

Chapter IV: Environmental Consequences

- A. Introduction.....4-2
- B. Assumptions and Methods.....4-2
 - 1. Analytical Assumptions.....4-3
 - 2. Resource Assumptions.....4-3
 - 3. Resource Uses Assumptions.....4-6
 - 4. Special Designation Assumptions.....4-13
 - 5. Social and Economic Assumptions.....4-14
 - 3. Subsistence Assumptions.....4-14
- C. Direct and Indirect Effects to Resources.....4-14
 - 1. Introduction.....4-14
 - 2. Resources with Effects Common to All Alternatives.....4-16
 - 3. Direct and Indirect Effects to Air Quality, Soils, Vegetation, and Water Resources.....4-18
 - 3. Direct and Indirect Effects to Fisheries and Aquatic Habitats.....4-31
 - 5. Direct and Indirect Effects to Wildlife and Wildlife Habitat.....4-42
 - 6. Direct and Indirect Effects for Special Status Species: Fish, Wildlife, and Vegetation Species..4-57
 - 7. Direct and Indirect Effects for Cultural Resources.....4-73
 - 8. Direct and Indirect Effects for Paleontological Resources.....4-75
 - 9. Direct and Indirect Effects for Visual Resource Management.....4-76
 - 10. Direct and Indirect Effects for Recreation Management.....4-81
 - 11. Direct and Indirect Effects for Travel Management.....4-82
- D. Resource Uses.....4-83
 - 1. Forest Products.....4-83
 - 2. Livestock and Reindeer Grazing.....4-83
 - 3. Direct and Indirect Effects to Minerals.....4-86
 - 4. Special Designations.....4-91
 - 5. Social and Economic Conditions.....4-94
 - 6. Environmental Justice.....4-99
 - 7. Subsistence.....4-99
- E. Cumulative Effects.....4-100
 - 1. Methods.....4-100
 - 2. Activities Considered in the Cumulative Case.....4-101
 - 3. Resources.....4-106
 - 4. Resource Uses.....4-111
- F. Irreversible and Irrecoverable Commitment of Resources.....4-115
 - 1. Resources.....4-115
 - 2. Resource Uses.....4-117
 - 3. Social and Economic Conditions.....4-118
 - 4. Subsistence.....4-118
- G. Unavoidable Adverse Impacts.....4-118
 - 1. Resources.....4-118
 - 2. Resource Uses.....4-122
 - 3. Social and Economic Conditions.....4-122
 - 4. Environmental Justice.....4-122
 - 5. Subsistence.....4-123

Chapter IV: Environmental Consequences

A. Introduction

This chapter describes the predicted consequences, or potential effects, on the physical, biological, and human environment from implementing the Alternatives described in Chapter 2. The analysis of impacts associated with the Alternatives is required by BLM planning regulations and by the Council on Environmental Quality (CEQ) regulations at 40 CFR 1500-1508 implementing the National Environmental Policy Act (NEPA). The analysis presents best estimates of impacts. As required by NEPA, direct, indirect, and cumulative effects are addressed. The chapter first provides a summary of the methods and approach used in the effects assessment, describes the type of effects analyzed, and summarizes the assumptions used during the analysis.

Effects are defined as modifications to the environment as it presently exists that are brought about by external actions or events. These effects may be beneficial or adverse, and may result from the action directly or indirectly. Effect levels are determined by their magnitude (measure of change), extent (size of change), duration (length of time; e.g. temporary, short-term or long-term), and likelihood of change. The characteristics of an effect level vary according to resource category; however, in general an effect that persists more than a few years would be considered long-term. Effects that would allow the resource to revert back to its predisturbance condition within a few years of the activity would be considered short-term. The magnitude or extent of an effect is dependent upon the current condition of the resource.

Chapter IV is organized into the following main sections:

- Introduction
- Assumptions and Methods
- Direct and Indirect Effects
- Cumulative Effects
- Irreversible and Irretrievable Commitment of Resources
- Unavoidable Adverse Impacts

B. Assumptions and Methods

The type and level of effects that could result from implementing the Alternatives have been identified using the information presented in Chapter III, which provides the current condition of the environment. Activities that may occur in the reasonably foreseeable future within the Bay planning area were also considered as part of the analysis. This effects analysis presents the best estimates of direct, indirect, and cumulative effects, and analysis and conclusions are based on interdisciplinary team knowledge of the resources in the planning area, on information provided by BLM and other agency experts, on relevant literature, and on professional judgment. At this time, no specific development projects have been proposed. It is the task of this EIS to describe the potential effects from a proposed Alternative, which exact kinds and locations of future projects are unknown. While the analysis of this chapter provides quantitative data wherever possible, qualitative analysis is also provided.

1. Analytical Assumptions

Assumptions and estimates were made to facilitate the analysis of the project effects. These assumptions set guidelines and provide reasonably foreseeable projected levels of development that would occur within the planning area over the next 20 years. These assumptions should not be interpreted as constraining or redefining the management objectives and actions proposed for each Alternative and described in Chapter II. If no assumptions were made for a resource, the heading is not included in the following sections.

- Sufficient funding and personnel would be available for implementation of the final decision.
- Implementation of actions from any of the Resource Management Plan/Environmental Impact Statement Alternatives would be in compliance with all valid existing rights, Federal regulations, bureau policies, and other requirements.
- The discussion of effects is based on the best available data. Knowledge of the planning area and professional judgment, based on observation and analysis of conditions and responses in similar areas, are used to infer environmental effects where data are limited.
- Acreage figures and other numbers used in the analysis are approximate projections for comparison and analytic purposes only. Readers should not infer that they reflect exact measurements or precise calculations.
- State and Native entitlements are being fulfilled rapidly, and will be met sometime within the next five to ten years. This will reduce the acreage of current BLM-managed lands within the Bay planning area.
- State-selected and Native-selected lands are segregated from mineral entry. These lands will become available for mineral entry or leasing only when they either are conveyed out of Federal ownership or are maintained in long-term BLM management upon rejection of land selection.
- Although it is currently not possible to identify BLM-selected lands that may remain in BLM jurisdiction over time, any isolated parcels that do may be considered, along with parcels identified in the Alternatives, for future exchange in order to consolidate existing discontinuous blocks of BLM unencumbered lands.

2. Resource Assumptions

a) Air Quality, Soil, and Water Resources

(1) Air Quality

- The air in the Bay planning area currently is judged to be pristine. Increasing uses of the area for recreation or development may cause deterioration in the current air quality, especially during seasons of high visitation.
- The most likely causes of deterioration in air quality in the Bay planning area are smoke and gases from wildland fire, dust from travel on unpaved roads, and dust and exhaust from new construction or development, including mining activities.

(2) Soils

- The majority of the soils present on BLM unencumbered lands in the Bay planning area are inceptisols; histosols make up another small percentage. There is very little soil formation with either type, and they may present challenges with respect to their susceptibility to erosion and the difficulty with which they can be reclaimed.

- Permafrost is found intermittently throughout the Bay planning area. The current regional environmental warming trend is bringing major changes in soil moisture, organic matter, changes in vegetation patterns, and weathering patterns. Changes will affect carbon and nitrogen cycles and gaseous emissions. Additionally, frost heave and slumping may affect soils.

(3) Water Resources

- Demand for clean water will increase should recreation use, population, commercial development, or infrastructure development increase. Water quality requirements would be achieved through the use of the Required Operating Procedures (ROPs).

b) Vegetation

- Demand for healthy fish and wildlife habitat, particularly riparian and wet and dry tundra habitats, will continue and may increase. Demand for subsistence uses associated with the various vegetation types present in the Bay planning area will also continue or may increase. In addition to rich habitat for fish and wildlife, current human uses of vegetation include gathering personal firewood and logs for home use and light construction, and subsistence gathering of berries and a variety of plants for food and crafts.
- Natural and human-caused fire events are expected to increase should the current drying trend and bark beetle infestation continue. In the past this region had few fires due to the well-watered nature of the area and the marine influence. Fire suppression efforts will continue in areas near villages and where wildland fire would produce undesirable resource effects.
- There is one plant on the Special Status Species list present in the Bay planning area. Increased visitor use or development activities may add to the necessity for additional protective measures where the plant occurs.

c) Wetland-Riparian

- The desired condition of wetland and riparian communities is proper functioning condition. Pressure on some riparian and wetland areas will increase should recreation, population, development projects, or infrastructure development increase. This will result in localized effects to riparian vegetation, but not at levels that threaten proper functioning condition except in localized areas that will need to be addressed on a case-by-case basis as they develop and are identified. Placer mining may threaten the properly functional condition of localized riparian and wetland communities.

d) Invasive Plant Management

- The Bay planning area vegetation is predominantly pristine and free from invasive non-native plants. Inventory efforts will continue to identify specific occurrences of legally-designated noxious weeds and invasive plants. Increases in invasive species will reduce habitat quality and quantity.

e) Wildlife, Fisheries and Aquatic Habitats

(1) Wildlife

- While a relationship exists between the quantity and quality of habitat and the potential size and distribution of wildlife populations, not all available habitats are occupied by wildlife. Populations of migratory species are affected by the availability and quality of wintering habitats outside the state or the planning area. BLM lands in the planning area provide seasonal and year round habitats that are required to maintain abundance, productivity and distribution.

- Management actions intending to benefit a specific habitat for a priority species of fish or wildlife may have beneficial or adverse effects to some other species of fish and wildlife occurring in that same habitat.
- Demand for a sufficient amount of quality wildlife habitat to sustain viable populations of wildlife and its human uses, particularly game species, will likely increase over the life of the plan. Additionally, animal populations can be expected to fluctuate in natural cycles over the course of the planning period. Quality wildlife habitat to maintain viable populations and human uses up to the carrying capacity of populations will be needed.

(2) Fisheries and Aquatic Habitats

- The demand for fisheries resources from increased subsistence, commercial, and recreational fishing will increase during the life of the plan, resulting in increased pressure on fish populations in the planning area.
- The international and national trends toward the protection and management of wild stocks would increase demands for production capability information in selected streams.
- Potential impacts to aquatic habitat quality will increase during the life of the plan should increased recreation, project development, and infrastructure development take place.
- The BLM will continue to manage fish habitat to protect important spawning, rearing, overwintering, and migratory habitat for resident and anadromous fish species.
- The BLM will cooperate with the Alaska Department of Fish and Game to manage, to protect, and to maintain the genetic integrity of Alaska's wildstock populations of resident and anadromous fish.

f) Special Status Plant and Animal Species

- Continuing current monitoring programs and adding new wildlife inventories and monitoring may identify additional Special Status Species on lands administered by BLM, or may document the expansion of known ranges of species currently on the BLM Alaska Special Status Species list.
- Nationally, the legal requirement for protection of species listed under the Endangered Species Act (ESA), as well as for species not yet listed, but of concern, will likely increase.
- There are two endangered species, one threatened species, one candidate species, and numerous sensitive wildlife species present in the Bay planning area. Demand for protection of these species may increase as inventory indicates critical habitat and recovery plans are developed and implemented. Increased visitor use or development activities may add to the demand for greater protective measures in areas where special status species occur.
- One plant on the BLM Special Status Species list has been documented on BLM-administered lands in the planning area. Increased visitor use or development activities in the plant's habitat could occur within the life of the plan.

g) Wildland Fires and Fuels Management

- Fire is an essential renewing force in interior forest (taiga) ecosystems, as the fire releases nitrogen and other essential nutrients from woody vegetation back into the soil, allowing for new plant growth.
- Depending on the characteristics of the fire, a burn can alter the vegetation composition of forest communities from late successional species such as spruce, 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 the interior forest (taiga).
- Fire is not a usual or consistent change agent in the coastal temperate forest. However, with increasing temperature and drying, the fire regime in the Bay planning area may change. Wildland fire frequency may increase over the planning period due to this trend, and with the possibility of increased recreation, population, project development and infrastructure development.

h) Cultural Resources

- Undertakings on BLM managed lands have the potential to damage cultural resources. Cultural resources will be considered before any undertakings on these lands are authorized (Section 106 of the National Historic Preservation Act) and damage will be avoided or mitigated before the undertaking is begun.
- All cultural resources will be treated as potentially eligible to the National Register of Historic Places until determined otherwise.
- Inventory efforts to identify cultural resources on BLM managed lands will continue and they will be evaluated for eligibility to the National Register of Historic Places.
- Resource use of cultural resources includes scientific research, interpretation, preservation for future research, and traditional cultural uses. This demand will increase in the future.

i) Paleontological Resources

- Undertakings on BLM managed lands have the potential to damage paleontological resources. Significant paleontological resources will be avoided or otherwise mitigated whenever possible.
- Authorized resource use of fossils includes scientific research, interpretation and educational outreach and limited collection of non-vertebrate fossils by the general public.

j) Visual Resources

- Scenic resources will remain in demand from local residents who want to maintain scenic quality, local businesses that depend on tourism, and an increasing level of recreational users within the Bay planning area over the life of the plan. Increasing tourism will increase the value of scenic views, undeveloped landscapes and open spaces.
- Wilderness characteristics of naturalness, solitude, and primitive and unconfined recreation are expected to remain in demand from local residents and those visitors who want to experience the primitive and unspoiled nature of the local landscape. Businesses that depend on natural landscapes for their excursions, such as ecotourism, guided hunting, and guided sport fishing, will favor an area that possesses wilderness characteristics. Recreationists who depend on a backcountry experience for their activities will also seek lands that have wilderness characteristics (BLM 2005).

3. Resource Uses Assumptions

a) Forest Products

There are few opportunities to utilize forest products for anything other than personal use, due to the fact that there are few forests on BLM lands in the Bay planning area, and the trees are not considered to be of commercial value. While forests are reportedly expanding due to the warming, drying climate trend, the bark beetle infestation and other insect invasions are also spreading. The current situation for forestry is not expected to change during the life of the plan.

b) Livestock Grazing

- No livestock grazing currently occurs under permit, nor has any interest been expressed in requesting livestock grazing authorization. The only anticipated grazing uses might be incidental use associated with recreational and commercial use of pack animals for hunting, fishing, and other back country recreation. Authorizations for grazing by pack animals will be examined on a case-by-case basis.

- No requests for reindeer grazing permits are anticipated. There are no current reindeer grazing authorizations within the Bay planning area.

c) Minerals

(1) *Leasable Minerals*

- No leasable mineral development with the exception of natural gas would occur within the life of the plan on BLM administered lands.
- Oil and gas exploration would occur as described in the Reasonably Foreseeable Development (RFD) Scenario. The RFD predicts activity based on geologic potential as well as past exploration, accessibility, and lack of existing infrastructure. The following is reasonably foreseeable to occur within the planning area:
 - One seismic survey would occur every five years covering 63 linear miles with a total of 250 miles collected over the next 20 years. Short term disturbance would average one acre per mile; however, long term disturbance will be minimal. The seismic surveys would begin by collecting 2-D seismic lines through the use of shot-hole or Vibroseis. The crew size for this operation would be 20-50 (35-65 for 3-D seismic), and the job would be completed in 2-4 weeks. Support equipment would be barged either to Dillingham, Naknek, or Pederson Point. A central "base" would not be established, as individual staging areas (164' x 164' or 650' x 650') would be used. The entire operation would be accomplished during the winter months if conditions were favorable. The acquisition of 3-D seismic data is a key step in the exploration process. It is used to identify and map the prospects of interest. Successful and accurate interpretation results in more efficient drilling with fewer dry holes, better drill pad positioning and higher petroleum recoveries. For the purposes of analysis, it is assumed that the drilling of holes (shot holes) by off-road, track-mounted drills and the detonation of explosives (shots) placed in the shot holes would account for approximately 46% of the source points total. Heli-portable drill rigs would access approximately 44 % of the source points on steeper terrain (slopes in excess of 20%). The vibroseis-mounted vehicles would access about 10% of the source points on off-road, less steep trails (less than or equal to 15% slopes). It is assumed that significant portions of the contract area are inaccessible for locating source and receiver points due to the steep topography.
 - Two exploratory gas wells would be drilled during the first five years of the plan. If possible, the operator will use nearby existing facilities for housing and feeding its crew. If the facilities are not available, a temporary camp of trailers may be placed on the pad. One of the two wells would have an appreciable gas show resulting in drilling one field delineation well. The delineation/confirmation well is likely to be required before a commitment is made to develop the project and a contract is signed with the local utility company. It is assumed that the discovery field will comprise 1,280 acres and will produce from two wells located on two drill sites, one mile apart. Typically, after analyses of the data and subsequent geotechnical description of the reservoir, exploration wells are not used for production purposes. Under this scenario, however, both the exploration well and delineation well are used for production of natural gas since pipeline construction costs and additional well drilling costs render the project sub economic.
 - Given a 15-year plan life, it is assumed that a total of 6 exploration wells would be drilled. Low ground pressure vehicles in conjunction with helicopters would transport equipment and crews to the drill sites.
 - One gravel staging area (6 acres) would be developed to receive and store equipment for the winter exploration program.
 - One gas field likely would be developed in the Koggiling Creek block (this block was picked due to its proximity to the Dillingham market). It is assumed the field would contain 18 bcf of gas reserves. Production from this field would come from the discovery well and delineation well, spaced one mile apart. The drilling of each well would disturb 6 acres. There would be up to 6 gas exploration wells plus one additional gas delineation well.

- The gravel pads would be joined by a 35-foot wide, 5-foot thick gravel road (40,000 cubic yards per mile). The road would link the drilling pads only and one section would also serve as an airstrip. Gravel required for construction would likely be mined during winter months to reduce impacts. The source would likely come to the closest feasible gravel source to the gas field, using one or two separate gravel deposits (10-20 acres in size).
- A typical life of a producing gas well is 10 to 12 years. Therefore, one or both gas production wells may be plugged after the planning period. Field abandonment may take from 2 - 5 years after production ends.
- Natural reservoir pressure would be adequate to push the gas through the 3-inch transmission pipeline 40 miles to the Dillingham market. No compression facility would be needed. The pipeline would be constructed during the winter months to reduce impacts, dependent upon the presence of sufficient snow cover and sufficiently cold temperatures to freeze the ground.
- One of the production wells would serve as an in-field underground injection well (annular injection) to dispose of drilling waste, wastewater, spent fluids, chemicals and the produced water. The ability to dispose of fluid downhole is dependent on the existence of suitable subsurface formations, the formation fluid content, proximity to any hydrocarbon bearing zones and the availability of an annulus between the casing strings set in the well.
- When there is insufficient snow cover for oil and gas related operations, low ground pressure vehicles will be used in conjunction with air support.
- This level of development is assumed for the purposes of impact analysis in the EIS. Actual exploration, development, and production may vary considerably based on exploration results, price of oil and gas, and marketability. Additionally, to market the gas in Dillingham, the current diesel plant would need to be converted to gas. For this to be economical, funding would need to come from energy subsidies derived from the State of Alaska or the Federal Government.
- An ongoing joint State/Federal program to determine the feasibility of developing coal bed natural gas (CBNG) for the benefit of rural communities does not plan to explore the Bristol Bay area at this time. If CBNG were available close to a rural community the development would occur on non-BLM administered lands. BLM lands in the planning area are not in proximity to the two largest communities, Dillingham, Naknek and King Salmon. Transportation costs associated with building a gas pipeline would render CBNG development uneconomic.

2) Locatable Minerals

- Chapter III summarizes the activity levels in the planning area based on surface disturbance tabulated from mining plans and notices of mining operations submitted through the Annual Placer Mining Application and Permit process for both placer and hard rock operations. The RFD for locatable minerals (BLM 2006) summarizes the historic data characterizing mineral occurrences by commodity and genetic ore deposit modeling, as well as differentiating between placer and lode mining methods. Based on this information, a placer mine scenario was developed around a medium-scale (250 cubic yards per day) placer mine as the most likely mining activity to occur in the planning area in the reasonable future. The typical placer mine would result in a maximum of 1-5 acres of surface disturbance at any given point in time. Two similar lode mining scenarios have been dropped from further consideration as it was determined that due to the length of time needed to bring a lode deposit to production and the undeveloped nature of the potential lode deposits, there would be no lode mining development, particularly on BLM unencumbered lands, during the life of the plan.
 - Placer Mining - Placer mining for gold and platinum is the most common type of mining that occurs in the planning area. Placer platinum is the most likely development target while placer gold is the most likely target for exploration and development. Mineral resource development in the planning area is occurring primarily on State, Native, and private lands. This can be attributed to the patenting of large numbers of Federal mining claims staked during the gold rush era and to the State and Native corporations targeting mineral resources for selection under the Alaska Native Claims Settlement Act (ANCSA).

