowshoe Hare	*Lepus americanus*	Collared Lemming	*Dicrostonyx torquetus*
River Otter	*Lontra canadensis*	Meadow Jumping Mouse	*Zapus hudsonius*
Lynx	*Lynx canadensis*	**Marine Mammals**	
Marten	*Martes americana*	Northern Fur Seal	*Callortinus ursinus*
Mink	*Mustela vison*	Bearded Seal	*Erignathus barbatus*
Ermine	*Mustela erminea*	Harbor Seal	*Phoca vitulina*
Least Weasel	*Mustela rivalis*	Ringed Seal	*Phoca hispide*
Muskrat	*Ondatra zibethicus*	Ribbon Seal	*Phoca fasciata*
Porcupine	*Erethizon dorsatum*	Spotted Seal	*Phoca largha*
Parka Squirrel (Arctic Ground Squirrel)	*Spermophilus parryii*	Steller Sea Lion	*Eumetopias jubatus*
Wolf	*Canis lupus*	Walrus	*Odobenus rosmarus*
		Beluga Whale	*Delphinapterus leucas*

Table 3.6. Table of Resident, Migratory, Wintering, Rare* and Accidental Birds (ADF&G CPDB 2005, Foster 1991, Udvardy 1977, USFWS 2005

Common Name	Scientific Name	Common Name	Scientific Name
Red-throated Loon	*Gavia stellata*	Short-billed Dowitcher	*Limnodromus griseus*
Pacific Loon	*Gavia pacifica*	Long-billed Dowitcher	*Limnodromus scolopaceus*
Common Loon	*Gavia immer*	Wilson's Snipe	*Gallinago gallinago*
Yellow-billed Loon	*Gavia adamsii**	Red-necked Phalarope	*Phalaropus lobatus*
Horned Grebe	*Podiceps auritus*	Red Phalarope	*Phalaropus fulicaria**
Red-necked Grebe	*Podiceps grisegena*	Pomarine Jaeger	*Stercorarius pomarinus*
Double-crested Cormorant	*Phalacrocorax auritus*	Long-tailed Jaeger	*Stercorarius longicaudus*
Pleagic Cormorant	*Phalacrocorax pelagicus*	Bonaparte's Gull	*Larus piladelphia*
Red-faced Cormorant	*Phalacrocorax urile*	Mew Gull	*Larus canus*
Tundra Swan	*Cygnus columbianus*	Herring Gull	*Larus argentatus*
Trumpeter Swan	*Cygnus buccinator*	Glaucous Gull	*Larus huperbor*
Greater White-fronted Goose	*Anser albifrons*	Glaucous-winged Gull	*Larus glaucescens*
Snow Goose	*Chen caerulescens*	Slaty-backed Gull	*Larus schistisagus*
Emperor Goose	*Philacte canagica*	Black-legged Kittiwake	*Rissa tridactyla*

Common Name	Scientific Name	Common Name	Scientific Name
Cackling Goose	*Branta canadensis minima*	Sabine's Gull	*Xema sabini*
Brant	*Branta bemicia*	Arctic Tern	*Stema paradisaea*
Mallard	*Anas platyrhyncos*	Aleutian Tern	*Stema aleutica*
Gadwell	*Anas strepera*	Common Murre	*Uria aalge*
Green-winged Teal	*Anas crecca*	Thick-billed Murre	*Uria lomvia*
Baikal Teal	*Anas formosa**	Pigeon Guillemot	*Cepphus colomba*
American Wigeon	*Anas americana*	Marbeled Murrelet	*Brachyramphus marmoratus*
Eurasian Wigeon	*Anas Penelope**	Parakeet Auklet	*Aethia psittacula*
Northern Pintail	*Anas acuta*	Kittlitz's Murrelet	*Brachyramphus brevirostris*
Blue-winged Teal	*Anas discors**	Horned Puffin	*Fratercula comiculata*
Garganey	*Anas querquedula**	Tufted Puffin	*Fratercula cirrhata*
Canvasback	*Aythya valisineria*	Short-eared Owl	*Asio flammeus*
Redhead	*Aythya Americana*	Great Horned Owl	*Bubo virginianus*
Ring-necked Duck	*Aythya collaris**	Snowy Owl	*Bubo scandiaca*
Tufted Duck	*Aythya fuligula**	Northern Saw-whet Owl	*Aegolius acadicus**
Greater Scaup	*Aythya marlia*	Northern Hawk Owl	*Sumia ulula*
Lesser Scaup	*Aythya afffinis*	Boreal Owl	*Aegolius funereus*
Common Eider	*Somateria mollissima*	Belted Kingfisher	*Ceryle alcon*
King Eider	*Somateria spectabilis*	Northern Flicker	*Colaptes auratus*
Spectacled Eider	*Somateria fischeri*	Downy Woodpecker	*Picoides pubescens*
Steller's Eider	*Polysticta stelleri*	Hairy Woodpecker	*Picoides villosus*
Black Scoter	*Melanitta nigra*	American Three-toed Woodpecker	*Picoides dorsalis*
White-winged Scoter	*Melanitta deglandi*	Black-backed woodpecker	*Picoides arcticus*
Surf Scoter	*Melanitta perspicillata*	Olive-sided Flycatcher	*Contopus cooperi*
Harlequin	*Histrionicus histrionicus*	Alder Flycatcher	*Empidonax alnorum*
Long-tailed Duck	*Clangula hyemalis*	Say's Phoebe	*Sayomis saya*
Barrow's Goldeneye	*Bucephala islandica*	Northern Shrike	*Lanius excubitor*
Common Goldeneye	*Bucephala clangula*	Gray Jay	*Perisoreus canadensis*
Bufflehead	*Bucephala albeola*	Black-billed Magpie	*Pica hudsonia*
Common Merganzer	*Mergus merganser*	Common Raven	*Corvus corax*
Red-breasted Merganzer	*Mergus merganser*	Horned Lark	*Eremophilla alpestris*
Osprey	*Pandion haliaetus*	Tree Swallow	*Tachycineta bicolor*
Northern Harrier	*Circus cyaneus*	Violet-green Swallow	*Tachycineta thalassina*
Golden Eagle	*Aquila chrysaetos*	Bank Swallow	*Riperia riparia*
Bald Eagle	*Haliaeetus leucocephalus*	Cliff Swallow	*Petrochelidon pyrrhonota*
Sharp-shinned Hawk	*Accipiter striatus*	Black-capped Chickadee	*Poecile hudsonica*
Northern Goshawk	*Accipiter laingi*	Boreal Chickadee	*Parus hudsonica*
Red-tailed Hawk	*Buteo jamaicensis*	Red-breasted Nuthatch	*Sitta canadensis*
Rough-legged Hawk	*Buteo lagopus*	Brown Creeper	*Certhia Americana*
American Kestrel	*Falco sparverius*	Winter Wren	*Troglodytes troglodytes*
Merlin	*Falco columbarus*	American Dipper	*Cinclus mexicanus*
Perigrine Falcon	*Falco peregrinus*	Golden-crowned Kinglet	*Regulus saatrapa*
Gyrfalcon	*Falco rusticolus*	Ruby-crowned Kinglet	*Regulus calendula*
Spruce Grouse	*Falcipennis canadensis*	Arctic Warbler	*Phylloscopus borealis**
White-tailed Ptarmigan	*Lagopus leucura*	Northern Wheatear	*Oenanthe oenanthe*
Rock Ptarmigan	*Lagopus muta*	Gray-cheeked Thrush	*Catharus minimus*
Willow Ptarmigan	*Lagopus lagopus*	Swainson's Thrush	*Catharus ustulatus*
Lesser Sandhill crane	*Grus canadensis*	Hermit Thrush	*Catharus guttatus*
Black-bellied Plover	*Pluvialis squatarole*	Varied Thrush	*Ixoreus naevius*

Common Name	Scientific Name	Common Name	Scientific Name
American Golden Plover	*Pluvialis dominica*	American Robin	*Turdus migratorius*
Pacific Golden Plover	*Pluvialis fulve*	Eastern Yellow Wagtail	*Motacilla flava tschutschensis*
Semipalmated Plover	*Charadrius semipalmatus*	American Pipit	*Anthusrubescens*
Lesser Sand Plover (Mongolian Plover)	*Charadrius mongolus**	Bohemian Waxwing	*Bombycillagarrulus*
Black Oystercatcher	*Haematopus bachmani*	Orange-crowned Warbler	*Vermivora celata*
Greater Yellowlegs	*Tringa melanoleuce*	Yellow-rumped Warbler	*Dendroica coronata*
Lesser Yellowlegs	*Tringa flavipes*	Townsend's Warbler	*Dendroica townesndi*
Wandering Tattler	*Heteroscelus incanus*	Blackpoll Warbler	*Dendroica striata*
Solitary Sandpiper	*Tringa solitaria*	Yellow Warbler	*Dendroica petechia*
Spotted Sandpiper	*Actitis macularius*	Wilson's Warbler	*Wilsonis pusilla*
Whimbrel	*Numenius phaeopus*	Northern Waterthrush	*Seiurus noveboracensis*
Bristle-thighed Curlew	*Numenius tahitiensis*	American Tree Sparrow	*Spizella arborea*
Black-tailed Godwit	*Limosa lapponica*	Fox Sparrow	*Passerella iliaca*
Hudsonian Godwit	*Limosa haemastica*	Savannah Sparrow	*Passerculus sandwicensis*
Black Turnstone	*Arenaria melanocephala*	Lincoln's Sparrow	*Melospiza lincolnii*
Ruddy Turnstone	*Arenaria interpres*	Song Sparrow	*Melospiza melodia*
Surfbird	*Aphriza virgata*	White-crowned Sparrow	*Zonotrichia leucophrys*
Rock Sandpiper	*Calidris ptilocnemis*	Golden-crowned Sparrow	*Zonotrichia atricapilla*
Red Knot	*Calidris canutus**	Slate-colored Junco	*Junco hyemalis*
Sanderling	*Calidris alba**	Lapland Longspur	*Calcarius lapponicus*
Dunlin	*Calidris alpine*	Snow Bunting	*Plectrophenax nivalis*
Semipalmated Sandpiper	*Calidris pusilla*	McKay's Bunting	*Plectrophenax hyperboreus**
Western Sandpiper	*Calidris pusilla*	Rusty Blackbird	*Euphagus carolinus*
Least Sandpiper	*Calidris minutilla*	Red Crossbill	*Loxia curvirostra*
Baird's Sandpiper	*Calidris bairdii**	White-winged Crossbill	*Loxia leucoptera*
Long-toed Stint	*Calidris subminuta**	Pine Grosbeak	*Pinicola enucleator*
Red-necked Stint	*Calidris ruficollis**	Pine Siskin	*Carduelis pinus*
Pectoral Sandpiper	*Calidris melanotos**	Gray-crowned Rosy Finch	*Leucosticte tephrocotis*
Sharp-tailed Sandpiper	*Calidris acuminate**	Common Redpoll	*Carduelis flammea*
Buff-breasted Sandpiper	*Tryngites subruficollis**	Hoary Redpoll	*Carduelis homemanni*

Table 3.7. Table of Marine Invertebrate Species of Subsistence or Recreational Interest Present at Coastal Locations Potentially Present in the Bay Planning Area (ADF&G CPDB 2005, Mountaineers 1994, Foster 1991)

Common Name	Scientific Name	Common Name	Scientific Name
Nutclams	*Nucula tenuis*		*Clinocardium californiense*
	Nuculana minuta		*Serripes groenlandickus*
	Nuculana permula	Gapers and Surfclams	*Mactromeris polynyma*
	Nuculana radiate	Razor Clams	*Siliqua alta*
	Nuclana fossa	Tellins and Macomas	*Tellina modesta*
Yoldias	*Yoldia scissurate*		*Tellina lutea*
	Yoldia myalis		*Macoma calcarea*
Mussels	*Mytilus edulis*		*Macoma oblique*
	Musculus discors		*Macoma middendorffi*
	Musculus corrugatus		*Macoma moesta*
	Musculus olivaceous		*Macoma lama*
	Musculus niger		*Macoma inquinata*
	Modiolus modiolus		*Macoma balthica*
Scallops	*Patinopecten caurinus*	Venus Clams	*Liocyma fluctuosa*
	Chalmys rubida	Butter Clams	*Saxidomus giganteus*
Jingles	*Pododesmus macroschisma*	Turtons	*Turtona minuta*
Axinopsids	*Axinopsida serricata*	Softshells	*Mya arenaria*
Diplodons	*Diplodonta aleutica*		*Mya pseudoarenaria*
Kelllyclams	*Kellia suborbicularis*		*Mya truncate*
Mysellas and Montacutids	*Boreacola vadosus*	Hiatellas and Roughmyas	*Cyrtodaria kurriana*
	Mysella tumida		*Hiatella arctica*
	Pseudopythina compressa		*Panomya priapus*
Carditas	*Crassicardia crassidens*		*Panomya ample*
	Cyclocardia ovata		*Panomya arctica*
	Cyclocardia crebricostatta	Piddocks	*Zirfaea pilsbryi*
Astartes	*Astarte esquimalti*		*Penitella penita*
	Astarte alaskensis	Shipworms	*Bankia setacea*
	Astarte borealis	Thracias	*Thracia myopsis*
	Astarte montagui	Lyonsias	*Lyonsia arenosa*
Cockles	*Clinocardium ciliatum*	Pandoras	*Pandora glacialis*
	Clinocardium nuttalli		

Two National Wildlife Refuges, two National Parks and Preserves, four NPS-administered Wild and Scenic Rivers, three State parks and special habitat management areas and two Western Hemispheric Shorebird Reserve Network (WHSRN) special management habitat areas are present in the planning area.

The Bristol Bay region is dominated by four major watersheds, the Kvichak River, the Alagnak River, the Naknek River, and the Nushagak River drainages. The Kvichak River flows from Lake Iliamna to Kvichak Bay in a west-southwest direction. Major tributaries include the Alagnak River, Ole Creek, Levelock Creek, Ben Courtney Creek, and Kaskanak Creek (Map 1.1, Photos 3.1, 3.3, and 3.6).

The Alagnak River is located to the south of the Kvichak River, and drains into it just above Cape Horn and immediately before the Kvichak empties into Kvichak Bay. The Alagnak is a designated Wild River by Title VI, Section 601(25) and 603(44) of ANILCA, which preserves the upper 56 miles of the river in a free-flowing condition. It is administered by the National Park Service. It originates from upland streams that feed into Kukaklek and Nonvianuk Lakes, located near the northwestern corner of Katmai National Park and Preserve.

The Nushagak River begins in the Nushagak Hills and flows generally southward to tidewater at the head of Nushagak Bay. The valley floor of the Nushagak River is an abandoned flood plain sloping southward

and is dotted with hundreds of small lakes. Large tributaries of the Nushagak include the Nuyakuk, Wood, Snake, and Igushik rivers. The mouth of the Nushagak River is directly east of Dillingham and just south of the mouth of the Wood River. The river maintains a continuous downstream current at Black Point, about 20 miles to the southeast. Tides affect the Nushagak as far upstream as the Keefer Cutoff, approximately 43 miles above the mouth of the river, where the Lowithla River flows into the Nushagak on its west side. Tidal waters, though having maxima of only 19 feet at Clarks Point and 21 feet at Dillingham, pile up in the narrow waterways of the lower parts of the Wood and Nushagak Rivers and raise the water levels upstream several feet. The tidal currents are strong, the ebb being the stronger because of the current from the Nushagak and Wood Rivers (Mertie 1938).

The Nushagak is navigable at an average stage of water for small boats for more than 250 miles upstream (Mertie 1938). Other tributaries flowing into the Nushagak from the west include Koggiling Creek, Lower Klutuk Creek, the Mulchatna River, and Cranberry Creek. Tributaries entering the Nushagak from the east above the Lowithla include Koklong Creek, Upper Klutuk Creek, and Napatoli Creek.

The Naknek River is the Southeasternmost major river in the Bay planning area. Its headwaters are in the western mountains of the Aleutian Range. It flows westward from Naknek Lake and empties into Bristol Bay. The communities of King Salmon, Naknek, and South Naknek are located on its banks. BLM lands in this vicinity are all either State- or Native-selected and are not expected to remain in Federal ownership.

The blocks of unencumbered BLM land in the Bristol Bay region can be found in Game Management Units (GMUs) 9(B), 9(C), 17(B) and 17(C). Uniform Coding Units (UCUs) are smaller units within GMUs (Maps 3.12 a, b, and c).

GMU 9(B) is located just west of Lake Iliamna, and is 2,004,000 mi^2. It is dominated by the Kvichak River and its tributaries, which crosses BLM lands. Thousands of large and small shallow lakes and ponds dot the landscape and provide riparian habitat and summer water-dependent vegetative habitat. BLM lands in this GMU are nearest to the communities of Port Alsworth, Nondalton, Pedro Bay, Iliamna, Newhalen, Kokhanok, Igiugig, and Levelock.

A portion of GMU 9(C) is in the Bay planning area. In its entirety, 9(C) is 818,000 mi^2. BLM lands in this GMU are located adjacent to the Alagnak Wild River on the south side of the river. To the east, elevations rise to as much as 2,085 feet at Sugarloaf Mountain. BLM lands in the area are drained by a large number of small streams that empty into the Alagnak River, and the entire area is dotted by numerous large and small lakes. Vegetation is predominantly wet tundra. The Southern most extent of BLM lands crosses into the Naknek River drainage at the headwaters of deciduous brush-lined Pauls Creek. GMU 9(C) includes the communities of Naknek, King Salmon, and South Naknek.

GMU 17(B) is drained by the Nushagak and Mulchatna rivers, their tributaries, lakes and ponds. BLM lands in this GMU are in the southcentral portion of the unit near the community of Koliganek. This area is part of the extensive glacially defined Bristol Bay Plain. BLM lands sit at elevations of from 200 to 600 feet, and are drained primarily by Klutuk Creek and other streams that empty into the Nushagak River. The rolling terrain has many kettle lakes, and is covered with wet tundra.

GMU 17(C) is contiguous to 17(B), extending southward and westward. BLM lands are located in the middle and lower Nushagak river drainage and its tributaries, nearest the communities of Koliganek, New Stuyahok, Ekwok, and Portage Creek. At a slightly greater distance, but still within their subsistence use areas, are the communities of Ekuk, Clarks Point, Dillingham, Aleknagik, and Manokotak. Many small lakes and ponds dominate the landscape in this region that is a continuation of the Bristol Bay Plain. To the north, north of the Lowithla River, are the Muklung Hills. North of Dillingham and Aleknagik are the headwaters of the Wood River and the Wood-Tikchik lakes.

b) The Role of Fish and Wildlife Habitats in the Bay Planning Area

Salmon is the single most important subsistence food in the diet of planning area residents. Residents are dependant upon a mixed subsistence-cash based economy based largely on traditional subsistence hunting and fishing and commercial fishing (ADF&G 2005a) (Maps 3.13 a, b, c, and d). Alaska's 2005 commercial exports to other countries were led by Alaskan seafood at 53% of the state's total exports. Southwest Alaska is home to the most productive and well-managed fisheries in the world (SWAMC 2005). In a recent 5-year average of salmon harvests of selected Alaska commercial salmon fisheries, Bristol Bay, the Alaska Peninsula and the Aleutian Islands ranked a close second to Southeast Alaska and Yakutat. During this period, Bristol Bay, the Alaska Peninsula, and the Aleutian Islands brought in 153,057,263 pounds of salmon worth $69,765,000, or 30% of the total value of the state fishery (Woodby et al. 2005).

The Bristol Bay commercial salmon district provided a harvest of approximately 26 million salmon in 2005, at a value of over $93,000,000. The 1985-2004 average sockeye salmon harvest for the Naknek-Kvichak district was 7,800,000 fish, or approximately 33% of the total sockeye take in all of the Bristol Bay districts, and the average sockeye salmon harvest for the Nushagak district for the same time period was 4,000,000 fish or 17% of the total. The 2005 Naknek-Kvichak district harvest was slightly less than average at 6,700,000 sockeye, and the Nushagak district harvest was more at 7,100,000 sockeye (ADF&G 2005c).

In addition to subsistence and commercial use of fish in the region, in 2004 there were 140 registered freshwater fishing guides on Bristol Bay freshwater streams and lakes (ADF&G 2004). Recreational angler effort in this region has risen steadily from 1977 to the present. In 1995, angler effort in the South West Management Area was 4.6% of the total angling effort in Alaska (Minard et al. 1998). Sockeye, Chinook and coho salmon are the most frequently harvested species, followed by Dolly Varden/Arctic char, rainbow trout, and Arctic grayling. Recreational fisheries in Southwest Alaska provide the angler with a unique combination of high quality salmon and rainbow trout fishing in a pristine wild and roadless setting. In 1997 the sport fishery was valued at over $50,000,000 (Minard et al. 1998).

The State's Catalog of Waters Important for Spawning, Rearing, or Migration of Anadromous Fishes – Southwestern Region lists many of the streams and rivers that cross BLM lands in the Bay planning area (Johnson et al. 2004). Fish require healthy watersheds and BLM lands in Bristol Bay contain important fish spawning and rearing habitat.

In addition to their commercial value, anadromous fish bring back deposit nutrients in the terrestrial environment. Salmon are a keystone species in vertebrate communities (Willson and Halupka 1995). Salmon feeding in the ocean put on approximately 90% of their body weight there, incorporating and accumulating nutrients from the marine environment in their body tissues (Finney et al. 2000). A massive movement of marine-derived nutrients then occurs from ocean to freshwater and terrestrial ecosystems via their migrations (Levy 1997). After spawning, salmon die and their carcasses fertilize the freshwater systems with marine-derived nutrients which are important nutrient sources for riparian vegetation and terrestrial fauna such as bears, wolves, birds, and small mammals (Juday et al. 1932; Willson et al. 1998; Cederholm et al. 1999). "Anadromous salmon provide a rich, seasonal food resource that affects the ecology of terrestrial and aquatic consumers, and indirectly affects the entire food-web that knits the water and land together" (Cederholm et al. 2000).

Caribou are second in importance only to salmon in the subsistence diet of residents of the planning area (ADF&G 2005a). They are also important to hunters from other regions of Alaska and to guided and unguided hunters from outside of Alaska. According to ADF&G Harvest records for caribou from 1983-2002, Game Management Units (GMUs) 9 and 17 provided approximately 25% of all caribou harvested in the state. This is an impressive number for a largely roadless area. BLM lands in the planning area provide prime caribou habitat and comprise a small but vital portion of these GMUs (Map 3.14).

In recent decades, the Bristol Bay region has witnessed both a rise and fall in the size of the Mulchatna Caribou Herd (MCH). The region, including BLM lands, provides winter range and calving aggregation and post-calving aggregation habitats for caribou (Hinkes et al. 2005).

The most significant wintering area for the MCH during the 1980s and early 1990s was along the west side of Iliamna Lake north and west of the Kvichak River, including BLM lands. More recently, the MCH has wintered in scattered clusters throughout an expanded range due to overgrazing of its traditional winter range areas (Woolington 2003a).

Since 1993, the MCH has shifted its core calving grounds to an area near BLM lands on the upper Nushagak and Mulchatna Rivers (Hinkes et al. 2005; Woolington 2003a. The herd does not move in a mass nor are its seasonal locations predictable. Biologists have however noted a recent trend in herd movement. Most of the herd moves to the western side of its range during the fall, back to the middle part of its range for calving and into the upper Mulchatna River drainage for post-calving aggregations. The herd is widely dispersed throughout its range in late summer. In the fall it forms into large groups and moves westward (Woolington 2003a). Study of the MCH distribution map in relation to BLM lands places the MCH squarely (but not exclusively) on BLM lands in the western Iliamna-Kvichak-Nushagak-Mulchatna watersheds for much if not all of the year (Hinkes et al. 2005) (Maps 3.14 and 3.15).

Moose run a close third in importance in the subsistence diet of Bay planning area residents. They are relative newcomers to the region and have yet to populate all available habitat (ADF&G 2005a). ADF&G harvest records for 1983 - 2002 indicate that Game Management Units 9 and 17 provided 7% of the total moose harvest in Alaska (ADF&G 2004). Moose hunting in this region by hunters from outside of Alaska provides an exceptional setting for those seeking a remote fly-in or boat-in experience and a trophy harvest. The entire Kvichak-Iliamna-Alagnak BLM land block is important moose habitat. Although many riparian areas along rivers and streams lie outside BLM lands, BLM lands in this block provide winter, calving and breeding habitat and yearlong migration routes to and from seasonal ranges (Maps 3.16 and 3.17).

Moose are dependant upon riparian and wetland vegetation. During fall and winter, moose eat large quantities of willow, birch, and aspen twigs. In spring moose take advantage of sedges, horsetail, pond weeds, and grasses. During summer they rely on vegetation in shallow ponds, eating forbs, and birch, willow and aspen leaves (Rausch and Gasaway 1994) (Maps 3.16 and 3.17).

Brown bears are found throughout the planning area, and are sought after by trophy hunters and occasionally by subsistence hunters (Map 3.18). Game Management Units 9 and 17 together produced 25% of the state's brown bear harvest (ADF&G 2004). Out-of-state brown bear hunters seek a remote hunting experience and a trophy harvest (Map 3.18).

Records of the numbers of caribou, moose, and brown bears taken specifically on BLM-managed lands from year to year are not kept. Patterns of use for humans and animals shift over time. Examples of such shifts in the planning area include the long-term changes in range use by the Mulchatna Caribou Herd. Alaska Department of Fish and Game Community Profile Database and Harvest Records (ADF&G 2004b) are the primary source for the following discussion. Information about General Management Units and Uniform Coding Units have been included as a means to orient the reader to the location of the discussion within the planning block(s) and to link the information to its source.

c) Wildlife and Wildlife Habitat Relative to Specific Unencumbered BLM Lands in the Bay Planning Area

(1) Iliamna Block (6 blocks) (Portions of GMU 9(B); UCUs 0202, 0203, 0301, 0303, 0701)(Portion of GMU 9(C); UCU 0701)(Map 3.2).

The Iliamna area is mountainous terrain which includes glaciers and ice fields of the Neacola, Aleutian, and Chigmit Mountains to the northeast of Iliamna Lake, with alpine tundra giving way as elevation decreases to dense tall willow and alder shrub thickets, coniferous and mixed conifer/deciduous forested glacially carved river valleys and rounded bedrock hills. Large, deep glacially carved lakes are scattered throughout the glacier scoured bedrock hills. Iliamna Lake and Lake Clark are examples of the very large glacially carved lakes that dominate the region.

The BLM lands that lie west and south of the communities of Iliamna, Iguigig and Kokhanok are dominated by terminal moraines that reflect the succession of major glacial periods since the early Pleistocene (Biekman 1980). The youngest of these moraine features occurs in a wide arc within 20-25 miles of the lower portions of Iliamna Lake and is a terrace of repeating small broken terminal moraines deposited as the last glaciers receded (Biekman 1980). Conifer timber consisting of black spruce in bogs with hundreds of lakes and associated narrow riparian shorelines, patchy deciduous forest on well-drained sites and wet tundra wetlands dominate the habitats found here (BLM 1994). This moraine is drained by Kaskanak, Ole, and Ben Courtney Creeks, all of which flow into the Kvichak River that is the outlet of Iliamna Lake (Photos 3.1 and 3.2). South of the Iliamna block, the Alagnak River, locally known as the Branch River, flows around the southern boundary of this most recent moraine complex (Photo 1.1). This morainal area is a transition zone between the habitats of tundra and trumpeter swan population distributions. Trumpeter swans are a Special Status Species.

The substantial salmon fishery resources in this area and the large lakes provide for high densities of brown bear. Bears can be found everywhere in the planning area, predictably near the most abundant resources available at the time. In spring, caribou and moose calves attract them, and in summer they congregate on salmon streams, following the salmon upriver into tributary streams. They are opportunistic omnivores and they range widely.

Photo 3.1. Kaskanak Creek, Northwest Iliamna Block, View North

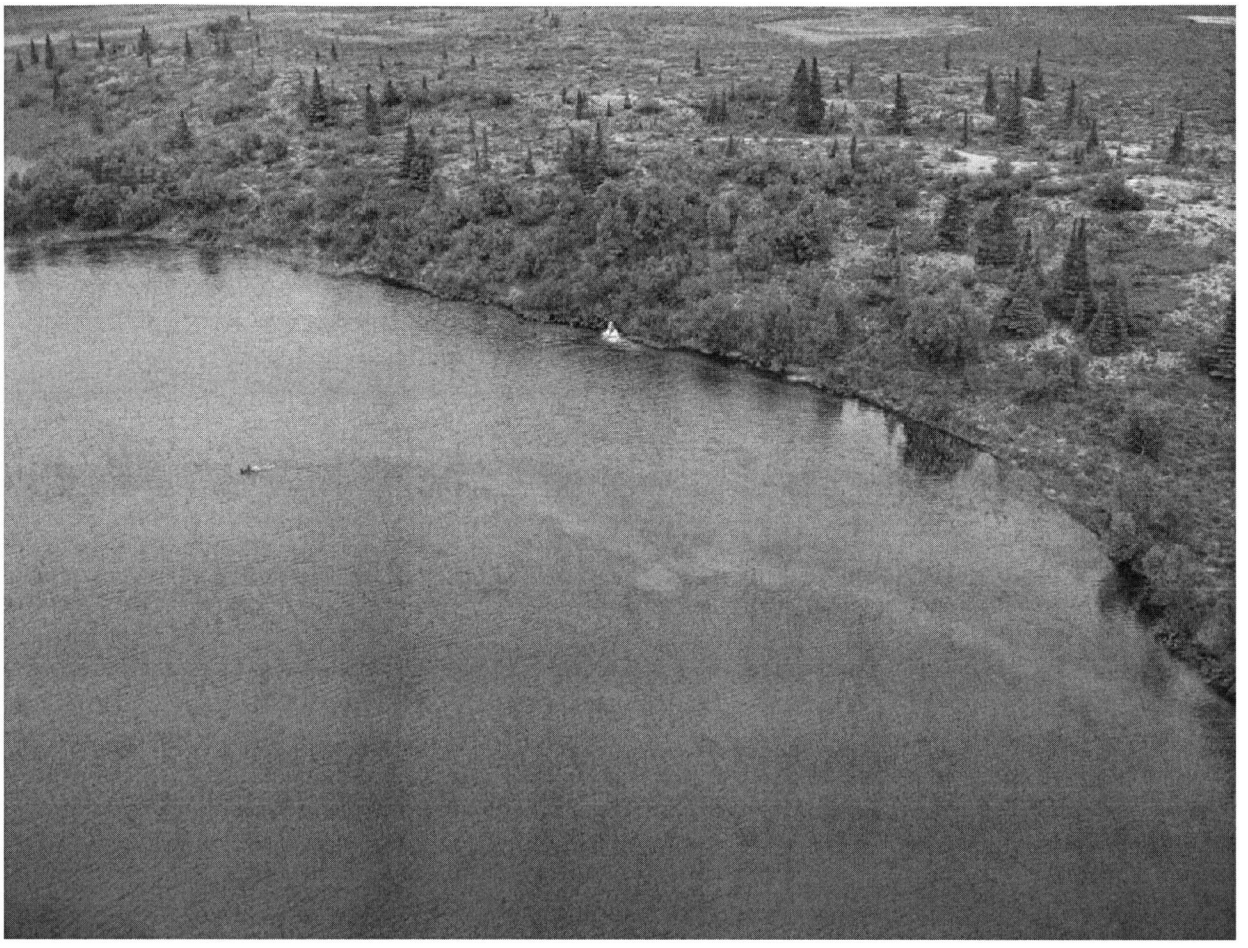

Photo 3.2. Tundra Lake on BLM Lands West of Lake Iliamna. There is a brown bear on the shoreline and a moose in the pond. The bear has been tracking the moose – note the wake in the pond.

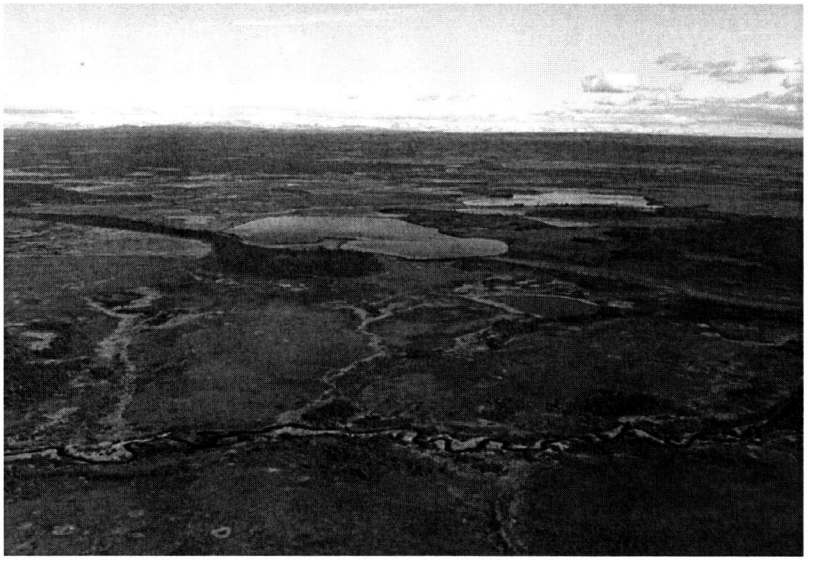

Photo 3.3. Ole Creek, Southwest Iliamna Block

Kaskanak Creek crosses and provides drainage for BLM-managed lands (Photo 3.1). BLM blocks of land are dotted with thousands of large and small shallow lakes and ponds that provide moisture for riparian habitat, summer water-dependent vegetative habitat, and tundra (Map 3.2).

Residents of the communities of Pedro Bay, Port Alsworth, Aleknagik, Dillingham, Ekwok, Igiugig, Iliamna, Kokhanok, Levelock, Manokotak, Nondalton, and New Stuyahok use BLM lands in the Iliamna Block for a wide variety of subsistence hunting and gathering activities during their yearly round of seasonal activities (Wright et al. 1985; Morris 1983, 1985, 1986; Endter-Wada and Levine 1992; Fall et al. 1986; Chythlook and Fall 1988; Schichnes and Chythlook 1985; ADF&G 2004b) (Appendix D).

- Nondalton (Iliamna East) – trapping, hunting black bear, moose, and caribou
- Pedro Bay (Iliamna East) – hunting brown bear, moose, and sheep
- Port Alsworth (Iliamna East) – gathering berries, hunting moose, caribou, black bear, waterfowl
- Iliamna (Iliamna East and West) – hunting caribou, moose, waterfowl, and trapping
- Igiugig (Iliamna East) – hunting moose, caribou, waterfowl, and trapping

In Game Management Unit 9(B), UCUs 0202 and 0203 include two large blocks of unencumbered BLM land located immediately west of Lake Iliamna. Except for one, the BLM Special Use Permit holders in this area have operations on either Native-selected or State-selected BLM lands in the Lake Iliamna area (Map 3.2 and Photo 3.4).

Photo 3.4. Chekok Creek, View North East. BLM lands in the background are in GMU 9(B) UCU 0303.

A smaller block of unencumbered BLM land is located in Iliamna East in UCU 0303, on the northeast side of Lake Iliamna on Chekok Creek (Map 3.2). UCU 0303 comprises only 206 mi², of which 10% is BLM unencumbered lands, located in the Chekok Creek drainage (Map 3.4). One of six Special Use Permit guides maintains a camp on unencumbered BLM lands in this UCU, which is accessed by aircraft for

hunting caribou, moose, and brown bear. However, there is also some use of boats for hunting brown bear. Six percent of all brown bears harvested in GMU 9(B) during the reporting period 1983 – 2002 were harvested in UCU 0303. The majority of them were taken by hunters from outside of Alaska. This region is known for trophy bear hunting opportunities. Subsistence hunting for brown bear in this region does not usually take place every year, but is more likely to occur once every several years. The only GMU 9(B) community recorded as having hunted brown bear in this UCU is Iliamna.

These three UCUs were second in importance for moose harvests in GMU 9(B) for the reporting period from 1983 - 2002. UCUs 0202 and 0203 vary in size from 463 mi² to 580 mi², and each is comprised of between 34% and 39% unencumbered BLM lands. Over half of the hunters have been from out of state in the southern UCU, and from outside of the region in Alaska for the northern UCU. Approximately 9% of moose hunters in these UCUs are local residents of the communities of Igiugig, Iliamna, King Salmon, Naknek, South Naknek and Pedro Bay. Moose harvest in this area was declining through 2002. Approximately ¾ of moose hunters access UCU 0202 by aircraft and ¼ by boat. Moose hunters access UCU 0203 primarily by boat, closely followed by fly-ins.

One or two out of state hunters have consistently hunted moose in East Iliamna. Alaskans from outside the region have also hunted moose in this area. Until 1999, residents of this GMU also hunted moose in the Chekok Creek area. The local moose hunters are residents of Iliamna and Port Alsworth. In addition, subsistence use area map data gathered in 1982 for Pedro Bay suggest that members of that community subsistence hunt Dall sheep on unencumbered BLM lands in the Chekok Creek drainage, along with moose and brown bear (Morris 1986). There are no ADF&G Harvest records further documenting sheep hunting in UCU 0303. However, the fact that Dall sheep have been hunted in this area by Pedro Bay residents was also reported to McClenahan by community members in the 1990s (McClenahan 2004, Pers. Comm.). Harvest records indicate that the Unit 9(B) communities of Iliamna, Nondalton, and Port Alsworth and the Unit 9(C) communities of King Salmon and Naknek hunt sheep in Unit 9(B). It is possible that these communities have also used UCU 0303 to hunt sheep in the past (Map 3.19).

The southern portion of the West Iliamna blocks were second in importance for caribou harvest between 1983 and 2002. Over half were taken by non-local Alaska residents. Over one-quarter were harvested in the southern portion of the block by local subsistence hunters from Igiugig, Kokhanok, King Salmon, Naknek, and South Naknek. Hunters from out of state hunted in the northern part of the block. There has been a general downward trend of caribou harvests in the northern portion since 2002. The overall trend for hunters from outside of this region hunting in the southern portion seems to be declining, while attempts by local subsistence users appeared to be increasing in the southern portion as of 2002. At the same time, the numbers of animals in the Northern Alaska Peninsula Caribou Herd nearest to the Unit 9(C) communities have been in serious decline, precluding much opportunity to hunt them. Caribou hunters hunt caribou in this area using aircraft, with some use of boats.

A small but significant part of the Southwestern most portion of the Iliamna blocks is within GMU 9(C) UCUs 0701 and 0703. This area is to the north of the Alagnak River drainage, and is discussed under the Alagnak Block.

A small isolated piece of unencumbered BLM land that makes up less than 2% of the 808 mi² UCU 0301 is located in the Northern most corner of the Iliamna Block at the Chulitna River (Map 3.2). Another small isolated piece of land is located south of Lake Iliamna near Gibralter Lake where it makes up less than 1% of 761 mi² UCU 0701 (Map 3.2). Due to their size they will not be detailed here.

(2) Alagnak Block (2 blocks) (portions of GMU 9(C) in UCUs 0701 and 0703) (Map 3.1)

The Alagnak Blocks of BLM lands lie in a strategic and picturesque region east of Kvichak Bay and south of the Alagnak River (Map 3.1). Residents of the communities of King Salmon, Naknek, South Naknek, Egegik, Levelock, and Kokhanok use BLM lands in this block for a wide variety of subsistence pursuits during their annual round of seasonal subsistence activities (Wright et al. 1985; Morris 1983; Wright et al. 1985; Krieg et al. 1996; Endter-Wada et al. 1982.; Schichnes and Chythlook 1985, 1989, and 1991; ADF&G 2004b) (Appendix D).

- Levelock – hunting caribou, moose, waterfowl, trapping, and gathering vegetation
- King Salmon – hunting moose and trapping
- Naknek – hunting moose and caribou and trapping
- South Naknek – hunting moose, caribou, and waterfowl and gathering vegetation

Hunters access these UCUs primarily by aircraft for moose, caribou, and brown bear hunting, except for caribou in UCU 0701, where snowmachines and four-wheelers are the principal modes of transportation. A small number of boats are used in both UCUs for moose hunting, and in UCU 0701 for brown bear hunting.

Photo 3.5. Coffee Creek

UCU 0701 is 598 mi², 50% BLM lands and is adjacent to the Alagnak River. UCU 0703 is 478 mi², contains 4% BLM lands, and is adjacent to the Alagnak River. This portion of GMU 9(C) has been a moderately productive area for moose during the reporting period from 1983–2002, particularly the Westernmost block. However, harvests have declined since peaks between 1990 and 1994. The majority of hunters trying to harvest moose in this portion of the block since 1990 have been subsistence users, residents primarily of the GMU 9(C) communities of King Salmon, Naknek, and South Naknek, but also several residents of the GMU 9(B) communities of Kokhanok, Igiugig and Levelock, the Unit 9(D) community of Cold Bay, and the Unit 9(E) community of Chignik. Subsistence hunters have been less consistent in their use of the eastern portion of area, but their efforts picked up between 1988 and 2002. There were four nonresident moose hunters per year attempting to harvest moose. There were one or two Alaska resident hunters from outside of the region attempting to harvest moose between 1999 and 2002.

Caribou harvests in the area of the western portion of this block were robust in 1992, 1993, and 1998. However, the numbers of caribou harvested in the area have been declining since the 1990s. The hunters most actively seeking to harvest caribou in this area are the Unit 9(C) residents of King Salmon and Naknek, followed by Alaska residents from other GMUs. Only since 1999 have hunters from outside of Alaska attempted to harvest caribou here, up to 15 per year in the eastern portion. Caribou hunting is on the decline.

Harvest of brown bears has been strongest in the eastern portion of the area, primarily by hunters from outside of Alaska, and harvest effort is increasing. Since 1997, the majority of hunters in the western portion of the area have been residents of GMUs 9(B) and 9(C), from the communities of Iliamna, Levelock, King Salmon, and Naknek. Subsistence hunters do not take bears every year, but may take a bear once every several years. Bear fat is greatly appreciated, particularly by the Elders, and is shared throughout a broad sharing network.

(3) Kvichak blocks (8 blocks) (portions of GMU 9(B) in UCU 0201, 0202 and 0203)(Map 3.1)

These smaller but very important blocks of BLM lands are in close proximity to the Kvichak River. Two pieces of land in this block are crossed by Ben Courtney Creek. The area consists of rolling tundra-covered hills and open spruce parklands, with wide floodplains vegetated with wet tundra, grasses, and deciduous brush (Maps 3.6 and 3.7).

The following Bay area communities use BLM lands in the Kvichak Block for several subsistence pursuits (Morris 1983; Endter-Wada and Levine 1992; Fall et al. 1986; Wolfe et al. 1984; ADF&G 2004b) (Appendix D).

- Iliamna – hunting moose and waterfowl, trapping, gathering vegetation
- Igiugig – trapping, hunting waterfowl, caribou, and moose
- Dillingham – hunting caribou and moose

Portions of the 554 mi^2 GMU 9(B) UCU 0201 are located in the Kvichak Blocks as well as the Yellow Creek Block of BLM land. The BLM blocks together comprise 32% of the UCU, with the Kvichak blocks being smaller than the Yellow Creek block. The two Kvichak blocks are located in the Southwestern portion of this UCU. A complete description of the moose harvest in this UCU is provided under the heading, "Yellow Creek Block," and will not be repeated here. Bear Creek crosses the Southwesternmost piece of land in this block (Photo 1.3).

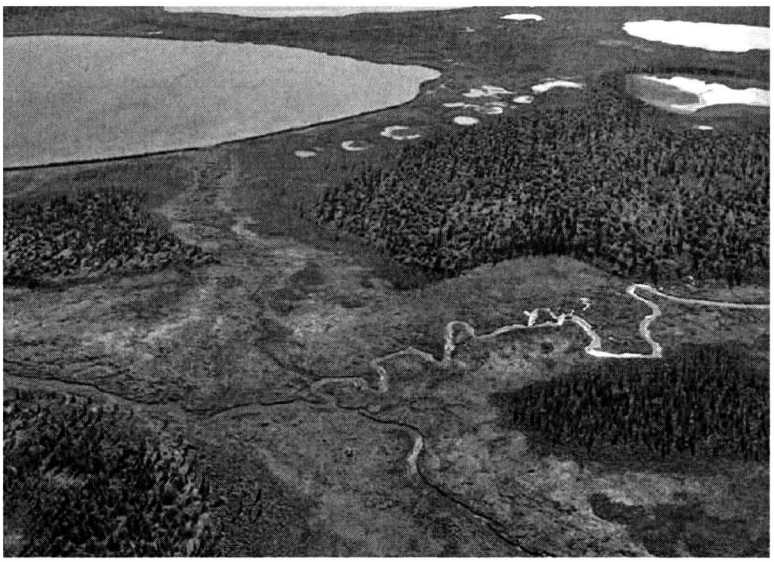

Photo 3.6. Confluence of Branches of Ben Courtney Creek

Photo 3.7. Headwaters of Ben Courtney Creek

Portions of UCU 0202 contain two blocks of BLM land in the Southeastern portion of the Kvichak Block. Since portions of UCU 0202 are also located in the Iliamna Block, the activities in this UCU will not be repeated here.

UCU 0203 contains the northernmost four small blocks within the Kvichak Block. Since a portion of the Iliamna Block is also within UCU 0203 and has already been discussed in that section, the reader is referred to the Iliamna Block discussion for details. Some of the more northerly Kvichak blocks are within the Kvichak River watershed and contain greater concentrations of riparian vegetation than the southern blocks. To the extent that moose are present in the area, they would be attracted to riparian vegetation. Moose hunters may frequent the area in search of game.

(4) Yellow Creek Block (one block of unencumbered land) (portions of GMU 9(B) in UCU 0201 and GMU 17(C) in UCUs 0901 and 0501)(Photo 3.8).

The Yellow Creek Block is located in a relatively flat, slightly elevated area of the Bristol Bay Plain between the Nushagak and Kvichak River drainages. The area is dominated by thousands of large and small kettle lakes and small drainages. Yellow Creek, one of the most prominent tributaries of the Kvichak River, drains the eastern portion of this piece of BLM land in a southeasterly direction (Map 3.8). In the western portion, the land is drained by Klutuk Creek and other small creeks that flow to the west and empty into the Nushagak River. Copses of spruce dot the landscape, which is dominated by wet tundra. The lakes and drainages support mixed deciduous growth (Photos 3.10 and 3.11).

Residents of the communities of New Stuyahok, Manokotak, Levelock, Kokhanok, Iliamna, Igiugig, Ekwok, Dillingham, and Platinum use the Yellow Creek Block of BLM lands to carry out a wide variety of subsistence activities. The following communities use the Yellow Creek Block for the following

subsistence purposes (Morris 1983; Schichnes and Chythlook 1991; Schichnes and Chythlook 1989; Wolfe et al 1987; Wright et al 1985; Fall et al. 1986; ADF&G 2004b) (Appendix D).