- Additional exploration should prove that development of placer properties in the Bonanza Creek, Goodnews Bay/Snow Gulch, Iliamna/Fog, Kijik Lake, Platinum, and Shotgun Hills areas in the planning area is feasible. These deposits would probably be developed either as small surface open-cut sluice box operation or as a bucket-line dredge operation (Goodnews Bay Platinum Mine).
- Anticipated placer mining activity in the Bay planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch area on BLM unencumbered lands. There is expected to be 1 to 3 small scale placer operations employing 3 to 5 people at each location. Most likely activity would occur on Barnum Creek, Domingo Creek, Faro Creek, or on Jacksmith Creek. Table 4.1 provides information on anticipated new placer mines under each Alternative.

Table 4.1. Anticipated New Placer Mines

	Alternative A	Alternative B	Alternative C	Alternative D
Anticipated placer mines on BLM-Managed Lands	0	1-3	0	1-3

- Hard Rock Exploration and Development - Historic producers of hard rock for mercury operated on a small scale in the early part of the twentieth century. Today, development projects involve gold and copper from developing new and old prospects. Most of these are located on State and Native lands in the Iliamna/Kvichak area. Hard rock exploration is up in the region, generated by the increasing price of gold and increased interest in mineral occurrences on State and Native lands.
- Elsewhere around the State, exploration has focused on deposits of rare metals (nickel and platinum group metals [PGM]) has occurred in the Broxson Gulch area north of the Denali Highway, East Central Alaska Range. Exploration results in this area indicate that there is the potential for a significant discovery of these metals. This interest, coupled with the rising price of platinum, has sparked recent exploration efforts in the Goodnews Bay along the Salmon River where platinum has historically been mined by placer methods.
- Additional exploration should prove that development of lode properties in the Bonanza Creek, Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasma Creek, Kemuk Mountain, Kijik Lake, Pebble Copper, Platinum, Shotgun Hills, and Sleitat Mountain areas in the planning area is feasible. These deposits would probably be developed either as open pit or as cut and fill underground mines. Surface disturbance will vary depending on the mine design, construction of roads, power line corridors, selection of tailing disposal method, and other factors. An order of magnitude estimate would be in the range of 1,300-3,400 acres. Road building, airstrips, and associated material sites account for the largest surface disturbance followed by mine, mill, tailings disposal site, and camp facilities. While most of these disturbances would occur on State or Native lands, some road construction or power lines could cross BLM-managed land.
- Currently in the pre-production phase of exploration and development is the Pebble Copper property on State lands near Lake Iliamna. This plan is a hard rock, combination open pit and underground mine with a mill that combines free milling processes with floatation and vat chemical leach circuits to recover gold and copper. This mill could include ore from locations situated close by, the Pebble South and the Big Chunk (BC) properties, to name a few. More than 100 employees would contribute to the Iliamna area economy and the mine mill complex could draw power from the Homer utilities grid.

- Table 4.2 provides information about anticipated new locatable lode exploration projects under each Alternative. Anticipated locatable lode exploration activity in the Bay planning area is expected to occur in the Snow Gulch part of the Goodnews Bay/Snow Gulch and Iliamna/Kvichak areas on BLM-managed lands. There is expected to be 1 to 2 small scale open pit operations employing up to 275 people at each location. Most likely open pit operations would occur activity would occur in the Faro Creek area on Figure Four and Island mountains. There is expected to be 1 to 2 small scale underground operations employing up to 300 people at each location. Most likely underground operations would occur activity would occur in the Iliamna/Kvichak area in the vicinity of the Nushagak River and Klutuk Creek.

Table 4.2 Anticipated New Locatable Lode Exploration Projects

	Alternative A	Alternative B	Alternative C	Alternative D
Anticipated locatable lode mines on BLM-managed lands	1	2-4	0	2-4

(3) Salable Minerals (Mineral Materials)

- Salable materials and industrial minerals including sand & gravel, building stone, pumice, clay, and limestone are common throughout the Bay planning area.
- Active rock quarries are located on Native land near Dillingham, Platinum, and Goodnews Bay. Numerous sand and gravel pits exist near Dillingham and King Salmon, mostly located on certified Native Allotments. Most communities in the planning area have a small gravel pit for local use.
- No active mineral material contracts, community pits, or free-use permits issued by BLM exist within the Bay planning area. Most of the sites in the planning area are roadside material sites owned by villages or the State, or certified Native Allotments.
- Mineral material sales would occur under Alternatives B and D in association with oil and gas development. These impacts are discussed under leasable minerals.
- Future sand and gravel needs for the Bay planning area will be well supplied by the existing sources on private land.
- Expected future needs will be project driven, related to the development of mines, oil and gas exploration and production, roads, airstrips/airports, village improvements, and other infrastructure needs.

d) Recreation

- Because much of the BLM-managed land within the Bay planning area generally consists of isolated parcels that are not accessible by road, increases, if any, will be focused on sport hunting and fishing, recreation OHV use (including snow machines), hiking, canoeing, and rafting.
- Currently, BLM manages six BLM Special Recreation Permits (SRPs) within the planning area, with the majority operating on State and Native selected lands. Commercial recreation applications are predicted to increase from the current six, to as many as ten applications in the next five years. These are strictly for large game guide hunting operations in the Iliamna Lake area in the eastern Bay planning area region.

- There is economic benefit to communities and businesses for providing opportunities to accommodate the public seeking professional guide services.
- An activity plan is proposed to further assess potential impacts, conflicts, and use levels for SRPs and air transporters, to be completed within five (5) years from plan approval.
- Public health and safety issues for visitors will receive priority consideration in the management of public lands. Demand for safe visits will increase with increasing numbers of public land users.

e) Travel Management

- The use of Off-Highway Vehicles (OHVs) for hunting and subsistence will remain stable or increase slightly. Primary factors for increases in use are the greater public interest in unconfined, outdoor recreational opportunities, and rising disposable income for use on recreational pursuits.
- Changes in OHV design and technology will continue, enabling OHV users to range into areas that were once thought of as inaccessible due to terrain and water or soil features.
- Future demand for roads to support mineral exploration and development or other resource developments on or across from BLM-managed lands may increase in proximity to villages and communities. Current demand for road development is limited due to the nature and location of the lands within Bay planning area.
- It is generally accepted practice that OHV designation starts at the “limited” classification. Use of designated or existing trails would be allowed for subsistence harvests by qualified subsistence users.
- No transportation or utility corridors have been identified as a result of this planning effort. The BLM recognizes that they may be proposed during the life of the plan and will consider them at that time.
- From public scoping input, there is community support to manage off-highway vehicle recreation while providing existing and reasonable access to still occur.
- At this time, there is little known concerning the specific OHV patterns or locations by either local users accessing traditional use areas or by commercial providers. A comprehensive trails and travel management plan is proposed for completion within five years of approval of the Bay plan.
- The use of OHVs for recreational purposes and subsistence hunting within the Bay planning area is centered around existing villages and communities such as Dillingham, Goodnews Bay, and King Salmon.
- The need for access to public lands may increase slightly as Native corporation entitlements are met and if restrictions on use of those private lands are implemented by the Native corporations. The public easements reserved through Section 17(b) of ANCSA will become more important during the life of the plan. The need to identify and maintain these easements on the ground will increase.
- For the purposes of this document, OHVs include snowmachines. However, most impacts described in this analysis result from OHVs used during snow-free months. Where impacts are specific to snowmachines, they are described as such.

f) Renewable Energy

- As the cost of fossil fuels rises, Federal, State, and local governments, private concerns and individuals in the Bay planning area will be seeking alternative sources of renewable energy. However, BLM unencumbered lands are not located in proximity to the villages, and the probability of receiving applications to permit or lease commercial construction of facilities on BLM lands is low.

g) Lands and Realty Actions

- Disposal or Land Exchange - Land conveyance to the State and Native corporations will be completed within the life of the plan. BLM would consider land exchanges to resolve issues of split estate of ownership of surface and subsurface resources. Land exchanges would not be pursued until State and Native entitlements are resolved on parcels being considered. Isolated parcels of land in the Iliamna East and Iliamna West Blocks and two sections east of Aleknagik would be identified in this RMP/EIS for potential exchange. Additional isolated parcels that revert back to BLM after all land conveyance is completed might also be considered for future exchange. Land exchange identified under Section 206 of the Federal Land Policy and Management Act (FLPMA)(1976) would be the preferred method of land ownership adjustment, and would be used to consolidate the larger, discontinuous tracts of BLM unencumbered lands. Any proposed disposals of land through sales would be considered on a case-by-case basis.
- Land Ownership Adjustment - State and Native corporation land entitlements will be met within the life of the plan. BLM may retain management of approximately 20% of lands currently selected by the State and Native corporations. Once land status is resolved, there would be a demand, both internally and externally, for land ownership adjustments to improve the manageability of Federal and non-Federal lands.
- Withdrawals (ANCSA 17(d)(1)) - ANCSA 17(d)(1) withdrawals are Public Land Orders implementing this provision of ANCSA. The review of these withdrawals within the planning area is addressed in this RMP/EIS. The revocation of ANCSA 17(d)(1) withdrawals would remove the restriction created in ANCSA, which closed the lands to all forms of appropriation under the public land laws, including mining (except in some locations for metalliferous minerals) and the mineral leasing laws. Recommendations for removing the ANCSA 17(d)(1) withdrawals would be implemented as described in each Alternative. Should new withdrawals of another type be proposed to take their place, existing withdrawals in these areas will be retained until the new withdrawal is in place.
- Withdrawals Other Than ANCSA 17(d)(1)(FLPMA Section 204) - Other withdrawals identified in the Bay Planning area are for administrative sites, power sites, and military purposes. Two water power withdrawals, seven military withdrawals, and nine administrative site withdrawals, comprise approximately 38,500 acres within the planning area. Creating, modifying, renewing or revoking withdrawals for other Federal agencies is forecast to continue to be an important function of the BLM. As populations grow throughout the region, pressures placed on resources will continue to escalate, which may impact the number of requests from Federal agencies for withdrawals and demands for withdrawal review may increase from the state and local governments. As part of the land planning process the BLM will review existing withdrawals.
- Land Use Authorizations and Rights-of-Way - As the State and Native Corporation land entitlements are met there will be a limited demand for land use authorizations under 43 CFR §2920 and 43 CFR §2800 within the Bay planning area. Only those remaining BLM unencumbered lands will require a land use authorization for permit activities involving rights-of-way, R&PP lease, and other actions within this category. These actions will fluctuate with the degree of economic growth and infrastructure occurring within and adjacent to the planning area.

In accordance with 43 CFR§2880, BLM shall place stipulations on these Rights of Way requiring:

- Restoration, revegetation, and curtailment of erosion.
 - Compliance with air and water quality standards.
 - Control or prevention of damage to the environment, to public or private property, and hazards to public health and safety.
 - Protection of the subsistence interests of those living along the right of way.
- Wind Energy Development - Future actions may demand processing energy-related rights-of-way applications to ensure that public lands are used to promote energy production. The request for future rights-of-way related to energy development may consist of such rights-of-way for petroleum pipelines, electric power lines, energy development and distribution facilities, roads, water facilities, and communication sites needed for energy development.
 - ANCSA 17(b) Easements - BLM would continue to manage ANCSA Section 17(b) easements that have been reserved in patents or interim conveyances to ANCSA corporations.
 - 17(b) easement management will be transferred to the National Park Service or the U.S. Fish and Wildlife Service for those easements that access lands administered by these agencies or are wholly within the boundaries of the park, preserve, Wild and Scenic River corridor, or refuge.
 - BLM will continue to mark and verify 17(b) easement locations as staffing and budgets allow.
 - BLM reserves easements to ensure access to Federal, State, and municipal corporation lands as ANCSA conveyances occur. BLM would continue to identify, sign, map, monitor use, and realign 17(b) easements, with priority based on:
 - Easements accessing lands that are permanently managed by BLM or are important to BLM programs.
 - Easements receiving high public use.
 - Easements required to implement an activity or implementation plan.
 - Easements where land owners support the activity allowed by the easement. (Often support of the landowner is key to resolving signing issues, realignment, mitigating damage, and addressing other issues).
 - Easements where signing or education would mitigate environmental damage to the land where the easement is located or to BLM-managed lands.
 - Access - BLM will continue to manage 17(b) easements that access public lands across Native lands. An effort will be made to transfer 17(b) easements that other Federal agencies and consider agreements to transfer management to State and local entities on a case-by-case basis.
 - There is no expected decrease in access needs currently provided by 17(b) easements. Road and utility easements associated with specific proposed activities will be considered on a case-by-case basis. BLM is able to transfer jurisdiction of a 17(b) easement to the State of Alaska or to a political subdivision if they agree to it.

4. Special Designation Assumptions

a) Areas of Critical Environmental Concern

Areas designated as Areas of Critical Environmental Concern (ACECs) will be managed to maintain the values for which they were designated.

b) Wild and Scenic Rivers

Recreational use of the river corridors being considered for proposed Wild and Scenic River (WSR) designation would increase. If the proposed corridors were designated, prescribed management would protect the Outstandingly Remarkable Value (ORV) for which the rivers were designated, requiring a mix of education and regulatory measures.

5. *Social and Economic Assumptions*

a) Public Safety

Public health and safety issues will receive priority consideration in the management of public lands. Demand for safe visits will increase with increasing numbers of public land users.

b) Social and Economic Conditions

While the population in some villages may decrease, overall the population in the Bay planning area is expected to increase during the life of this plan.

c) Tribal Treaty Rights

As a government agency, the BLM will maintain a special government-to-government relationship with Federally-recognized Indian Tribes. Residents of these areas utilize Native and village corporation lands as well as BLM-managed public lands for traditional subsistence activities, and will continue to do so. Through this planning process, the BLM has initiated consultation with different village entities. This consultation will continue throughout the planning period.

3. *Subsistence Assumptions*

BLM will continue to play a role in the management of subsistence resources on Federal public lands. Based on current trends, the demand for subsistence resources will stay the same or will increase during the life of the plan.

C. Direct and Indirect Effects to Resources

1. *Introduction*

Direct, indirect, and cumulative impacts are considered in effects analysis, consistent with direction provided in 40 CFR 1502.16.

- ***Direct effects*** are caused by an action or by implementation of an Alternative and occur at the same time and place as that action or implementation.
- ***Indirect effects*** also result from an action or implementation of an Alternative, but usually occur later in time or are removed in distance from the action or implementation, but are still reasonably foreseeable.
- ***Cumulative effects*** result from individually minor but collectively significant actions over time. A cumulative impact is an impact on the environment that results from the incremental impact of the

action when added to other past, present, and reasonably foreseeable future actions regardless of what agency, entity (Federal or non-Federal), or individual undertakes such other actions (40 Code of Federal Regulations 1508.7 and 1508.8).

Actions anticipated during the life of the plan on all lands in the planning area, including private, State, Native corporation, and Federal (FWS and NPS) lands, have been considered in the analysis to the extent reasonable and possible. Decisions about other actions occurring within the planning area could be made by many public and private entities, though the location, timing, and magnitude of these actions are not well known. Assumptions about actions outside of the BLM's jurisdiction that are considered in the cumulative effects analysis include:

- ANCSA and State land entitlements will be fulfilled within the life of this plan.
- The BLM will retain approximately 14% of the lands currently selected by the State or Native corporations, while approximately 86% will be conveyed.
- Land sales (settlement and remote settlement areas) will continue on State lands consistent with the Alaska Department of Natural Resources area plans.
- Mineral exploration and development will increase on State and Native lands.
- Mineral exploration and development will remain minimal in National Parks and Preserves within the planning area, and in the Wildlife Refuges.
- National Parks, Preserves, and Wild and Scenic Rivers within and adjacent to the planning area will continue to manage for remote, primitive recreation experiences. Access into parks will continue to be primarily by air and boat.
- National Wildlife Refuges within or adjacent to the planning area will continue to be managed for wildlife and compatible remote, primitive recreation experiences. Access into refuges will continue to be primarily by air and by boat.
- Road construction will increase on State and Native corporation lands in support of local communities, and mineral exploration and development.
- Use of communication sites will increase.

Irreversible or irretrievable commitment of resources and unavoidable adverse impacts are discussed after the Cumulative Impacts section.

- *Irreversible commitment of resources* result from actions in which resources are considered permanently changed.
- *Irretrievable commitment of resources* result from actions in which resources are considered permanently lost.
- *Unavoidable adverse impacts* are those that remain following the implementation of mitigation measures, and include impacts for which there is no mitigation.

Treatment of BLM Critical Elements

BLM's National Environmental Policy Act (NEPA) Handbook, as supplemented with BLM Instruction Memorandum No. 99-178, identifies 14 "Critical Elements of the Human Environment" that must be addressed during environmental analysis (BLM 1988; BLM 1999):

- Air Quality
- Areas of Critical Environmental Concern (ACECs)
- Cultural Resources
- Environmental Justice
- Floodplains
- Hazardous or Solid Wastes
- Invasive, Non-native Species
- Native American Religious Concerns
- Prime or Unique Farmlands
- Threatened or Endangered Species
- Water Quality

- Wetlands/Riparian Zones
- Wild and Scenic Rivers (WSRs)
- Wilderness

No Prime or Unique Farmlands, designated Wild and Scenic Rivers, designated ACECs, or designated Wilderness currently exist on BLM-managed lands within the Bay planning area (NRCS 2006). Impacts related to proposed designations or findings are described. The remaining elements are identified and addressed in the relevant sections of this chapter.

Availability of Data and Complete Information

The best available information relevant to the decisions to be made was used in development of the RMP. Considerable effort over a two-year period has been taken to acquire and convert resource data into digital format for use in the plan. Data have been acquired from BLM sources and from outside sources such as the State of Alaska, U.S. Fish and Wildlife Service, and National Park Service.

Some information was unavailable for use in developing this plan, usually because inventories have not been conducted or are not complete. Specific data that were unavailable include:

- Inventory and assessment of trails
- Detailed soils surveys
- Recreation use information for waterways
- Definitive Special Status Species and habitat occurrence (plant and animal); delineation of identification and conservation measures
- Riparian assessments
- Certain key wildlife seasonal and life function habitat occurrences; use/concentration areas identification and delineation
- Watershed assessments
- Cultural Resource inventories of uplands and smaller drainages

As a result of these deficiencies, impacts cannot be quantified given the proposed management of certain resources in these instances, impacts are projected in qualitative terms or in some cases are described as unknown. Inventory efforts identified in Chapter 2 will continue to update and refine the information used to implement this plan.

2. Resources with Effects Common to All Alternatives

a) Air Resources

Much of the Bay planning area is designated as unclassifiable, with regard to air resources (USEPA 2004a). Regardless of the selected Alternative, Air resources in the Bay planning area will be affected. Although there will be varying degrees of effects throughout the planning area, it is expected that Alternative B may result in a greater magnitude of impacts due to potential mineral development or OHV activity. Due to the scattered nature of BLM lands and the low potential for reasonably foreseeable mineral development, the impacts on air resources would be minimal under all Alternatives. Impacts from OHV activity will be localized and would be expected to dissipate quickly.

b) Climate, Physiography, and Geology

The proposed Alternatives would have little direct or indirect effect on climate in the Bay planning area. There is a moderate likelihood of development associated with locatable and salable minerals, and a low to moderate likelihood of development associated with leasable minerals on BLM-administered lands in the Bay planning area during the life of this plan. There is a small amount of OHV use on BLM lands in

the eastern part of the Bay planning area, but effects on the physiographic and geologic resources are expected to be negligible.

c) Floodplains

The land management actions proposed under any Alternative would have minimal effects to floodplains. Alternative B has the potential to impact more areas due to mineral development and OHV activity. Impacts on floodplains under Alternative B would be greater in magnitude than under any of the other Alternatives. However, the scattered nature of BLM lands and low potential for reasonably foreseeable mineral development indicate that effects on floodplains would be minimal under all Alternatives.

The potential impacts from exploration and mining for locatable (metalliferous minerals) in floodplains under any of the Alternatives could include the destruction of the structure and stability of the floodplain. Impacts under all Alternatives would be reduced with the implementation of Required Operating Procedures and mitigation measures developed during the NEPA analysis for specific action proposals.

d) Wildlife and Special Status Species

Some of the sensitive migratory bird species are subject to subsistence hunting by Alaska Natives. The recent changes in the Migratory Bird Treaty Act relative to subsistence taking of migratory birds refers to all migratory birds including waterfowl, shorebirds, and other species groups. These populations are monitored by the USFWS and spring and summer migratory bird harvests are managed under legislation implementing the Migratory Bird Treaty Act Amendments. BLM provides input as necessary to the USFWS regarding decisions on harvest regulations and therefore has no direct role in mortality rates of these species. BLM is involved indirectly in allowing access across its lands, but these transportation requests and historic trails serve a multitude of purposes in addition to access for hunting. Activities on BLM administered lands that require permits are reviewed for consistency with applicable wildlife conservation laws such as the Bald Eagle Protection Act, Migratory Bird Treaty Act, Marine Mammal Protection Act, and others during the permitting process.