- Iliamna – trapping
- Aleknagik –hunting caribou
- Ekwok – hunting caribou and moose
- Dillingham – trapping and gathering wild vegetables
- Platinum – hunting caribou

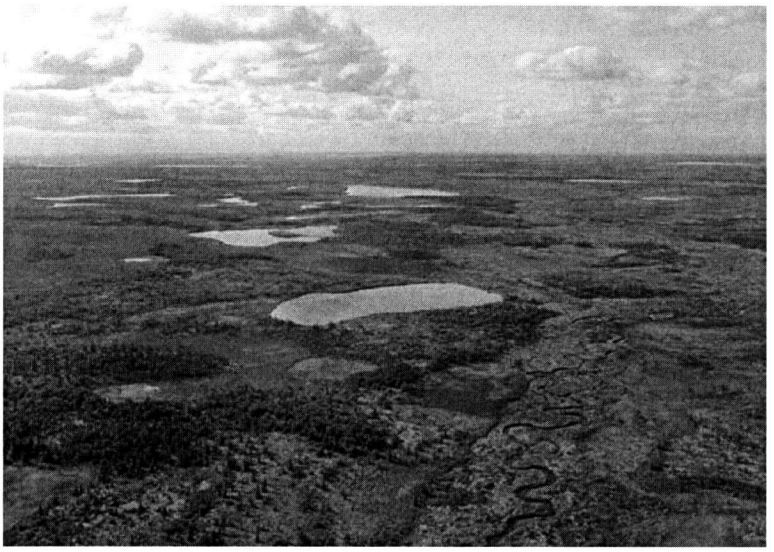

Photo 3.8. Upper Yellow Creek, View North West

The Yellow Creek block is located in UCUs that are the most significant for harvesting moose of all the UCUs containing BLM blocks in the planning area. GMU 9(B) UCU 0201 is 554 mi² and includes 32% BLM land, GMU 17(C) UCU 0501 is 1,326 mi² and includes 26% unencumbered BLM land, and UCU 0901 is 505 mi² and is 40% BLM land. Yellow Creek block shares UCUs 0801 and 0901 with Klutuk Block.

Fifty-four percent of moose hunters in the northern part of the area were subsistence users, including residents from Igiugig and Levelock in GMU 9(B), and from King Salmon, Naknek, and South Naknek in GMU 9(C). Seventeen percent were non-local Alaska residents, and 27% were non-residents, making this area important for resident hunting for nearby villages, but also somewhat important for guided and non-guided hunting by hunters from outside of Alaska. Moose hunters access this area primarily by boat, with some use of aircraft.

From 1983 to 2002, 829 moose were harvested from UCU 0501. Hunting in the western portion of this area steadily increased during the reporting period from 1983 to 2002. From 1983 to 1989, between 9 and 20 moose were harvested annually; from 1990 to 1995 annual harvest numbers were between 13 and 46 animals. From 1996 to 2002, annual moose harvest numbers were between 34 and 105 animals, with the greatest numbers occurring in 2001 and 2002. Hunters from outside of Alaska have played a very small role in harvests in this area, and have made no effort since 1994. Residents of the GMU 17(C) communities of Aleknagik, Clarks Point, Dillingham, Ekwok, Manokotak, New Stuyahok, and Portage Creek were the principal harvesters. Other GMU 9 and 17 communities harvesting in this area are King Salmon, Koliganek, Naknek, Pilot Point, Port Moller, and Togiak. The remainder are Alaska residents from outside of the region. Moose, caribou, and brown bear hunters access this area with a mix of boats, snowmachines, and aircraft.

The northern area is also very important for the residents of GMU 17, who accounted for 74% of the hunters attempting to harvest moose, and for 78% of the moose harvested during the reporting period of 1983 to 2002. GMU 17(C) communities participating in the moose hunt included Dillingham, Clarks Point, Ekwok, and New Stuyahok; from GMU 17(B) the community of Koliganek, and from GMU 17(A) the community of Togiak. Hunters from outside of Alaska accounted for 6% of those hunting for moose in this area, and for 7% of the moose harvested during the reporting period. The remainder were Alaska residents from outside of the region. Moose harvests peaked in this UCU in the late 1990s and have been declining since. Moose hunters access this area using boats, snowmachines, and aircraft.

Caribou hunters in the western part of this unit were successful during the reporting period 1983 – 2002, but harvest numbers declined to 19 animals in 2002. Leading in harvest are the residents of the GMU 17(C) communities of Aleknagik, Clarks Point, Dillingham, Ekwok and Portage Creek. Other GMU 9, 17, and 18 communities harvesting in this area are Chevak, King Cove, and Koliganek. Hunters from outside of Alaska account for only 19% of the harvest for the reporting years. The northern portion of this planning block lies in an area where hunters have also been very successful. This portion and the equally promising western section are discussed in the "Klutuk Creek" section.

Only 15 brown bears were harvested in the western portion during the reporting period 1972-1999, four of them by hunters from outside of Alaska and the rest (where the residency is known) by residents of the GMU 17(C) community of Dillingham. Hunting remained at one or two hunters per year during the reporting period. Hunting success in the other areas was roughly similar during the reporting period.

(5) Koggiling Creek Block (portions of GMU 9(B) in UCU 0101 and portions of GMU 17(C) in UCU 0501 (Photo 3.9).

As one proceeds west across the Nushagak River to the Koliganek area, and southward to the shores of Bristol Bay, the character of the habitat changes to older, more eroded moraines that are more gently rolling terrain and lowlands dominated by wet tundra, small patches of deciduous and mixed forest and thousands of large and small lakes with associated riparian shorelines (Photo 3.9). The Koggiling Creek Block, like the Yellow Creek Block, is situated at the junction of the Nushagak and Kvichak river drainages. The block is drained to the east by King Salmon Creek and Copenhagen Creek, which flow into the upper reaches of Kvichak Bay, and to the west by Koggiling Creek which flows into the Nushagak River to the north of Keefer Cutoff (Photo 3.9). The western portion of this area transitions to spruce woodland as one travels west toward the Wood-Tikchik lakes. This region hosts high-density tundra swan nesting populations, and is one of the five high waterfowl areas in Alaska (USFWS 2005c). The communities of New Stuyahok, Levelock, Dillingham, and Naknek use BLM lands in the Koggiling Creek Block for a variety of subsistence activities (ADF&G 2004). The following communities use these BLM lands for the following subsistence resources (Schichnes and Chythlook 1991; Wolfe et al. 1984; Wright et el. 1985; Fall et al. 1986; Wolfe et al. 1984; Morris 1985; Krieg et al. 1998; ADF&G 2004a) (Appendix D).

- New Stuyahok – caribou and waterfowl hunting, trapping
- Dillingham – trapping
- Naknek – hunting waterfowl

Activities in GMU 9(B) UCU 0101are discussed in detail under the Yellow Creek and Klutuk Creek Blocks, and will not be repeated here. Hunters access this area to hunt caribou and brown bear using aircraft, and moose using a mix of boats and some aircraft. In the southern portion, hunters use a mix of boats, snowmachines, and aircraft to hunt moose, caribou and brown bear.

Photo 3.9. King Salmon Creek

(6) Klutuk Creek Block (Two blocks) (portions of GMU 17(B) in UCU0101 and GMU 17(C) in UCUs 0801 and 0901 (Photos 3.10 and 3.11).

BLM lands in the Klutuk Creek Block are also part of an older glacially formed landscape of more eroded moraines and gently undulating terrain of wet tundra-dominated lowlands, copses of spruce, and fewer large and small lakes and ponds than are found in the Yellow Creek Block. As one proceeds westward, the size of the trees and the density of the spruce forests and mixed deciduous forests increase. The larger block of BLM land is drained to the southwest into the Nushagak River most prominently by Klutuk Creek (Photos 3.10 and 3.11). The smaller block, situated to the southwest, sits adjacent to the Kakwok River and one of its main tributaries, which also flows into the Nushagak River. Residents of the communities of New Stuyahok, Manokotak, Ekwok, and Dillingham use the Klutuk Block of BLM lands for a wide variety of subsistence resources in their annual round of seasonal subsistence activities (Schichnes and Chythlook 1985; Wolfe et al. 1987; Wright et al. 1985; ADF&G 2004b) (Appendix D).

ADF&G Subsistence Division subsistence use area maps drawn up in the 1980s and 1990s indicate that the following communities were utilizing the following subsistence resources on BLM lands:

- Ekwok – caribou and moose hunting
- Aleknagik – caribou hunting
- Dillingham – caribou and moose hunting

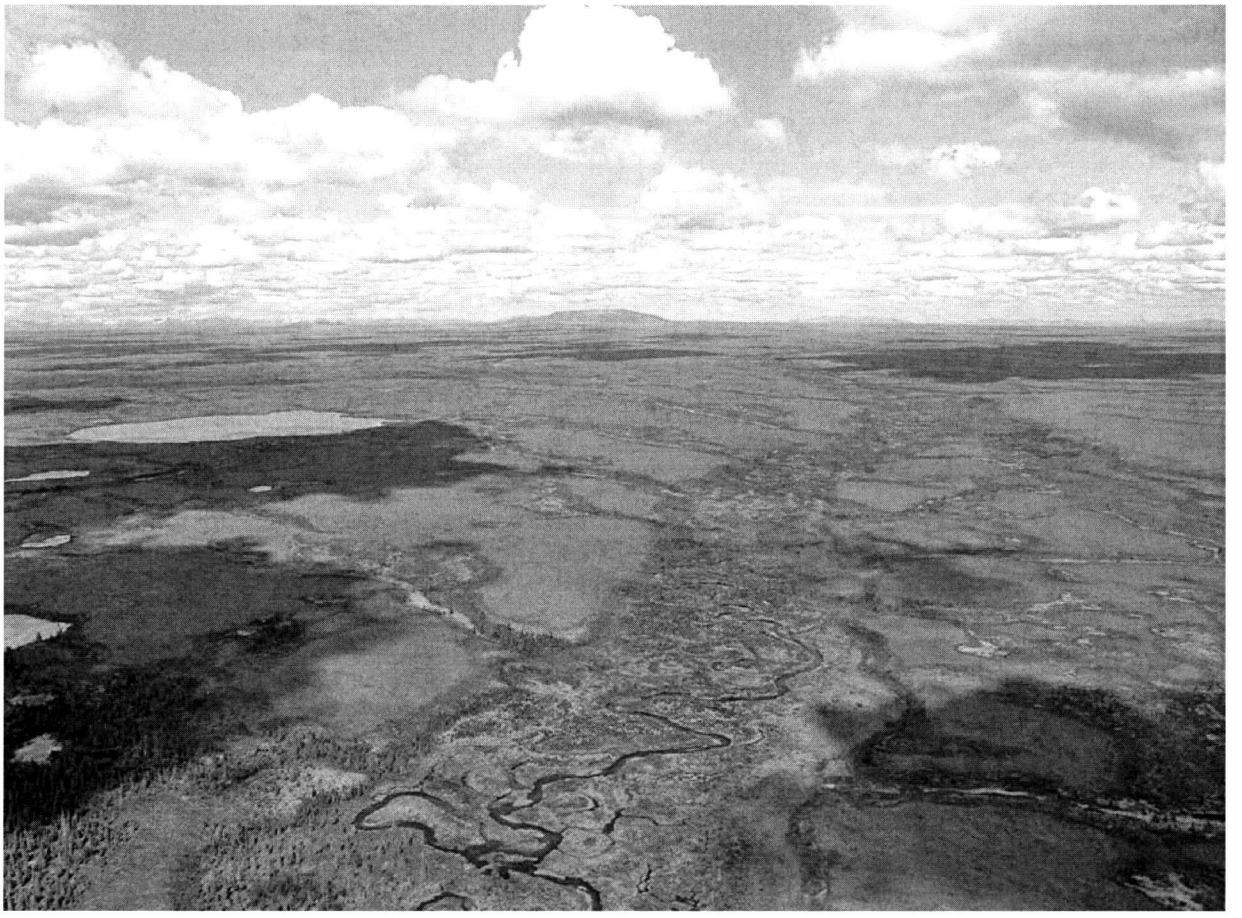

Photo 3.10. Klutuk Creek

BLM land in GMU 17(B) is located in the southcentral part of the GMU, specifically a portion of UCU 0101, near the community of Koliganek. This UCU comprises 454 mi² and is made up of 31% BLM land. In the western portion of this block and in surrounding lands, GMU 17(C) 0801 is 198 mi² and is 29% BLM land. In the southeast portion of the block and surrounding lands, GMU 17(C) 0901 is 505 mi² and contains 40% BLM lands.

During the reporting period 1983-2002, the northern area provided a good moose harvest. Moose harvest has been increasing since 1983. The number of moose harvested per year between 1995 and 2002 doubled, and in a few cases more than doubled the number taken between 1983 and 1994. This northern area is important to local residents, who took 55% of the harvested moose. Hunters from the GMU 17(C) communities of Dillingham, New Stuyahok, and Ekwok, the 17(B) community of Koliganek, the 17(A) community of Togiak, and the 9(C) community of King Salmon hunted for moose in this area. It is also important to guided and nonguided hunters from outside of Alaska, who harvested 29% of the moose taken in the area. Eleven percent were taken by Alaska residents from outside this region. Hunters use aircraft, snowmachines and boats to hunt moose in the area.

For the reporting period 1998-2002, caribou take in this block was the best in the planning area. Nonresident hunter efforts were consistently larger than those of Alaska residents, although the number of nonresident hunters has declined since 1999. The second highest number of caribou hunters in this area was Alaska residents from outside the region. GMU 9 and 17 residents accounted for the smallest number of hunters hunting in this area, although there was marked increase in local hunters in 2002. They were from the GMU 17(B) community of Koliganek, the 17(C) community of New Stuyahok, the 17(A) community of Togiak, the 9(C) community of King Salmon, and the 9(D) community of King Cove.

Residents of Alaska Peninsula communities sometimes subsistence hunt and fish in Bristol Bay during the commercial fishing season. Caribou hunters primarily use aircraft for access in this area, followed by boats, four-wheelers, and snowmachines.

During the reporting period 1984 – 2001 only nine brown bears were harvested in this northern area. Hunters were fairly balanced between hunters from outside of Alaska, Alaska residents from outside of the region, and residents of GMU 17 (Dillingham and Koliganek). Bear hunters primarily use aircraft to access this area, although some hunters do use boats and snowmachines to access the area.

In the western portion of this area, a total of 160 moose were reported harvested during the reporting period 1983-2002, with 333 hunters attempting to harvest during the same period. Only a very small number of hunters from outside of Alaska attempted to hunt moose in the western area during the reporting period. The area is used by moose hunters from the GMU 17(C) communities of Dillingham, Aleknagik, Ekwok, Manokotak and New Stuyahok, the 17(B) community of Koliganek, the 9(B) community of Pedro Bay, and the 9(C) community of King Salmon. Hunters from these communities harvested 73% of all the moose taken in this area during the reporting period. Moose hunters access the area primarily by boat, followed by snowmachines and aircraft.

The western area is also good for harvesting caribou. During the reporting period 1998-2002, 51% of hunters were from outside of Alaska, 37% were residents of the Bristol Bay region, and 12% were Alaska residents from outside of the region. Local communities harvesting in this area include the GMU 17(C) communities of Dillingham, Ekwok, and New Stuyahok, the 17(B) community of Koliganek, and the 9(C) community of King Salmon. The caribou harvest trend in this western area has been downward since 1998. Access to this UCU for caribou hunting is primarily by aircraft, with some use of boats, four-wheelers, and snowmachines.

During the reporting period 1985-2001 only a few bears were harvested in the western area, three by residents from outside of Alaska, and two by GMU 17(C) residents of Ekwok and New Stuyahok. The residency of the remainder of hunters is not known. Bear hunting has remained consistent at one or two bears harvested a year in this area. Hunters access the area by aircraft and boats.

The southeast area has also been good for moose harvesting. However, nearly twice as many hunters attempted to harvest than were actually able to harvest a moose during the reporting period 1983 - 2002. This southeast area is very important for the residents of GMU 17, who accounted for 74% of the hunters attempting to harvest moose, and for 78% of the moose harvested. Local communities harvesting in this area include the GMU 17(C) communities of Dillingham, Clarks Point, Ekwok, and New Stuyahok, from the 17(B) community of Koliganek, and the 17(A) community of Togiak. Hunters from outside of Alaska accounted for 6% of those hunting for moose in this area, and for 7% of the moose harvested during the reporting period. The remainder were Alaska residents from outside of the region. Moose harvests peaked in this area in the late 1990s and have been declining since. Moose hunters access this area using boats, snowmachines, and aircraft.

Caribou hunting efforts and the 300 caribou harvested in the southeast area during the reporting period from 1998 to 2002 were fairly evenly divided among nonresidents, Alaska residents from outside of the region, and local residents. Hunters from outside of Alaska accounted for 37% of hunters trying for caribou in this area, and for 40% of the caribou harvested. Residents of GMUs 9 and 17 accounted for 32% of hunters attempting to harvest and for 30% of the caribou harvested during the reporting period. The remainder were Alaska residents from outside the region. The GMU 17(C) communities of Aleknagik, Dillingham, Ekwok, Manokotak, and New Stuyahok used the southeast area during this period, as did the 17(B) community Koliganek, the 9(C) communities of King Salmon and Naknek, and the 9(B) community Port Alsworth. The greatest majority of caribou hunters access the area by aircraft, but a few use snowmachines, boats, and four-wheelers.

Hunters from outside of Alaska accounted for the harvest of the majority of the brown bears harvested in the southeast area during the reporting period from 1990 to 1997. No harvests by residents of the Bristol

Bay region were reported during this period. Bear harvests in this area dropped off after 1994. Access for brown bear hunting is by aircraft.

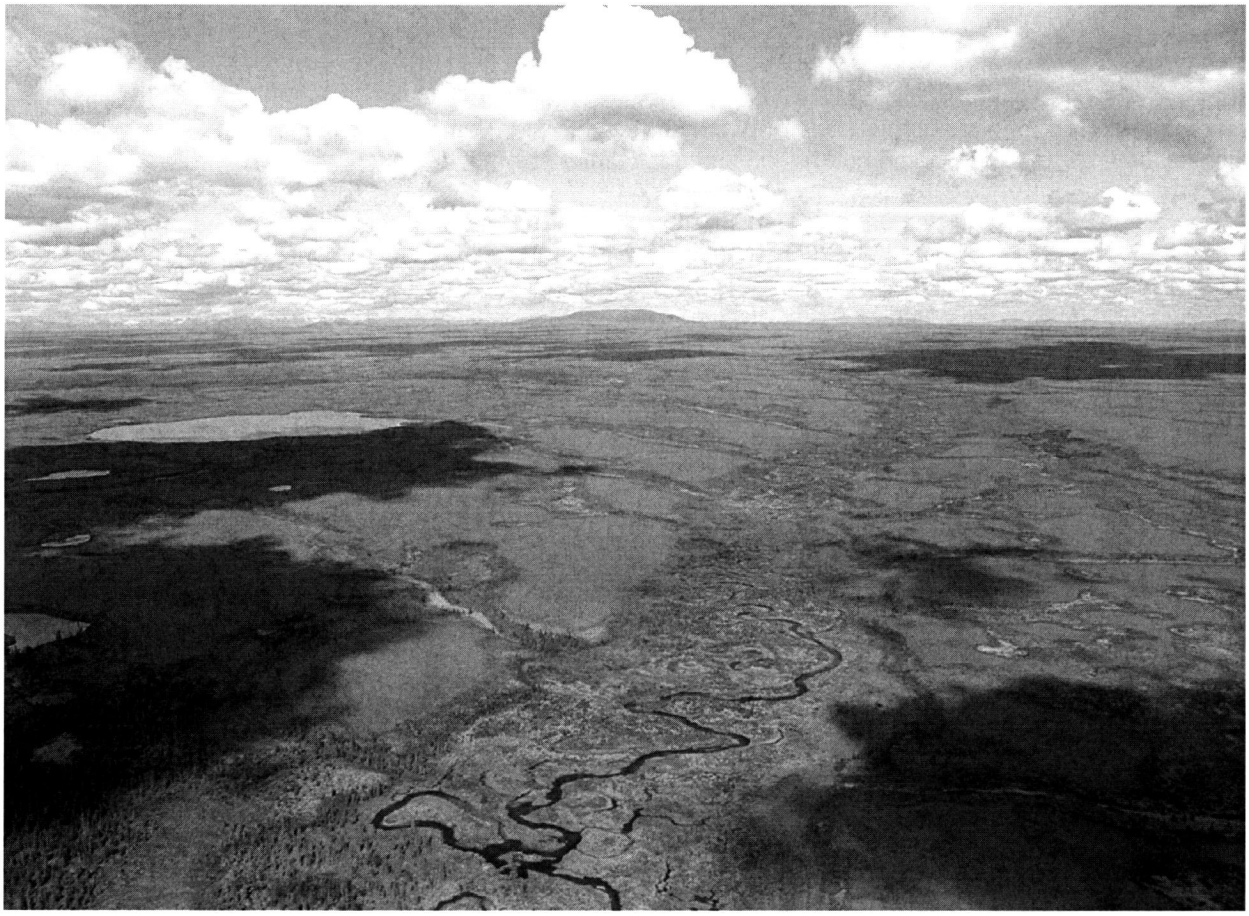

Photo 3.11 . Klutuk Creek in regional perspective

A small portion of GMU 18 lies within the westernmost part of the planning area. The communities closest to BLM lands in this region are Goodnews Bay, Platinum, Quinhagak, Togiak and Twin Hills. These are the communities primarily using BLM lands in this block for a wide variety of subsistence (ADF&G 2004). ADF&G Subsistence Division subsistence use area maps gathered in the 1980s and 1990s indicate that residents of the community of Platinum were using BLM lands in the Goodnews Block for hunting waterfowl, trapping, and gathering plants.

(7) Goodnews Bay Block (GMU 18; UCUs 1701 and 1801)(Map 3.3)

The Goodnews block lies on Alaska's west coast and is surrounded by the Togiak National Wildlife Refuge. Habitats are varied, and include beaches, ocean spits, tidal mud flats, coastal salt marshes, and coastal wetlands in a narrow zone between Kuskokwim Bay and the front of the Ahklund Mountains (Photos 1.2 and 3.12). This narrow complex of habitats forms a funnel for large numbers of migratory waterfowl and shorebirds from the Yukon Delta, Western Alaska and the North Slope. These migratory birds include T&E Species. The area is important nesting, molting and brooding habitat for several special status species including Steller's eider, bristle-thigh curlew, white-front geese, emperor geese, and numerous sea ducks (Seppi 1997, Peterson et al. 1991, Shaw et al. 2005). The Carter Spit area is

on the southern fringes of the Yukon Kuskokwim Delta, Western Hemisphere Shorebird Reserve Network, which is of global importance.

Carter Spit and adjacent unnamed spits and wetlands are important for the abundance and variety of birds and plants. Sea bird nesting colonies also occur on BLM-managed lands in Goodnews Bay (Peterson et al. 1991, Shaw et al. 2005). The Ahklun Mountains are non-forested alpine tundra with willow-lined drainages and tall shrub (willow and alder) thickets skirting the bases of the hills and occurring in scattered patches throughout.

Photo 3.12. Takiketak, View South

UCU 1701 is 2,308 miles², of which 10% is BLM lands. There is less than 1% moose habitat on these lands, and only one moose was recorded killed during the recording period 1983-2002, although 25 hunters attempted to harvest a moose. All of the hunters except one were from the GMU 18 communities of Bethel and Quinhagak. Currently there is a moratorium on hunting moose in this region and a conservation effort to enhance the moose population in the area. In the past, moose hunters accessed this area by boat. UCU 1801 contains 1,495 mi², of which 5% is BLM land. Less than 2% of this UCU is suitable moose habitat. During the reporting period of 1983 to 2002, only 15 hunters attempted to harvest moose and only six moose were harvested. Of the six moose harvested, five were taken by GMU 18 residents from Bethel and Goodnews Bay. The remainder of the hunters in this area were from Alaska communities outside of this region. This area also has a moratorium on moose hunting. In the past, moose hunters used boats and some aircraft to access the area.

Caribou have been absent from most of GMU 18 for over 130 years and have only recently begun to migrate into the area. Caribou were not plentiful in UCU 1701 during the reporting period 1994-2002, and only 46 were harvested during that time. Eight caribou were taken in 1994, followed by a decline in harvest numbers until 2000, when 15 were harvested. Twelve were harvested in 2002. Few hunters from outside of Alaska attempted to harvest caribou in this UCU. A majority of the animals were taken by

residents of the GMU 18 communities of Bethel, Goodnews Bay, Kasigluk, and Quinhagak, the 17(A) communities of Togiak and Twin Hills, and the 17(C) community of Dillingham. Transportation for caribou hunting is by aircraft, boat, and snowmachine.

During the reporting period between 1994 and 2002, 32 caribou were harvested in UCU 1801. Only four were harvested by hunters from outside of Alaska. The largest number, 22 or 69% were harvested by residents of the region, including residents of the GMU 18 communities of Bethel, Chevak, and Goodnews Bay, the GMU 17(C) communities of Aleknagik, and Manokotak, and the 17(A) communities of Togiak and Twin Hills. Hunting increased dramatically in 2002. Caribou hunters use aircraft, boats, and snowmachines to access this UCU.

The harvest of brown bears in UCU 1701 has varied from one to three animals taken approximately every other year during the reporting period 1984-2002. During that time, 16 brown bears were harvested by hunters from outside of Alaska, and only one was harvested by a resident of the GMU 18 community of Bethel. The remaining five were harvested by Alaska residents from outside the region. Aircraft and some boats are used to access the area.

Between 1971 and 2002, 18 brown bears were reported harvested in UCU 1801. The harvest of brown bears in UCU 1801 has varied from one to three animals taken approximately every other year during the reporting period 1971-2002 except for 1984, when ten were harvested. Only two bears were taken by hunters from outside of Alaska during the reporting period, and the rest were harvested by residents of the GMU 18 communities of Goodnews Bay and Platinum. Snowmachines, aircraft and boats are all used by bear hunters as modes of transport to this UCU.

d) Large Mammals

(1) Caribou

Caribou (*Rangifer terandus*) inhabit treeless tundra, high mountain, and coastal areas in the Bay planning area. They have occupied various regions in the planning area in 150 to 200 year cycles (ADF&G 2005a; Whitaker 1980). Where boreal forests are available, herds may choose to winter there. Calving areas are usually located in mountains or on open, coastal tundra. Caribou tend to calve in the same general areas year after year, but migration routes may vary. Being herd animals, caribou must use a wide area to find food. Large herds may migrate up to 400 miles between summer and winter ranges. In summer, caribou eat the leaves of willows, sedges, flowering tundra plants and mushrooms. Beginning in September, they eat lichens, dried sedges, and small shrubs such as blueberry (Valkenburg 1999). Maps 3.8, 3.9, 3.10, and 3.11 show vegetation types for many BLM lands in the planning area. Maps 3.14 and 3.15 provide information about caribou ranges. Their chief predators are humans and wolves, but brown (grizzly) bears, wolverines, lynx and golden eagles may pray on the young (Whitaker 1980).

Two large caribou herds occupy tundra habitats on BLM lands in the planning area. They are the Mulchatna Caribou Herd (MCH) and the Northern Alaska Peninsula Caribou Herd (NAPCH). A third, smaller more resident herd, the Nushagak Peninsula Caribou Herd (NPCH) occupies the Nushagak Peninsula on the Togiak NWR. Numbers for all herds combined in the Bay planning area have ranged between 200,000-350,000 over the last decade, but in the last three years herds have experienced significant declines to between 85,000 and 100,000 animals (Woolington 2003b; Woolington 2005).

The 1999 photo census of the MCH indicated a population size of 160-180,000. The aerial photocensus in 2002 provided a minimum estimate of 147,000 caribou in the MCH, and the 2004 photo census indicated a population estimate of 85,000 (Woolington 2003b; Woolington 2005).

The MCH has demonstrated somewhat unusual behavior in making significant shifts in calving ranges and winter ranges in the last two decades. The traditional way to identify caribou herds has been the discrete and consistent use of long term calving areas (Valkenberg 1999). During the 2000-2002 reporting period, the MCH did not move into the traditional wintering areas along the west side of Iliamna

Lake, north of the Kvichak River, but scattered throughout the herd's range. Approximately 10,000 to 20,000 caribou spent most of their winter in southern GMU 9(B) and southeastern GMU 17(B). In March, 2002, many of these caribou moved south to the King Salmon-Naknek area for a short time before returning to the lower Mulchatna River area (Woolington 2003b).

While an objective assessment of the condition of the MCH winter range has not been made, Brelsford (1987) and Woolington (2003b) reported that the carrying capacity of the traditional wintering areas had been surpassed and that in order to continue growing, the herd had to seek other range. The 2003 ADF&G Caribou Management Report noted that portions of the range were showing signs of heavy use in the form of extensive trailing along migration routes, trampling and heavily-grazed vegetation in some summer/fall range near the Tikchik lakes. Signs of heavy use are also evident on traditional winter range on the north and west sides of Iliamna Lake (Woolington 2003b). Arctic tundra vegetation can take from 35 to over 100 years to regenerate.

All of the planning area communities are dependent on caribou as a staple of their residents' diets. Based on information from one study year, for the 17 Bay planning area communities that were surveyed, large land mammals (caribou, moose, bear, and Dall sheep) comprised 24% of the subsistence diet, and 13% was caribou (ADF&G 2005a). Harvest pressure on the MCH may increase as caribou become more plentiful near the villages; however, less pressure may be put on the local moose populations (Woolington 2003). Wolf densities follow the fluctuations in caribou numbers (Skoog 1968). Wolf predation rates traditionally were low, but probably increased as the herd grew and provided a more stable food source for wolves. Many local residents in the Bay planning area report an increase in wolf populations in the past several years (Woolington 2003b).

In addition to the ongoing monitoring efforts, a coordinated working group is currently being established for the Mulchatna Caribou Herd. The Association of Village Council Presidents in Bethel, and the Western Interior Subsistence Regional Advisory Council are working to establish this working group. This group would promote communication between stakeholders of the MCH, define population objectives for the herd, determine needed management and research, submit funding proposals to State and Federal agencies in an effort to protect, and conserve the Mulchatna Caribou Herd. As a cooperative partner in the efforts to manage the MCH, the BLM Anchorage Field Office will be involved in research objectives and management decisions for the herd.

The Northern Alaska Peninsula Caribou Herd (NAPCH) is distributed throughout the northern Alaska Peninsula and the eastern Bristol Bay regions, primarily in Game Management Units 9(C) and 9(E). The NAPCH is an important subsistence resource for the residents of this region (Woolington 2003b). Hunting is currently restricted to limited permit hunts and a bag limit of one bull. This herd has fluctuated from a high of 20,000 animals in the early 1940s to a current population of 1,200 or fewer (Sellers 2003a). Current habitat condition, nutritional deficiencies, parasites, and diseases are believed to be the primary causes of the decline (Squibb 2005, Pers. Comm.). Scientific studies carried out between 1995 and 2001 demonstrate that the NAPCH is under moderate nutritional stress (Valkenburg et al. 1996; Sellers et al. 1998a, 1998b, 1999, 2000; Woolington 2003b).

Low bull:cow ratios noted in the last four years (i.e. 25.7 bulls to 100 cows in the fall of 2002) in the MCH are reflected in the composition of fewer bulls and more cows harvested. Opportunity to harvest large bulls has declined, contributing to decline in hunter demand (Woolington 2005).

Nushagak Peninsula caribou are localized and harvest is governed by a limited permit system for local subsistence users only. Demand is expected to remain high from local users (Aderman 2004). Currently Nushagak caribou are hunted under limited drawing permit hunts only.

Current management practices allow annual monitoring to document short and long term fluctuations in productivity, disease, seasonal habitat selection, movements, population trends, and accessibility of major herds. ADF&G has limited baseline data. The agency has established an adaptive management regime with monitoring guidelines and measurable goals and objectives aimed at habitat usage, population changes, and uses of caribou in the planning area.

ADF&G management goals and objectives for caribou in Game Management Units 9 and 17 include (Woolington 2005):

- Reduce the Northern Alaska Peninsula Caribou Herd midsummer population objective of 15,000 – 20,000 caribou to 12,000 – 15,000 with an October sex ratio of at least 25 bulls: 100 cows.
- Maintain the Mulchatna Caribou Herd at a population of 100,000 – 150,000 with a minimum bull:cow ratio of 35:100.
- Manage the Mulchatna Caribou Herd for a maximum opportunity to hunt caribou.
- Manage the Mulchatna Caribou Herd in a manner that encourages range expansion west and north of the Nushagak River.

(2) Moose

Moose (*Alces alces*), a relative newcomer to this region, occupy or appear to be moving into suitable habitats throughout the planning area and are a high value recreational and subsistence species. Moose are the world's largest member of the deer family, and those found in Alaska are the largest of all moose.

Moose are found throughout the planning area, particularly in riparian habitats. They are most abundant in areas that have recently burned, in areas that contain willow and birch shrubs, on timberline plateaus, in well-watered wetland tundra areas in small lakes and ponds, and along rivers and streams. They are generally limited by their requirements for food, availability for cover, and the depth of winter snow. In fall and winter moose eat large amounts of willow, birch, and aspen twigs. In spring and summer they graze on grasses, forbs and the leaves of trees and shrubs as well as various aquatic plants (Rausch and Gasaway 1994). In summer and fall moose use wetland areas, lakes and ponds. Moose habitats are more restricted to high forage value riparian and tall shrub/mixed open forest types in winter, where they browse on woody plants, including willow, aspen, and birch. Calving and rutting concentrations take place in winter range habitats.

Moose populations are stable to increasing in the western portion of the planning area, especially notable on the Togiak Refuge in GMU 17(A) and the Goodnews drainage and are stable to decreasing in GMU 9 (Aderman 2004; Aderman and Woolington 2001b; Butler 2003). Recent radio tracking of GMU 19 moose north of the Bay planning area indicates significant movement into the planning area from GMU 19 during the winter period.

No intensive field surveys have been carried out on BLM lands in the planning area. Maps 3.8, 3.9, 3.10 and 3.11 provide information about vegetation types on most BLM-managed lands in the planning area. Maps 3.16 and 3.17 show moose range. A preliminary study of riparian areas on BLM lands in the Bristol Bay area suggests that of 2,193,902 acres of BLM lands, 12,852 acres are estimated to be riparian habitat. In the Goodnews Bay riparian study area, of the 315,052 acres of BLM lands, approximately 7,996 acres are estimated to be riparian habitat. No previous study has defined riparian areas for this region (Denton 2006 Pers Comm.).

Today much of the moose habitat in the Bay planning area is believed to be pristine. The distribution of habitat quality and quantity that supports moose populations may decline in localized areas, especially those adjacent to village areas, while that of less populated areas will fluctuate with natural events such as wildland fires or succession, as well as any future increased levels of human use and infrastructure development. In most years, the most important natural force responsible for enhancing moose habitat has been the scouring of gravel bars and low-lying riparian areas by ice and water during spring thaw, especially on the Nushagak and Mulchatna rivers and the lower reaches of their major tributaries (Woolington 2002). In the past, lightning-caused fires have not been prevalent in the Bay planning area (Cella 1996, Pers. Comm.; Maps 3.23 a,b and 3.24). However, the region is currently experiencing a warming and drying trend that may produce more fire-favorable conditions. In addition, the current trend is encouraging expansion of the type of tall shrub growth that moose prefer.

In portions of the planning area moose are currently among the most productive herds in Alaska and are expanding to new habitats in the western portion of the planning area in the Nushigak, Togiak and Goodnews Bay drainages. Moose numbers appear to be in decline in the eastern portion of the Bay planning area west of the Kvichak drainage (Woolington 2004; Butler 2003; and Seavoy 2003). These animals are highly valued for subsistence and general hunting as well as non-consumptive uses. The Bay planning area includes all or portions of State Game Management Units (GMUs) 9(B), 9(C), 17(A), 17(B), 17(C) and 18.

Unit 9(C) outside Katmai National Park had approximately 500 to 600 moose, and there were approximately 200 moose in Unit 9(B) in 2001 (ADF&G 2002a). The moose population in Unit 17(A) was 652 in 2001 (Aderman and Woolington 2001b), the population in 17(B) was estimated to be 1,953 in the western portion of the unit (Woolington 2004), and the population in 17(C) north of the Igushik River was estimated to be approximately 3,000 moose in 1999 (Woolington 2004). A gross estimated population in the planning area is around 7,500 to 10,000 moose.

Moose are the most visible large mammal for viewing in Alaska for residents and visitors. Overall consumptive and non-consumptive demand for moose is generally increasing due to many factors. The supply is stable to increasing in GMU 17, and is especially notable recently in the Goodnews drainage in GMU 18 (Aderman 2001, 2005) and is stable to decreasing in GMU 9. Generally, demand occurs in areas where moose habitat is accessible by boat and aircraft. Competition for this resource indicates that supply generally meets demand. That may change with increased access to remote areas Consistent criteria to define and determine moose habitat and resource conditions have not been established by BLM AFO, and so are not available at this time.

Alaska Department of Fish and Game Goals and Objectives for moose management in GMUs 9, 17, and 18 include (Woolington 2004):

- Allow the Unit 18 moose populations to increase to the levels the habitat can support.
- Maintain healthy age and sex structures for moose populations within the Yukon and Kuskokwim river drainages (this includes the Goodnews Block of BLM lands).
- Determine population size, trend, and composition of Unit 18 moose populations.
- Achieve a continual harvest of bulls without hindering population growth.
- Improve harvest reporting and compliance with hunting regulations.
- Minimize conflicts among user groups interested in moose within and adjacent to Unit 18.
- ADF&G population objectives are not comparable between GMUs but fall within a gross cumulative range of approximately 10,000 to 10,500 moose (ADF&G 1998).
- Allow the lower Kuskokwim River moose population to increase above its estimated size of 75-250 moose to at least 2,000 moose.
- Maintain the current age and sex structure with a minimum of 30 bulls: 100 cows for the Kuskokwim River moose.
- Conduct seasonal sex and age composition surveys for the Kuskokwim River moose as weather allows.
- Conduct winter census and recruitment surveys in the established Unit 18 survey areas.
- Conduct fall and/or winter trend counts in Unit 18 to determine population trends.
- Conduct hunts consistent with population goals.
- Improve educational outreach and hunter contacts.

(3) Brown (Grizzly) Bears

Brown/Grizzly bears (*Ursus arctos*) are found throughout the planning area with seasonal aggregations at sites of abundant food, including at caribou and moose calving locations in spring and on the many productive salmon rivers and streams in the summer. In fall they take advantage of the seasonally available berries. Den sites are used in winter, and are usually located at higher elevations. Denning areas appear to be used consistently from year to year. After bears emerge from their dens anywhere from April until June they graze on sedges and grasses and scavenge for whatever might present itself.

Current habitat in the planning area is highly productive and sustains a vigorous and relatively stable bear population (Map 3.18). Bears are somewhat tolerated in bush communities, where they visit local dumps, fish camps and homes.

Bear management is a primary function of the various agencies in the planning area. GMUs 9(B), 17(A), 17(B), 17(C), and 18 fall within the Western Brown Bear Management Area where Federal and State agencies coordinate annual management and monitoring efforts. The Togiak NWR, ADF&G, BLM, and Regional Office of the USFWS are in the process of finalizing the Togiak Refuge and BLM Goodnews Bay brown bear density and population estimate. ADF&G, USFWS, NPS and BLM coordinate other bear census and density estimates as well as harvest monitoring.

Southwestern Alaska brown bears are the most sought-after brown bear populations globally due to accessibility and trophy quality. Commercial guiding, outfitting and viewing for brown bear is a significant contributor to stability, diversification and value of regional and local economies and personal income. The Bay planning area overlaps Game Management Units 9(B), 9(C), 17(A), 17(B), 17(C) and 18. Guides/outfitters are required for out-of-State brown bear hunters, and brown bear opportunity contributes to the planning area's economy. The planning area encompasses Katmai National Park and other bear viewing areas that draw thousands of visitors annually and provide a reservoir of harvestable bears that venture outside the Park. Up to 2,500 brown bears two years old and older occupy the Bay planning area (ADF&G 1998). This resource provides for up to 90 hunters annually for a harvest range of approximately 60-80 bears.

Area management varies from drawing permits to registration permits, alternate year open seasons and general open hunting depending on the specific area, demand, accessibility and brown bear population. Public demand for brown bears is being met while bear populations are increasing (ADF&G 2000). Local concern with predation on caribou and moose has contributed to incentives to reduce large-predator populations, including the brown bear population.

Sustained yield. State game management practices of the past decade have resulted in a stable harvest of highly sought after trophy animals. Management practices may shift toward predator control with a decline in caribou and moose populations.

Brown bear habitat in the eastern portion of the Bay planning area is believed to be good to excellent, based on the number of bears inhabiting the area. Habitat in the western portion is believed to be good though bear densities appear to drop off as one moves west in the planning area (Dewhurst 2000).

The Alaska Department of Fish and game management objective for brown bear in these units is (Woolington 2003c; Seller 2003c; and Seavoy 2005):

- Maintain a brown bear population that will sustain an annual harvest of 50 bears composed of at least 50% males.

(4) Black Bears

Black bears (*Ursus americanus*) inhabit riparian areas and forested uplands, habitat used in common with the brown bear. Woodlands provide escape cover for black bears. Black bears are distributed throughout the planning area but do not extend southward beyond the Alagnak River or into the Goodnews Bay area. Forest provides escape cover for black bears. From November to late April black bears are in their dens, a specialized seasonal habitat requirement. Black bears are omnivorous. Most of the diet consists of vegetation, grubs, beetles, crickets and ants. Bears also eat small to medium-size mammals or other vertebrates and a variety of fish.

Black bears are not a popular game animal in the planning area, but they are used to some extent for subsistence purposes. In this remote region, the non-resident makes up 72 to 85% of the hunters, other Alaska residents comprise around 15 to 22% of hunters, and local residents up to 6%. Reported harvest and defense of life and property (DLP) mortality for the past 10 years has varied from 13 to 30 animals

per year. Animal take has increased as greater numbers of hunters seeking Mulchatna caribou have incidentally taken black bears (ADF&G 1998, 1999, 2000).

International trade of gall bladders and bear parts creates a demand of local consequence. No objective data are available for the population of black bears, nor for their densities, key denning areas, or other aspects of bear populations in GMUs 9, 17 or 18. However, local residents indicate that black bear populations in some areas are declining (ADF&G 1998, 2000). Brown bear-dominated habitats occur in GMU 9 and 18, where black bear densities are very low and black bears are limited by lack of favorable habitat, as well as by brown bear predation and competition for food sources, although it must be said that both bears are omnivorous and seldom fail to find something to eat (Whitaker 1980; ADF&G 1998). Black bears are in low demand in the Bay planning area for the commercial tourism industry or for watchable wildlife opportunities for Alaskans. Neither illegal harvest nor unreported harvest data are gathered or estimated for black bears by ADF&G.

Under the State's existing black bear management regime, sustainable yield thresholds and population characteristics, abundance, distribution, and habitat use have been identified for portions of the planning area. Populations are generally moderate to high although harvests are below the level of sustainable yield. As with brown bear, black bear may pose an ungulate predation problem. Black bear do pose a nuisance problem in areas of human habitation. Within the planning area, black bear bag limits are liberal (two to three bears per year). Yet, subsistence harvest and utilization of black bear is low. The majority of the harvest is by local residents. Black bear populations should remain stable in the near future. Declines in brown bear populations or expansion of black bear habitat may increase black bear populations and correspondingly their range.

(5) Dall Sheep

Dall Sheep (*Ovis dalli)* occupy habitats in the southwestern portions of the Alaska Range including Lake Clark National Park and Preserve, and areas as far south as the mountains between Lake Clark and Lake Iliamna. Historically sheep were present in portions of Katmai National Park until the volcanic eruption of 1912 displaced them. Sheep prefer rocky mountainous areas (Map 3.19).

Sheep are very loyal to their home ranges. Ewes lamb in particularly rugged cliffs in their spring range, where they remain a few days until the lambs are strong enough to travel (Heimer 1994). In winter the entire herd feeds together on woody plants including dry frozen grasses, willow, sedge stems, sage, crowberry, cranberry, and sometimes lichen and mosses. Foods available for consumption vary from range to range. In spring the herd splits into two groups. One consists of ewes, lambs, and yearling rams, and the other is made up of older rams. The oldest member of the group is its leader. Their summer forage is grasses, sedges and forbs. In late fall the rams compete as they try to gather harems of ewes. Wolves are the main predator, but lynx, wolverine, bears, and eagles also prey on sheep (Whitaker 1980).

There are historic accounts of Dall sheep in other areas of the western portion of the planning area. Simple carved sheep horn spoons, likely unsuitable for trade, were found in the PaugVik Village site near Naknek. The PaugVik Village site was occupied from at least 1100 A.D. until 1910 (Dumond and VanStone 1995). Today the sheep only inhabit the Lake Clark National Park portion of the planning area.

The general remoteness and inaccessibility of BLM sheep habitat and current management of habitat and harvest is anticipated to remain unchanged. Dall sheep populations and habitats are largely pristine. In the planning area, sheep are primarily affected by natural events. The Dall sheep resource is expected to remain healthy and vigorous. However, Heimer (1994) suggests that they are susceptible to disease introduced by domestic livestock.

(6) Wolf

Wolves (*Canis lupus*) are considered both big game and furbearers in Alaska. Wolf populations and densities are dependent on many factors, the most important being the presence and abundance of prey.

Large ungulates and their newborns, calves or lambs provide late fall, winter and spring prey in the planning area. During the summer, when wolf pups are in or near the den or rendezvous sites, beaver, ground squirrels, lemmings, hares, birds and fish are prey.

Wolf population density, pack structure and territory size depend on prey abundance and distribution. In the planning area wolves are widespread. Estimates by ADF&G (2000) suggest the planning area has a population of 780-835 wolves in 40-60 packs. Wolves are a valuable fur animal and used for personal use and Native crafts.

In GMU 17, wolves are reported to prefer the major drainages of the Nushagak and Mulchatna rivers, where they are believed to have established territories and take advantage of caribou as they migrate through (Woolington 2003b). Wolves inhabit the Kilbuk Mountains from Whitefish Lake to the southernmost tip of Unit 18 near Cape Newenham. Wolf distribution is believed to change with caribou availability. Some resident wolf packs remain throughout the year but must shift to other prey resources when caribou return to Unit 17 to calve (Seavoy 2003). Caribou distribution on the upper Alaska Peninsula is predominantly on the Bristol Bay Plain.

Wolves are carnivorous, and moose, caribou and to a more limited extent Dall sheep, are their primary prey. Wolves also dine on salmon when they are available. During summer, small mammals including voles, lemmings, ground squirrels, snowshoe hares, beaver, and occasionally birds and fish are eaten (Stephenson 1994). Wolves serve an important function in maintaining ungulate herd health and equilibrium within their habitat. They are considered a highly valued component of Alaska's fauna (Stephenson 1994).

Wolf density has been estimated to be up to one wolf per 25 square miles in favorable habitats (Stephenson 1994). Between 1992 and 1999 wolf estimates ranged from 780 to 835 animals, and the number of wolf packs were estimated at between 40 and 60 for the Bay planning area (ADF&G 2000). Based on the increasing trend in reported harvest, trapper questionnaire data, reported sightings, other reports by the public, and anecdotal information, the wolf population in the Bay planning area increased between 1999 and the most recent published estimates in 2001. In all of GMUs 9, 10, 17, and 18 it is estimated that there were between 1,050 and 1,200 wolves in from 77 to 96 packs in 2001 (Sellers 2003b).

Wolves as well as wolverines are classified as fur bearers in addition to being game species in Alaska. Over the last decade, harvests of wolves have varied widely and are a reflection of fur prices, access, predator control concerns and population changes. An overall estimate of populations is not available for the BLM management units in the planning area. Wolves are hunted and trapped primarily by local residents, but wolves are also harvested opportunistically by non-local hunters. Successful wolf harvests have been the result of relatively few participants, which have steadily increased since 1996. From 50 to 260 wolves were harvested each year from 1992 to 1999 in Game Management Units (GMUs) within the planning area (ADF&G 2000). During this time, between 40 and 98 trappers/hunters were responsible for the majority of the documented harvest in the planning area (ADF&G 2000).