Species of wildlife listed on the Alaska BLM sensitive species list are considered in proposals for uses of BLM lands to mitigate impacts to these species in order to avoid their potential listing under the Endangered Species Act.

Some Special Status Species are subject to subsistence hunts by Alaska Natives (e.g., Steller's eider, Steller sea lions), but the numbers killed each year are managed under the terms of the Marine Mammal Protection Act, and the Endangered Species Act (ESA), which provide exemptions for certain qualifying Alaska Native subsistence harvests. Because many marine species are susceptible to oil pollution in the water, any activities on BLM lands that had the potential for accidental release of oil or other harmful materials into the marine and coastal environments should receive careful scrutiny for prevention and mitigation measures during the permitting process under all Alternatives. These measures would protect T&E species from potential mortality as well as decreased reproductive rates. Other protective measures for T&E species and their habitats would also be considered under all Alternatives during the permitting process for other types of proposed activities on BLM lands such as mining and road building.

BLM is required by law and by its own policies to cooperate and coordinate with the USFWS and NMFS to develop and implement appropriate conservation measures for T&E species on BLM lands. This applies to all the Alternatives and all regions of the Bay planning area. The policy common to all Alternatives is to be consistent with the ESA during the planning and permitting processes.

Critical habitats for Steller sea lions and Steller's eiders have been established, and critical habitat for other listed species has been designated by the USFWS and NMFS. (No critical habitat has been established on BLM-administered lands in the Bay planning area.) Recovery plans have been established for Steller sea lions in conjunction with NMFS and Steller's eiders in conjunction with USFWS. BLM has not undertaken any specific monitoring or surveys for Special Status Species on its lands.

3. Direct and Indirect Effects to Air Quality, Soils, Vegetation, and Water Resources

a) Effects Common to all Alternatives

Proposed management of the following resources/resources uses/programs would have no anticipated impacts to vegetation management: Cultural Resources, Paleontological Resources, Visual Resources, Renewable Energy, Lands and Realty Actions, Social and Economic Conditions, and Subsistence.

(1) Effects to Soils from Environmental Change (Common to All)

One aspect of environmental studies is to anticipate how soils will change with regional environmental warming. Changes will affect carbon and nitrogen cycles and gaseous emissions, including the release of greenhouse gases (Birkeland 1999; Lal and others 1995) and the increased uptake of carbon dioxide and the production of oxygen. Major changes include (1) changes in soil moisture, with wetter ones experiencing greater leaching, and drier ones accumulating salts, (2) changes in organic matter, which will equilibrate at new levels as a function of changing climate-vegetation patterns, (3) greater weathering will release more nutrients, which could influence biomass production, the impact which will vary from place to place.

(2) Effects to Soils, Water, Vegetation and Air from Vegetation Management (Common to All)

Vegetation throughout the planning area would benefit from proper management of soils, water, and Special Status Species plant resources. Implementation of mitigation measures to protect terrestrial and wetlands vegetation on a project-specific basis would benefit not only vegetation but also soils, water, and air quality. It would limit disturbance and thermokarst subsidence to permafrost soils (some of which are present in the Bay planning area), would reduce soil erosion, limit blowing dust and airborne particulates, and control sediment runoff that impairs water quality, and would assist the recovery of terrestrial and aquatic habitat from permitted uses. Direct and indirect effects for Special Status Species plants will be discussed separately.

(3) Effects to Soils, Water, Vegetation and Air Quality from Fire and Fire Management (Common to All)

Fire is recognized as an essential ecological process and natural agent of change in ecosystems. At the same time, it has impacts to air quality, soil, and water resources as described in detail in the Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska (BLM 2004). Soils can be affected by fire in several ways. Fire can be beneficial in stimulating new vegetative growth, in helping maintain a mixture of vegetation types and age classes that provide soil stability, and in providing essential nutrients to the soil matrix. Implementation of various fire management options (Critical, Full, Modified, or Limited) in wildland fires and the level at which fire would be used to manipulate the vegetation would directly affect the diversity of the habitats present in the planning area and the successional stages of the plant communities throughout. Fire can also strip soils completely of vegetation and make them vulnerable to erosion if heavy rains occur before vegetative regrowth takes place. Species such as willow and alder sprout quickly after a fire and bring soil stabilization. If the fire is sufficiently hot, it can sterilize the earth, precluding regeneration of the plant species that were present before the fire, and allowing introduction of new species. Wildland fires have not occurred with great regularity in the planning area due to the marine influence on the region's climate and the well-watered nature of the wet tundra environment. Should the current warming and drying trend continue, the fire regime might change.

(4) Effects to Soils, Water, Air and Vegetation from Livestock Grazing (Common to All)

Grazing by domestic livestock (cattle, horses, sheep and goats), ranched wildlife, or reindeer can impact soil, water, air and vegetation resources. Grazing can degrade wetlands, stream, riparian, and tundra

vegetation by creating localized areas of trampled and over utilized natural vegetation including lichens, mosses, grasses, forbs, willow, and dwarf birch. It can denude areas of vegetation and cause conversion of naturally occurring plant communities to less productive or less desirable ones. It can create a proliferation of trails, impacting habitat by compacting soils under them, by reducing the viability of vegetative ground cover, and by making soils susceptible to wind and water erosion due to keeping the animals in one general area. Trampling at watering locations can cause destruction of the vegetation mat and silting of the water body. Although there is a history of reindeer herding in the Bay planning area, due to the fact that there currently are no herds of cattle, caribou, or other livestock in the Bay planning area, and no interest has been expressed in this activity, this type of impact is not likely to be a problem for the foreseeable future. Should grazing be permitted, assessment and application of proper use criteria, range suitability criteria and carrying capacity, annual monitoring of grazing allotments, consultation with herders, and use of allotment management plans encourage proper range management and help to prevent or mitigate adverse effects to soil, water, air and vegetation resources.

(5) Effects to Soils, Water, Vegetation and Air from Hazardous Materials Management (Common to All)

The BLM management actions under all Alternatives for hazardous or solid wastes may beneficially affect soil, water and air quality by ensuring adequate protections against soil, water and air becoming polluted by hazardous or solid wastes at current and future permitted sites, and conducting clean-up of soils and water that have become polluted, as those sites are discovered.

(6) Effects to Soils, Water, Vegetation, and Air from Forestry Management (Common to All)

There is no commercial use of timber and no associated road construction activity on BLM lands within the Bay planning area. No commercial use of timber is anticipated due to the lack of commercial-grade timber resources. A small amount of household use of timber takes place in the form of gathering firewood and house logs. Effects to soil, water, vegetation and air are expected to be minimal to nonexistent should the existing kinds and amounts of forest products be available and the current pattern of use continue into the future.

(7) Effects to Soils, Water, Vegetation and Air from Locatable Minerals (Common to All)

Some mining exploration and development could occur on some BLM unencumbered lands in the Bay planning area, and on existing Federal claims under any Alternative. Potential effects include disturbance and redistribution of gravel, overburden, and soil materials. Existing and future locatable mineral activities unfavorably impact wetlands, stream, riparian and tundra vegetation and habitats by stripping away the vegetative mat as part of mine site overburden, trampling or eliminating vegetation in the development of mine site infrastructure, and increase the potential for introduction and spread of exotic and invasive plant species. The structure of the soil profile and the stability of floodplains is destroyed on a temporary basis and can result in long-term, permanent changes. Removal of soil could also cause an increase in stream sedimentation and turbidity and a decrease in stream channel stability. Required Operating Procedures (ROPS) to protect soil include separating organic overburden from mined gravels for future reclamation, backfilling all mining pits with tailings as the mining progresses and spreading the remaining vegetation and overburden piles on the ground surface up to the stream channel. Current soil storage handling stipulations do not prevent damage to soil health and viability and this reduces the soil's capability to support revegetation.

(8) Effects to Soils, Water, Vegetation and Air from Mineral Materials (Common to All)

Few mineral materials requests for BLM unencumbered lands in the Bay planning area are anticipated due to the generally isolated and remote location of these lands and the activities that are anticipated during the life of the plan. Mineral materials would be needed to support oil and gas development if it occurred. Such exploration and development activities on BLM lands might only be economically feasible in the Koggiling Creek block. Mineral material acquisition and disposal can unfavorably impact vegetation by destroying vegetation growing on the site and by compacting and removing soils, hindering plant

regrowth. Mineral material excavation and disposal may degrade soil resources. Because soil development is slow in this region, some sites may recover to the original vegetative cover very slowly or not at all. Impacts would be reduced under all Alternatives with implementation of Required Operating Procedures. Additional mitigation measures, if necessary, could be developed during NEPA analysis of specific material site disposal actions.

(9) Effects to Soils, Water, Vegetation and Air from Recreation and Travel Management (Common to All)

Recreation use takes place throughout the Bay planning area. Most of it is focused on guided and unguided sport hunting and fishing, which tends to make use of different areas in different months and years, influenced by the movements and abundance of wildlife. Effects would include impacts to vegetation and soils from temporary campsites, development of social trails, and aircraft landings, that may result in erosion should the vegetative cover be destroyed, and/or compaction of soils. Repeated scrambling up and down river and stream banks can destroy riparian vegetation and create bank erosion.

Off-Highway Vehicles (OHVs) are mostly used in areas with proximity to villages. Under all Alternatives there would be some impacts to soils by OHV use, since no areas would be completely closed to OHV use. Impacts to wetlands would include the potential for loss of vegetative cover, soil erosion, soil compaction, thermokarst subsidence, water diversions, and ponding. Commercial and non-commercial recreation activities could cause effects to wetlands, stream, riparian and tundra vegetation. Temporary and repeated use of campsites and aircraft landings at remote sites are two common activities on BLM lands in the Bay planning area that may have direct effects to riparian and tundra vegetation. Impacts could include trampled and broken vegetation, compacted and disturbed soil, and an increased potential for wildland fires. There would be a slight possibility of localized soil and water contamination from hydrocarbons or from lead-acid batteries. Where trails cross streams, riparian soil and vegetation may be altered or destroyed, increasing soil loss and sedimentation into aquatic habitats and resulting in diminished water quality. Given the relatively low level of recreational use on the remote BLM-managed lands, these impacts would be minimal overall and degradation of air quality, soil and water resources should not increase in the foreseeable future.

(10) Effects to Soils, Water, Vegetation and Air from Lands and Realty Management (Common to All)

There are minor impacts to air quality, soil, and water resources from lands and realty actions under all Alternatives. An exception would be a right-of-way that authorized road construction.

Access (Rights-of-Way and Easements) - Construction of access roads, railroads, bridges, culverts, and gravel pads in easements may adversely affect soil in the region. Construction of roads has a major local impact, removing soils. Construction of bridges and culverts may create diversion of water and subsequent soil erosion at the site. Development of borrow pits for road construction can impact soils by removing them. Currently there are no proposals for developments. Should BLM receive proposals for road or gravel pad construction, impacts would be reduced under all Alternatives by implementing Required Operating Procedures. Additional mitigation measures could be developed during the NEPA analysis of specific realty actions.

Disposals and Acquisitions - Disposal of BLM lands results in removal of the land from the public domain to state entitlements, Native Settlements, private or state exchanges, mining patents, Recreation and Public Purposes (R&PP) sales, and Federal Land Policy and Management Act (FLPMA) sales. The relinquishment of BLM-managed lands removes them from the requirements of BLM policies that currently provide some degree of protective measures to soil resources. Should lands be acquired by BLM, they would then be subject to BLM protective policies. Should BLM lands be transferred to other Federal or State agencies, they would be managed under protective measures similar to those of BLM.

Withdrawals - Effects to soils on lands withdrawn under authority other than (d)(1) would be the same for all Alternatives. In the Bay planning area they include FERC sites and military sites, to name two.

Contamination by hazardous materials, compaction, erosion, and solifluction from changes in the condition of the permafrost could all occur.

b) Effects to Soils, Water, Vegetation and Air Quality for Alternative A

(1) Effects to Soils, Water, Vegetation, and Air from Vegetation Management (Alternative A)

Impacts to soil, water, vegetation and air resources from vegetation management would be the same as that discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation from Livestock Grazing (Alternative A)

Impacts to soil, water, and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives. Under this Alternative, applications for grazing permits would be considered throughout the planning area but would likely not be approved for areas within occupied caribou habitat, due to the difficulty of managing reindeer within occupied caribou habitat.

(3) Effects to Soils, Water, and Air from Lands and Realty: ANCSA 17(d)(1) Withdrawals (Alternative A)

In Alternative A, existing ANCSA 17(d)(1) withdrawals would be retained. For those lands currently closed to mineral exploration and development, they would remain closed, and impacts to soils, air, and water from minerals exploration and development would be the same as they are today.

(4) Effects to Soils, Water, and Air from Leasable, Locatable, and Salable Minerals (Alternative A)

Leasable Minerals. Under Alternative A, BLM-managed lands would be closed to fluid mineral leasing; however, BLM has the authority to lease lands where oil and gas are being drained, and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study.

Locatable Minerals and Salable Mineral Materials. Under Alternative A, 152,746 acres of BLM-administered lands within the planning area, acreage currently not withdrawn under ANCSA 17(d)(1), would be open to hard rock mineral exploration. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than 17(d)(1). Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan. Hard rock mineral exploration and development activities could adversely affect soils, water and air quality including

- Loss of vegetative cover and subsequent erosion of soil, rutting, ponding
- Disturbances to and removal of soil from development of gravel roads, borrow pits, bridges, exploratory drilling work, erection of temporary campsites, seismic tests, construction of gravel pads, and use of heavy equipment for extraction.
- Compaction of soils from vehicles, heavy equipment, social trails
- Sedimentation of water bodies
- Wind-blown particulates
- Smoke and exhaust

(5) Effects to Soil, Water, Vegetation, and Air from Travel Management (Alternative A)

Under Alternative A, impacts from OHV use and travel management would be the same as today. They would be greater than in Alternatives C and D. The planning area would remain undesignated and cross-

country use of OHVs weighing 2,000 pounds or less Gross Vehicle Weight Rating (GVWR) would be allowed throughout. Sensitive habitat areas would not receive additional protection from OHV impacts.

c) Effects to Soils, Water, Vegetation and Air Quality for Alternative B

(1) Effects to Soil, Water, and Air from Vegetation Management (Alternative B)

Since Alternative B promotes exploration and development activities, impacts to soil resources from vegetation management would likely increase somewhat, due to a projected increase in surface-disturbing activities. In addition to the information that was provided in Impacts Common to All Alternatives, management of vegetative resources under Alternative B would implement Required Operating Procedures to preserve the protective vegetation cover on soil and permafrost, and to reduce erosion and sediment runoff that degrades water quality.

(2) Effects to Soil, Water, Air and Vegetation from Livestock Grazing (Alternative B)

Impacts to soil from livestock grazing under Alternative B would be the same as that for impacts Common to All Alternatives.

(3) Effects to Soil, Water, Air, and Vegetation from Leasable Minerals (Alternative B)

Under Alternative B, all unencumbered lands (1,176,269 acres) except for 3,999 acres withdrawn under Public Land Orders other than ANCSA 17(d)(1) and any selected lands whose selections are relinquished or revoked would be open for fluid mineral leasing. Based on the reasonably foreseeable development scenario, while there is a medium potential for the generation of oil and gas in the Alaska Peninsula and the Bristol Bay Nushagak Basin, and a low potential for the Goodnews Bay region, there is a low development potential for all areas. The Reasonably Foreseeable Development Scenario assumes exploration for gas in the Koggiling Block of BLM unencumbered lands in the Bristol Bay area. However, in the Bristol Bay Nushagak Basin no oil or gas exploration has taken place to date. The region is remote, and it lacks existing infrastructure to deliver the product to market.

Using the Reasonably Foreseeable Development Scenario for the Bay planning area, the Resource Assumptions for Leasable Minerals on pages 7 and 8 were formulated. Based on that Scenario, the following effects could occur.

Assuming use of modern Alaska oil construction and operations practices, there would be relatively few long-term impacts to soil resources. Modern operations have substantially decreased the footprint of drill pads, which now affect approximately two to four acres, from which the topsoil is removed and stockpiled. However, current soil storage handling stipulations do not prevent damage to soil health and viability and this reduces the soil's capability to support revegetation. 20 Alaska Administrative Code [AAC] 25.520 requires a maximum of four oil wells, or one gas well, for each 640 acres. An oil spill or natural gas blowout may adversely affect soil in the immediate areas by contamination; should compacted soil also be present, the amount of compacted soil could increase the affected area. Post-production oil and gas remediation measures include the removal of structures, including drill pads, redistribution of stockpiled topsoil over the disturbed area, and subsequent reseeding, recontouring, and drainage control. The full magnitude of production effects is dependent upon the location, depth, size, and soil composition of the project area.

Coal Bed Natural Gas - CBNG is methane gas that is extracted from coal beds. Exploration for CBNG usually requires four to five wells, each requiring a gravel pad of approximately one square acre. Drilling mud and cuttings are typically disposed of on-site. Upon completion of exploration, the drill rig, all debris and other waste material are removed from the site. Should this type of development occur, it is expected that an average of five to seven acres of soil resources would be affected per well. This includes construction and operation of the well site, support sites, access roads, temporary roads, pump stations, injection facilities, utility lines and pipelines. Requiring utilization of existing road systems (few of which

exist in the Bay planning area) and vehicles that do not cause significant damage to the vegetation cover or to soils would reduce some effects.

Seismic Exploration - Seismic surveys involve seasonal occupation and transport of seismic equipment and camps using sledge-drawn trailers at locations chosen for best transport, preferably at times when the snow cover accumulation is sufficient to insulate the tundra and after the ground, lakes, and rivers are frozen. In the Bay planning area during the past 20 years, snow accumulations in some years have been insufficient to drive snow machines across, and the timing of freeze-up has been uncertain with the regional warming trend.

Historically, the principal effect of seismic activities on soil and water resources has been diversions of shallow water tracks and ponding in places where track depression compresses the organic mat sufficiently to alter the thermal regime, melt surface ground ice, and alter the native vegetation (Emers and Jorgenson 1997). More recently, modern seismic lines, with newer low-ground pressure equipment have less impact on the tundra than older, outdated types, but impacts to the tundra are more likely to occur during the camp move (WesternGeco 2003). A 2D operation covers fewer line miles, but the camp moves virtually every day. While a 3D seismic operation covers more line miles, the camp moves less often (WesternGeco 2003). While extensive thermokarst erosion along recent winter seismic trails is seldom observed, impacts to vegetation and surficial compaction are still in evidence (Jorgenson et al. 2003). Adequate protection of the tundra requires a uniformly distributed snow pack with a hard surface crust. Often, less than ideal snow conditions exist in the Bay planning area. Varying levels of disturbance elsewhere have been documented even where the snow depth exceeded two feet (Felix et al. 1989).

Observations by the BLM and others (National Research Council) indicate that short-term transitory impacts, such as surficial compaction, diversions of shallow water tracks and limited ponding are estimated at about one percent of the proposed seismic lines per season, though newer, low ground pressure equipment could reduce this significantly. Since tundra vegetative mat has been shown to recover in 7 to 10 years where damage is not severe (Abele et al. 1984, Jorgenson et al. 2003), the long term impacts due to thermokarst erosion, such as permanent diversions of shallow water tracks and limited ponding, are estimated at only about one percent of the short-term impacts. These impacts are strongly influenced by snow depth and distribution and may only happen when seismic activities occur under less than ideal snow conditions (National Research Council 2003). Where disturbance does occur, it could take from several years to several decades for the effects to be ameliorated (Walker et al. 1987).

These types of impacts would be reduced by implementation of ROPs, including limiting most seismic exploration to those times during the winter when the ground is frozen and snow cover is adequate, or, those conditions lacking, utilization of Alternative means of travel and transport, such as helicopter.

Exploratory Drilling and Field Development- Exploratory drilling in Alaska typically occurs in the winter when snow pack and frozen ground help minimize impacts from surface disturbing activities. Surface disturbance directly impacts plant communities through vegetation removal and mechanical damage to plants. Indirect impacts of surface disturbance on vegetation include soil compaction, erosion, changes in hydrology, and encroachment by invasive plant species. These indirect impacts can limit recovery or rehabilitation of vegetative communities following disturbance. Construction of gravel pads and in-field roads, and overland travel by low-ground-pressure vehicles would temporarily impact various vegetation regimes by soil compaction, damage or destruction of tussocks, disturbance to tundra wetlands, and acceleration of stream bank or lake shore erosion.