Harvest methods vary widely from area to area depending on access methods, climatic conditions, terrain, and population availability. In some areas, wolves are readily accessible with snowmachines, whereas in other areas aircraft access for trapping or shooting is the major method of taking. Wolf hunting methods such as same-day airborne hunting, aerial gunning, bounty systems, poisons and a wide variety of predator control methods are still in demand; however, these methods lack public support. An unknown number of wolves, not reported, are harvested for subsistence. They are used for clothing and Native cultural and craft purposes. This unreported harvest may be significant in some areas, but varies with year, access and abundance of wolves.

Fluctuations in wolf numbers are expected to continue, and adaptive management of wolves and their prey bases is necessary to balance predator/ prey (moose and caribou) relationships with the high demand of human use for both groups of species.

e) Furbearers

Furbearers include those species of mammals that are routinely sought after by licensed trappers who place commercial value on the animals' pelts. Furbearers found in the planning area include wolverine, wolf, coyote, red fox, Arctic fox, Canada lynx, marten, otter, mink, weasel, beaver, and muskrat (ADF&G 2005a; Whitaker 1980).

Wolverines (*Gulo gulo)* are widely distributed and travel widely throughout their range. Wolverines are still of high value in the fur market and are pursued by trappers and hunters for that reason. The planning area enjoys widespread distribution of wolverines and in some cases expanding and increasing populations, based on contacts with local residents and trappers. GMUs 9 and 17(B) produce the greater harvest of wolverines from the GMUs in the Bay planning area.

Beaver (*Castor canadensis)* are widely distributed and increasing in the planning area's streams and lakes and in riparian and aquatic habitats. In many areas beaver also occur in treeless tundra areas where tall and low shrub materials are available near streams. Beaver eat the bark of favored deciduous trees and shrubs. Currently beaver are widespread and abundant throughout their available habitat. The Goodnews area has a rare phenotype pelt coloration that is unique to that area (Van Dael 2005).

Muskrat (*Ondatra zibethica)* are widely distributed throughout the wetland habitats in the planning area but are currently uncommon to scarce in most areas. Minor use of muskrat for food and personal use of fur occurs but the price for muskrat pelts is very low and the quality of muskrat fur from this region is moderate to poor. Harvest is very low.

Coyote (*Canis latrans)* arrived in Alaska around 1915 and have rapidly expanded since that time. Coyotes are widespread the planning area and occur west to Goodnews Bay. Coyotes are not abundant or common in the planning area. A few are harvested incidental to hunting or trapping fox, wolverine, wolf or lynx. Healthy wolf populations tend to dampen the rate of increase and movement of coyotes into new areas.

Arctic fox (*Alopex lagopus)* occur along the west coast of the planning area along marine beaches primarily. Foxes eat carrion, microtine rodents, lemmings as well as seasonally available birds and eggs. Population densities are linked to fluctuations in small rodent populations, with periodic peaks approximately every four years. Arctic foxes are occasionally taken in the planning area but are used for subsistence and personal use and normally are not sold as fur.

Red fox (*Vulpes vulpes*) including red, cross and black color phases, occur in the planning area. Red fox are omnivorous and diets often change seasonally but may consist of carrion, plant material, rabbits and other small mammals, ptarmigan, birds, eggs, and invertebrates.

Canada lynx (*Lynx Canadensis*) are classified as a furbearer in Alaska.

River otter (*Ljutra canadensis)* are abundant and widespread throughout the planning area and inhabit stream and lake riparian habitats. They primarily prey on the rich fishery resources as well as mussels, clams, insects, frogs, small mammals, birds or eggs, and vegetable matter.

Both least and short-tailed weasel (ermine) occur in the planning area. Least weasels are sparsely distributed and utilize forest and tundra habitats where they feed on mice, voles, insects, small birds and worms. Short-tailed weasels occur throughout a wide variety of habitats but prefer brushy, forested and broken terrain. Prey includes microtine rodents, mice, shrews, birds, eggs, ptarmigan, hares, fish and insects. Weasels are also preyed upon by a variety of avian and mammalian predators including owls, hawks, lynx, fox, coyote and mink. Fur value is low but ermine is popular to trim parkas, Native crafts, and tourist items.

Furbearer populations in the planning area are assumed to be healthy and are under the present circumstances under-harvested, according to anecdotal information. This is a diverse group of species and each is unique in its habitat requirements, productivity, distribution, and population dynamics.

The popularity of trapping furbearers has declined in recent years due to price declines and declines in world demand. Demand for furbearers is significantly dependent upon fur prices, population fluctuations, access, weather conditions, personal use, Native crafts, raw material needs, and accessibility of the resource. These species also play an important role in ecosystem functions.

Commercial and subsistence demand are primary drivers for furbearer harvest, however; much of this harvest does not require reporting and harvest is not monitored. Required sealing (wolverine, wolf, marten, river otter, beaver and lynx) and monitoring do not account for subsistence take for personal use. Furbearer species not requiring sealing are harvested but data provide only gross minimum estimates. Currently no monitoring of demand is being conducted. Poor fur prices have decreased participation in recent years (ADF&G 1998). The lack of efficient means to estimate and directly monitor populations, general low overall demand and participation, and lack of reliable snow conditions for fur harvest in the planning area hampers development of population objectives for furbearers. Voluntary trapper questionnaires, opportunistic observation and sealing requirements are the current management tools in use. This appears sufficient at this time for the relatively low trapping effort.

f) Small Mammals

Small mammals include a wide variety of shrews, mice, microtine rodents (lemmings, meadow voles), non-game and small game species such as pika and porcupine. These species and their fluctuating abundance and cycles are keystone to ecosystem function.

g) Marine Mammals

Marine mammal species occur in nearshore and offshore areas of the planning area, but do not occur on coastal BLM lands, with the possible exception of beluga whales which may travel miles up rivers in pursuit of salmon.

h) Birds

Public lands in Alaska encompass the breeding grounds, migration and staging sites and seasonal habitats for many species of resident and migratory birds. The Bay planning area includes breeding areas important for the production of migratory waterfowl, shorebirds and land birds that represent large portions of the North American populations that winter in Central and South America, as well as long distant migrant shorebird species that utilize wintering areas as distant as Hawaii, Tahiti, New Zealand and Southern Asia (Marchant et al. 1986). Some of these breeding, staging and migration areas are on public lands managed by BLM in the planning area (Goodnews Bay, Kvichak Bay areas).

(1) Landbirds

At least 50 species of migrant and 23 species of resident landbirds breed in the unbroken forests, shrub field and tall riparian shrub habitats that exist on BLM lands in the planning area (Handel et al. 1998). The area's migrant land birds winter in the lower 48 states and Central and South America. Land birds play a significant ecological role on both the breeding and wintering grounds, and many species are considered indicators of environmental and ecological changes, including global climate change (Maley et. al. 2003). The demand for landbird species involves a growing public interest nationwide in viewing, field identification and life history of landbirds, as well as ecological research related to habitat conservation. Four migrant species (olive-sided flycatcher, blackpoll warbler, gray-cheeked thrush, Townsend's warbler) occur in the planning area and are considered sensitive species. Although it is not

currently on BLM's Special Status Species list, the rusty blackbird has experienced a dramatic decline recently and monitoring is recommended (Hannah 2004, Andres 1999).

A number of rare Asian species are occasional visitors to some portions of the planning area (Petersen et al. 1991) and are highly sought by birders seeking to add rare North American species to their list.

The demand for landbirds as a game species is low, however harvest regulations do allow for the taking of landbirds for food or traditional clothing under the Migratory Bird Treaty Act (Office of Subsistence Management 2004/2005). The harvest of landbirds in the planning area is unknown.

(2) Waterfowl

At least 25 species of migratory waterfowl (ducks, geese and swans) breed or use migration staging areas in the planning area, (Bellrose 1980), and involve consumptive use demands for both resident and non-resident hunters. Wintering areas are in coastal Alaska and Canada, the western and southern United States, and Mexico. Spring and fall migration staging areas for waterfowl include the Goodnews Bay/Carter Spit area and the Kvichak Bay coastal areas. Inland waterfowl breeding wetlands and estuaries are found on large blocks of public lands in the Kvichak River and Alagnak River area and represent some of the highest waterfowl breeding densities in the State (Connant and Groves, 1993) (Map 3.20).

Wetlands in this region are associated with an extensive glacial moraine and are unique with respect to limnological characteristics and water chemistry which affects their use by breeding waterfowl (Seppi 1997). Alaska overall produces approximately 50% of the annual waterfowl production in the Pacific Flyway, with the coastal wetlands of Goodnews Bay and Carter Spit and Kvichak Bay being important migration staging sites in Alaska. Demands for waterfowl in the region include spring subsistence hunts and gathering of eggs from ducks and geese and fall hunts of several species. Resident and non-resident hunting in Alaska of all species of ducks, geese and swans occurs throughout the planning area during fall migration. Three migratory species, the tule white-fronted goose, the dusky Canada goose, and the trumpeter swan are considered sensitive species. Sport hunting of waterfowl produced in the planning area continues as birds migrate through Canada and the lower 48 states to wintering areas in the southern states and Mexico. Subsistence hunting also occurs in regions south of the United States on wintering grounds. The Steller's eider is listed as threatened, yet is subsistence hunted in the planning area in spring and during fall migration. Steller's eiders winter in coastal areas of the Alaska Peninsula, and use the Goodnews Bay area for staging and fall migration (Seppi 1997).

(3) Upland Game Birds

Upland game birds are hunted for recreation and for subsistence. However, access limits the harvest and use of this resource except near communities and road systems. Five grouse species occur in the planning area. Spruce and ruffed grouse inhabit forested areas, rock ptarmigan are on higher elevation barren habitats and tundra, and willow ptarmigan in willow and alder thickets. Demand and harvest levels of grouse in the bush is largely unknown, but is considered light in relation to the distribution and abundance of these birds. Most take is likely opportunistic in association with other hunting and subsistence activities.

(4) Shorebirds and other Waterbirds

Most shorebird species migrate and stage on coastal mudflats and nest in coastal or inland habitats, depending on the species. Sandhill cranes use these same habitats, which can be found throughout the planning area and are of regional and hemispheric importance to these and many other species of wildlife.

There are at least 17 species of shorebirds that breed or migrate within or through the planning area (National Geographic Society 1987), using alpine, tundra and forest edge habitats for breeding and coastal mud flats for foraging, staging and migration. Most shorebird species are long distant migrants,

breeding in arctic and sub-arctic habitats in Alaska and wintering in Central and South America, while other species complete transoceanic migrations to islands in the south pacific, Asia and Australia. Few shorebirds are taken for subsistence in Alaska, but birds produced in Alaska are hunted for food on wintering grounds in Central and South America. The numbers of shorebirds produced in the Bay planning area, or the numbers taken on wintering grounds is unknown. Designated Western Hemisphere Shorebird Reserve Network sites are within and adjacent to the planning area. The Carter Spit and Goodnews Bay area have been proposed as a regional fall migration shorebird staging site, and the adjacent Kuskokwim Bay has been recognized as a world class hemispheric site for spring and fall shorebird migrations (Myers et al. 1987).

Kvichak Bay is internationally recognized as a hemispheric migration stopover site for arctic nesting shorebirds, and hosts nine species of breeding and migrating shorebirds (Myers et al. 1987). Within the planning area, Goodnews Bay, Nanvak Bay, Carter Bay and the Kuskokwim River Delta are recognized as key areas for shorebird conservation in the U. S. shorebird conservation plan, of which BLM is a partner (Brown et. al 2001). Large numbers of migrant shorebirds, species diversity, and ecological importance of these sites make the region an attractive viewing area for birders. The bristle-thighed curlew and red-throated loon are BLM sensitive species potentially present in the planning area.

(5) Raptors

Raptors include various species of hawks, eagles, owls and falcons. The planning area contains various habitats that host 21 species of raptors (National Geographic Society 1987), including the northern goshawk and the Arctic peregrine falcon, BLM special status species. Eagles are protected under the Eagle Protection Act, and all other raptors under the Migratory Bird Treaty Act. Snowy owls are an exception, and are legal to subsistence hunt, but the numbers taken are likely low due to their relative rare occurrence. Owl, hawk, eagle and falcon species include both resident and migratory species that winter in coastal areas, the lower 48 states and Central America. Demand for raptors as watchable wildlife, especially during migration when birds pass through corridors where they can be counted and viewed, is large and growing. The population and productivity of raptors in the planning area is unknown. The planning area hosts 10 species of owls, 7 species of hawks, including osprey, 2 species of eagles and 4 falcons.

(6) Seabirds

Twenty species of seabirds are found in the planning area, and include gulls, cormorants, kittiwakes, guillemots, auklets, murrelets, murres, puffins and terns. Many species are pelagic oceanic birds or coastal species that nest on coastal cliffs and fringes. Coastal tidal nesting habitats important to seabirds exist in the southern portion of the planning area, with cliff nesting habitats at Goodnews Bay and Chagvan Bay. Demands for seabirds include subsistence uses and egging for some species where they are accessible. Population and harvest numbers for the planning area are unknown. Sea birds on the Special Status Species list that may be found seasonally on BLM lands include the marbeled murrelet, harlequin duck, king eider, long-tailed duck, black scoter, black guillemot, black brant, and surf scoter.

i) Fish

Throughout the Bay planning area there is a lack of detailed baseline data on the size of fish populations, fish spawning and rearing areas, and the productive capacity of the waters administered by the Bureau of Land Management. BLM does not currently operate any salmon escapement projects in the Bay planning area to assess run timing. The Alaska Department of Fish and Game, Division of Commercial Fisheries (ADF&G - CF) operates salmon escapement projects on several major rivers in the Bristol Bay area. Data concerning the salmon count and run timing for these rivers can be found at http://csfish.adfg.state.ak.us/mariner/brbcatch/brbsummary.php. In addition, the ADF&G - CF operates a weir on the Middle Fork of the Goodnews River. Data from this project are available at http://www.cf.adfg.state.ak.us/region3/kuskhome.php.

There are six major watersheds in the planning area. The Goodnews and Arolik Rivers flow into Kuskokwim Bay and the Kvichak, Alagnek, Nushagak, and Naknek Rivers flow into Bristol Bay. Fish occurring in the planning area include all five species of Pacific salmon and a wide variety of resident species (Table 3.8). Maps (3.13a-d) display known anadromous and resident fish streams within the planning area.

Table 3.8. Common Fish Species Endemic to the Waters of the Bay Planning Area

Common Name	Scientific name	Subsistence /sport species
Chinook salmon	*Oncorhynchus tshawytscha*	Sb/s
coho salmon	*Oncorhynchus kisutch*	Sb/s
sockeye salmon	*Oncorhynchus nerka*	Sb/s
chum salmon	*Oncorhynchus keta*	Sb/s
pink salmon	*Oncorhynchus gorbuscha*	Sb/s
rainbow trout	*Oncorhynchus mykiss*	Sb/s
Arctic grayling	*Thymallus arcticus*	Sb/s
Dolly Varden	*Salvelinus malma*	Sb/s
Arctic char	*Salvelinus alpinus*	Sb/s
northern pike	*Esox lucius*	Sb/s
Alaska blackfish	*Dallia pectoralis*	Sb
burbot	*Lota lota*	Sb/s
lake trout	*Salvelinus namaycush*	Sb/s
round whitefish	*Prosopium cylindraceum*	Sb
humpback whitefish	*Coregonus pidschian*	Sb
pygmy whitefish	*Prosopium coulteri*	Sb
Bering cisco	*Coregonus laurettae*	Sb

*Sb = Species harvested for subsistence.
*s = Species targeted for sport fishing.

Other species reported to occur in the planning area include ninespine stickleback (*Pungitius pungitius*), threespine stickleback (*Gasterosteus aculeatus*), slimey sculpin (*Cotus cognatus*), longnose sucker (*Catostomas catostomas*), Alaska blackfish (*Dallia pectoralis*), Rainbow smelt (*Osmerus mordax*), Arctic lamprey (*Lampetra japonica*), and Pacific lamprey (*Lampetra tridentata*). The rainbow smelt and Pacific lamprey are subsistence species. Whitefish play an important role in the food chain as prey for other fish, as well as being a popular subsistence fish (ADF&G 2004).

(1) Essential Fish Habitat

Through the Magnuson-Stevens Fishery Conservation Act, Essential Fish Habitat for Alaska is defined by NOAA as all salmon streams listed in Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes (ADF&G 2005a, 2005b). This Catalog defines the essential habitat as any stream or lake or other water body that is used for migration, spawning, and rearing by anadromous fish. The planning area contains numerous streams listed in the Catalog, and these waterbodies are shown in Maps 3.13a-d.

(2) Fish Habitat Description

Public lands in the planning area provide important spawning, rearing, and over-wintering habitat for resident and anadromous fish. Waters in the planning area provide a diverse array of lotic and lentic fish habitat. Glaciers have influenced the geomorphology of the area and have provided for lakes ranging from small potholes to the largest freshwater lake in Alaska, Illiamna. Stream types include small steep high energy systems, large wide valley multiple channel systems, and slightly entrenched meandering streams. Nearly all waters in the planning area provide habitat to these fish species during all or some of their spawning, rearing and migrating life stages.

Small isolated lakes with depths greater than three feet are likely to provide habitat for Alaska blackfish and sticklebacks. Alaska blackfish utilize heavily vegetated freshwater swamps and ponds, but also are found in vegetated flowing waters and lakes. They can tolerate cold water and have the ability to breathe atmospheric oxygen, which helps them survive in stagnant, hypoxic muskeg or tundra pools (ADF&G 2004, Morrow 1980). Larger lakes connected to streams are important to juvenile sockeye salmon and northern pike utilize weed areas in lakes, sloughs, and flooded areas.

First and second order higher gradient streams are likely to be quality rearing habitat for juvenile char and coho salmon. Moderate sloped tributary streams with cobble and gravel substrate provide some of the best spawning habitat for salmon. The lower, middle and upper reaches of larger streams provide spawning and rearing habitat for chum, coho, and Chinook salmon. Lower reaches of the major rivers influenced by saltwater and whose substrate is fine material are used by salmon as migratory routes to access spawning areas in the upper reaches and tributaries of streams.

Drainages in the Southwestern portion of the planning block are within the Ahklun Mountains Province. Streams slope gradient over most of the province range between zero and eight degrees (Gallant et al. 1995). Mountains in the province have elevations of approximately 1,800 feet and are drained by shallow clear streams dominated with gravel and cobble substrate that flow directly to the Bering Sea. Fish distribution is influenced by elevation, relief, lithology, and geologic structure.

A National Hydrolographic dataset is not available from the U.S. Geological Survey for the Hydrological Unit that comprises streams on BLM lands in the Southwestern portion of the planning area. Statistics on stream miles for this area were derived from named streams in the planning area and may not include tributaries. Therefore, the total miles of streams in the BLM Bay planning area are underestimated.

Most streams on the BLM lands in the Goodnews Bay area are remote with limited access. BLM manages 249 miles of streams in the Goodnews watershed and 50 miles of these streams are directly utilized for subsistence and/or sport fisheries, which includes: 30 miles of the Goodnews River, eight miles of the Middle Fork of the Goodnews River, eight miles of the South Fork of the Goodnews River, and four miles of the East Fork of the Arolik River. The remaining BLM-managed streams and stream sections are not directly utilized for subsistence, commercial, and recreational fisheries but provide important spawning and rearing habitat that support these fisheries. Commercial, subsistence, and recreational fisheries intercept fish that are bound for BLM lands.

The Goodnews River originates and flows through the Togiak National Wildlife Refuge before entering BLM lands. The historical average salmon escapement to the mainstem of the Goodnews River is 3,137 Chinook salmon, 36,925 sockeye salmon, 21,284 chum salmon, and 27,897 coho salmon (Linderman 2005a). Residents of Quinhagak, Goodnews Bay, and Platinum, located along the south shore of Kuskokwim Bay (approximately 220 households), harvest subsistence salmon primarily from the Kanektok, Arolik, and Goodnews River drainages (ADF&G 2001). The Goodnews River is the primary source of commercial fisheries for the village of Goodnews and also contributes to the commercial fisheries in the villages of Quinhagak and Togiak. The rainbow trout stocks which inhabit the Kuskokwim Bay streams are considered "world class" with high catch rates and are capable of producing rainbow trout that exceed 25 inches (ADF&G 2004a). The mainstem of the Goodnews River supports the second largest sport fishery in Kuskokwim Bay Area and angler effort (angler days) has averaged 2,522 from 1983 to 2002 (Lafferty 2004).

During recent inventories of Goodnews River watershed, many first and second order streams were found to provide rearing habitat for coho salmon, and char. Sculpin were also common in most of these higher elevation streams. In addition to coho rearing, small schools of adult sockeye salmon were observed spawning in some of the larger third and fourth order streams not associated with lakes. Resident species, Dolly Varden, rainbow trout, and Arctic grayling were also found to inhabit most of the larger streams on BLM lands. These observations were documented on the ADF&G Freshwater Fish Inventory website (ADF&G 2005a, 2005b). The maps spatially display the sampling locations where fish have been collected or observed and also include field data and sampling location photos.

The South Fork of the Goodnews River contains Chinook, coho, chum salmon, Arctic char, and whitefish. These anadromous fish species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS), Anadromous Water Catalog (AWC) #335-00-10850-2080. The Middle Fork of the Goodnews River contains Chinook, coho, chum, pink, sockeye salmon, Arctic char, and whitefish. These anadromous fish species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as EFH by the NMFS, AWC #335-00-10850-2090.

The Arolik River is also a significant salmon producing river that drains into Kuskokwim Bay (Linderman 2005b). The Arolik River flows through the Togiak National Wildlife Refuge downstream of BLM lands. The Arolik River is accessible from Arolik Lake by plane and/or by boat from the village of Quinhagak. Residents of Quinhagak, Goodnews Bay, and Platinum, located along the south shore of Kuskokwim Bay, harvest subsistence salmon primarily from Kanektok, Arolik, and Goodnews River drainages (ADF&G 2001). The Arolik River supports the third largest rainbow trout sport fishery in Kuskokwim Bay and angler catch has averaged 1,122 fish from 1997 to 2002 (Lafferty 2004). The South and East Fork of the Arolik River and Faro Creek also contribute to the Kuskokwim Bay watershed. The rainbow trout stocks of the Arolik River are considered "world class" with high catch rates and are capable of producing rainbow trout that exceed 25 inches (ADF&G 2004a). The Arolik River supports the third largest rainbow trout sport fishery in Kuskokwim Bay and angler catch has averaged 1,122 fish from 1997to 2002 (Lafferty 2004).

Faro Creek and the South and East Fork of the Arolik River contribute the majority of the drainage to the Arolik River. They provide important spawning and rearing habitat for economically important subsistence, commercial, and recreational fisheries. Faro Creek, a major headwater tributary to the Arolik River contains Chinook, coho, and chum salmon. These anadromous salmon species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as EFH by the NMFS, AWC #335-00-10650-2300. The East Fork of the Arolik River contains Chinook, coho, sockeye, chum salmon, Arctic char, and whitefish. These anadromous fish species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as EFH by NMFS, AWC #335-00-10650-2401. The South Fork of the Arolik River contains Chinook, coho, sockeye, chum, pink salmon, Arctic char, and whitefish. These anadromous fish species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as EFH by the NMFS, AWC #335-00-10650-2472.

Jacksmith Creek contains Coho (*O. kissutch*), Chinook (*O. tshawytscha*), Sockeye (*O. nerka*), Chum (*O. keta*), Pink (*O. gorbushcha*) salmon and drains into the Kuskokwim Bay. Chinook, chum, pink, sockeye, and coho salmon, Arctic char, and whitefish use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as Essential Fish Habitat (EFH) by the National Marine Fisheries Service (NMFS), Anadromous Water Catalog (AWC) #335-00-10700. Production of salmon from this river contributes to the subsistence and commercial harvest for the villages of Goodnews and Quinhagak.

Cripple Creek also drains into the Kuskokwim Bay and produces Chinook, chum, pink, and coho salmon, and whitefish. These anadromous fish species use the river for spawning, rearing, and migratory habitat; therefore this river is characterized as EFH by the NMFS, AWC #335-00-10750. Production of salmon from this river also contributes to the subsistence and commercial harvest for the villages of Goodnews and Quinhagak.

BLM manages several large areas in the Southeast of the planning area. The physiography of this area is referred to as the Nushagak-Bristol Bay Lowlands, and they have a large influence on fish distribution. The lowlands are underlain by outwash and morainal deposits that are mantled with silt and peat. The local relief of the lowlands is 50 to 250 feet, and elevation ranges from sea level to about 300 feet with slope gradients of less than 2% (Wahrhaftig 1965, Gallant et al. 1995). The majority of streams in the lowlands are low gradient, low velocity, silt and peat substrate, and tannic colored water. Results of fish and habitat surveys by BLM and ADF&G of these low gradient streams with silt, sand, and/or small gravel substrate suggest they provide marginal habitat for salmon spawning and rearing (ADF&G 2005a, 2005b). Although, these lowland streams are connected to some of most productive salmon watersheds

(Kvichak, Alagnek, Nushagak and Naknek) in the world (Minard et al. 1998) which arise from the mountains and lakes of this eco-region.

The Nushagak watershed is the largest in the Southeastern portion of the planning area, with a watershed area of 12,000 square miles. It has over 20,900 stream miles, of which BLM manages 2,000 miles (10%). In the Alagnak and Naknek watershed there are 1,600 and 4,331 streams miles in each watershed, respectively, of which BLM manages 547 (34%) and 358 (8%) miles. The Kvichak watershed is 5,915 square miles with over 6,500 miles of streams, of which BLM manages 2,301 miles (34%).

Nushagak and Bristol Bay Lowlands are also dotted with moraine and thaw lakes (Wahrhaftig 1965). There are over 8,000 lakes between 2 and 150 acres and over 70 lakes greater than 150 acres in the planning area. Most are small internal drainages often with no outlet or inlet stream and very few have been inventoried. An inventory of six lakes in 2003 found they all contained northern pike, threespine stickleback, whitefish (probably least cisco) (Haas, 2004). In addition, char and sculpin were found in one of the lakes that had an outlet stream. This species assemblage is probably typical of these lowland lakes.

Small parcels of land of less than one or two townships make up most of the remaining planning area. There are more than 700 miles of streams and 620 lakes between 2 and 150 acres within these small parcels. Fish distribution data is not available for most of these parcels.

(3) Factors Affecting Fish Habitat and Production

Many factors influence the productivity of a resident fish population, including water temperature, streamflow, food availability, adequate spawning and rearing habitat, spawner-recruit ratio, and fishing pressure. Anadromous species complicate matters by introducing ocean conditions which influence marine survival. Inter- and intraspecies competition also plays a role in determining how many fish a watershed produces. Fisheries habitat on BLM lands in the planning area is mostly undisturbed and currently should not be limiting to the production of resident and anadromous fish.

Although most of the fisheries habitat within the planning area exists in an undisturbed state, there are few areas that have been impacted by mining. The Salmon River is a relatively short river (about 10 miles long) in southwest Alaska with a basin area of about 30 square miles. The placer platinum deposits in this tributary to Kuskokwim Bay have been commercially mined since 1927, including about 40 years of mining with a bucket line dredge. The Salmon River and its tributaries provide habitat for all five species of Pacific salmon and several resident fish species. Typical woody riparian vegetation is tall shrub willows and alders.

Mining operations have reduced or eliminated access for fish between the Salmon River and several tributaries, and have significantly altered much of the river's riparian habitat. Some tributaries have also been mined. Despite extensive dragline work done in the early 1990s to establish a new channel for the Salmon River through the tailings along the west side of the valley, the Salmon River flow goes subsurface in several places at normal discharge levels. It is believed that fish passage upstream through the entire length of the tailings can only occur at high water levels.

The State of Alaska developed the Bristol Bay Area Plan (1984, 2005), which identified 64 designated anadromous streams to be closed to new mineral entry. Salmon production was recognized as a significant surface use of state land. The development of mining claims within the active stream channel in these designated anadromous streams and adjacent uplands creates an incompatible surface use conflict with salmon propagation and production, and jeopardizes the economy of the Bristol Bay region and the management of the commercial, sport, and subsistence fisheries in the Bristol Bay Area. Klutuk Creek was only one of the designated 64 anadromous streams closed to new mineral entry by the State that is located on the BLM lands. It originates in the Kemuk Mountains and flows southeasterly 36 miles into the Nushagak River. Klutuk Creek was determined navigable on the BLM lands in T. 7 S., R. 49 W., Secs. 11-13, 24 and up to the feeder creek in the E2 of Sec. 2 and T. 7 S., R. 48 W., Sec. 19 (BLM 1991a) and therefore the State of Alaska has title to the submerged lands of Klutuk Creek.

7. Special Status Species

a) Special Status Plants

The botany of the Bay planning area is poorly known. However, inventory of the Ahklun Mountains and Goodnews Bay vicinity in 1990 and 2004, and the northwestern Alaska Peninsula in 2003 provided information about plants of the area. Taken together, the two surveys and the additional ALA holdings from the area documented 379 vascular plant species for the region. There are 47 plant species on the Alaska BLM Special Status Species list. The list is developed through a process that considers two factors – rarity and endangerment. Plants that are imperiled and critically imperiled in the state are considered for the list. Threatened or endangered species are on this list. However, not all rare plants are included. One plant on the Special Status Species list has been documented in the planning area (Table 3.9). Others may be added as the list is updated. Five plants that could be considered for the list were recently found (Table 3.10). The current Special Status Species list was last updated in 2003.

Table 3.9. Rare and Imperiled Plant Species and BLM Special Status Species Documented in the Planning Area

Common Name	Scientific Name	BLM SSS List	Status: AKNHP Ranking
Forbs			
Pearshaped smelowskia	*Smelowskia pyriformis* Drury and Rollins	Yes	S2

Table 3.10. Other Rare and Imperiled Plant Species Documented in the Planning Area

Common Name	Scientific Name	BLM SSS List	Status: AKNHP Ranking
Grass and Grasslike			
Kamchatka spikerush	*Eleocharis Kamtschatica* C.A. Meyer	No	S2S3
MacKenzie Valley mannagrass	*Glyceria pulchella (Nash) Schum*	No	S2S3
Forbs			
Fragile rockbrake	*Cryptogramma stelleri* (S.G. Gmel.) Prantl	No	S2S3
Chukchi primrose	*Primula tschuktschorum* Kjellm.	No	S2S3
Kamchatka buttercup	*Ranunculus Kamchaticus* DC	No	S2S3

As Alaska becomes more developed, BLM lands will become increasingly valuable to preserving plant species diversity. It is BLM's policy to prevent management actions from causing a species to decline to a point where listing under the ESA would be warranted (BLM 2001) 6840 manual and the Special Status Species list is used to assist in meeting this policy.

The flora of this region appear to be a blend of coastal and interior floristic elements (Parker 2005). One plant, the Walpole poppy (*Papaver walpolei)*, reported as rare in earlier studies (Lipkin 1996) was found to be present. According to Parker (2005) this tiny white-flowered poppy is often relatively abundant when found. A recommendation to designate the area as an ACEC on the basis of the occurrence of the Walpole poppy at Goodnews Bay was officially accepted in the Southwest Planning Area Management Framework Plan, signed and published in 1981 based on the information about the poppy at that time. Because of the newer information on the poppy, the poppy as a basis for the ACEC is no longer supported in the current Bay RMP/EIS.

b) Special Status Fish

Sensitive Status Fish Species & Essential Fish Habitat. There are no threatened, endangered or sensitive fish species in the BLM Bay planning area.

c) Special Status Wildlife

(1) Threatened, Endangered, and Sensitive Species

The purpose of this BLM program is to provide policy and guidance, consistent with appropriate laws, for the conservation of special status species of plants and animals, and the ecosystems upon which they depend. Special Status Species are species which are proposed for listing, officially listed as threatened or endangered, or are candidates for listing as threatened or endangered under the provisions of the Endangered Species Act (ESA); those listed by a State in a category such as threatened or endangered implying potential endangerment or extinction; and those designated by each State Director as sensitive (BLM 2005c). BLM objectives for Special Status Species are to ensure that actions authorized on BLM-managed lands do not contribute to the need to list a species under the Endangered Species Act, to conserve threatened or endangered species and the ecosystems on which they depend, and to assist efforts to de-list through conservation of existing habitats and populations.

> *"Addressing special status species is a requirement in our land use plans and environmental assessments to ensure that actions taken by the BLM are consistent with the conservation needs of special status species. This also ensures the BLM does not contribute to the need to list any special status species under the provisions of the Endangered Species Act of 1973, as amended."* (BLM 2005c).

Special Status Species conservation entails the use of methods and procedures which are necessary to improve the condition of Special Status Species and their habitats to a point where their special status recognition is no longer warranted (BLM 2001).

(2) Federally-listed Threatened and Endangered Species and Designated Critical Habitats.

Table 3.11. Federally-listed Threatened and Endangered Animal Species Present in the Bay Planning Area

Species Common Name	Species Scientific Name
Eskimo Curlew*	*Numenius borealis*
Steller's Eider	*Polystricta stelleri*
Steller Sea Lion	*Eumetopias jubatus*
Federally-listed Candidate Species That May be Present in the Bay Planning Area	
Kittlitz's Murrelet**	*Brachyramphus brevirostris*

* Eskimo Curlews have not been seen in Alaska since the mid-1800s (Gill et al 1998).
**Rare in the Bay planning area.

There are no designated Critical Habitats in the Bay planning area. One endangered species (Eskimo Curlew), one threatened species (Steller's eider), and one candidate species (Kittlitz's murrelet) are found in the planning area. They are listed under the Endangered Species Act. The Eskimo curlew has not been seen in Alaska since the mid-1800s. The Steller sea lion may be an occasional visitor to the coastal spits of Carter's Bay but there are no known haulouts located on BLM-managed land in the Bay planning area (Table 3.11). Historically, spectacled eiders, a threatened species, nested discontinuously along the coast of Alaska from Nushagak Peninsula on Bristol Bay to Barrow and eastward nearly to the Yukon border. Today, spectacled eiders' breeding distribution is only on the Yukon-Kuskokwim Delta, to the north and west of the planning area and on the north coast of Alaska, but do not breed within the planning area based on current knowledge of the species (Petersen et al 1991). Spectacled eiders migrate

between winter and breeding ground following coastal and offshore migration corridors through the Bering and Chukchi seas to offshore wintering areas. Molting areas include the eastern portion of Norton Sound and Ledyard Bay, between Cape Lisburne and Point Lay. The primary wintering area is in the central Bering Sea south and southwest of St. Lawrence Island (U. S. FWS 2002c). Spectacled eiders do not migrate, breed or molt within the planning area.

BLM is consulting with the appropriate Federal agencies on potential impacts to threatened and endangered species as required under Section 7 of the ESA. These consultations are required during the development of a BLM land use plan and environmental impact statement.

Steller's Eider. Steller's eider occurs within the planning area as a migrant between wintering and breeding areas (see Map 3.21). Birds stage and molt in shallow near shore marine waters adjacent to Carter Spit in the planning area. The Alaska breeding population is listed as threatened (Federal Register 1997). Current breeding distribution includes the Arctic coastal regions of northern Alaska from Wainwright to Prudhoe Bay up to 56 miles inland, and Arctic coastal regions of Russia (Federal Register 1997). Historically, Steller's eider was a common breeder in the Yukon-Kuskokwim Delta but now occurs there at low densities (USFWS 2002c). Spectacled eiders are not as closely tied to the coastal areas as the other eider species. Preferred nesting habitat includes inland tundra ponds of various sizes. A recovery plan has been developed for the species (USFWS 2002c).

The recovery plan for the Steller's eider identifies recovery criteria and preliminary management actions needed for delisting.

When the Alaska-breeding population of the Steller's Eider was listed as threatened, the factor or factors causing the decline were unknown. Factors identified as potential causes of decline in the final rule listing the population as threatened (62 FR 31748) included predation, hunting, ingestion of spent lead shot in wetlands, and changes in the marine environment that could affect Steller's Eider food or other resources. Since listing, other potential threats, such as exposure to oil or other contaminants near fish processing facilities in southwest Alaska, have been identified, but the causes of decline and obstacles to recovery remain poorly understood. A significant number of early recovery tasks, therefore, will involve research to identify threats and evaluate their impacts.

(3) Candidate Species

Consistent with existing laws, BLM is required to implement management plans that conserve candidate species and their habitats, and will ensure that actions authorized, funded, or carried out by BLM do not contribute to the need for the species to become listed. The Kittlitz's murrelet is a Federally-listed candidate species (Federal Register 2004) that may be present in the Bay planning area seasonally (Table 3.11).

Kittlitz's Murrelet. Kittlitz's murrelet is a Beringian species that nests along most coastal regions from southwestern to western Alaska (Day et al. 1999). In Alaska, the majority of the summer populations are found in Southeastern Alaska, Prince William Sound, and Cook Inlet (Day et al. 1999). It is also known to breed in the coastal areas of Bristol and Kuskokwim Bays. Nesting habitat consists of unvegetated scree slopes or steep, rocky slopes. The scarcity of breeding records makes determination of exact breeding range difficult. Nesting sites are most often inland, up to 16 miles from the coast (Kessel 1989). The winter marine range is poorly known. There is no reliable population information at this time. Indications are that a substantial proportion of the world population died as a result of the Exxon Valdez oil spill in 1989. One estimate of this mortality was 5–10% (Van Vliet and McAllister 1994). This species is sparsely distributed within the planning area (Map 3.22). The only potential nesting area where a risk to the habitat might exist is on the scree-covered slopes of lode-bearing mountains on BLM lands in the Goodnews block. To date no Kittlitz's murrelets have been observed nesting in that area.

(4) State Listed Species

It is BLM policy, found in the 6840 manual, to carry out management for the conservation of State listed plants and animals. Four species of neotropical migrant landbirds that are State of Alaska species of special concern occur in the planning area (Table 3.12).

(5) BLM Sensitive Species

Fifteen birds and two mammals identified as BLM sensitive species occur within the planning area on more than an accidental basis (Table 3.12). Information on distribution, habitat condition, and population trends for most of these species is limited. Only those species occurring in the planning area on more than an accidental basis are discussed below.

Table 3.12. BLM Alaska Sensitive Animal Species Present in the Bay Planning Area

Species Common Name	Species Scientific Name	Known or Potential Presence on BLM Lands
Canada Lynx	*Lynx canadensis*	Yes
Harbor Seal	*Phoca vitulina*	Yes
Northern Goshawk	*Accipiter gentiles laingi*	Yes
Tule White-fronted Goose	*Anser albifrons elgasi*	Yes
Marbled Murrelet	*Brachyramphus marmoratus*	Not Known
Dusky Canada Goose	*Branta Canadensis occidentalis*	Not Known
Gray-cheeked Thrush	*Catharus minimus*	Yes
Olive-sided Flycatcher	*Contopus cooperi/borealis*	Yes
Trumpeter Swan	*Cygnus buccinator*	Yes
Blackpoll Warbler	*Dendroica striata*	Yes
Townsend's Warbler	*Dendroica townsendi*	Yes
American Peregrine Falcon	*Falco peregrinus anatum*	Yes rare in the plan area
Arctic Peregrine Falcon	*Falco peregrinus tundrius*	Yes
Harlequin Duck	*Histrionicus histrionicus*	Yes
Bristle-thighed Curlew	*Numenius tahitiensis*	Yes
Buff-breasted Sandpiper	*Tryngites subruficollis*	Yes-accidental
King Eider	*Somateria spectabilis*	Yes
Long-tailed Duck	*Clangula hyemalis*	Yes
Black Scoter	*Melanitta nigra*	Yes
Black Guillemot	*Cepphus grill*	Yes - offshore
Dovekie	*Alle alle*	Yes rare in the plan area
Red-throated Loon	*Gavia stellata*	Yes
Black Brant	*Branta bernicla*	Yes
Red Knot	*Calidris canutus*	Yes-but rare
Black-tailed Godwit	*Limosa limosa*	Yes-accidental
Surf Scoter	*Melanitta perspicillata*	Yes
McKay's Bunting	*Plectrophenax hyperboreus*	Visitors from St. Math. Is?
Marbled Godwit	*Limosa fedoa*	Not Known

Source: Armstrong 1995; Kaufman 2000; National Geographic Society 1987; Sibley 2000; Udvardy 1977; Seppi 1997, Peterson et al. 1991, Shaw et. al 2005; Whitaker 1980

Canada lynx. The Canada lynx (*Lynx Canadensis*) is the only indigenous wild cat in Alaska. Density, abundance, productivity and distribution of Canada lynx populations are dependent upon the cyclic fluctuations of snowshoe hare and to a lesser degree other small mammal and upland game populations. Canada lynx are now Federally-listed as a threatened species in the Rocky Mountains of the lower 48 states. For that reason, BLM Alaska considers the Canada lynx a sensitive species. At the same time,

they are considered a furbearer, legal to harvest. Lynx can be found in the planning area in forested habitat where snowshoe hare populations are present. Hare habitat features grasses, green vegetation, berries, conifers, aspen, alder, and willow. Lynx will be found where they can primarily hunt snowshoe hare, and to a lesser degree, other small animal populations. Lynx populations expand and contract in direct response to snowshoe hare population cycles (Whitaker 1980).

Harbor seal. The harbor seal (P*hoca vitulina)* inhabits the coastal waters and river mouths of Alaska, including the planning area. A population of seals resides permanently in the fresh water of Lake Iliamna. There are no harbor seal haulouts in the planning area; however, harbor seals may be found individually on the beaches in the Goodnews block. In the spring seals may follow salmon runs upriver for many miles, not returning to coastal waters until fall (Whitaker 1980).

Northern goshawk. The northern goshawk (*Accipiter gentilis liangi*) resembles the red-tailed hawk in shape but is gray and white in coloring. It inhabits taiga, the northern coniferous forests. It nests in a tall tree in dense coniferous forests. It migrates and winters in lowlands as far south as northern Mexico, and feeds mainly on grouse and smaller birds (Udvardy 1977).

Tule white-fronted goose. White-fronted geese, *Anser albifrons*, in Alaska nest mainly on the Yukon-Kuskokwim Delta, with smaller numbers in interior Alaska and the north slope. They are known to breed at Carter Bay in the Goodnews block of the planning area (Seppi 1997), and pacific flyway birds migrate through the Bristol Bay area en route to wintering grounds in the Central Valley of California (Bellrose 1980). White-fronted geese have declined in the Pacific flyway since the 1970's, but have rebounded to about 295,000 after the breeding season in 1993 (Rothe 1994).

Gray-cheeked thrush. The gray-cheeked thrush, *Catharus minimus,* uses a variety of habitats, including willow and alder thickets, upland and riparian deciduous forests, and conifer forests (McCaffery 1996. Nests are typically 5-6 meters above ground in willow, alder, and spruce. The species has been found breeding in riparian zones in the Goodnews block (Seppi 1997), and in the Alagnak and Illiamna blocks in Bristol Bay (USFWS 1997). This thrush is a shy bird that feeds on beetles, weevils, ants, caterpillars, cicadas, berries, and invertebrates, generally on the ground. Alaska is an important breeding ground for this bird, which migrates the longest distance of all the small thrushes to Columbia, Venezuela, Peru, and northwestern Brazil in South America (DeGraaf and Rappole 1995). Breeding bird survey data suggests a population decline in eastern North America (Sauer and Droege 1992), but it is considered common in south coastal Alaska and the Alaska Peninsula, during the breeding season and in fall migration (Eskelin and Dewhurst 1996).

Olive-sided Flycatcher. The olive-sided flycatcher, *Contopus cooperi/borealis,* inhabits and breeds in low densities in coniferous boreal and coastal forests of Alaska. Their North American breeding range extends into Canada and the lower 48 states. They migrate from Alaska in early August and winter primarily in South America. Their current density, population trends, and distribution on BLM lands in the planning area are not known; however, the species has been recorded in breeding bird surveys on BLM lands in the Alagnak and Iliamna blocks of the planning area (USFWS 1997), and in the adjacent Katmai National Park (USDI NPS 1996). Olive sided fly-catchers prefer to nest in spruce trees (Wright 1997) and are likely found in forested and riparian bottoms of the planning area. Breeding bird survey data provide strong evidence for population declines of the species over most of its breeding range (Handel et al. 1998).

Trumpeter Swan. The trumpeter swan (*Cygnus buccinator*) occurs primarily in the northeasternmost Kvichak blocks of BLM land in the planning area. They are normally found in forested areas but are casual breeders west of the taiga of interior Alaska (Hansen et al. 1971). Breeding swans prefer secluded wetland areas containing extensive areas of shallow lakes with abundant emergent vegetation. Adjacent waters and marshes are important for foraging. During a 1990 census they were found to number over 13,000 statewide (Mitchell 1994).

Blackpoll Warbler. The blackpoll warbler, *Dendroica striata,* also inhabits spruce forests of western Alaska, where it breeds. Habitat preferences include tall riparian shrubs, and coniferous or deciduous forest and in western Alaska in taiga/coastal tundra transition zones (McCaffery 1996). In August it migrates southward where it winters primarily outside the North American continent, in northern South America. It is largely insectivorous and prefers to nest low in spruce trees and occasionally on the ground. This species has been recorded breeding on BLM lands in the Goodnews block (Seppi 1997), and in the Alagnak and Iliamna blocks of Bristol Bay (USFWS 1997), and is considered a common breeder in these areas. Breeding bird survey data indicate a downward population trend in North America (Sauer et al. 1997).

Townsend's Warbler. Townsend's warbler, *Dendroica townsendi*, is a neotropical migrant found in summer in coastal locations in coniferous forests of Alaska, where it constructs a nest in a conifer at mid-story canopy and raises its young. It eats primarily insects and some seeds (Gough 2005). It departs Alaska in late August, and winters in Central America (Udvardy 1977). Its breeding habitat is largely restricted to mature forest with tall coniferous trees throughout its breeding range, and therefore is uncommon in the Bay planning area.

Arctic Peregrine Falcon. The Arctic peregrine falcon (*Falco peregrinus tundrinus)* can be found in low numbers throughout the planning area, nesting in areas with suitable habitat and migrating throughout the region. Falcons can be found in open country. Nesting habitat generally consists of bluffs or cliffs adjacent to water. Peregrines were listed as endangered in 1970, and the Arctic peregrine was delisted in 1994 (Federal Register 1994). Monitoring of Arctic peregrine indicates that populations have increased or remained stable since delisting (White et al. 2002).

Harlequin Duck. Harlequin ducks, *Histrionicus histrionicus*, are found in northeastern Siberia, the Kamchatka Peninsula, the Aleutian Islands and interior and south coastal Alaska (Bellrose 1980). Harlequins winter in the Aleutians and the Alaska gulf coast, coastal British Columbia, and as far south as Washington and Oregon in coastal nearshore areas. The harlequin duck is widely distributed throughout the mountains of southwestern Alaska (Petersen et al 1991, McCaffery and Harwood 1994) and is associated with pristine turbulent waters to nest and raise broods throughout their range (Bellrose 1980). In spring they prefer to nest on mountain streams, and especially inhabit the upper portions of drainages. Their nests are usually built very close to water, on the ground in dense vegetation, in tree roots, or in rock crevices. They eat the larvae of aquatic insects that are found in the highly oxygenated waters of swift mountain streams, the eggs of spawning salmon, and herring spawn. Much of their habitat is pristine; however, while they are on the coast they are vulnerable to oil spills in their intertidal habitats close to shore (Rosenberg, Patten and Rothe 2005). Harlequin ducks are known to occur in the Goodnews Bay (Seppi 1997) and Kvichak blocks of the planning area (USFWS 1992), and have been reported in all major rivers in the Togiak Refuge, directly adjacent to BLM lands in the Goodnews blocks (McDonald 2003). Baseline spring inventories of breeding pairs are scheduled for the Goodnews Bay and Kvichak and Alagnak blocks of the Bay planning area in May 2006.

Bristle-thighed Curlew. The bristle-thighed curlew, *Numenius tahitiensis*, is a large shorebird that inhabits mountainous tundra in the Bay planning area in summer, and island beaches in winter. It is one of the rarest American birds. Its breeding area is limited to small mountainous areas of western Alaska. Its nests are made on a depression and lined with tundra mosses.