Most allowable uses have the potential to affect soil resources to some degree. Surface-disturbing actions would result in removal of vegetative cover, loosening the surface soil, formation of compacted layers, reduced infiltration, changes in physical and biological properties, reduction in organic matter content, and increasing the potential for accelerated erosion by exposing soil particles to wind and water. There also would be a loss of soil productivity through disruption of natural soil horizons and removal of vegetated acreage for use by roads, well pads, and other facilities. Operating vehicles on moist soils, especially heavy equipment, is likely to cause compaction of the surface layer, decrease infiltration and aeration, and reduction of soil productivity by making it more difficult for plant roots to grow and obtain soil moisture and nutrients. Indirect impacts caused by disrupting soil stability, increased compaction, and

moisture and nutrients. Indirect impacts caused by disrupting soil stability, increasing compaction, and reducing productivity include (1) sedimentation of drainages and perennial water bodies primarily by wind or water erosion, (2) particulate matter affecting air quality through wind erosion, (3) reduced infiltration, (4) an increase in surface water runoff that could cause higher peak streamflows and possibly downstream flooding, and (5) changes in surface water quality caused by exposing soils or bedrock with undesirable chemical characteristics.

The extent of the impacts to water resources would depend on the location and the nature of the exploration area. Possible impacts include drainage disruption, sedimentation, water removal, gravel removal, and thermokarsting in areas where permafrost is present. An impact to riparian and wetland areas impacts the physical, chemical, and biological components of an ecosystem. Activities that contribute to the decline in abundance, distribution, or functionality of riparian and wetland communities are considered adverse impacts. Direct impacts to riparian and wetland communities result from disturbing vegetation or ground surfaces. Indirect impacts to riparian and wetland communities result from actions within a watershed that cause a change in riparian and wetland functionality (e.g., increased rates of sediment loading into streams or increased surface runoff to streams), a change in water chemistry, or spread of invasive nonnative species. Changes in water chemistry, for example, can affect riparian and wetland areas primarily through changes in plant species composition, which could impact use of the area by wildlife.

Inadequate design or placement of structures, culverts, or bridges can alter natural sediment transport and deposition, creating scour holes or channel bars. Improper placement or sizing of gravel fill can result in erosion from pads or roadbeds adjacent to streams or lakes. Natural drainage patterns can be disrupted when activities or structures divert, impede, or block flow in stream channels, lake currents, or shallow-water tracks. Blockages or diversions to areas with insufficient flow capacity can result in seasonal or permanent impoundments. Diverting stream flow or lake currents also can result in increased bank or shoreline erosion and sedimentation that degrades water quality. Proper location and adequate design capacity of culverts, bridges, pipelines, and other control structures would minimize drainage problems. Winter or low-water construction and transport activities and adequate armoring of fill would minimize erosion and sedimentation problems.

Short-term air quality impacts from leasable minerals development and production would occur from two primary sources: (1) combustive emissions (vehicle tailpipe and exhaust stack emissions) due to the operation of mobile and stationary source construction equipment, and (2) fugitive dust emissions (particulate matter less than 10 microns in diameter [PM10]) due to earth moving activities and the operation of vehicles on unpaved surfaces. Minerals production would generate long-term combustive and fugitive dust emissions from two sources: (1) stationary sources, such as natural gas flaring, natural gas-fired compressors, and storage and handling of equipment; and (2) mobile sources that access and service oil and gas facilities. The planning area is a large region with a maximum east-west extent of 280 miles and a north-south extent of about 150 miles. Given the good air quality that currently exists in the region and the expected separation of sources within the planning area, it is unlikely emissions from Alternative B activities would exceed national or State ambient air quality standards. There could be localized air quality impacts depending on the locations and emissions levels of proposed sources in the area, the surrounding topographical characteristics, and the site-specific meteorology.

Sources of hazardous air pollutants within the planning area would include fossil fuel combustion, fugitive volatile organic compounds, and emissions due to oil and gas production. The accidental release of sour natural gas (rich in hydrogen sulfide (H₂S)) poses the main risk under Alternative B. Another source of release of H₂S is at oil and gas fields where secondary recovery operations are occurring. To mitigate H₂S impacts, applications for permit to drill (APDs) in sour gas areas would include a contingency plan that may include requirements to monitor wind speed, wind direction, and atmospheric stability and to conduct dispersion modeling analyses. These requirements would apply to areas where public health and safety or important resource values are a concern, such as proposed well sites in proximity to residences. If the BLM determines after review of a contingency plan that additional data or safety precautions are needed, the BLM would require these items as conditions of approval (COAs). The potential release of H₂S during production operations in sour gas areas may be mitigated by health and safety plans.

The preferred and normal means of disposing of drilling wastes, including muds and cuttings, is reinjection into wells. Cuttings may be stored temporarily to facilitate reinjection and/or backhaul operations. Use of mud pits may be allowed by the Authorizing Officer. If mud and cuttings are stored on the surface, sediments and other contaminants could be flushed into the watershed. However, requirements that wastes be stored in lined and bermed areas and disposed of before spring break-up would reduce the potential of sediments and other contaminants being flushed into the watershed. Adherence to the Required Operating Procedures and Stipulations, and to project-specific requirements by all permitted operations would help prevent pollution to any stream or lake.

Consumptive water use in the summer seldom is a problem on the coastal Bristol Bay Plain, as water generally is abundant. Exceptions would be in small lakes and ponds, smaller coastal streams or most foothill streams during early summer when flow is low, and recently in summer if conditions are hot and dry. In these instances shallow pools might be pumped dry. Depending on the areas leased and number of development wells drilled, annual water usage for development activities under Alternative B would vary considerably. Annual water use during development could be similar to that for exploration (i.e., use for dust abatement). If more than 15 per cent is removed, then fewer lakes would be required, but if it is being used in winter, less of the critical overwintering habitat would remain in the pumped lakes or rivers. Adherence to the Required Operating Procedures and Stipulations for all permitted operations would prevent the unlimited drawdown or pollution of any stream or lake.

While some of the gravel used for the construction of permanent facilities may be obtained from non-BLM managed lands, some of the material sites would probably be located on BLM-managed lands within the planning area. Improper location of gravel-removal operations can result in alteration or destruction of soils, stream channel or lake configuration, stream-flow hydraulics or lake dynamics, erosion and sedimentation, and ice damming and aufeis formation. Locating gravel pits far enough away from streams and lakes to avoid break-up or storm flooding would greatly minimize these effects to water resources.

Under the potential development activities, spills and spill cleanup would involve both crude oil and refined petroleum products, probably from fuel-storage areas or handling operations. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup efforts is kept to a minimum. Crude oil spill cleanup associated with production operations and pipelines is possible and could adversely affect streams and lakes. While the petroleum residue from a spill could be flushed from streams within a few years, the impacts to lakes and ponds could persist for decades. Spill cleanup in a watershed would involve containing the spill, diverting or isolating it within the waterbody, skimming off the oil, and treating the remaining oil-contaminated water and sediments. Prevention and rapid response with adequate removal equipment would minimize effects. The Required Operating Procedures associated with Alternatives B, C, and D are designed to prevent or otherwise mitigate oil spills in the planning area.

Spills of chemicals and saline waters would be rapidly diluted in a large lake or river. In small lakes, tundra ponds, and shallow water tracks, the impacts would be greater, with waters remaining toxic to sensitive species for several years. These spills could be pumped out of the water body, if confined, or neutralized and then diluted with uncontaminated fresh water. Seppi's (2006) work on lake water chemistry and productivity indicate that many Bristol Bay lakes are chemically sensitive; spills, dilution or neutralization may be detrimental or may create unwanted changes.

Air quality impacts may result from the emissions of hydrocarbons and gaseous byproducts of combustion (Hydrogen sulfide) or wind-borne particulates. Ambient air quality on the North Slope of Alaska, however, is relatively pristine even though oil and gas exploration, development, and production have been under way for more than 30 years. In the Bay planning area, prevailing winds may blow these emissions and particulates to other areas of Alaska, where they might affect air quality elsewhere. Arctic haze is a phenomenon resulting from elevated concentrations of fine particulate matter found over the Arctic, primarily in winter and spring. Scientists believe that most of the pollutants contributing to Arctic haze are from combustion sources in Europe and Asia. It is not known to what extent local sources in Alaska contribute to Arctic haze. However, the Arctic haze phenomenon was first observed in the 1950s, long

before oil development started on the North Slope. Emissions from development resulting from Alternative B would be small compared to the emissions from North Slope oil production.

Effects of Oil, Gasoline, and Diesel Spills - Spills could occur from pipelines, production and exploration pads and ancillary facilities, airstrips, roads, fuel storage containers, and mechanical equipment. Spills that leave the pads and roadbeds could reach one or more of several environments and habitat types, including wet and dry tundra, riparian areas, tundra ponds, lakes, flowing creeks and rivers, the water table, and potentially Bristol Bay. Spills could occur at any time during the year.

Specific primary spill response options include mechanical or physical, chemical, biological, in-situ burning and natural recovery. Mechanical or physical methods are used to control spills through containment and recovery. Physical response methods include but are not limited to:

- Booming
- Skimming
- Barrier/Berm
- Physical Herding
- Debris Removal
- Vegetation Removal
- Manual Removal/Cleaning
- Mechanical Removal
- Sorbents
- Vacuum
- Flushing
- In-situ Burning

In the case of debris removal, vegetation removal, manual removal or cleaning, vacuum, flushing, and in-situ burning, direct effects to the ground surface, to soil, vegetation, and small living things could be expected (USFWS 2005).

Chemical treatment employs the use of dispersing agents that contain surfactants, or compounds that break up substances such as oil into small droplets. Chemical dispersants would only be used when the associated impacts of the dispersed oil would be less harmful than non-dispersed oil (USFWS 2005). Both direct effects and potential indirect effects to wildlife, especially waterfowl, could be anticipated.

Biological treatment uses biological agents such as nutrients, enzyme microorganisms that increase the rate at which natural biodegradation takes place. This is a natural process that slowly removes oil from the environment (USFWS 2005). This method does not work as efficiently in colder climates as it does in temperate climates.

In-situ burning of oil involves the ignition and controlled combustion of a spill. It can be used when oil is spilled on a water body or on land (USFWS 2005). One problem with burning on land is that the vegetation cover would be completely destroyed, and the heat of the fire might sterilize the soil so that native vegetation might not recover, and the area would be susceptible to invasive vegetative species.

Natural recovery, leaving the spill alone, allows natural processes to remove oil from the environment. Natural processes include evaporation, oxidation and biodegradation (USFWS 2005). Natural recovery is not recommended in cases where the spill might migrate into water bodies or into the water table.

Air Quality - Volatiles from the oil spill can present an immediate health hazard to humans and wildlife during the first few hours to days of a spill. The rate at which the volatile (gaseous) component of an oil spill disperses into the atmosphere is dependent upon many factors, including the volume of the spill, the thickness of the oil on the surface, the air and/or water temperature, weather, and the amount of wind (Trust 2006, Pers.Comm.; McClenahan 2006, Pers. Comm). The Northeast Integrated Activity Plan (IAP) and EIS (BLM and MMS 1998) provides a discussion regarding the rate of evaporation, ambient concentrations, and the types of compounds the EPA classifies as hazardous air pollutants. The heavier the compound the longer it takes to evaporate. The EIS discusses the rate of evaporation, ambient

concentrations, and the types of compounds the EPA classifies as hazardous air pollutants. In the event of an oil spill on land, the air quality effects would be less severe than offshore because some of the oil would be absorbed by vegetation or into the ground during months of the year other than winter when everything is frozen.

Diesel fuel oil could be spilled either while being transported or from accidents involving vehicles or equipment. A diesel spill would evaporate faster than the volatiles from a crude oil spill. Ambient hydrocarbon concentrations would be higher than those from a crude oil spill, but would also persist for a shorter time. Since a diesel spill probably would be smaller than a potential crude oil spill, any air quality effects from a diesel spill likely would be lower than those from other types of spills. Fire would be another source of airborne contaminants. Oil or gas blowouts may catch fire. Additionally, in-situ burning during the first few hours after an oil spill is a preferred technique for cleanup and disposal of oil spilled into water. This type of burning would be less likely to be used in the case of oil spilled on land, but the effects to air quality if some of the oil were burned would be similar. Burning could affect air quality in two important ways. For a gas blowout, burning would reduce emissions of gaseous hydrocarbons but would slightly increase emissions of other pollutants temporarily. If an oil spill were ignited immediately after spillage, the burn could combust most of the volatiles that otherwise would evaporate. Incomplete combustion of oil would release an oily soot of unburned hydrocarbons and minor quantities of other pollutants into the air.

Soil and Vegetation Resources - Oil spills could affect vegetation and impact soils, primarily when the surface vegetation is altered. The oil would kill vegetation and/or decrease vegetation growth, but would leave the organic mat largely intact although probably saturated with oil. The depth to which the soil would be saturated would depend on a number of factors, including the amount of oil spilled, the viscosity of the oil, the type of soil present, the permeability of the soil and the covering vegetation mat, ambient temperature, and the presence or absence of frozen ground and/or permafrost. Surface and underground dispersal of the spill would also depend on many of the same factors, as well as the amount and force of water running through the ground at the site of the spill and the degree of slope of the terrain. Snow, ice, and a frozen ground surface would limit oil absorption into the soil and surface organic mat (though not eliminate it), and would simplify cleanup. Spill cleanup, however, is more likely to damage soils when the ground surface is not frozen. Cleanups are not always well controlled; heavy traffic and digging are common, resulting in damaged soils. Oil spill cleanup mitigates impacts on soils only if cleanup methods and operations are very carefully controlled to minimize surface disturbance. The impacts to vegetation and soil resources from surface disturbing activities during oil spill cleanup when the tundra is unfrozen may be greater than the impact of the spilled oil, as the area affected may not be limited to that area immediately adjacent to and covered by the spill.

Water Resources - Small crude or diesel spills (<1 bbl and smaller) are projected to occur onshore. It is likely that all small fuel spills would occur on or near pads or roadbeds, though some fuel may possibly reach adjacent waters. In the case of a complete freeze up of the ground during the winter at the location of a spill, spill response likely would remove almost all of the spill from the frozen tundra prior to snowmelt. During that part of the year when the soil and vegetation are unfrozen, late May through around October 15, spills could reach and adversely impact tundra waters before oil spill response is initiated or completed. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup effort is kept to a minimum. Since most oil exploration and development activities, as well as pipeline and facilities construction, would occur during winter when the ground is frozen, it is likely that most anticipated small fuel spills would be largely contained and removed prior to reaching tundra waters.

In the case of a larger spill, the Northeast NPR-A IAP/EIS (BLM and MMS 1998), analyzed the effects of a 325 bbl spill reaching the Colville River and Teshekpuk Lake in summer, and the effects are incorporated here by reference. In the Colville River, in the view of the analysis, the high rate of water flow would rapidly disperse the spill and preclude any effects on dissolved oxygen concentrations. Direct toxicity in the water column would be minimal and limited to the first few reservoir pools down current of where the spill entered the river. Analysts believe that some toxicity might persist in initial reservoir pools for a few days to weeks until toxic compounds were washed out of the oil trapped in the sediment or the oiled sediment was buried under cleaner sediment. However, based on studies carried out by NOAA at post-

spill areas of the 1989 EXXON Valdez oil spill (EVOS) between 1989 and 2005, researchers found that oil persists in pockets and reservoir pools and in many cases was not washed away. Some of the residual oil weathered and some did not; however, the oil remained toxic with polynuclear aromatic hydrocarbons (PAH) and a suite of persistent organic pollutants (POP) ten to fifteen years after the incident (Short et al. 2001; Rice et al. 2005; Springman et al. 2005; Short et al. 2005; Babcock et al. 1998). Scientific studies of the lingering potency of EVOS oil were carried out on a variety of animal species, including otters, harlequin ducks, rainbow trout, and salmon, and were found to be the source of a variety of adverse physiological responses in these animals (Babcock et al. 1998; Rice et al. 2005; Springman et al. 2005; Short et al. 2005).

According to the Northeast NPR-A analysis (BLM and MMS 1998), the primary effect of an oil spill in tundra ponds would be long-term direct toxicity. Similar effects would be expected for any of the lakes in the planning area should an oil spill occur.

Spill cleanup in a watershed would involve containing the spill, diverting or isolating it within the waterbody, skimming off the oil, and treating the remaining, oil-contaminated water and sediments. Storage of fuel in lined and bermed areas and the onsite availability of absorbents and removal equipment would help ensure that the size of any area affected by a spill and cleanup efforts is kept to a minimum. Prevention and rapid response with adequate removal equipment would reduce effects but probably would not completely eliminate them (Short et al. 2001).

(4) Effects to Soil, Water, Air, and Vegetation Resources from Locatable Minerals and Mineral Materials (Alternative B)

Locatable Minerals. Mining exploration could occur on existing Federal or State claims under any Alternative. However, Under Alternative B, ANCSA 17(d)(1) withdrawals would be revoked, and BLM unencumbered lands would be open to Locatable Mineral exploration and development. The type of mining most likely to occur is placer mining. The range of potential impacts to soil resources includes disturbance and redistribution of gravel, overburden, and soils. The structure of the soil profile could be destroyed and may require decades to recover. Soil development in the Arctic is a slow process. Removal of vegetative cover and soil could cause an increase in erosion, stream sedimentation, and turbidity as well as a decrease in stream channel stability. Water could be contaminated by toxic materials introduced by the mining process. Denuded soil and contaminated soil particulates could become airborne. Some effects may be mitigated by utilizing Required Operating Procedures that protect soil, including separating vegetative cover and soil from mine tailings for future recovery, backfilling and replacing topsoil as appropriate, as mining progresses, and returning the stored soil to the ground surface upon completion of the mining project.

Mineral Materials. Mineral material excavation and disposal may degrade soil resources, and may cause erosion and an increase in stream sedimentation and turbidity. Sites may never recover native vegetative cover due to loss of soil from the site. Construction of access roads to the site may add to the impacts in terms of soil loss, soil compaction, and erosion. The degree of impact would depend on the type of soil present, the type of road, the terrain, and the presence or absence of permafrost.

(5) Effects to Soil, Water, Air, and Vegetation Resources from Recreation Management (Alternative B)

Impacts to air quality, soil, vegetation and water resources from recreation management would be similar to those discussed under Impacts Common to All Alternatives.

(6) Effects to Soil, Water, Air, and Vegetation Resources from Travel Management (Alternative B)

Impacts to air quality, soil, vegetation, and water resources from OHV use and travel management would be similar to those discussed under Alternative A.

(7) Effects to Soil, Water, Air, and Vegetation Resources from Lands and Realty Actions (Alternative B)

Impacts to air, soil, vegetation, and water resources would be similar to those discussed under Impacts Common to All Alternatives. Implementation of Required Operating Procedures would further reduce the potential for impacts compared to Alternative A.

d) Effects to Soils, Water, Vegetation and Air Quality for Alternative C

(1) Effects to Soils, Water, and Air from Vegetation Management (Alternative C)

Impacts to soil, water, and air resources from vegetation management would be similar to those discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation Resources from Livestock Grazing (Alternative C)

Impacts to soil, water, vegetation and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives.

(3) Effects to Soils, Water, Vegetation and Air Resources from Lands and Realty (Alternative C)

In Alternative C, existing ANCSA 17(d)(1) withdrawals would be removed. For those lands currently closed to mineral exploration and development, they would be open with the exception that ANCSA 17(d)(1) withdrawals would be retained at locations where Wild and Scenic Rivers are proposed until Congress has had an opportunity to act. Impacts to soils, air, vegetation and water from minerals exploration and development would be greater than in Alternative A but slightly less than in Alternatives B and D.

Delineating Right-of-Way avoidance areas would have a positive impact on soils.

(4) Effects to Soils, Water, Vegetation and Air from Leasable, Locatable, and Salable Minerals (Alternative C)

Leasable Minerals. Under Alternative C, BLM-managed lands would be open to fluid mineral leasing and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study. Impacts to soils, vegetation, water and air would be greater than in Alternative A and slightly less than Alternative B. Soils, vegetation, water and air resources would benefit from Required Operating Procedures, Stipulations, and project-specific requirements. Effects from leasable mineral activities would not be expected outside of the Koggiling Block during the life of this plan.

Locatable Minerals and Salable Mineral Materials. Under Alternative C, all unencumbered BLM-administered lands within the planning area would be open to hard rock mineral exploration. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than ANCSA 17(d)(1), and ANCSA 17(d)(1) withdrawals at locations of proposed Wild and Scenic Rivers would be retained in place until Congress had had an opportunity to act. Impacts to soils, water, air, and vegetation resources from locatable and salable mineral exploration and development would be expected to be similar to those for Alternative B. However, Required Operating Procedures and project-specific requirements would play a greater role in the two proposed Areas of Critical Environmental Concern. Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan.