King Eider. King eider, *Somateria spectabilis*, have a circumpolar range, occurring throughout the arctic lands of coastal Canada, Alaska, Siberia, Russia, Scandinavia, Spitsbergen, and Greenland (Bellrose 1980). In Alaska, king eiders winter south along the Aleutian chain and southern coast of the Alaska Peninsula, or as far north as the sea remains ice free. In spring they nest on ponds on Arctic tundra, and when they are not breeding, they can be found in coastal waters. Their nests are inland on tundra and consist of a down-lined scrape, covered with down when the female leaves the nest (Udvardy 1977). Large flocks of king eiders have been found in nearshore areas of Carter Bay in the Goodnews block during spring migration (Larned 1995). Nearshore areas in the shoals of Kvichak Bay are also recognized as a major king eider staging area in spring (Larned 1998) and a molting area in summer (Larned and

Tiplady 1998), directly adjacent to large blocks of BLM lands in the Kvichak and Nushagak watershed where breeding habitat exists and produce broods.

Long-tailed Duck. Long-tailed duck, *Clangula hyemalis,* are diving ducks that winter on upper Pacific coasts on inshore waters with shallow mussel banks and breed in Alaska on bays, lakes, tundra ponds and marshes. They nest near water on offshore islands along the coast or on tundra ponds and lakes. They eat aquatic invertebrates (mollusks, insects, crustaceans), fish, and some plant matter (Gough 2005; Udvardy 1977). Non-breeding birds have been documented in the planning area at Carter Spit (Seppi 1997) and in the Kvichak block (USFWS 1992).

Black Scoter. In Alaska, Black Scoters, *Melanitta nigra*, breed on the Yukon-Kuskokwim Delta and in Bristol Bay. They are considered a common breeder in the Carter Bay in the Goodnews block of the planning area (Seppi 1997), as well as in the Kvichak block in the Bristol Bay area (Seppi 1994). Black Scoters winter in nearshore areas along the Aleutian Islands and from the Gulf of Alaska to the Baja Peninsula (Udvardy 1977). Based on slight morphological differences, Pacific Coast birds come only from Alaska. In summer they breed and nest in tundra and boreal woodland settings that are interspersed with lakes or rivers.

Red-throated Loon. Red-throated loon (*Gavia stellata*) breed within the Bay planning area. They breed largely in coastal areas throughout the state, and winter throughout the Aleutian Islands and in nearshore areas south to Mexico. They were found to be a common breeder on coastal ponds on BLM lands in the Goodnews block at Carter Bay and in the Kvichak and Alagnak Block in Bristol Bay (Seppi 1994, 1997).

Black Brant. Brant or black brant, *Branta bernicla*, are marine birds that breed on coastal tundra in Alaska and Canada, where they build nests close to the water. They are never far from salt water, and most nest along the Yukon Kuskokwim Delta coast. They live in bays and estuaries in winter. They are found on circumpolar Arctic shores of Eurasia and North America. Brant that breed in Alaska winter on the Pacific coast from Vancouver Island to Baja California. Their chief food is eelgrass and sea lettuce. Brant are threatened by the steady loss of their winter habitats. Small numbers of brant were recorded on vegetated intertidal areas and mudflats in August during fall staging and migration at Carter Spit (Seppi 1997).

Surf Scoter. The surf scoter (*Melanitta perspicillata)* is found in coastal locations in much of Alaska and British Columbia. In the planning area, it breeds along the western coast of the Bering Sea as far south as the Goodnews block. Its distribution is not completely known. In the breeding season it inhabits tundra and forest bogs, where it lays its eggs in a down-lined scrape on the tundra. It can be found in coastal waters some distance from shore in the winter (Udvardy 1977).

8. Fire Management and Ecology

a) Wildland Fire and Fuels

The Wildland Fire and Fuels Management program emphasizes firefighter and public safety as the highest priority in all activities related to fire management and recognizes fire as an essential ecological process and natural change agent of many Alaskan ecosystems. However, within the planning area, fire has not historically been a dominant ecological agent.

(1) Fire Policy in Alaska

BLM participated with other Federal and State land management agencies and Native groups in completing 13 interagency fire management plans between 1980 and 1988. Plans for areas applicable to the Bay RMP are:

- Alaska Interagency Fire Management Plan, Kuskokwim-Iliamna Planning Area (1983)
- Alaska Interagency Fire Management Plan, Yukon-Togiak Planning Area (1984)
- Alaska Interagency Fire Management Plan, Kodiak-Alaska Peninsula Planning Area (1986).

These plans provide a cost effective, coordinated, statewide, landscape scale approach to fire suppression. Each plan contains a description of the local environmental and socioeconomic conditions, natural and cultural resources, fire history and behavior, and local subsistence activities. The plans provide for a consistent interagency approach to operational procedures and the identification and prioritization of values to be protected. The four management options (Critical, Full, Modified and Limited) defined in the plans were implemented at the completion of each plan and are flexible enough to allow different agencies to manage fire on their lands according to policies and mandates exclusive to their agencies. The common operational direction in these plans were consolidated in 1998 to provided unified guidance in a single document: the Alaska Interagency Wildland Fire Management Plan (AIWFMP)

In order to comply with the National Fire Plan and the 2001 Review and Update of the 1995 Federal Wildland Fire Management Policy (IFWFPR Working Group 2001), BLM Alaska amended all of its land use plans in July 2005. The Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska (BLM 2004d) identifies land use and resource objectives, wildland fire suppression options, and fuels (vegetation) management activities that achieve those objectives. Management options as defined in the interagency plans were incorporated. The amendment is applicable to all BLM-managed lands in Alaska. A BLM Fire Management Plan was completed in 2005 to meet national policy; it also is applicable statewide on BLM-managed lands and supports the interagency program and direction in the Land Use Plan Amendment.

(2) Fire Management

Fire is an essential renewing force in interior forest (taiga) ecosystems, ecosystems that are present in the planning area. Fire releases nitrogen and other essential nutrients from woody vegetation back into the soil, allowing for new plant growth. Depending on the characteristics of a fire, a burn can alter the vegetation composition of any vegetational community from late successional species to early successional or pioneer species such as alder and fireweed (nitrate-fixing plants) (USFS 2002). A well-managed fire implementation plan is beneficial to any ecosystem. Fire however is not a common change agent in coastal temperate forests or alpine tundra ecosystems.

Fire suppression strategies within the planning area are directly tied to the interagency program. The four management options (Critical, Full, Modified, Limited) defined during the 1980s planning effort have been assigned (Table 3.13) in collaboration with adjacent land managers, to all BLM lands (Maps 3.23a, 3.23b and 3.24). The management option classifications establish priorities for allocating fire-fighting resources and are based on values to be protected, resource management objectives, policies, and mandates. Fires are suppressed at minimum cost considering firefighter and public safety, benefits, values to be protected, and consistency with resource objectives. If a wildland fire is not contained by initial response forces, a Wildland Fire Situation Analysis is completed by the protection agency and field office staff to identify suppression alternatives and management constraints.

In addition to landscape scale management options, site-specific designation of Critical, Full, Avoid, and Non-sensitive have been established for structures, cultural, and paleontological sites, small areas of high resource value and Threatened and Endangered Species critical habitat in order for the field office staff to give protection agencies more specific guidance for small sites. BLM permits and leases that authorize structures on BLM lands should contain wildland fire management information. It is the individual's responsibility to take precautions in order to protect the permitted/leased site and personal property on that site from wildland fire intrusion. Unauthorized structures are not protected. BLM's Policy on Structure Protection can be found in Appendix E.

Table 3.13. Fire Suppression Classes

Option	Intent	Management
Critical	Protect areas where there is a threat to human life, inhabited property, designated physical developments, and structural resources designated at National Historic Landmarks	Highest priority for assignment of available suppression resources to exclude fire from the area/site
Full	Protect cultural and historical sites, uninhabited authorized structures, natural resource high-value areas, and other high-value areas that do not involve the protection of human life and inhabited property	Priority is below Critical for available suppression resources to suppress fires at the smallest reasonably possible acres.
Limited	Allow fires to burn under the influence of natural forces within predetermined areas to accomplish land and resource management objectives. Estimated costs of suppression efforts are also a factor.	Surveillance to observe fire activity and to determine is site-specific values or adjacent higher priority management areas are compromised. Site-specific actions when necessary, to protect human life and site-specific values.
Modified	Balance acres burned with suppression costs and accomplish land and resource objectives. Strategies are based on an annual conversion date.	Assignment priority of available suppression resources is below Full. When risks of large fires are high, the initial response to a fire is analogous to Full without the intent to minimize acres, but to balance acres burned with suppression costs. When the risks are low, the appropriate response is to a wildland fire is analogous to Limited.

Protection agencies implement the appropriate management response to a wildland fire based on the management option assigned. Under a Reciprocal Fire Protection Agreement between BLM and the State of Alaska, fire suppression on BLM-managed lands is delegated to the State of Alaska, Department of Natural Resources, Division of Forestry, Southwest Area Office. Other than suppression, fire and fuels management activities on BLM land including, but not limited to, fire trespass, prevention, education, prescribed fire, and hazardous fuels reduction are the responsibility of the AFO staff.

(3) Fuels Management

Fuels Management assists in achieving resource and land use objectives. Complete exclusion of wildland fires is not realistically feasible.

To date, the BLM has not expended funds within the planning area for fuels treatment to meet resource objectives. Prescribed fire and manual fuels reduction projects would be the most viable although mechanical projects are still a consideration. However, as reflected in the fire history of the planning area, wildland fires are uncommon due to the climate regime and the extent of wet tundra.

(4) Fire History

Fire history can be found in Maps 3.23a, 3.23b, and 3.24. Since the implementation of the interagency fire management plans statewide (1988) to the present (2006), there have been approximately 90 fires within the planning area. The largest was a lightning-ignited fire that burned 20,191 acres in Wood-Tikchik State Park. Nine fires have originated on BLM lands; 6 fires were less than 10 acres; 1 fire was reported to be 50 acres, 1 fire was 114 acres and the largest fire was 1,193 acres.

Alagnak Block. Since 1950, no large fires have been reported within this block. If a fire should occur it would be a wind driven fire due to the domination of tundra vegetation in this block.

Goodnews Block. No large fires have been reported on BLM-managed lands within this block. This block falls within two different vegetative classifications–Bering Tundra North to the west and Ahklun Mountains Tundra to the east. In the western portion of this block, vegetation ranges from wet grasses along the coast to woody plant material in a vegetation transition zone between the coast and the mountains. In the eastern portion of the block, Alpine tundra dominates the mountainous terrain. Black spruce may be found on ridges and hills, while a mixture of hardwoods and white spruce may be found on higher points along major rivers. The vegetation regime and maritime influence have kept fires from occurring on lands within the block.

Iliamna Blocks. Fire as an environmental factor is insignificant due to the maritime influence and tundra vegetation. Fire occurrence on BLM lands within the block is very low; when fires do occur they are generally fast moving and of low intensity. The majority of fires are small, human-caused, and associated with recreational activities. Fires have been ignited by lightning but these are not the norm.

The Iliamna Fire (#88), the largest fire in the planning area, was reported in 1957. The final fire size was 40,200 acres. No map is available; the point of origin was at latitude of 59 degrees 5 minutes and longitude 156 degrees.

Alagnak fire (A420), started and burned on Full Management Option land and burned 1193 acres on BLM land in 1990.

However, as the temperature rises with regional environmental change, plant communities are changing, allowing for the possibility of more frequent fires.

Chulitna River, Chekok Creek, and Gibraltar Lake Blocks. These small isolated blocks of land in the northeast corner of the planning area have not had any recorded fires. Although there is a pronounced maritime influence here, it is a transition zone where vegetation graduates from open tundra, mixed deciduous, and spruce forests, to other types of vegetation as the elevation rises on the slopes of the Aleutian Range.

Klutuk Creek Block. This planning block falls within the same vegetative classification as the other blocks within the general region. This block has had one fire on the border of this block and the Yellow Creek block. That fire is discussed in the Yellow Creek discussion that follows.

Koggiling Creek Block. This block is comprised of the same type of vegetation: tundra, grasses and dwarf shrubs. The area is influenced by a maritime weather pattern. One fire on BLM-managed lands has been reported in the Block.

Koggling Creek 2 Fire (B542), Point of origin was in Modified and burned 140 acres in 1997.

Kivichak Blocks. Fire is also insignificant due to a maritime weather pattern and tundra type vegetation. Fire records show that no fires have burned in this block since 1950.

Yellow Creek Block. There was one recorded fire incident in 1957.

The point of ignition for the Cormick Fire (005), was reported at latitude 59 degrees 31 minutes and longitude 157 degrees. The fire burned 4,500 acres.

This area is the same as the previous blocks with regard to vegetation: tundra, grasses and dwarf shrubs. Fires that would burn in these areas would spread rapidly and burn surface vegetation.

Interagency fire management practices within the planning area are directly tied to the AIWFMP. BLM-managed lands have been assigned an appropriate management option. These management options are Critical, Full, Modified and Limited. As the landscape changes, land managers are encouraged to review and update management option designations annually. The options are based on Intent, Policy, Objective, Operational Considerations and Operational Procedures, and are described fully within the AIWFMP. At present, Wildland Fire Use is permitted in the planning area.

9. Cultural Resources

a) Introduction

The cultural resource program is responsible for the identification, monitoring, and protection of all historic and prehistoric resources on BLM-managed lands. Cultural resources within the planning area are extremely varied in respect to age, cultural affiliation, function, and physical remains. While this chapter deals with the past, it is important to note that the Native peoples in this region still actively participate in a traditional way of life by hunting, fishing, gathering and sharing traditional foods with their families, community and Elders.

The planning area spans three linguistic groups: central Yup'ik, Alutiiq and Dena'ina (Map 3.25). The following sections present an overview of the prehistory and history of each group and the current status of cultural resource work on the BLM lands. A general overview is presented in Table 3.14 and a historical/cultural timeline for the planning area is presented in Table 3.15.

(1) Central Yup'ik Area Prehistory and History

Overview of Archaeological Data from the Region and the General Area

The oldest sites of human occupation in the area (6000-3000 B.C.) occur in two phases, both representing a focus upon caribou or large land mammal hunting. The earlier Paleoarctic is represented by a blade-making tradition; the later Northern Archaic contains diagnostic corner-notched projectile points (Ackerman 1980; Dumond 1987). A somewhat later tradition, the Arctic Small Tool tradition (2000-1000 B.C.) also appears to focus primarily upon land mammal hunting. This phase is distinguished by fine microblades and microblade cores.

In the larger region even older sites have been found that are believed to extend back to about 9500 B.C. These areas lie to the northwest in the vicinity of the Kisaralik River and Nukluk Mountain. The younger known sites of the Central Yup'ik considered in this plan are the oldest that occur here (Ackerman 1980).

The Norton tradition (300 B.C. – 1000 A.D.) marked a shift in subsistence focus. Settlements became more permanent and were located along the coast and rivers. Ackerman (1981) has found isolated Norton materials inland. Constructed house remains and the development of local pottery support this view. Ground stone net sinkers indicate that salmon resources were utilized in great amounts and were probably being preserved and stored as food for most of the rest of the year (Ackerman 1981; Dumond 1987; Kowta 1963; Larson 1950; Shaw 1986).

Table 3.14. Cultural Contexts for the Bay Planning Area

Dates	Location	Theme	Diagnostic Cultural Features, Artifacts
1000 – 1800 AD	Primarily coastal	Thule tradition	Kayaks, toggling harpoons, floats, dog traction, gravel tempered pottery
300 BC – 1000 AD	Along coast and major rivers, some isolated finds inland	Norton tradition	Constructed houses, fiber tempered pottery, first ground stone, net sinkers
2000 – 1000 B.C.	widespread	Arctic Small Tool tradition	Finely flaked small stone tools, microblades, microblade cores
3000 – 2000 B.C.	Coastal, river drainages	Archaic/Pacific Coastal	side-notched points, unifacial scrapers
6000 – 5500 B.C.	widespread	PaleoArctic/PaleoIndian tradition	Microblade technology
9500 – 7000 B.C.	Kisarilik River, Nukluk Mountain	Earliest Human Occupation of the larger Region	Narrow, wedge-shaped microblade cores, microblades, Donnely-like burins, blade-like flakes

Table 3.15. Timeline for Historic Period

Dates	Event
1867 to present	**American Era**
1912	Mt. Katmai erupts; Savonoski village abandoned
1904	Chinese Exclusion Act- marks beginning of local fishermen's unions efforts to be included in the commercial fishing industry
1886	Moravian church mission established in Nushagak
1883	1st cannery in Nushagak Bay
1868	1st U.S. government visit to Bristol Bay region in U.S. Revenue steamer *Wayanda*
~1767-1867	**Russian Era**
1835-6	Smallpox epidemic throughout region and beyond
1818-1819	First major trading post in Bristol Bay area built –Alexandrovsky Redoubt (Nushagak)
1799	Czar grants monopoly for fur trade to Russian American Co.
1798	Iliamna trading post destroyed
1796	Lebedev-Lastochkin company establishes a small trading post at Lake Iliamna
1767	First exploration of Bristol Bay

Historic People

Oswalt (1990) presents a breakdown of language subgroups for this area during the historic and late prehistoric periods. The Bristol Bay area was occupied by the Tuyuruaniut; the inland Wood-Tikchik Lake and north to the Kuskowim area was inhabited by the Kiatagmiut; the Quinaghak area on the eastern side of Kuskokwim Bay was occupied by the Caninermiut; and the Nushagak River drainage was occupied by the Aglemiut (Aglurmiut). These groups were by no means permanently fixed through time. Just prior to the period of Russian influence, the Aglemiut had moved to the Nushagak Bay and River as a result of warfare on the Yukon-Kuskokwim delta.

The Central Yup'ik during the historic period practiced a central based wandering lifestyle based upon permanent villages. Subsistence was focused on salmon fishing. Along the coast, sea mammal hunting provided a large part of the diet. In the interior, large land mammal hunting was very important. Other seasonal subsistence pursuits included waterfowl, fresh water fish, and berry gathering, as well as the pursuit of furbearers which, depending on species, were also eaten (VanStone 1967,1968, 1971).

Russian Period

The first Russian exploration into the Bristol Bay area is implied in the 1767 chart of Admiral Nagaev and a chart reflecting Poptap Zaikov's 1772-3 baidarka expedition from False Pass (Bailey and Orth 1990). In the 1790's, competing fur trading company employees explored the north coast of the Alaska Peninsula and Bristol Bay, ascended the Kvichak River to Iliamna Lake and traveled overland to Kamishak Bay (Solovjova and Vovnyanko 2002).

In 1799 the Russian Czar gave the Russian American Company a monopoly on the Alaskan fur trade. The first trading post in the planning area was established as a result of the 1818-1819 Korsakovsky exploration of the Nushagak River via Iliamna Lake. While Korsakovsky continued to explore up the coast to the mouth of the Togiak River and to Goodnews Bay, a work crew from his party stayed at the mouth of the Nushagak River and built Novo-Alexandrovsky Redoubt (Black 2004; VanStone 1988).

When the Russian American Company was awarded a monopoly over the fur trade, as a condition it was obliged to support the mission of the Orthodox Church in Alaska. The company paid for clergy, churches and schools. Early relations between the Russian clergy and the Native people were for the most part good; however, relations could be extremely tense as evidenced by the killing of Father Juvenal and his Russians and Alutiiq attendants in 1796 (Pierce1990).

The Aglemiut were displaced from the Yukon-Kuskowkim delta area by warfare shortly before the Russians arrived in the area. Because they were new to the Nushagak River area and the adult male population was so low from warfare, they turned to the Russian American Company for protection from the Kiatagmiut and others (Oswalt 1990; VanStone 1971). As a consequence of this relationship, many members of this group worked for the company. Small clusters of Native children throughout the area were educated in small Russian Orthodox schools set up at fur trading outposts. Marriages between Russian traders and Native women were sanctioned by both the church and the company throughout the region. Both Native and mixed Native-Russians became employees of the Russian American Company. Working within the fur trade gave Native people throughout the area their first exposure to a market economy.

The explorations of Bocharoff, Kvichak, Korsakovskiy,Vasiliev, Kolmakov, Lukin (some of these men of mixed Native/Russian creole class) and countless unnamed traders of the Russian American Company contributed a great deal not only to the Russian fur trade but to the general knowledge of the area. By 1867 the Russians had, for the most part, accurately mapped the region.

American Period

The sale of Alaska to the United States in 1867 marked the end to the Russian American Company. Its assets were sold to Hutcheson Kohl, a company based in San Francisco. Hutcheson Kohl later became the Alaska Commercial Company which to this day remains a major commercial source of western goods in the region.

The American government did not take an active interest in its new purchase for several decades—at least not in this area of Alaska. In 1868 Captain J. W. White in the United States Revenue steamer *Wayanda* made a cursory visit to the area, stopping long enough at Nushagak to make a description of the old Alexandrovsky Redoubt (VanStone 1967)

With the sale of Alaska to the United States, the Russian Orthodox Church was in a quandry. The Russian American Company supported the Russian Orthodox Church. The company's departure from

the area significantly undermined the church's base of support and amounts for a loss of missionary personnel. With fewer clergy some areas received fewer or no visits.

Into this perceived void stepped Sheldon Jackson, a Presbyterian who had been working in southeast Alaska since 1877. He undertook a series of public lectures during the early 1880's advocating the need to bring Alaska Natives into Protestant Christianity. His crusade influenced Moravian Church officials to send a mission to the lower Kuskokwim in 1884. Having established a mission on the Kuskokwim another was quickly thereafter established near Nushagak in 1886 (Oswalt 1990; VanStone 1979).

The Russians first looked at developing a commercial fishery from the abundant resources in Alaska but the commercial saltery never became viable. In the meantime canning technology continued to improve and by the 1870s canneries became more commercially viable. During this period commercial fishing developed on major rivers in California, Oregon, British Columbia and Southeast Alaska. By 1883 the first cannery in Nushagak Bay appeared at Kanulik. After that many more were established throughout the area. By 1908 there were 10 canneries in Nushagak Bay alone, and by the 1920s 25 were operating within Bristol Bay with floating canneries starting to make an appearance. Initially, salmon were caught from sailboats with gill nets. Power boats were introduced in 1922 but were quickly banned.

The blocking of river mouths with fish dams and over-harvesting methods resulted in poor returns for the commercial fishing industry as well as poor subsistence fishing. The Bureau of Fisheries tried to stem the tide of illegal and over-fishing, but was ineffective due to lack of enforcement. A 1918 program initiated a practice of installing stream guards on major salmon streams. These men lived in small huts at remote locations for the season. Subsequently the salmon markets dropped.

Native involvement in the commercial fishing industry was severely limited until after WWII. The canneries imported most of their labor for both the cannery operation and the fishing crews. The Chinese Labor Exclusion Act of 1904 and its extension reduced the number of imported Chinese workers, but canneries responded by importing Filipino and Mexican laborers. The organization of fishermen's unions began the fight for local inclusion in the commercial fishing industry. Wages from commercial fishing still makes up a significant portion of Native peoples' income in the region (Selkregg 1998).

For the next several decades Federal attempts at regulation of the commercial fishing industry were weak. During this time commercial fish traps were used by the big cannery companies which both effectively lowered the number of salmon reaching spawning grounds and shutting out local seine fishermen. Outrage by Alaskans against the big companies which were owned by outside interests fueled a campaign to have fish traps outlawed. The effort was only partially successful. Some traps were closed for conservation reasons. Meanwhile cold storage technology and improved transportation made it possible for the big companies to get relatively fresh fish to markets (Lichatowich 1999).

Unlike much of the rest of Alaska there were no gold stampedes of any significance. However, the presence of gold strikes in other areas, however, did result in a backwash of ever hopeful prospectors entering into this country. Small amounts of gold were found near the confluence of the Kakhtul and Mulchatna rivers in the late 1880s.