(5) Effects to Soil, Water, Vegetation, and Air Resources from Recreation Management (Alternative C)

Impacts to air quality, soil, vegetation, and water resources would be similar to Alternative B.

(6) Effects to Soil, Water, Vegetation, and Air Resources from Travel Management (Alternative C)

Under Alternative C, impacts from OHV use and travel management would be less than in Alternatives A and B. The planning area would be designated as limited to existing trails by OHVs weighing 2,000 pounds or less Gross Vehicle Weight Rating (GVWR). Sensitive habitat areas would receive additional protection from OHV impacts. The fewest impacts to air, soil, vegetation, and water resources would occur under Alternatives C and D.

d) Effects to Soils, Water, Vegetation and Air Quality for Alternative D

(1) Effects to Soils, Water, Vegetation and Air from Vegetation Management (Alternative D)

Impacts to soil, water, vegetation and air resources from vegetation management would be similar to those discussed under Impacts Common to All Alternatives.

(2) Effects to Soils, Water, Air and Vegetation Resources from Livestock Grazing (Alternative D)

Impacts to soil, water, vegetation and air resources from livestock grazing would be similar to those discussed under Impacts Common to All Alternatives.

(3) Effects to Soils, Vegetation, Water, and Air from Leasable, Locatable, and Salable Minerals (Alternative D)

Leasable Minerals. Under Alternative D, BLM-managed lands would be open to fluid mineral leasing. Impacts to soils, vegetation, water and air would be greater than in Alternative A or C and similar to those in Alternative B. Soils, vegetation, water and air resources would benefit from Required Operating Procedures, Stipulations, and project-specific requirements. Effects from leasable mineral activities would not be expected outside of the Koggiling Block during the life of this plan.

Locatable Minerals and Salable Mineral Materials. Under Alternative D, all unencumbered BLM-administered lands within the planning area would be open to hard rock mineral exploration, and those areas subject to leasing under 43 CFR 3400.2 would be open to coal exploration and study. Within the Bay planning area, approximately 3,999 acres would remain withdrawn from mineral entry due to withdrawals other than ANCSA 17(d)(1). Impacts to soils, water, air, and vegetation resources from locatable and salable mineral exploration and development would be expected to be similar to those for Alternative B. However, Required Operating Procedures and project-specific requirements would play a greater role in the proposed Carter Spit Area of Critical Environmental Concern. Development of salable minerals on BLM-managed lands is not expected to occur during the life of this plan.

(4) Effects to Soil, Water, Vegetation, and Air Resources from Recreation Management (Alternative D)

Impacts to air quality, soil, vegetation, and water resources would be similar to Alternative B.

(5) Effects to Soil, Water, Vegetation, and Air Resources from Travel Management (Alternative D)

Under Alternative D, impacts from OHV use and travel management would be less than in Alternatives A and B. The planning area would be designated as limited to existing trails by OHVs weighing 2,000

pounds or less Gross Vehicle Weight Rating (GVWR). Sensitive habitat areas would receive additional protection from OHV impacts. The fewest impacts to air, soil, vegetation, and water resources from OHV use would occur under Alternatives C and D.

(6) Effects to Soils, Water, Vegetation and Air Resources from Lands and Realty (Alternative D)

In Alternative D, existing ANCSA 17(d)(1) withdrawals would be removed. For those lands currently closed to mineral exploration and development, they would be open. Impacts to soils, air, vegetation and water from minerals exploration and development would be slightly less than Alternative B but greater than in Alternatives A and C.

Delineating Right-of-Way avoidance areas would have a positive impact on soils, vegetation and water resources.

3. Direct and Indirect Effects to Fisheries and Aquatic Habitats

a) Effects Common to All Alternatives

(1) Effects to Fisheries and Aquatic Habitat from Hazardous or Solid Waste Management (Common to All)

The BLM management actions under all Alternatives for hazardous or solid wastes may have localized, beneficial effects on fish habitat quality through prevention measures and mitigation practices as sites become known.

(2) Effects to Fisheries and Aquatic Habitat from Soil, Water, Vegetation and Air Quality Management (Common to All)

All Alternatives propose some activities, such as mining, oil and gas exploration and development, road construction, and the use of OHV trails and stream crossings, which could contribute to erosion and/or sedimentation into streams and rivers. Currently there are no proposals for mining, oil and gas exploration or development, road construction or other development activities for BLM lands in the Bay planning area. Project-specific descriptions would provide information that would help determine what impacts would be expected, and to what degree sedimentation may occur.

Removing the vegetative cover, altering the natural topsoil, or changing the shape of the slope can increase the potential for erosion, increased runoff, and can create additional sediment in waterbodies.

The main factors influencing erosion rate include the volume and velocity of runoff from precipitation, the rate of precipitation infiltration through the soil, the amount of plant cover, the slope length or the distance from the point of origin of overland flow to the point of deposition, and operational erosion control structures (EPA 1997). Accelerated erosion occurs whenever the soil surface is disturbed. Sediments created by accelerated erosion clog streams and fill lakes and impair the water-holding capacity. Erosion decreases the productive value of the soil; additionally, it reduces the quality of the waters that receive the sediment.

Significant increases in sediment yield can lead to alteration of stream channel morphology, substrate composition, and surface-ground water interaction; decreased survival of fish in the egg and young-of-the-year stages; changes in macro invertebrate community structure; and decreased primary production (Madison 1981, Van Nieuwenhuyse 1983, Weber and Post 1985, Bjerklie and LaPerriere 1985, Lloyd et al. 1987, Reynolds et al. 1989, Buhl and Hamilton 1990).

Stream channel instability occurs when excessive sediment deposition leads to destructive lateral erosion of streambank and progressively wider and shallower stream channels (Elmore and Leonard 1998).

Accelerated runoff can trigger downcutting, which lowers the streambed, alters the water table, dries out the riparian area, destabilizes streambanks, increases erosion, and further accelerates runoff. Unless stopped by some form of intervention or a hard geologic formation, downcutting will migrate upstream and eventually disrupt the hydrologic functioning of the entire watershed (Chaney and others 1993).

These changes can lead to decreased survival of fish in the egg and alevin stages; decreased density, biomass, and diversity of aquatic insects the fish depend on for food; and decreased primary fish production (Cordone and Kelley 1961; Cooper 1965; Van Nieuwenhuysse 1983; Webber and Post 1985; Lloyd and others 1987; Buhl and Hamilton 1990).

Increased turbidity and sedimentation from erosion can inhibit feeding and spawning success. All members of the biotic community have the potential to be affected. Potential effects of sedimentation on benthic macroinvertebrates - which are prey species for fish - include interference with respiration, and interruption of filter-feeding insects' capability to secure food. A more important impact to benthic invertebrates would be smothering of physical habitat by increased sediment loads. A loss of interstitial space in the substrate would be highly detrimental to burrowing species. A decrease in abundance could be expected in these situations. In Arctic environments, where fish depend on summer food sources to grow and reproduce, a reduced prey base may preclude fish from directing energy towards spawning.

Direct threats to fish from sediment include changes to physical habitat, subsequent decreased reproductive success, and loss of rearing habitat. Physical habitat changes from sediments are most often attributed to finer size particles. Developing eggs can be smothered and newly hatched fry can be killed by deposited sediment that prevents emergence from spawning gravels and interferes with respiration. Developing fish eggs and larvae need a constant supply of cold, oxygen rich water which flows through the interstitial spaces in stream gravels. Embedded sediments fill these interstitial spaces and also limit essential winter habitat used by juvenile fish for cover from predators, ice scour, and high-velocity stream flows. The filling of pools with sediment further limits overwintering sites for juvenile and adult fish.

Beneficial effects to fish from proper management of soils, water, and vegetation resources would occur. Implementation of mitigation measures to protect soil, water, and vegetation on a project specific basis, particularly in riparian zones of watersheds, would reduce disturbance to fish habitats and would aid in the recovery of aquatic habitat from permitted uses. Improper management of soil, water, and vegetation resources can reduce the quality of the waters and the productive value of the soil. Climate change and the resultant melting permafrost along stream banks may increase localized input of sediments and decrease bank stability.

Riparian vegetation condition directly influences the condition, quality, and maintenance of aquatic habitat. Riparian plants filter sediments and nutrients, provide shade, stabilize streambanks, provide cover in the form of large and small woody debris, produce leaf litter energy inputs, and promote infiltration and recharge of the alluvial aquifer (Orth and White 1993; Wesche 1993). As a result of these functions, spawning beds for fish and microhabitats for macroinvertebrates remain relatively free of damaging fine sediment deposits. Riparian vegetation reduces sedimentation of pools, thereby maintaining water depths and structural diversity of the channel. Base flow levels are augmented throughout the year by the slow release of water stored in aquifers. Complex off-channel habitats, such as backwaters, eddies, and side channels, are often formed by the interaction of streamflow and riparian features such as living vegetation and large woody debris. These areas of slower water provide critical refuge during floods for a variety of aquatic species and serve as rearing areas for juvenile fish.

The bank stabilizing function of streamside vegetation not only helps reduce erosion and influence channel morphology but also acts to supplement in-stream cover by the developing of undercut streambanks and by providing overhanging vegetation. Well-vegetated stream channels and stable streambanks help reduce turbidity and channel scouring resulting from high runoff rates and, in turn, can enhance primary production. In cold regions well-vegetated stream channels help reduce the formation of aufeis (ice formed by the overflow of water onto existing ice). Aufeis can decrease primary productivity, delay riparian plant growth, increase erosion, tie up water in the form of ice during critical low-flow periods,

and cause the formation of new stream channels due to channel blockage (Churchill 1990; Michel 1971; Slaughter 1990).

(3) Effects to Fisheries and Aquatic Habitat from Fire and Fire Management (Common to All)

Fire effects which directly impact fish populations are increased siltation, altered water quality (dissolved oxygen, pH, suspended and dissolved solids, total hardness, turbidity), and water temperature changes. Indirectly, any alteration of the nutrient flow that adversely affects aquatic organisms or results in a reduction in emergent insect production would also affect fish populations, at least temporarily.

Fish species and aquatic fauna have been exposed to indirect effects of wildland fire for thousands of years. Fire can indirectly influence fish populations or their prey through the factors mentioned previously as well as changes in nutrient input to water system and changes in permafrost status that can lead to altered hydrology. The extent of surface erosion after a fire largely depends on the topography and soil types of the immediate area, and the amount of ice-rich frozen ground within the active layer. Stream siltation is usually negligible from surface erosion on burned sites in interior Alaska due to its gentle topographical features. Siltation may be a factor where severe burns occur on steep slopes or even shallow slopes with ice-rich active layers, where fire has severely damaged riparian protection of bank soils' integrity, or where heavy equipment is used in suppression activities. Lakes are also potentially vulnerable to fire effects of concentration of nutrients, sedimentation, and erosion of riparian protected shorelines from wave and wind action. Response of deciduous riparian foliage after a fire is related to already existing riparian vegetation; the impact of a fire is a change in age structure and short-term productivity.

Data on how fires affect stream temperatures and productivity are currently inadequate to accurately assess the effects of fire on anadromous or resident fish habitats. Much of the published work has focused on changes in lake systems (McEachern et al. 2000, St-Onge and Magnan 2000). Analyses of long-term fire effects on stream ecology are currently under way as part of Frostfire, a landscape-scale prescribed research burn in the boreal forest of Interior Alaska conducted in July 1999.

Fish populations have generally shown a positive response during the initial five-year period after wildland fire where populations exhibit good connectivity with key refugia throughout the watershed (Gresswell 1999; Minshall et al. 1989). Fish will generally reinvade fire-affected areas rapidly where movement is not limited by barriers. These new colonists generally come from areas upstream of the affected area, from surrounding watersheds and from mainstem rivers where migration is not limited. Fish population recovery generally tracks the increase in primary and secondary production that occurs in the early post-fire period. Where sediment is continually delivered into the stream, there could be short-term negative effects on fish and macro-invertebrate communities.

Fuels projects are designed and implemented in a "non-emergency" manner that minimizes impacts to aquatic resources. Although wildland fires may still occur in areas where hazardous fuel loads have been reduced, fires which may occur are expected to be predominately ground fires rather than crown fires. Ground fires are easier to control with lower-impact suppression methods (such as hand-built fire line) that are less likely to adversely affect aquatic resources. In contrast, the crown fires associated with heavier fuel loads often require suppression techniques likely to have greater adverse impacts to aquatic habitats and species.

Competent planning and implementation will minimize the effects of fuels treatments. Some projects involve multiple treatments of the same area. Prescribed fires conducted in the spring (when drainage-bottoms are still snow covered) help to protect riparian vegetation and soils. The primary goal of these projects is to reduce the occurrence, risk, and impacts of wildland fires, not restore the natural capacity of aquatic species to withstand the effects of natural fires.

Removal of vegetation to reduce future fuel loading may be accomplished with minimal impacts in some areas, but in others, sensitivity to ground disturbance from loss of vegetation can cause increased erosion, compacted soils, and a loss of nutrients (FS 2000, Beschta et al. 1995). To protect water quality and the diversity of habitats for fish, amphibians and other aquatic organisms, standard operating

procedures are in place to protect the proper functioning condition of riparian area and stream characteristics.

Impacts to fisheries from fire and fuels management would be the same under all Alternatives. Most of the area within the planning region is in a Limited fire management option designation, which means that the standard response is to monitor fires and only to initiate suppression actions if necessary to protect identified values. In a worst case scenario, there may be some episodic events related to fire suppression that may affect fish and fish habitat. These effects would be from increased erosion and ground-based control, and alterations of water chemistry from aerial applications of fire retardant. Erosion impacts would likely be small in scale and localized, and could be minimized by rapid rehabilitation after the fire is under control, although improperly located bulldozer line firebreaks could greatly increase local stream sediment loads. The use of fire retardant in/near fish bearing streams is a serious threat to these aquatic ecosystems. The by-products of certain retardants are toxic to fish and will result in fish kills. To decrease the potential of affecting fish habitats and stream conditions, it is a standard operating procedure of the suppression agencies to avoid dropping retardant near or in water bodies.

(4) Effects to Fisheries and Aquatic Habitat from Minerals (Common to All)

While the Salmon River mine is operating, currently there are no new proposed projects for mining on BLM lands in the Bay planning area. However, under all Alternatives, some BLM unencumbered lands are available for metalliferous metals exploration and mining. In general, surface mining activities increase erosion and accelerated sediment production and input into nearby streams and lakes. Mine development may also alter the natural input rate of organic matter and nutrients to aquatic systems. Mine sites can include open pits, heap and dump leaches, waste rock and overburden piles, tailings piles and dams, haul roads and access roads, ore stockpiles, vehicle and equipment maintenance areas, and exploration and reclamation areas. These areas are all major sources of erosion and sediment.

Surface mining operations may also disrupt surface and ground water flow patterns. Mining operations also have the potential to release pollutants to surface waters and ground water, the deposition of contaminants into soils, and the eventual incorporation of pollutants into plant tissue. Both water and soil contamination may be harmful to riparian-wetland vegetation.

Naturally occurring substances in the ore may create a major source of pollutants. Mined ore not only contains the mineral being extracted but varying concentrations of a wide range of other minerals. Frequently other minerals may be present at much higher concentrations and can be much more mobile than the target mineral. Depending on the local geology, the ore (and the surrounding waste rock and overburden) can include trace levels of aluminum, arsenic, asbestos, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, silver, selenium, and zinc, as well as naturally occurring radioactive materials.

As with many surface disturbing activities, one of the most detrimental impacts associated with mining is increased sediment yield. Because of the large area of land disturbed by mining operations and the large quantities of earthen materials exposed at sites, erosion can be a major concern at hardrock mining sites. Erosion may cause significant loadings of sediments to nearby waterbodies and associated riparian-wetland areas, especially during severe storm events and high snow melt periods. Placer mining inherently degrades or completely destroys channel features and riparian habitat, resulting in increased erosion and sedimentation.

During placer mining, streams are often diverted into bypass channels while the original channel is mined and then returned to a newly built channel once mining is complete. It has been common practice to construct stream bypasses and new channels with different geometry and physical characteristics (e.g. flood prone and bankfull widths, bankfull depth, sinuosity, slope, entrenchment, and substrate size) than that of the natural channel. This difference is often necessary because of the removal of streamside vegetation and other hard structural elements that help define the natural channel morphology. As a result, new channels are often straighter, have a higher gradient, and consequently have more energy than the natural channel. In addition, new channels often lack the diversity of habitats (pools, glides,

riffles) and cover components (undercut bank, overhanging vegetation, and large woody debris) that enhance the quality of habitat in natural channels.

Mining activities, placer operations in particular, may lead to a loss of riparian-wetland vegetation. All vegetation within the active mining area is removed before and during mine development and operation. Vegetation immediately adjacent may be affected by the roads, water diversions or other development. Riparian-wetland vegetation has a significant influence on the stability of uplands and certain stream types. Changes in the composition, vigor, and density of riparian vegetation can result in changes in sediment input from uplands, stream shade, and protection from instream erosional processes, terrestrial insect habitat, and the contribution of detritus and structural components to the stream channel. Water quality and esthetic values are also affected by disturbance to riparian-wetlands (Rosgen 1996).

The altering of surface hydrology often results in stream conditions that are no longer suitable to species or life stages of fish and other aquatic organisms that occurred before disturbance. For example, increased stream flow may result in water velocities that (1) cause involuntary downstream displacement and mortality of juveniles, (2) result in scour-related mortality of eggs and alevins, (3) accelerate streambank erosion, and (4) over the long term, deplete large woody debris and organic material. The enlargement of stream channels may result in a shallow, slow water environment during periods of low flow. This new environment could result in crowding, loss of spawning habitat, reduced primary and secondary productivity, increased vulnerability to predation, and increased sedimentation (Swanston 1991; Hicks and others 1991; National Research Council 1992; Strouder and others 1997).

The removal of streamside riparian-wetland vegetation during mining would result in loss or degradation of aquatic habitat until proper functioning condition could be reestablished. In general, the time required for riparian-wetland areas to attain proper functioning condition would be dictated by natural processes and may require decades to centuries before it approximates the structure and function of the original aquatic habitat (NCSU 1998; BLM and Montana Dept. of Environ. Quality 1996; BLM 1988).

The current state of knowledge of suction dredging and its impacts on aquatic resources suggests that the practice could be either detrimental or beneficial, depending on site-specific use by aquatic organisms and physical habitat limitations. In either case, evaluation of the location and timing of suction dredging activities would benefit aquatic resources.

Suction dredging has been shown to locally reduce benthic (bottom dwelling) invertebrates (Thomas 1985; Harvey 1986) and cause mortality to early life stages of fish due to entrainment by the dredging equipment (Griffith and Andrews 1981). Suction dredging may also destabilize spawning and incubation habitat, remove large roughness elements such as boulders and woody debris that are important for forming pool habitat and that can govern the location and deposition of spawning gravels (Harvey and Lisle 1998). Suction dredging may also increase suspended sediment, decreasing the feeding efficiency of sight-feeding fish (Barrett and others 1992); reducing living space by depositing fine sediment (Harvey 1986); and cause fish to avoid certain habitats because of their response to divers (Roelofs 1983).

On the other hand, suction dredging may temporarily improve fish habitat by creating deep pools or by creating more living space by stacking large unembedded substrate (Harvey and Lisle 1998). In general, invertebrates and periphyton all rapidly recolonize small patches of new or disturbed substrate in streams as long as the area of disturbance is not so widespread as to limit the number of organisms to recolonize (Griffith and Andrews 1981; Thomas 1985; Harvey 1986). In addition, dredge tailings may increase spawning sites in streams lacking spawning gravel or streams that are armored by substrate too large to be moved by fish (Kondolf and others 1991). In some cases the reduction in the feeding efficiency of fish may be offset by reduced visibility and the corresponding reduced risk of predation at moderate levels of suspended sediment (Gregory 1993).

Bridges, culverts, and low-flow crossings are integral features to road development associated with surface mining. These features can also interfere with stream bedload (substrate) movement, migrations to spawning, feeding, rearing, and overwintering sites if improperly designed. Current concerns related to surface mining and road placement include diverting or eliminating flow from small tributaries that connect lakes or connect lakes and rivers. Fish species found in the planning area that move between these

habitat types are vulnerable to impact. Potential loss of migratory capacity could stress or kill these fish if they are unable to migrate to food-rich habitat in the summer, reach spawning areas, or move into overwintering habitat. Proper placement of these structures is critical in minimizing impacts to fish.

(5) Effects to Fisheries and Aquatic Habitats from Forestry (Common to All)

Some minimal forestry activity generally occurs within the Bay planning area each year, consisting of small-scale localized timber removal for personal use, including gathering firewood and house logs. While it is unlikely that any type of road construction will occur in conjunction with this activity, it is conceivable that short spur or temporary roads may be constructed to access parcels of timber in the future, which could affect fisheries riparian habitat and water quality.

(6) Effects to Fisheries and Aquatic Habitats from Renewable Energy (Common to All)

Proposed renewable energy program sites would be evaluated on a case-by-case basis. Renewable energy programs (i.e., hydroelectric, solar, and wind power generation) in the Bay planning area would generally be expected to be small. Effects from renewable energy programs on fish habitat may include runoff due to the presence of access roads and other structures, which may carry sediment and petroleum hydrocarbons. These programs would not likely affect the mortality of fish to the same degree as mineral resource development.

b) Effects to Fisheries and Aquatic Habitat for Alternative A

(1) Effects to Fisheries and Aquatic Habitat from Recreation Management (Alternative A)

The main impacts on fish would come from a potential for an increased number of OHV trails or roads under this Alternative, which may gather runoff and begin to rut, thereby leading to increased erosion and subsequent sedimentation of fish-bearing streams. It has been documented in Alaska that multiple stream crossings by OHVs can cause alterations of the stream bank's structure and function and may cause the introduction of sediment into the waterway (Weidmer 2002). Extensive adverse effects may occur to fish habitat located in areas of high OHV use.

(2) Effects to Fisheries and Aquatic Habitat from Minerals (Alternative A)

Leasable Minerals. Under Alternative A no lands would be identified as open for fluid mineral leasing. Impacts to fisheries and aquatic habitat would be minimal (where leasing is required to protect hydrocarbon resources from drainage) to non-existent from this activity under this Alternative.

Locatable Minerals. Impacts to fish would be similar in type to those discussed under Impacts Common to All Alternatives. Under Alternative A, few BLM lands not withdrawn under ANCSA 17(d)(1) withdrawals would be available for locatable mineral exploration and development in the planning area.

Salable Materials. There are approximately 1,176,269 acres available for the sale of mineral materials (i.e. sand and gravel). Measures to minimize impacts to fish habitat are considered on a case-by-case basis. Alternative A would have the greatest potential of all the Alternatives for impacts to fisheries habitat from salable minerals. Gravel mining activities conducted in fish-bearing streams or in tributaries to fish-bearing streams can block and reroute stream channels and increase silt concentrations resulting in reduced primary production, loss of invertebrate prey species, and disruption of feeding patterns for sight dependent feeders (Branson and Batch 1971, Cooper 1965). For general mining impacts to fisheries, see *Impacts Common to All Alternatives*.

(3) Effects to Fisheries and Aquatic Habitat from Lands and Realty (Alternative A)

ANCSA 17(d)(1) Withdrawals - Under Alternative A, no withdrawal review would take place and all ANCSA 17 (d)(1) withdrawals would remain in place. These withdrawals would protect fish habitat by excluding mineral leasing and, in some cases, locatable mineral entry.

Rights-of-Way - Rights-of-Way grants and easements may promote the construction of paved or unpaved access roads, gravel pads, railways, all of which may adversely affect fish habitat through runoff that may introduce sediment and contaminants into the water. Under Alternative A, avoidance or exclusion areas would be identified on a case-by-case basis for potential impacts.

(4) Effects to Fisheries and Aquatic Habitat from Recreation (Alternative A)

Under Alternative A, recreation management is custodial and impacts would be similar to those discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Unmanaged trail proliferation would continue, with no guidance for proper construction and placement of new trails. Of all the Alternatives, Alternative A would have the most negative impacts to fish and fish habitat from recreation activities.

Recreation - Under Alternative A, recreation management is custodial and impacts would be similar to those discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Unmanaged trail proliferation would continue, with no guidance for proper construction and placement of new trails.

Off-Highway Vehicles (OHV) - Under Alternative A, BLM-managed lands would remain undesignated and impacts would be similar to those discussed under Impacts Common to All Alternatives. There would be no SRMAs that would set recreation objectives or develop visitor use limits. Areas of high OHV use, and any correlations to areas that may include important fish habitat have not been identified. The unauthorized and unmanaged proliferation of trails would potentially increase under this Alternative, with a resulting potential for increase in erosion and sediment impacts.

(5) Effects to Fisheries and Aquatic Habitats from Wild and Scenic River Nominations (Alternative A)

Under Alternative A, there would be no Wild and Scenic Rivers recommended for designation under the National System. Additional protections and regulations to fish habitat would be outlined in the Stipulations, Required Operating Procedures, and project-specific approved Plans of Operations.

c) Effects to Fisheries and Aquatic Habitat for Alternative B

(1) Effects to Fisheries and Aquatic Habitat from Lands and Realty Actions (Alternative B)

Revoking existing ANCSA 17(d)(1) withdrawals that currently withdraw BLM lands from mineral entry could have a negative impact on fisheries and fish habitat with the potential for upcoming land-use development activities. Alternative B would revoke all ANCSA 17(d)(1) withdrawals to allow for increased mineral exploration and development. Potential effects of mineral development on fish habitat under this Alternative are described under Impacts Common to All Alternatives.

Disposal or exchange of BLM lands results in transfer of the land to the State of Alaska, Native corporations, individuals, and local governments. Alternative B identifies two parcels in the Iliamna East planning block and one parcel in on the Iliamna West planning block for disposal or land exchange. Under Alternative B, the lands that are considered for disposal do not provide key fisheries habitat, and have small influence on the fisheries resources. Should other BLM-administered lands currently selected by the State or Native corporations be rejected or revert back to BLM, those lands might also be considered for future exchange. Land disposal could result in loss of valuable fisheries habitat. Should BLM-managed lands be transferred to or exchanged with other Federal agencies (e.g., NPS or USFWS), fish resources would be managed under existing conservation and protective guidelines.

Rights-of-Way grants and easements may promote the construction of paved or unpaved access roads, gravel pads, railways, all of which may adversely affect fish habitat through runoff that may introduce sediment and contaminants into the water. Under Alternative B, avoidance or exclusion areas would be identified on a case-by-case basis for potential impacts.

(2) Effects to Fisheries and Aquatic Habitat from Minerals (Alternative B)

Fluid Leasable Minerals

Alternative B would revoke all ANCSA 17(d)(1) withdrawals to allow for increased fluid mineral leasing. Alternative B anticipates a baseline exploration and development scenario, at least approximately 1,142,775 acres of BLM-administered lands would be available for mineral leasing in the Bay planning area during the life of the plan. These lands in the Bay planning area are currently designated as having low development potential. Oil and gas operations could affect fisheries resources in several ways, as described below.

Effects from Seismic Surveys - Potential threats to overwintering fish from seismic surveys in the planning area would primarily stem from 1) stress associated with acoustic energy pulses transmitted into the ground directly over overwintering pools, and 2) physical damage to overwintering habitat caused by seismic vehicles. Large overwintering pools might allow fish to flee immediate areas of intense stress, whereas fish occupying small pools might not have that option. Depending on proximity, adult fish could suffer no more than temporary discomfort, whereas intense acoustical pulses could be lethal to juveniles. Given that overwintering habitat represents only a small percent of the planning area, it is unlikely that seismic transmissions would occur directly over overwintering sites with any degree of regularity. Furthermore, seismic crews could avoid known overwintering areas. Overall, any effects to overwintering fish caused by winter seismic surveys would be localized and would not be likely to have any effect on fish populations within the planning area.

Effects from Water Demand - Overwintering areas are limited to deep-water pools and channels in rivers and streams and to lakes deep enough to provide sufficient under-ice free water during winter. In standing waters, 7 feet is considered the minimum depth for supporting overwintering fish (Phillips Alaska, Inc. 2002). Moving waters may deter the thickening of ice, thereby providing overwintering habitat at shallower depths.

Under Alternatives B, C, and D, greater levels of water withdrawal would be expected in conjunction with the increased land available for exploration and development activities as compared to Alternative A.

Effects from Exploratory Drilling - Drilling operations require large amounts of water for blending into drilling muds. Operations also produce large amounts of rock cuttings. If an exploratory well were to be plugged and abandoned, drilling muds and cuttings would be re-injected into the bore hole. If the well were to go into production, muds and cuttings would be removed to an approved disposal site. Any chemical leaching into surrounding waters by cuttings temporarily being stored at the drill site could affect nearby fish habitat. Even though the disturbance under Alternatives B, C and D would be greater than the amount of disturbance under Alternative A, the prevention of drilling in rivers and streams would provide fish with adequate protection. In general, it is not expected that exploratory drilling would have a measurable effect on fish populations in and adjacent to the planning area under this Alternative.

Effects from Pad, Road, and Pipeline Construction - Impacts from pad, road, and pipeline constructions are mainly increased erosion and sedimentation, subsurface and surface flow disruption, and increased pollution in runoff.

Effects of Spills - Oil spills can have a range of effects on fish (Malins 1977; Hamilton et al. 1979; Starr et al. 1981). The specific effects depend on the concentration of petroleum present, the length of exposure, and the stage of fish development involved (eggs, larva, and juveniles are most sensitive). If lethal concentrations are encountered (or sub-lethal concentrations over a long enough period), fish mortality is likely to occur. Most acute-toxicity values (96-hour lethal concentration for 50 percent of test organisms)

for fish generally are on the order of 1 to 10 parts per million (ppm). Concentrations measured under the slicks of former oil spills at sea have been less than the acute values for fish and plankton. For example, concentrations of oil 1.6 to 3.3 feet beneath a slick from the Tsesis spill ranged from 50 to 60 parts per billion (Kineman et al. 1980). Extensive sampling following the Exxon Valdez oil spill also found hydrocarbon levels in the water column well below those known to be toxic or to cause sub-lethal effects in plankton (Neff 1991). The low concentration of hydrocarbons in the water column following even a large oil spill at sea appears to be the primary reason for the lack of lethal effects on fish and plankton.

Locatable Minerals. This Alternative would anticipate the greatest exploration and development for locatable minerals given the revocation of all ANCSA 17(d)(1) withdrawals. Dependent on gold prices, a moderate increase in small placer operations on BLM-managed lands could occur during the life of this plan. Large operations could be possible, but would most likely occur on State lands. Roads or infrastructure necessary for those operations, however, could cross BLM-managed lands. For general mining impacts to fisheries, see *Impacts Common to All Alternatives*.

The Required Operating Procedures (ROPs) common to Alternatives B, C, and D are designed to minimize or prevent impacts from erosion, altered stream flow, stream crossings, and riparian impacts. Strict adherence to the ROPs would minimize effects to fish and fish habitat within the planning area. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Salable Minerals. There would be approximately 1,142,775 acres available for the sale of mineral materials under Alternative B. Under this Alternative and Alternatives C and D, Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel mine sites within active channels. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Gravel mining activities conducted in fish-bearing streams or in tributaries to fish-bearing streams can block and reroute stream channels and increase silt concentrations resulting in reduced primary production, loss of invertebrate prey species, and disruption of feeding patterns for sight dependent feeders (Branson and Batch 1971, Cooper 1965). For general mining impacts to fisheries, see *Impacts Common to All Alternatives*.

(3) Effects to Fisheries and Aquatic Habitat from Recreation (Alternative B)

Recreation management under Alternative B would be expected to be the same as that for Alternative A. Impacts to fish from recreational use would be the same as discussed under impacts for Alternative A.

(4) Effects to Fisheries and Aquatic Habitat from Off-Highway Vehicles (Alternative B)

Under Alternative B, BLM-managed lands would be designated as “open” to OHV use and, resulting in some continued localized impacts from erosion due mainly to unauthorized stream crossings. Locations that may include important fish habitat have not been identified. Inventoried OHV trails have authorized anadromous stream crossings with a permit from the State Department of Natural Resources. The unauthorized and unmanaged proliferation of trails could increase under this Alternative, with a resulting increase in erosion and sediment impacts. Potential adverse effects to fish habitat from OHV use are discussed under *Impacts Common to All Alternatives*. There are no SRMAs that would set recreation objectives or develop visitor use limits. Alternative B includes vehicle weight limits for limited areas to 2,000 pounds gross vehicle weight rating (GVWR includes load capacity), which would positively influence environmental conditions.

(5) Effects to Fisheries and Aquatic Habitat from Wild and Scenic River Nominations (Alternative B)

Under Alternative B, there would be no Wild and Scenic Rivers recommended for designation under the National System. Additional protections and regulations to fish habitat would continue to be limited to those outlined in the Stipulations, ROPs, and project-specific approved Plans of Operations.

d) Effects to Fisheries and Aquatic Habitat for Alternative C

(1) Effects to Fisheries and Aquatic Habitats from Minerals (Alternative C)

Fluid Leasable Minerals. The anticipated level of fluid mineral leasing under Alternative C would be the same as that identified under Alternative B, but would include retaining 17(d)(1) withdrawals for proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (15,125 acres) as an interim measure to provide an opportunity for Congressional action. Retention of these 17 (d)(1) withdrawals would further minimize impacts to fish and fisheries habitat from oil and gas leasing activity. The potential level of oil and gas leasing activity would be slightly greater under Alternatives B and D than under Alternative C.

Locatable Minerals. The anticipated level of exploration and development for locatable minerals under Alternative C would be similar to that identified under Alternative B, but would include retaining 17(d)(1) withdraws for proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (15,125 acres) as an interim measure to provide an opportunity for Congressional action. Retention of these 17 (d)(1) withdrawals would further minimize impacts to fish from what limited oil and gas leasing activity might occur. The potential level of locatable minerals activity could be slightly greater under Alternatives A and B than under Alternative C. The protection provided to fish and fish habitat under Alternatives B and C would be superior to that provided under Alternative A.

Salable Minerals. The anticipated level of exploration and development for salable minerals under Alternative C would be similar to that identified under Alternative B, but the following lands would be closed to sale: (1) Proposed Carter Spit ACEC (52,862 acres); (2) Proposed Bristol Bay ACEC (989,202); and (3) Retain 17(d)(1) withdrawals for proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork (15,125 acres) as an interim measure to provide an opportunity for Congressional action. There are approximately 1,176,269 acres available for the sale of mineral materials. Under Alternatives B, C, and D, Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel mine sites within active channels. The potential level of salable minerals activity would be greater under Alternatives A and B, than under Alternative C. The protection provided to fish and fish habitat under Alternatives C and D would be superior to that provided under Alternative A.

(2) Effects to Fisheries and Aquatic Habitats from Lands and Realty (Alternative C)

Disposal or Land Exchange - Impacts are the same as those discussed under Alternative B.

Withdrawals - The anticipated level of withdrawals under Alternative C would be similar to those identified under Alternative B, but would include retaining 17(d)(1) withdrawals for the proposed wild river segments of Alagnak, Goodnews mainstem, and Goodnews Middle Fork (15,125 acres). The potential level of withdrawals would be greater under Alternatives A and C, than under Alternatives B and D. The protection provided to fish and fish habitat under Alternatives A and C would be superior to that provided under Alternative B and D.

Rights-of-Way - The anticipated avoidance area level for Rights-of-Way grants and easements under Alternative C would be similar to those identified under Alternative B, but the proposed Bristol Bay ACEC (989,202 acres) and the proposed Carter Spit ACEC (62,862 acres) would be identified as avoidance areas for Rights-of-Way. The potential level of avoidance for Rights-of-Way would be greater under

Alternatives C and D, than under Alternatives A and B. The protection provided to fish and fish habitat under Alternative C would be superior to that provided under Alternative A, B, or D.

(3) Effects to Fisheries and Aquatic Habitat from Recreation (Alternative C)

Off-Highway Vehicles - Under Alternative C, OHV use would be limited to existing roads and rails, providing less opportunity for potential impact to fisheries and aquatic habitat from OHV use than in Alternative A or B. Under this Alternative, OHV trails would be managed with the objective of minimizing the unmanaged proliferation of trails. Locations that may include important fish habitat have not been identified. Inventoried OHV trails have authorized anadromous stream crossings with a permit from the State Department of Natural Resources. Potential adverse effects to fish habitat from OHV use are discussed under Impacts Common to All Alternatives. There are no SRMAs that would set recreation objectives or develop visitor use limits. Alternative C includes vehicle weights limits for limited areas to 2,000 pounds gross vehicle weight rating (GVWR includes load capacity).

(4) Effects to Fisheries and Aquatic Habitat from Wild and Scenic Rivers (Alternative C)

Under Alternative C, BLM would propose Wild and Scenic River designation of identified river segments under the National System. The following river segments would be recommended for Wild and Scenic River designation: Alagnak River (626 acres), Goodnews River mainstem (7,138 acres), and Goodnews River Middle Fork (7,361 acres).

This designation would provide legal protections from adverse development and would provide a mechanism for management of the river's resources. Wild rivers would allow unobtrusive development and activities, but typically do not allow motorized use. Scenic rivers can allow motorized use, though mining and leasing operations must be conducted in accordance with the Stipulations, Required Operating Procedures and/or project-specific Approved Plans of Operations, if motorized use is tied to a project such as oil and gas exploration or development, locatable mineral exploration or development, or some other form of permitted activity. Recreational rivers contain the least stringent regulations, but activities must still not produce any adverse effects on the river and its immediate environment. Some recreational rivers would perhaps see increases in use levels, but in general these designations would provide increased protections for fish and fish habitat.

e) Effects to Fisheries and Aquatic Habitat for Alternative D

(1) Effects to Fisheries and Aquatic Habitat from Leasable, Locatable, and Salable Minerals (Alternative D)

Fluid Leasable Minerals. The anticipated level of mineral leasing under Alternative D would be the same as identified under Alternative C, but the Proposed Carter Spit ACEC (62,862 acres) and specific blocks of unencumbered land in the Bristol Bay area (Koggiling, Yellow Creek, Kvichak, Iliamna West, Alagnak, and Klutuk blocks (989,202 acres) would be subject to Stipulations, Required Operating Procedures, and other special requirements on a project-specific basis, such as seasonal restrictions. Such restrictions would further minimize potential impacts to fish and fisheries habitat from oil and gas leasing. The potential level of oil and gas leasing would be greater under Alternative B than under Alternatives A, C or D.

Locatable Minerals. The anticipated level of locatable mineral exploration and extraction under Alternative D would be the same as identified under Alternative C. All BLM lands would be subject to Required Operating Procedures. The potential level of locatable mineral exploration and extraction would be greater under Alternatives B, C, and D than under Alternative A.

Salable Minerals. The anticipated level of exploration and development for salable minerals under Alternative D would be similar as identified under Alternative B, but the proposed Carter Spit ACEC (62,862 acres) would be closed to sale. There would be approximately 1,176,269 acres of salable

materials available. Under Alternatives B, C, and D, the Required Operating Procedures would minimize the effects of gravel extraction on fish by avoiding gravel mine sites within active channels. The potential level of salable minerals activity would be greater under Alternatives A and B than under Alternative D. The protection provided to fish and fish habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

(2) Effects on Fisheries and Aquatic Habitat from Lands and Realty (Alternative D)

Rights-of-Way - The anticipated level of Rights-of-Way grants and easements under Alternative C would be similar to those identified under Alternative B, but the Carter Spit ACEC would be identified as an avoidance area for Rights-of-Way (62,862 acres). The potential level of impacts from Rights-of-Way would be greater under Alternatives A and B, than under Alternative C or D. The protection provided to fish and fish habitat under Alternatives C and D would be superior to that provided under Alternative A and B.

Off-Highway Vehicles - The anticipated impact of OHV use would be the similar to that identified under Alternative B, but would include limitations defined within the proposed Cater Spit ACEC.

Alternatives B, C, and D include vehicle weights limits for limited areas to 2,000 pounds gross vehicle weight rating (GVWR includes load capacity). OHV use under Alternative D would be restricted to existing roads and trails, resulting in fewer potential impacts to fish and fish habitat from unauthorized stream crossings or sedimentation into streams or rivers.

5. Direct and Indirect Effects to Wildlife and Wildlife Habitat

a) Direct and Indirect Effects to Wildlife Common for All Alternatives

Proposed management of the following resources/resource uses/programs would have no anticipated impacts to wildlife management: Air Quality, Fisheries Management, Special Status Species, Cultural Resources, Paleontological Resources, Visual Resources, Wilderness Characteristics, Public Safety, Forest Products, Social and Economic Conditions, and Subsistence.

(1) Effects to Wildlife from Soil, Water, and Vegetation (Common to all)

There would be beneficial effects to wildlife from proper management of soils, vegetation, and water resources. Implementation of mitigation measures to protect soil, water, vegetation, and air on a project specific basis would reduce disturbance to wildlife habitats and aid in the recovery of habitat from permitted uses.