The significant mining story of the region began in 1926 by Walter Smith, a Native from Chagvan Bay. While prospecting near Goodnews Bay he encountered a strange dull grey heavy metal ore which turned out to be platinum. On this news a modest 8-10 miners entered the area and began prospecting (Lindstrom and Olson 2004). This was just the beginning of platinum mining in the Goodnews Bay area.

When Andrew Olsen and Walter Culver met on a train between Seward and Anchorage in the spring of 1933 the biggest platinum mine in the United States was born. Olson was on his way to Flat where he and his brother and partners operated a dragline operation. Culver was planning a prospecting trip to Goodnews Bay. By the spring of 1934 a dragline and elevated sluice box were on their way to Goodnews Bay. The operation was so successful that a dredge was in operation by 1937 (Johnson 1940).

Smith (1938) describes the Goodnews Bay mining company as "the outstanding development in the platinum-mining industry in Alaska, as well as the United States proper." Later during WWII when most gold mining operations were shut down the platinum mined at the Goodnews Bay Mining Company was listed as critical and the mine was one of few that continued to operate through the war.

Current Status

Most of the blocks of BLM land or Native-selected land within the planning area lie within the lands traditionally inhabited and used by the Central Yup'ik. Within the region a number of surveys have been conducted along the coast, major rivers and some of the lakes and upland areas. On BLM lands there has been limited permitted use except for mining in the Platinum area and wide ranging guiding operations. Few archaeological surveys have been done on BLM lands due to limited accessibility and resource development. BLM archaeologists have performed on the ground inspections of mining and permitted activities over the last several decades. Typically they inspect adjacent areas as time and logistics permit; recording properties as encountered.

The Bureau of Indian Affairs ANCSA program has recorded many properties while doing ongoing 14 (h)(1) inventories on Native-selected lands. During the late 1970s and early 1980s Robert Ackerman and his crews surveyed both BLM and USF&WS lands in the drainages of the Goodnews Bay area. Robert Shaw also surveyed BLM lands during this time period on Hagemeister Island and in the Goodnews Bay area. In 2004 a research permit was issued to the University Museum (University of Alaska, Fairbanks) for archaeological survey at Canyon Lake, an interior area of the Goodnews Bay region (Odess 2005).

(2) Alutiiq Area Prehistory and History

Overview of Archaeological Data from the Region and the General Area

The Paleoarctic tradition within the upper Alaska Peninsula dates to between 8000 B.C and 5500 B.C. It is best known from interior sites from the uplands of the Alaska Peninsula. The oldest sites are known from the upper Ugashik drainage located farther down the Alaska Peninsula and outside of the planning area (Dumond 1981). The tools recovered from these paleoarctic sites imply a life style based upon large land mammal hunting, presumably caribou. People during this period are thought to have been extremely mobile; living in skin tents and following game.

There is a 2500-year break between the Paleoarctic period and the Northern Archaic period. This may be the time when interior hunting people settled the coastal areas and learned a maritime subsistence lifestyle as evidenced by the Ocean Bay 1 sites found along the coastal areas of Kodiak Island, the Alaska Peninsula, the east side of the Kenai Peninsula and the Prince William Sound area (Steffian 2001). Ocean Bay tradition peoples developed many specialized tools for maritime subsistence. Continuing relatively smoothly from the Ocean Bay tradition is the Katchemak tradition, in which dwellings became larger and more permanent, maritime subsistence became more refined, the carving of bone and stone became an art form, and ceremonial life became more elaborate. The region at this time appeared to be a crossroads for cultural contact as seen archaeologically by the appearance of ground slate and oil lamps from this region appearing in a wide arc. At the same time toggling harpoons from the north, labrets from the Northwest coast and pottery types from Siberia made their appearance here (Crowell and Luhrmann 2001).

Historic Native People

From excavations on Kodiak Island, archaeologists believe that the Alutiiq descended smoothly from the end of the Katchamak tradition (Jordan and Knect 1988). The Thule migrations from the north may have displaced Alutiiqs, especially within the plan area on the north side of the Alaska Peninsula. Dumond's (1987) work shows prehistoric Alutiiq occupation on the upper course of the Nakek River and on the Savonovski River for approximately 4,500 years, with a focus for the first 500 years on hunting (most likely caribou) and fishing during the last 4,000 years.

Over time the late prehistoric Alutiiq most likely moved down the river drainages to the coast. The later migrations of the Central Yup'ik group, the Aglemiut, most probably displaced Alutiiq people living near the mouth of the Naknek River. By historic times the Alutiiq living within the plan area were living in the Naknek Lake/Savonoski drainage area (Crowell and Lurhmann 2001).

Russian Period

The Russian presence within this area essentially reflects what occurred within the Central Yup'ik area. The Russian fur trade for this part of Alaska was administered from Three Saints Bay on Kodiak Island in 1784. However, the trading post was located at the mouth of the Nushagak River at Alexandrovsky. Redoubt had the most contact with people of this area. It was established during the 1818-1819 exploration of Bristol Bay and the coastal areas to the north.

American Period

In 1867 Alaska was sold to the United States. American influence on the Alaska Peninsula came slowly. The first substantive American contact came with missionaries who arrived in the late 1880s. This was followed by the establishment of various commercial fisheries which were developed soon after.

On June 6, 1912 Novarupta erupted, sending more than 5 ½ cubic tons of debris into the air. This was a significant historical event for this region and it also leaves a datable stratigraphic mark upon undisturbed historic and prehistoric sites of this region. The ash fall at the village of Savonoski was so massive that the people moved down river to the mouth and established New Savonoski.

Current Status

There are no BLM lands within the area traditionally inhabited and used by the interior Alutiiq. Fairly extensive surveys and excavations have occurred along the length of the Naknek drainage.

(3) Dena'ina Area Prehistory and History

Overview of Archaeological Data from the Region and the General Area

The Iliamna - Lake Clark area is not a well known area archaeologically. What little survey work that has been done in this area has been concentrated around the lake shores and specific areas of projected construction (Kodack n.d.; Yarborough 1986). This work essentially documents the late prehistoric occupation of the area. Smith and Shields (1977) added some sites but not much time depth. They give some suggestions for older site locations at slightly higher levels than present day lake shores and caves and also suggest that water fluctuations may have destroyed information for some periods. Inventory in this area otherwise has not been as actively pursued as more accessible, less heavily vegetated areas. In spite of this situation there are indications from the broader region that this area has long been inhabited.

The best evidence so far for time depth comes from Yarborough's 1986 survey of the eastern terraces of the Tazimina River. He found a microblade core fragment and a retouched flake. As can be seen from the more recent historic sites and the continuity of a subsistence lifestyle still practiced today, this is an area with bountiful resources.

Historic Native People

The Dena'ina living in the Iliamna and Lake Clark area as well as those of the upper Mulchatna and Stony rivers are grouped together as the Interior Society. This is one of three societies within the Dena'ina. The Interior Society has a subsistence focus upon salmon. They also rely upon large land mammals, waterfowl, fresh water fish, and berries in season. The group around Iliamna Lake harvests seals since

this is one of the few freshwater lakes in the world with a resident seal population. The Iliamna group also travels to Cook Inlet to hunt beluga (Townsend 1965; 1981).

All societies maintained winter villages from which they set forth seasonally to collect and hunt the foods they depended upon. Until the middle of the 19th century villages tended to be hidden to foil attacks. After this period winter villages were located along the shores of rivers and lakes. By 1906 Dena'ina houses in the Iliamna-Lake Clark area were all above ground structures although the Iliamna Eskimo still had semi-subterranean houses (Townsend 1981; VanStone and Townsend 1970).

Russian Period

By the 1790s it was obvious to the Russians plying the fur trade in the coastal waters of Alaska that the marine mammal fur market was declining. A shift toward land mammal furs took place and exploration of the interior became more attractive (Solovjova and Vovnyanko 2002; VanStone 1988). Valsily Kvichak explored the Kvichak River and north along the coast as far as the Kuskokwim perhaps even to the Yukon as seen in composite maps drawn by Kobelev in 1779 (Oleksa 1990). One of the competing Russian fur trading companies, the Lebedev-Lastochkin company, began actively operating in the Iliamna area in 1796 (Solovjova and Vovnyanko 2002).

A year later a party from the largest competitor, Shelikov's company, visited the Iliamna artel (a small fortified settlement). Medvednikov and Kashavarov visited the Iliamna artel with a small party and described it as containing a barracks, several Dena'ina-style bark houses and a stockade complete with a guard and sword. A man named Tokmanov was in charge of fifteen Russians and Kamchatkans. All of them were married to Native women and had children (Solovjova and Vovyanko 2002).

Around this time Vasily Ivanov, heading a group of Russians and Dena'ina, explored to the north of Iliamna. Because only secondhand accounts of this trip and its route survive, it is not known but it is believed that they went across Iliamna, Lake Clark, up the Mulchatna to either the Stoney River or Holitna River and down the Kuskowim as far as Ohagamiut then portaged across to the Yukon (Solovjova and Vovyanko 2002; VanStone 1988). In 1798 the Iliamna artel was destroyed by Natives and it was not until 1821 that another Russian trading post was established in the area (Vanstone and Townsend 1970).

During Korsakovsky's 1818 trip he left some of his party at the mouth of the Nushagak to build Alexandrovsky Redoubt and ascended the Kvichak to Iliamna where he met Eremy Rodionov who offered to lead a party north to Lake Clark and the upper reaches of the Mulchaltna River. This trip was very similar to that reported for Ivanov. The September return trip brought the travelers back to Iliamna then overland to Cook Inlet and back to Kodiak (VanStone1988). This travel route between Iliamna and Cook Inlet was not surprising considering the Iliamna Dena'ina ties with Cook Inlet Dena'ina. After the Russians established themselves in the Cook Inlet area, trade with the interior Dena'ina was conducted through Cook Inlet Dena'ina middlemen as well as directly with posts around Cook Inlet and the Kenai Peninsula (Townsend 1981; VanStone and Townsend 1970).

American Period

As elsewhere in this region, the American period started slowly. The 1867 purchase of Alaska did not immediately result in much attention or change in the lives of the people living in this area. In the 1880's commercial fish traps set at the mouth of Kvichak River resulted in so little escapement that people at Nondalton faced starvation and had to rely on "backup" drainages for fish like the Kuskokwim River (Ellanna and Balluta 1992). Other shortages resulted because of similar blockages on other rivers connecting with Iliamna and Lake Clark (Townsend 1981). A reindeer herd was established at Iliamna in 1905 to help the economy. Some Dena'ina became herders but this endeavor was never very successful and herding all but disappeared by the 1940's (ibid). Like the Central Yup'ik and Alutiiq, the Dena'ina were eventually able to participate in the commercial salmon fishing industry during the 20th century after breaching the barriers to local employment. Their continued participation in that industry is an important part of the local cash economy today.

Current Status

Very little BLM land or Native-selected land lies within the area traditionally inhabited and used by the Dena'ina. There has been limited permitted use except for wide ranging guiding operations for these isolated parcels. Little on the ground inventory has been done for these smaller parcels due to the high costs to access such remote parcels coupled with the lack of ground disturbing projects at these locations. Smith and Shields performed a survey on primarily NPS lands in the Lake Clark area in the late 1970s but also found sites on adjacent small BLM parcels.

10. Paleontological Resources

a) Introduction

The paleontology program is responsible for the identification, evaluation, monitoring, and protection of fossil resources on BLM lands.

An inventory of known paleontological resources on selected BLM lands was contracted in 1986 (Lindsey 1986). This study was done from available literature. Two BLM land blocks lie within the current planning effort. Area 1 encompasses the BLM block lying within the Dillingham, Iliamna, Naknek and Mt. Katmai quadrangles. Lindsey's Area 2 encompasses BLM lands within the Goodnews Bay quadrangle. An examination of the Alaska Paleontological Database (alaskafossil.org) shows no scientifically significant discoveries more recently reported for BLM lands within the planning area.

While none of these finds has been assessed as scientifically important, any earthmoving projects should be assessed with on the ground inspections.

b) Nushagak/Iliamna/Naknek Region

Lindsey's (1986) Area 1 encompasses the BLM blocks lying within the Dillingham, Iliamna, Naknek and Mt. Katmai quadrangles. While Lindsey reported that no fossils have been reported from this area, the extensive Quaternary deposits present the potential for future finds. Mammoth remains were excavated by archaeologists in secondary context in Naknek although none is known from BLM lands (Dumond and VanStone 1995).

c) Goodnews Bay Region

Lindsey's Area 2 encompasses BLM lands within the Goodnews Bay quadrangle. Small, poorly preserved Permian brachiopods and a Jurassic bivalve are both reported for the Gemuk group. While these fossils may be useful to determine the age and stratigraphy of the Gemuk Group, no special management of these resources is recommended. Findings of Jurassic age radiolaria and fragmentary ammonites have also been reported for the Goodnews Bay and Hagemeister Island quadrangles (Hoare and Conrad 1978).

11. Visual Resources

a) Visual Resources Management Introduction

Scenic quality is an essential component of most recreation activities. In Alaska, the opportunity to experience a natural environment that has been, for the most part, undisturbed by modern human influence, creates a romantic image that appeals to recreationists across the globe. The wide-open spaces, and relatively few public roads throughout the state make recreating in Alaska an appealing

destination. BLM uses Visual Resource Management (VRM) on BLM-managed lands within the Bristol Bay planning area to manage the quality of the landscape. Management objectives include minimizing potential impacts to visual resources resulting from development activities.

The visual resources of BLM-managed lands within the Bristol Bay planning area were inventoried and classified in accordance with procedures outlined in BLM Handbook 8410-1 (BLM 1986). This involved identifying the visual resources through a photo inventory process and use of data collection sheets, and then assigning the areas to Visual Resource Inventory classes. These classes do not establish management direction, but are used by management to ultimately establish VRM Management classes that will be codified in the final Bay RMP. VRM Inventory classes are assigned through the inventory process while VRM Management classes established in the final RMP.

The four different VRM classes (the same for both Inventory and Management Classes) identify the objectives for managing visual resources on BLM lands. The class assignments take into consideration the value of the visual qualities of the existing landscape and anticipated future land uses, and define the maximum amount of landscape alteration and surface disturbance that can occur.

BLM evaluates visual values based on a rating system that looks at:

- Scenic Quality: the visual appeal of a piece of land,
- Sensitivity Level: the levels of use and public concern for the scenic qualities of the land, and
- Distance zones: the relative visibility of the landscape from access routes and observation points.

Based on these factors, lands are placed in one of four visual resource inventory classes. Inventory classes II through IV (the lowest) are assigned based upon the combined scores from the three factors, while class I is reserved for lands previously designated by Congress or administratively to preserve a natural landscape, such as a Wilderness area or a wild portion of a Wild and Scenic River.

During planning, BLM assigns VRM classes. These define the visual objectives that BLM intends to achieve for its lands. The objectives for VRM classes are:

Class I Objective. The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

Class II Objective. The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

Class III Objective. The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

Class IV Objective. The objective of this class is to provide for management activities which require major modifications of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

b) Description of Bay Visual Resources

Visual resources on BLM lands in the planning area are concentrated in three geographic areas that tend to demonstrate similar scenery: a Goodnews Bay Block in the west, a Nushagak/Kvichak Block in the central portion and an Illiamna Block in the east.

Goodnews Block.

The Goodnews Bay Block consists of large tracts of selected and unselected BLM lands located in the Goodnews River and Arolik River watersheds including coastal plains, slopes and mountains on the Bering Sea to the west and river plains and the Ahklun Mountains to the east. These low mountains and hills can be rather steep and rugged, or support gentle, tundra-clad slopes that increase in elevation towards the northeast, often containing cirques and other glacial features, rock outcrops, talus slopes and cliffs. Shrubs and tundra dominate the block while trees are generally lacking, except in the broad riverine bottoms and along various tributaries where alder and willow predominate. Expansive tundra-covered coastal plains bisected by sinuous west-flowing rivers including Indian and Cripple Creek bound the Pacific Coast western side of the Goodnews Block. Much of this BLM land is adjacent to the 700,000 acre Togiak National Wildlife Refuge, portions of which are managed as designated wilderness by the US Fish and Wildlife Service. Remnants of commercial gold and platinum placer mining activities are occasionally visible near Goodnews Bay to the south.

Nushagak/Kvichak Area

The Nushagak/Kvichak Area, in the central portion of planning area, contains selected and unselected BLM lands in the middle watersheds of the Nushagak, Kvichak, and Alagnak Rivers, reported to be some of the most productive salmon fishery and spawning waters in the world. The land between these rivers and that situated to the west and east, is a vast patchwork of lowland wet tundra, broad low ridges of successive ancient moraine deposits supporting scattered stands of dwarf birch and black and white spruce, sand blows, and thousands of pothole lakes and tributary streams. The land is rich in moose and salmon, rainbow trout and seasonal caribou. The BLM lands in this region bound the Alagnak Wild River and Katmai National Park and Preserve, both administered by the National Park Service, and a small portion of the Becharof National Wildlife Refuge.

Iliamna Area

The Iliamna Area incorporates mostly Native-selected and State-selected lands north, south, and east of Illiamna Lake, and contains the highest mountains and most stunning scenery in the planning area. This includes rocky, snowcapped mountains towering 4,000 feet above short valleys that drain to Illiamna Lake, with heavier white spruce forests and frequent outcrops of glacially smoothed rock below the dry tundra slopes above tree line. BLM lands in this block share boundaries with Lake Clark National Park and Preserve as well as State of Alaska and Bristol Bay Native Corporation lands. Based upon Alaska Native selections and the State of Alaska's priority list for conveyance, the vast majority of BLM lands in this block, including the high mountains and ridges, are likely be conveyed out of BLM ownership. Virtually all lands in the Illiamna Block are slated to be conveyed.

c) Condition and Trend

High quality visual resources are in ever greater demand nationally and internationally as commercial, residential, and industrial development associated with growing populations impacts these resources. The quality of visual resources is a critical element in an observer's impression of a landscape and is in great demand by the local residents as well as the many individuals and users who fly over and recreate on public lands in Alaska.

The quality of visual resources directly impacts the quality of a resident's everyday life as well as a given visitor's overall Alaskan experience. Visual resources are therefore very important to the residents, to the

visitors who recreate in the planning area, and to the many commercial businesses that serve them. Both the numbers of visitors, sportspeople, and rafters that are drawn to the area's wildlife, topography, and scenery and the local commercial enterprises that transport, lodge, and guide them are linked to this demand.

Much of the land in the planning area consists of wildlife refuges and national and state park lands administered by the U.S. Fish and Wildlife Service, National Park Service, and Alaska State Parks. Although the annual visitation statistics fluctuate, all agencies are experiencing increases in visitation over the long term according to their public statistics, and predict it will continue to increase, as greater numbers of national and international travelers discover and visit these public lands. Travel forecasts by the Alaska travel industry also continue to predict increases in Alaska tourism as more and more visitors are attracted to Alaska's wild lands to hike, fish, hunt, and especially, sight-see.

Outside visitation varies widely over the planning area, but tends to concentrate in the central and eastern salmon and rainbow-rich watersheds of the Nushagak, Kvichak, Alagnak, and Naknek Rivers. The Alagnak River Wild River and adjacent Katmai National Park and Preserve draw over 50,000 sightseers, fisherman, and float enthusiasts annually. Numerous fishing and hunting lodges operate along these drainages, and many more flying services based in Dillingham, King Salmon, Illiamna, Anchorage, and other locations provide transportation to fishing, hunting, and rafting locations throughout the planning area. The quality of visual resources is extremely important to the financial health of these local businesses, outfitter-guides, and transporters who cater to the needs of area visitors.

Local residents in the planning area express a strong appreciation for the quality of the unaltered visual landscapes that surround them and often speak in terms of the recreational and spiritual benefits they gain from these natural landscapes. The majority of the residents in the planning area practice subsistence lifestyles and travel the land year-round, harvesting natural products including berries, salmon, moose, and caribou, accessing trapping and fishing sites, and conducting social and business activities. Travel patterns concentrate along the main waterways, both summer and winter, and the heaviest used lands tend to be closely associated with the river corridors. In the snow season, residents also utilize an extensive system of winter trails, well-marked with tripods, reflectors and GPS locations, to travel between villages and throughout the area for school and church events, business and family needs.

The quality of visual resources as viewed from the air are especially significant on an area-wide scale as virtually all recreational users and many local citizens access the country by aircraft. This includes both scheduled commercial flights between communities with larger airports including Illiamna, King Salmon, Bethel, and Dillingham, as well as service to smaller villages who all maintain gravel airstrips. Private pilots and transporters annually fly thousands of flights into the bush supporting flightseeing, recreational and subsistence activities. Alaska Fish and Game harvest records for moose, bear and caribou hunts in the BBPA from 1983-2002 indicate that aircraft delivered 46% of these hunters into the field.

Visual resources in the planning area are essentially pristine. With the exception of ATV tracks radiating out from villages, vestigial summer scars of overland snowmachine routes, occasional airstrips, infrequent abandoned mining operations and various lodges, fishing camps, boats and aircraft along the waterways, the visual resources in the planning area are virtually undisturbed from their natural state. Although difficult to quantify, the vast majority of residents and visitors in the planning area share an appreciation for these natural, uniquely Alaskan, visual landscapes.

d) Visual Resource Management Classes

The 1981 Southwest Management Framework Plan (MFP) addresses VRM considerations, but covers only a portion of the actual land within the planning area. Objective VR-1 states "Allow only very limited visual change in areas designated "Wild" portions of Wild and Scenic Rivers." These areas are to be designated VRM Class I which provides for primarily natural ecological changes in visual resources, but does not preclude limited management activities.

The MFP VR-2 objective is to "Maintain the visual quality of the planning area." The rationale further states that "The planning area is virtually undisturbed by human activities. Any major development would be highly visible from aircraft. Development should be designed for minimum impact to visual resources and to reduce unnecessary surface disturbance."

The MFP multiple-use recommendation calls for evaluating all proposed management activities using the visual resource management contrast rating system and encouraging activities that are compatible or designed to be compatible with the character of the natural landscape.

Current management practices require that a specialist analyze the visual resource impacts of proposed actions on a case-by-case basis. BLM's policy is to minimize impacts to visual resources and place stipulations on permits to accomplish this goal. To date, most VRM actions in the planning area have been applied to communication tower permits and have addressed mitigation issues related to structure heights and color schemes.

Identifying and monitoring visual resources in the planning area is extremely difficult and costly due to the vast size and remoteness of the land, and the scattered nature of BLM holdings. BLM staff often learn about developing and existing conditions through conversations with pilots, SRP holders, land managers from other agencies, and local residents and visitors.

Current demands on visual resources beyond the expectations of visitors and adjacent land management agencies have the potential to degrade pristine VRM values. Unlimited and unregulated OHV traffic, increases and expansion in lodge construction and visitation, increases in transporter and charter trips to the area, and utility and infrastructure development associated with human development all have potential to affect VRM throughout the planning area.

There currently are no new mineral development proposals for BLM lands in the planning area. However, the development and associated infrastructure of new mining activities may affect visual resources in the planning area. Future exploration and development of deposits may also affect the visual landscape.

The planning area holds limited potential for commercial timber sales although no permit requests have been received in the last ten years. Free use permits for domestic fuel wood and house log use are authorized by 43 CFR 5511-2.1, but also have not been requested in the past ten years. NEPA documentation for either uses would address VRM elements on a project specific basis and include VRM stipulations as appropriate.

An analysis of wildfire history in the planning area from 1950-2004 shows limited wild-land fire activity compared to other Alaska locations. Smoke management, fireline construction, and other impacts of suppression activities have the potential to affect visual resources and visual resource impacts and will be taken into consideration in the event of large wild land fire events.

The impacts of climate change on visual resources in Alaska have already been recognized. Shrubs and small trees are colonizing former tundra landscapes above the traditional northern limit of tree growth, and an increased incidence of wildfire frequency and intensity seems to be occurring. The future effects of climate change on visual resources in the planning area may be widespread and profound, but with the exception of fire, these impacts may not necessarily reduce the quality of the visual landscape.