(2) Effects to Wildlife from Fire and Fuels Management (Common to all)

A large percentage of the planning areas is comprised of herbaceous or shrub habitats. Fire is less prevalent in these vegetation types compared to boreal forests; therefore, effects of fire on wildlife and habitats are lower in the planning area than may be anticipated for Interior Alaska.

Fire has both direct and indirect effects on wildlife and their habitats. These effects are described in detail in the Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska (BLM 2004). Generally, the effects on habitat are much greater than the effects on resident animals. Short-term negative impacts from fire on resident wildlife include displacement, disruption of reproductive activities, and occasional mortalities. However, populations of certain species can recover quickly if suitable habitat is available. Adverse effects to current individuals are generally offset by the benefits of beneficial habitat changes for future generations.

Fire helps maintain a mixture of vegetation types and age classes that provide habitat and forage for a variety of wildlife. Fire alters habitats and may improve habitat components for some species while degrading habitat for other species. Over time, as vegetation recovers from fire disturbance, various species of wildlife will benefit from various successional stages of vegetation. Herbivores are directly affected by the changes in vegetative cover and forage associated with fire, whereas predators respond to both changes in cover and abundance of prey.

Wildlife has evolved in the presence of fire and has adapted to it. Overall, a natural fire regime has a beneficial effect on maintaining a diversity of wildlife and wildlife habitats. Grasses, sedges and herbaceous plants that quickly re-sprout after fire provide forage and cover for small mammals, wet and alpine tundra birds, and grazing species. Browsers such as moose, hares, and ptarmigan benefit from fire when trees and shrubs reestablish themselves. If fires are not too severe, sprouting of some shrub species will occur soon after burning.

Moose generally benefit from fire due to increased production of high quality browse for 23-30 years after fire (McCracken and Viereck 1990). Prescribed fires are a management tool used to increase moose habitat. Moose populations generally react in a strongly positive manner to areas with increased browse. The level of effect is variable, depending upon the health of the moose population prior to the fire and the amount of browse available. If browse is not a limiting factor on moose populations, then fire will have little impact on populations over the short-term (BLM 2004b).

The short-term effects of fire on caribou winter range are negative, and vary depending upon the severity of the burn. Lichens, which are primary winter forage for caribou, are highly susceptible to wildland fire. Impacts to habitat include reduced availability of forage lichens for up to 80 years after a fire (Klein 1982, Joly et al. 2003). On caribou summer ranges, forage quality of vascular plants is improved by fire. Fire also affects caribou movement patterns. Research has shown that caribou actively avoid burned areas for 35-50 years after a fire (Joly et al. 2003). Over the long-term, fire is likely beneficial to caribou as it helps maintain the ecological diversity of the habitat and may prevent mosses from out-competing forage lichens. Light fires may rejuvenate stands of lichen and replace old forest stands where lichen has been replaced by moss. Periodic fires create a mosaic of fuel types and fire conditions that naturally preclude large, extensive fires (BLM 2004b).

Fire is very rare in subalpine habitats used by Dall sheep. Fire may enhance sheep habitat by reducing encroachment of shrubs and spruce into subalpine habitats. Fire can also increase the amount or quality of herbaceous and graminoid forage available and reduce cover used by bears and wolves when hunting sheep.

Fire has both beneficial and negative effects on bears. Beneficial effects include increasing the availability of forage plants such as berries, grasses and forbs. On the negative side, some forage species may be reduced or temporarily eliminated by fire. Moose calves are an important prey item for both black and grizzly bears. Early stages of plant succession due to fire tend to increase moose production, resulting in more calves available for prey (BLM 2004b). Fire has little direct effect on grizzly bears as it is infrequent in tundra habitats and tundra fires tend to be small.

The effects of fire on furbearers are variable depending on the species. Carnivorous furbearers (e.g., coyote, fox, wolf, wolverine, lynx) respond to fire in a manner similar to their prey species, though there tends to be a lag period. If prey species benefit from fire, predators do as well. Snowshoe hares, voles, and other small mammals tend to respond positively to vigorous re-growth triggered by wild fires. Species such as marten and lynx tend to increase as well, tracking these prey species (Johnson et al. 1990). Fire is not common in the coastal habitats favored by Arctic foxes and so they are minimally affected. Herbivorous furbearers (such as muskrats) may benefit from fire due to rejuvenation of forage plants and maintenance of open water. Beavers may be negatively affected by severe fires until forage species recolonize the area.

Fire near wetlands can consume dead grass and sedges, opening up dense marsh vegetation to maintain habitat for waterfowl. Burning also stimulates new shoots that have greater forage value. Under the right conditions, fire may create new ponds or prevent old ponds from filling in with vegetation. Fire can have

short-term negative effects on waterfowl when it occurs during nesting or molting periods, or when it eliminates woody vegetative cover (BLM 2004b).

(3) Effects to Wildlife from Livestock Grazing (Common to all)

Livestock grazing permits could be considered on a case-by-case basis under any Alternative. Grazing by reindeer can indirectly impact wildlife by degrading habitat or reducing the availability of preferred forage species. The greatest potential for impact would be on caribou as they have the same forage requirements as reindeer. Reindeer remain in the same allotment yearlong, and may overuse lichen in localized areas. Reindeer herders utilize the same area year after year. This may result in reduction of lichen biomass in some areas and may decrease the opportunity and potential for the area to support caribou in key seasonal or life function habitats.

Herding activities may result in disturbance impacts to wildlife. These impacts would be negative, especially during stressful times such as winter or reproductive periods. Reindeer herders may attempt to separate their reindeer from caribou, resulting in disturbance impacts to caribou. Disturbance to wintering moose by reindeer herding activities may result in increased stress on these animals.

Effects of grazing on riparian, wetlands and stream habitats can decrease quality and quantity of fish habitat and productivity. Such impacts have indirect impact on terrestrial predators and scavengers such as bears, osprey, and eagles that are dependent upon abundant fish resources for food.

Authorization of grazing may negatively impact brown bear and wolf populations due to the increased number of predators harvested by reindeer herders in defense of life and property and predator control programs. Harvest of predators by reindeer herders in some parts of the Seward Peninsula, outside of the Bay planning area, has been substantial in the past (ADF&G 2002). From 1996 to 1998, nine bears were reported harvested in defense of life and property (DLP) in GMU 22. This reported total does not accurately represent the actual number of non-hunting kills due to low compliance with reporting requirements. Nelson (1993) estimated that an additional 10 to 30 bears were killed annually and not reported in GMU 22.

Approval of grazing permits may result in conflicts between wildlife management and reindeer grazing. ADF&G and the Federal subsistence program intensively manage caribou hunts and public outreach relative to caribou movement in areas that overlap with reindeer ranges in an attempt to reduce accidental harvest of reindeer by hunters in regions outside of the Bay planning area where reindeer grazing is currently engaged in.

Disease and parasite transmission between reindeer and caribou may negatively affect the caribou. Reindeer and caribou are the same species. If disease transmission did occur, it could have serious, negative impacts on the Mulchatna Caribou Herd and other herds in the planning area. Grazing associated with Special Recreation Permits (SRPs) could be authorized under all Alternatives on a case-by-case basis. Potential impacts include transmission of disease and parasites to wildlife from a variety of domestic animals; reduction of forage availability; and introduction of noxious or invasive plants from manure and feed carried in for pack animals.

(4) Effects to Wildlife from Hazardous Materials (Common to all)

Hazardous materials in the planning area have the potential to enter the food chain and contaminate wildlife species that are consumed by humans, causing negative health effects. This could occur in sport hunted species, and particularly in subsistence species where human consumption levels are higher. Hazardous materials may also directly and indirectly affect wildlife by causing direct mortality, reduced survival, and reduced productivity thereby reducing species abundance.

The hazardous materials program could have a beneficial effect on wildlife by identifying and rehabilitating hazardous sites.

(5) Effects to Wildlife from Fluid Mineral Leasing (Common to all)

Although Leasable Mineral development is not anticipated under every Alternative, some mineral-related activities may occur under any Alternative. Mining and oil and gas leasing could have adverse effects to wildlife species and important habitat. Ancillary infrastructure including separation ponds, pipelines, and roads would cause surface disturbance and loss of wildlife habitat. There is also potential for oil spills that would further degrade habitat. Where Rights of Way are associated with development on non-BLM-managed lands, or associated with mining or oil and gas leasing, there could be localized impacts to habitat, migratory patterns, and wildlife abundance and distribution. Direct habitat loss may also lead to wildlife displacement and habitat fragmentation. Surface disturbing activities may displace animals into lower quality habitat and increase competition for available resources with other species uses. Direct mortality of wildlife from vehicle collisions, oil associated with treatment and production facilities, hydrogen sulfide poisoning, oil field worker access, and enhanced access for non-oil industry related individuals would increase authorized and non-authorized harvests. Effects are likely to occur during construction and mineral extraction activities, and could cause long and short term effects resulting in permanent loss or alteration of wildlife habitat and disruption of migratory patterns. Direct and indirect impacts to fish and fish habitat may result in impacts to terrestrial predators and scavengers by reducing or contaminating forage sources.

(6) Effects to Wildlife from Minerals (Common to all)

Locatable Minerals. Locatable Mineral exploration and development to some degree may occur under every Alternative. Potential impacts to wildlife would include temporary displacement in localized areas, temporary and long term loss of habitat, long-term degradation of habitat, and possible direct mortality of small mammals or nestlings and brooding birds. Both direct and indirect impacts may be reduced under all Alternatives due to implementation of the Required Operating Procedures.

Salable Minerals. Mineral material mining and disposal has both direct and indirect impacts on wildlife and their habitat. Habitat is degraded or destroyed, depending upon the location of the material site. Some sites may recover to the original vegetation cover within a relatively short time frame. Other sites may never recover to the original vegetative cover due to loss of soil from the site. In some cases, disturbance to the site by mining of mineral materials may result in improved habitat for species which depend upon habitats in a low seral stage. Temporary displacement and disturbance impacts would occur to larger and more mobile animals. Direct mortality may result to smaller and less mobile animals such as lemmings, voles, or nestling birds. Both direct and indirect impacts may be reduced under all Alternatives due to implementation of mitigation measures developed during NEPA analysis of specific mineral materials actions.

Impacts to wildlife from mineral material mining and disposal would be minimal under most Alternatives. Sufficient material sources exist on private lands to meet the needs of most communities within the planning area. Under all Alternatives mineral material mining and disposal would occur in association with transportation infrastructure development and minerals development and would impact wildlife.

(7) Effects to Wildlife from Recreation Management (Common to all)

There may be impacts to wildlife from both commercial and non-commercial recreation activities. The primary impacts may be temporary stress, displacement, enhanced or excessive harvest, or habitat abandonment of wildlife due to recreational activities, or to recreation associated access (aircraft overflight and landing in remote areas). In areas that are repeatedly used for camping sites, there may be minor, site-specific degradation of habitat. Special recreation permits for guiding and outfitting game species may result in population effects to caribou, moose, and bears.

(8) Effects to Wildlife from Travel Management (Common to all)

The noise and activity associated with OHV use (including snowmachines) can adversely affect wildlife both directly and indirectly. Direct effects include stress and displacement of animals, possibly to less suitable habitats, especially in important seasonal habitats. Stress and displacement may result in reduced productivity (ADF&G 1990). Changes to traditional movement patterns, distribution and behavior

of wildlife, and increased harvest vulnerability, can result from exposure to OHVs. Wildlife are particularly vulnerable to disturbance at periods of time and in areas of concentration such as caribou calving grounds, or during stressful periods during life history (i.e. caribou and moose calving, post calving aggregations, winter habitats, bear natal dens and foraging concentrations, bird nesting and staging areas). OHV use may result in habitat abandonment or changes in density or species population, age, and sex composition in the vicinity of the trail.

Indirect effects include habitat degradation and alteration, and increased access into habitats. Remote areas will become more accessible over time as OHVs become more powerful and as the human population in the planning area increases. Improved technology and increased demand for resources may lead to increased harvest of wildlife. Snowmachine use compacts snow and may inhibit movement under the snow by small rodents. Fragile habitats such as wetlands and riparian areas may be degraded seasonally by OHV use.

(9) Effects to Wildlife from Renewable Energy (Common to all)

Renewable energy sources such as wind could be developed on BLM-managed lands within the planning area under all Alternatives. Should such development take place, there would be both direct and indirect impacts on wildlife. Direct impacts would include disturbance during construction and maintenance activities, mortality due to bird strikes on wind towers, and mortality of small, less mobile animals such as small mammals or nestling birds during construction and maintenance. Indirect impacts would include minor loss of habitat due to facility construction. Higher mortality may be expected if wind towers are sighted in bird movement corridors. To be most useful, these types of development need to be located near population centers. However, most land near villages is private. Due to the remoteness of BLM unencumbered lands, little renewable energy development is anticipated on BLM-managed lands, actual impacts would be minimal, and would not have population level effects. The increasing cost of fuel may make wind energy more cost effective in the future, including power for mineral development. At this time, solar energy technology options do not appear to have the potential for impact on wildlife on BLM lands. Limited opportunity for using available geothermal energy, and local, small scale opportunity for use of solar energy would result in insignificant impacts.

(10) Effects to Wildlife from Climate (Common to all)

The climate within the Bay planning area is described as maritime near the coasts, and more transitional farther inland. Current scientific evidence suggests the climate warming in Alaska can be linked to changes occurring in the structure and function of terrestrial ecosystems throughout the state. These changes include the thawing of permafrost, the conversion of tundra to more shrub habitats, and the drying and decrease in areas of closed basin lakes, causing alteration and conversion of wildlife habitats. Climate change has also been linked to changes in disturbance regimes such as fire potential and insect outbreaks, further affecting ecosystem processes and causing habitat changes in some areas. Warming climates may be instrumental in the introduction of disease and parasites previously unknown in the planning area, Current research suggests that these trends will continue, and will likely occur to a greater extent and magnitude at higher latitudes first. These climatic changes and subsequent habitat changes will impact wildlife by expanding habitats for some species, and limiting habitat for other species, thereby altering the distribution and abundance of some species, particularly those dependent on wetlands, tundra, shrub or closed forest habitats. BLM lands in the Bay planning area will be subjected to these climate and habitat changes.

(11) Effects to Wildlife from Lands and Realty Actions (Common to All)

There would be both direct and indirect impacts to wildlife from lands and realty actions under all Alternatives. Wildlife may be temporarily displaced or disturbed or movement patterns disrupted during activities authorized under this program. There may be direct mortality and/or habitat abandonment by wildlife species. Actions that increase access may create increased harvest opportunities. Wildlife habitat may be destroyed, fragmented, or degraded. Acquisitions and exchanges may benefit wildlife by

consolidating and protecting important wildlife habitats. Disposal action may fragment blocks of land, remove protections for wildlife habitats, and make them available for other uses detrimental to wildlife.

b) Effects to Wildlife for Alternative A

Under the current management system, Alternative A, compliance, monitoring, and mitigation requirements for wildlife are determined on a case-by-case basis during the permitting process.

(1) Effects to Wildlife from Soil, Water, and Vegetation Management (Alternative A)

Effects to wildlife from the soil, water, and vegetation management programs would be the same as those discussed under Common to All Alternatives.

(2) Effects to Wildlife from Realty and Lands Actions (Alternative A)

The nature of impacts would be the same as discussed under those Common to All Alternatives. Under this Alternative, no lands would be identified for disposal or land exchange, ANCSA 17(d)(1) mineral entry withdrawals would be retained. The degree of impacts that would occur to wildlife and wildlife habitat under this Alternative would be less than under Alternatives B, C, or D. Avoidance or exclusion areas and specific mitigation requirements would be identified on a case-by-case basis for Rights-of-Way, including access and utility corridors and ancillary facilities.

(3) Effects to Wildlife from Minerals (Alternative A)

Fluid Leasable Minerals. Under Alternative A, in some situations, BLM has the authority to lease lands where oil and gas is being drained. No lands would be open for fluid mineral leasing, with the exception of drainage from an adjacent ownership. In those areas, leases are subject to standard lease terms, including seasonal or other constraints. Geophysical exploration would be considered on a case-by-case basis. Impacts to wildlife would be the same as discussed under Common to All Alternatives.

Locatable Minerals. Under Alternative A, most BLM lands within the planning area would remain closed to locatable mineral entry due to existing ANCSA 17(d)(1) withdrawals. However, some BLM lands are open, and there are some active mining operations on BLM-managed lands where exploration or mining could take place or continue. Existing placer mining operations could continue. These operations and any future proposals for locatable minerals exploration and development would be subject to review through the administration of Plans of Operations. Measures to maintain the integrity of wildlife habitat in these areas would be implemented; where unavoidable, compensation for habitat loss would be identified and required as part of the individual mine operating plan.

Salable Minerals (Mineral Materials). Impacts to wildlife would be the same as under Impacts Common to All Alternatives. No impacts would be expected in areas withdrawn from mineral entry.

(4) Effects to Wildlife from Recreation Management (Alternative A)

Recreation Experience Opportunities - Under Alternative A, both commercial and non-commercial recreation would continue to be managed on a case-by-case basis. Consequently, no areas would be identified for commercial or non-commercial use limits, and impacts to wildlife associated with these activities would continue to be handled on a case-by-case basis. No recreation facility construction would be considered, which could lead to localized habitat degradation at heavy-use dispersed camp sites. Kinds of impacts to wildlife would be the same as discussed under those Common to All Alternatives.

Special Recreation Management Areas - Under Alternative A, no Special Recreation Management Areas would be established. Impacts to wildlife would be the same as those discussed under Common to All Alternatives.

Visual Resource Management - Under Alternative A, no VRM classes would be established in the Bay planning area. Impacts to wildlife would be the same as those discussed under Common to All Alternatives.

(5) Effects to Wildlife from Travel Management (Alternative A)

Kinds of impacts to wildlife would be the same as discussed under Impacts Common to All Alternatives. Under Alternative A, there would be no OHV designations within the Bay planning area. No vehicle weight limit would exist, and there would be no route restrictions. Cross country travel would be allowed everywhere on BLM-administered lands within the Bay planning area. The degree of potential impacts to wildlife and wildlife habitat would be greater than in Alternatives C or D.

(6) Effects to Wildlife from Special Management Area Designations (Alternative A)

Wild and Scenic Rivers - Under Alternative A, no Wild and Scenic Rivers would be recommended in the Bay planning area. These areas would therefore be open to all multiple use activities permitted on BLM lands except for mineral exploration and development in most areas. Impacts to wildlife from those activities would be the same as those discussed for each activity under Common to All Alternatives.

Area of Critical Environmental Concern - Under Alternative A, no Areas of Critical Environmental Concern would be recommended in the Bay planning area. BLM would manage wildlife habitat and would address concerns on a case-by-case basis during the review of permits. No habitat management plan would be developed for wildlife habitat.

c) Effects to Wildlife for Alternative B

(1) Effects to Wildlife from Soil, Water, and Vegetation Management (Alternative B)

There would be beneficial impacts to wildlife from proper management of soils, water, and vegetation resources. Implementation of Required Operating Procedures, stipulations, and project-specific requirements would reduce disturbance to wildlife habitats and would assist the recovery of habitat from permitted uses.

(2) Effects to Wildlife from Realty and Lands Actions (Alternative B)

Land Exchanges - Large blocks of BLM-managed lands would be retained in Federal ownership, reducing the potential for habitat fragmentation. Small isolated parcels identified in Alternative B for disposal could result in privatization of some tracts and could increase levels of access and human activity in wildlife habitat. Wildlife may be displaced from preferred habitats, and habitat may be destroyed or degraded. Exchanges could result in larger, contiguous blocks of BLM lands that are of high wildlife value. Land would have to meet the criteria for disposal in the Federal Land Policy Management Act (FLPMA).

Withdrawals - ANCSA 17(d)(1) withdrawals would be revoked under this Alternative. Because of the constraints currently in place under these withdrawals, rejection of the withdrawals could increase potential resource development and wildlife and habitat disturbing activities. Associated impacts to wildlife and wildlife habitat would be expected from minerals exploration and development and infrastructure development. Proposals would be handled on a case-by-case basis, and would be subject to Required Operating Procedures and Stipulations.

Rights-of-Way - Impacts to wildlife from Rights-of-Way would be the same as those in Alternative A.

(3) Effects to Wildlife from Minerals (Alternative B)

Fluid Leasable Minerals

Under Alternative B, ANCSA 17(d)(1) withdrawals would be removed. Because of the constraints currently in place under these withdrawals, removal of the withdrawals could increase resource development and wildlife and habitat disturbing activities. Potentially wildlife and habitat disturbing activities associated with oil and gas exploration and development would be limited in footprint. However, another risk to wildlife and wildlife habitat would be presented by the possibility of an oil, fuel, or diesel spill. Impacts to wildlife from leasable minerals could come from several activities.

Seismic Exploration - Seismic exploration would have direct impacts on wildlife, including temporary disturbance or stress on wildlife. In one study, seismic activities within 1.15 miles of a grizzly bear den caused changes in heart rate and movement of the female bear and cubs (Reynolds et al. 1986). The investigators suggest that seismic testing activities within approximately 600 feet of the den may cause abandonment of the den.

For approximately the past 15 years, the Mulchatna Caribou Herd has been inconsistent and unpredictable in its choice of overwintering and calving areas within the larger herd range (Hinkes et al. 2005). In spring 2006 there are two large calving groups, one located near Lime Village and the other located south of Koliganek, in a generalized area that includes BLM unencumbered lands. Caribou are also in the Goodnews Bay area this year (J. Denton 2006, Pers. Comm.). Planning for seismic exploration on BLM lands in the Bay planning area for a time when caribou are not present could prove challenging with such unpredictable behavior.

The National Research Council's report, *Cumulative Environmental Effects of Oil and Gas Activities on Alaska's North Slope* (2003), suggests that the optimum time to conduct seismic activities in caribou winter range and primary calving areas is in summer when caribou are not present. However, even in winter on winter range, the Committee believed that direct effects on caribou in the National Petroleum Reserve - Alaska in the 1970s and 1980s from low intensity two-dimensional (2-D) surveys with low seismic line density were temporary and minor (NRC 2003). Wintering bands of caribou tend to be small and often widely dispersed, so few caribou would have come in contact with seismic activities at the same time. Additionally, Roby (1978, NRC 2003) suggests that caribou appear least sensitive to human-induced disturbance during winter.

Dyer and others (2001) suggests that avoidance of seismic lines and the attendant human activity could reduce caribou's ability to avoid areas of deep snow. Bradshaw and others (1998) propose that the energy costs of multiple encounters with seismic disturbance could increase winter weight loss and reduce calf production and survival (NRC 2003).

Information about the effects of noise on moose was gathered for the Mackenzie Gas Project in Canada (AMEC 2005). In a 1974 study recording the response of moose in the Richardson Mountains to fixed-wing aircraft, McCourt and others found that of 46 observations, moose reacted visibly to aircraft overflights of less than 60 meters of altitude 55% of the time, and to overflights of 60 meters to 180 meters 37.5% of the time. Moose are known to avoid roads, pipelines and seismic lines (Horesji 1979, Rolley and Keith 1980, Morgantini 1984, Rudd and Irwin 1985, Singer and Beattie 1986, Jalkotzy et al. 1997). Horesji (1979) also reported that moose were less likely to be found within 1 km of seismic lines while seismic operations were underway.

Based on data from prior studies, caribou, moose, and bears can all be hazed away from their habitats by seismic testing. The following factors would be key in the degree of effects:

- The timing and location of tests and whether caribou, moose, or bears are present or absent.
- The number of seismic lines involved, the amount of temporary infrastructure developed, and the amount of ancillary human activity accompanying the testing, including helicopter activities.
- The total duration and intensity of the project or cumulative projects in a specific area.
- The type of testing, subsurface or above ground; 2-D or 3-D procedures.

Seismic camps may provide additional food sources for foxes and bears at dumpster sites near the galley and dining halls and at dump sites (Eberhardt et al. 1982, Rodrigues et al. 1994). However, seismic crews are required by stipulation to incinerate and remove waste materials from BLM lands. This activity is not expected to enhance the survival of foxes. Bears would generally be hibernating during seismic exploration it is carried out in winter, and so would not be expected to be affected by human sources of food. Testing by helicopter-supported ground crews could easily be done in summer months (which has been the case in the past) and so would also be expected not to be a source of impacts.

Small mammals (lemmings, voles) and their predators would be affected locally at camps and along seismic lines by direct mortality and loss of habitat. The numbers lost would be insignificant in the greater population.

Should seismic surveys occur during winter months, many birds are absent from the region. Overwintering birds including ravens, ptarmigan, and gyrfalcons could be temporarily displaced by seismic activities. In the unlikely event that a seismic operation extended into May, disturbance of early breeding season activities of some species could occur. Because the campsites and survey areas are occupied for relatively brief periods, and most of the birds are dispersed in relatively low numbers over a large area, the duration of disturbance incidents is likely to be brief and infrequent. Stipulations, Required Operating Procedures, and project-specific requirements such as those describing seasonal activities and buffers, for example, would be available to minimize potential impacts.

Indirect impacts to wildlife from seismic operation may include degradation of habitat (impacts to soil and vegetation) due to seismic exploration. These types of impacts would be reduced by implementation of the Required Operating Procedures, including limiting seismic surveys to the winter when the ground is frozen and covered with snow.

Exploratory Drilling - Effects to wildlife from exploratory drilling for oil and gas or coal would be similar to those discussed under seismic exploration. As exploratory drilling should occur during winter, potential disturbance would come primarily from aircraft and surface traffic, and activities associated with road and drill pad construction. Numerous studies show that wildlife such as caribou react to low flying aircraft by exhibiting various behaviors from panic to strong escape responses (Calef et al. 1976). Disturbance reactions to each incident with aircraft would be brief, lasting only minutes to less than one hour; however, effects of cumulative incidents must also be considered. Wildlife may be temporarily disturbed from ground traffic and activities associated with ice road construction. Wildlife may temporarily avoid the local area but would reoccupy the area after the exploration activities were complete. Small and less mobile animals such as lemmings and voles may suffer direct mortality during ice road or pad construction. These losses would not result in population level effects.

Development - Based on the Reasonably Foreseeable Development Scenario, one site in the Koggiling Block of BLM lands is explored and potentially developed for natural gas and a pipeline is constructed to Dillingham. Using this scenario, the following effects could occur.

Although initial construction could occur primarily during winter, development of oil and gas resources would bring year-round facilities and activities to wildlife habitat on BLM unencumbered lands in the southern part of the Nushagak - Kvichak drainages. Potential effects of development activities include direct habitat loss for bears, caribou, moose, waterfowl, small mammals and their predators, and other animals from gravel mining and oil field facilities, and indirect habitat loss through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other ancillary facilities, and by road and air traffic. Depending on location and season, oil and gas activities, and human conduct in areas where waterfowl, caribou, moose, bear and other species occur could result in increased disturbance and mortality to individual animals from routine aircraft operations, gravel-mining operations, presence of gravel pads and facilities, associated improved human access for vehicle and foot traffic from both workers and the general public.

For example, the National Research Council (2003) found that intensive oil and gas development on the North Slope has altered the distribution of female caribou during the summer insect season, and that elsewhere a network of roads, pipelines, and facilities has interfered with caribou movements between

coastal insect relief and inland feeding areas. Radio-collared female caribou west of the Sagavanirktok River shifted their calving concentration area from developed areas near the coast to undeveloped areas inland, to an area of lower green-plant biomass. During a six year period parturition rates of radio-collared females in regular contact with oil-field infrastructure were lower than those of undisturbed females, exacerbated by intense insect harassment during the period. Possible consequences of these disturbances include reduced nutrient acquisition and retention throughout the calving and midsummer periods, poorer condition in autumn, and a lowered probability of producing a calf the following spring (NRC 2003).

Disturbance and stress impacts would be similar to those discussed under Seismic Exploration, but would be more extensive and long term due to the yearlong exposure. Various species could be affected to some extent by disturbance events such as passage of aircraft, although most incidents are expected to result in negligible effects from which individuals would recover within hours to one day. However, the cumulative effect of repeated disturbance could extend for longer periods and potentially may adversely affect physiological condition, reproductive success, productivity, and the use of key seasonal and life function habitats.

Disturbance impacts to grizzly bears would be similar to those discussed under seismic impacts. A similar effect could occur from construction activities within 600 feet of dens. The National Research Council (2003) found that oil and gas activities on Alaska's North Slope had changed the demographics of the grizzly bear population. Harding and Nagy (1980) found that grizzly bears initially avoid human settlements because of the noise and disturbance, but if the area includes an important food source, some bears are likely to habituate to the noise and human presence, leading to an increase in encounters and mortalities.

Fox populations also increase, primarily because of the availability of human food sources. One concern is that increasing fox populations could affect regional populations of some bird species.

Development of infrastructure in the region would increase potential hunter access by road and airstrip and would enhance opportunity for both legal and unauthorized harvest of wildlife as well as introduce injury or mortality factors such as vehicle collisions. Contaminated food, hydrogen sulfide gas poisoning, and other oil-development related sources could contribute to increased wildlife mortality. Defense of life and property mortality for brown bears could increase with increase in human residence and increased presence of human food. Increased access to caribou, moose, bears, and migratory waterfowl for sport and subsistence hunting could increase the number of animals taken with the development of additional roads and landing strips.

Other effects on birds observed at other oil and gas sites in Alaska include shifts in nesting distribution of shorebirds and artificially high densities of ravens and gulls (NRC 2003).

Effects of Oil, Gasoline, or Diesel Spills - Oil or diesel spills and water treatment pits could negatively affect wildlife in several ways. Animals may be coated with oil or diesel and suffer from loss of thermal insulation, loss of flight capability, and buoyancy; breathe toxic aromatics; ingest oil during grooming; or absorb toxic hydrocarbons through the skin. Oil or diesel may be ingested through contamination of forage or prey.

Oil may adhere to birds' feathers, causing the feathers to lose their insulating capabilities, resulting in hypothermia (Patten et al. 1991). This effect would be particularly severe for birds that come in contact with water where feather integrity is necessary to maintain their water-repellent qualities and buoyancy. Birds could also suffer toxic effects from ingestion of oil by consumption of food contaminated by a spill or from oil ingestion resulting from preening oiled feathers (Hansen 1981). Oil contacting bird eggs could cause toxic effects to embryos (Patten and Patten 1979, Stickel and Dieter 1979). Oil could come in contact with eggs directly as a result of a spill, or indirectly from oiled feathers of incubating adults.

A spill occurring during the summer breeding, fledging, and molting seasons would have a greater impact on birds than a spill occurring during the winter, when most birds are on wintering grounds. Cleanup of spilled oil during periods when water is ice-covered or during periods of broken ice, and lingering oil may

be present and may be hazardous to spring migrating birds. Lingering effects from a winter spill could impact returning birds during the following breeding season if clean up activities did not adequately remove contaminants from bird habitats. In addition, oiled carcasses of dead birds could also be hazardous to scavenging birds and mammals.

Adult caribou may ingest, inhale, or absorb toxic hydrocarbons through the skin. The oiling of young calves could reduce their thermal insulation, leading to death (BLM and MMS 1998). Control and clean up operations at a spill site would frighten caribou and moose away from the spill and would limit the likelihood that they would ingest oiled vegetation.

If an oil spill were to contaminate grizzly bear habitat, some bears (and other predators and scavengers, such as bald eagles) would likely ingest contaminated food. An oiling experiment on captive polar bears indicated that if a bear's fur becomes oiled and the bear ingests a considerable amount of oil while grooming, kidney failure and other complications could lead to the bear's death (Oritsland et al. 1981). One young bear on the Shelikof Strait Coast in an area effected by the EXXON Valdez oil spill, was observed to have oil on its fur and to be consuming oil contaminated foods. The bear died with high concentrations of aromatic hydrocarbons in its bile and might have died from oil ingestion (Lewis and Sellers 1991).

Treatment - Clean up response may result in temporary disturbance and displacement of wildlife, or may put wildlife at risk. Bears in Katmai National Park were observed seeking out and rolling in fuel-contaminated soil that had been removed from a contaminated site and was being treated in another location (McClenahan 2006, Pers. Comm.). This behavior has been commonly observed in logging areas where equipment waste oil dump sites are used by bears in a similar way (Denton 2006, Pers. Comm.).

Chemical dispersants, used to treat spills, break up substances such as oil into small droplets. They contain surfactants. They should only be used when the associated impacts of dispersed oil are less harmful than non-dispersed oil. All wildlife in the dispersant target zone should be identified prior to approving the use of dispersants. Birds within the dispersant target zone should be hazed or they should be captured if they become contaminated. Dispersants should not be applied where there are large concentrations of birds (FWS 2005).

Locatable Minerals

This Alternative would anticipate the greatest exploration and development for locatable minerals given the revocation of all ANCSA 17(d)(1) withdrawals. Dependent on gold prices, a moderate increase in small placer operations on BLM-managed lands could occur during the life of this plan. Large operations could be possible, but would most likely occur on State or Native lands. Roads or infrastructure necessary for those operations, however, could cross BLM-managed lands.

Approximately 1,176,269 acres would be available for locatable mineral entry. Existing placer mining operations would continue. Approximately 3,999 acres would remain withdrawn due to other withdrawals. Existing mining operations and any future proposals for locatable minerals exploration and development would be subject to review and Required Operating Procedures through the administration of Plans of Operations. Measures to maintain the integrity of wildlife habitat in these areas would be implemented; and where unavoidable, compensation for habitat loss would be identified and required as part of the individual mine operating plan.

The Required Operating Procedures (ROPs) common to Alternatives B, C, and D are designed to minimize or prevent impacts to wildlife and wildlife habitats. Strict adherence to the ROPs would minimize effects to wildlife and wildlife habitat within the planning area. The protection provided to wildlife and wildlife habitat under Alternatives B, C, and D would be superior to that provided under Alternative A.

Salable Minerals (Mineral Materials)

Impacts to wildlife would be the same as under Impacts Common to All Alternatives. No impacts would be expected in areas withdrawn from mineral entry.

(4) Effects to Wildlife of Off-highway Vehicles (Alternative B)

Impacts to wildlife would be the same as those discussed under Common to All Alternatives. Under Alternative B, all lands would be open to OHV use, a vehicle weight limit of 2000 GVWR would exist, and there would be no route restrictions. In the Bay planning area, vehicles weighing 2000 GVWR currently are the vehicles of choice off established highways, and so establishing the vehicle weight limit would do little to change the current situation with regard to effects to wildlife and wildlife habitat. Lack of restrictions in this Alternative would mean that cross country travel would be allowed everywhere on BLM-administered lands within the Bay planning area. Wildlife harvest could potentially increase and impacts of access could affect important wildlife habitat, and access to important seasonal and life function habitats could still occur. Impacts from OHVs on fish and fish habitat might impact terrestrial predators and scavengers by altering availability, seasonal abundance, and distribution of important fish-related food resources.

(5) Effects to Wildlife of Recreation Experience Opportunities (Alternative B)

Under Alternative B, lands would be managed as roaded natural under the Recreation Opportunity spectrum. Impacts to wildlife would be the same as those in Alternative A.

(6) Effects to Wildlife of Recreation -Special Recreation Management Areas (Alternative B)

Under Alternative B, lands would be managed as an Extensive Recreation Management Area. Wildlife impacts would be mitigated with Required Operating Procedures, Stipulations, and other conservation actions.

(7) Effects to Wildlife of Visual Resource Management (Alternative B)

Under Alternative B, all lands would be managed under VRM class IV. This classification could result in fragmentation of wildlife habitat and may indirectly affect population distribution, productivity and movements.

(8) Effects to Wildlife of VRM in Special Management Areas (Alternative B)

Under Alternative B, no Special Management Areas are proposed. BLM lands would be managed under VRM class III. This classification could result in fragmentation of wildlife habitat and may indirectly affect population distribution, productivity and movements outside of the viewshed.

(9) Effects to Wildlife of Special Management Area Designations - Wild and Scenic Rivers Effects on Wildlife (Alternative B)

Under Alternative B, the impacts to wildlife would be the same as for Alternative A.

(10) Effects to Wildlife of Special Management Area Designations - Area of Critical Environmental Concern (Alternative B)

Impacts to wildlife would be the same as in Alternative A.

d) Effects to Wildlife for Alternative C***(1) Effects to Wildlife from Soil, Water, Air, and Vegetation Management (Alternative C)***

There would be beneficial impacts to wildlife from proper management of soils, water, and vegetation resources. Implementation of Required Operating Procedures, stipulations, and project-specific

requirements would reduce disturbance to wildlife habitats and would assist the recovery of habitat from permitted uses.

(2) Effects to Wildlife of Realty and Lands Actions (Alternative C)

Land Exchanges - Impacts to wildlife for land exchanges and acquisitions would be the same as for Alternative A.

Withdrawals - Actions addressing ANCSA 17(d)(1) withdrawals would be the same as in Alternative B, except for withdrawals on proposed wild river segments on the Alagnak, Goodnews mainstem and Goodnews Middle Fork (97,344 acres) would be retained until Congress had had an opportunity to act. This would be beneficial for wildlife habitat.

Rights-of-Way - Impacts to wildlife from Rights-of-Way would be the same as in Alternative A, with the exception that the proposed Bristol Bay and Carter Spit ACECs would be identified as avoidance areas. This would conserve important wildlife habitats and high interest species.

(3) Effects to Wildlife of Minerals (Alternative C)

Fluid Leasable Minerals

Under Alternative C, ANCSA 17(d)(1) withdrawals to mineral entry would be removed, with the exception of 15,125 acres in the Alagnak, Goodnews and Goodnews Middle Fork Rivers, where (d)(1) withdrawals would be retained until Congress has had an opportunity to act. The retention of the withdrawal would conserve wildlife habitat within these areas. Outside those areas, removal of the withdrawals could increase potential resource exploration and development and wildlife and habitat disturbing activities. Impacts to wildlife would be the same as under Impacts Common to all Alternatives.

Locatable and Salable Minerals (Alternative C)

Locatable Minerals - The effects to wildlife of Locatable Minerals would be the same as those in Alternative B, except segments of the Alagnak River, the mainstem of the Goodnews River, and the Goodnews Middle Fork, the proposed Carter Spit ACEC, and the proposed Bristol Bay ACEC would be closed to mineral entry. Conservation of these areas would benefit fish and wildlife by protecting important habitats.

Salable Minerals (Mineral Materials) - Same as Alternative A except the proposed Carter Spit ACEC, the proposed Bristol Bay ACEC, and segments of the Alagnak, Goodnews mainstem and Goodnews Middle Fork rivers proposed for Wild and Scenic River designation would be closed to mineral sales. This Alternative would provide the highest benefit to wildlife populations by protecting important river and coastal habitats.

(4) Effects to Wildlife of Off-highway Vehicles (Alternative C)

Under Alternative C, all lands would receive a "limited" designation for OHV use, which would require vehicles to stay on existing trails whenever possible. A vehicle weight limit of 2000 pounds would be proposed. These restrictions would benefit wildlife by reducing proliferation of trails and degradation of habitats, and would reduce the indirect impacts to wildlife created by noise and disturbance, causing abandonment from preferred habitats.

(5) Effects to Wildlife of Recreation Experience Opportunities (Alternative C)

Under Alternative C, the entire recreation area setting would be managed as semi-primitive motorized. Impacts to wildlife would be the same as those common to all Alternatives.

(6) Effects to Wildlife of Recreation - Special Recreation Management Areas (Alternative C)

Impacts to wildlife would be the same as those identified in Alternative B.

(7) Effects to Wildlife of Visual Resource Management (Alternative C)

Under Alternative C, portions of the planning area would be managed under VRM Class III up to 5 miles from established trail systems and National Conservation Units. All other BLM lands would be managed at VRM Class IV. This Alternative would offer some benefit to wildlife near areas where development is more restricted, but would still result in loss of habitat and restriction of movement to wildlife and may indirectly affect population distribution and productivity.

(8) Effects to Wildlife of Visual Resource Management in Special Management Areas (Alternative C)

Under Alternative C, lands in the proposed Carter Spit and Bristol Bay ACECs and the Alagnak, Goodnews and Middle Fork Goodnews proposed as National Wild and Scenic Rivers would be managed under VRM class III. This classification could result in less fragmentation of wildlife habitat and could indirectly positively affect population distribution, productivity and movements, and could benefit wildlife by conserving habitat within the viewshed in the two ACECs and three proposed Wild and Scenic Rivers.

(9) Effects to Wildlife of Special Management Area Designations - Wild and Scenic Rivers (Alternative C)

Under Alternative C, segments of the Alagnak, Goodnews mainstem and Middle Fork Goodnews rivers would be proposed as Wild and Scenic Rivers, closed to mineral exploration or development. These actions would be beneficial to wildlife by protecting riparian habitats from disturbance and providing undisturbed wildlife habitats to riparian species.

(10) Effects to Wildlife of Special Management Area Designations - Areas of Critical Environmental Concern (Alternative C)

Under Alternative C, the Carter Spit ACEC (62,862 acres) and the Bristol Bay ACEC (989,202 acres) would be proposed. These designations would benefit wildlife populations by proposing development of Habitat Management Plans that would to mitigate impacts from development and other resource uses.

e) Effects to Wildlife for Alternative D

(1) Effects to Wildlife from Soil, Water, Air, and Vegetation Management (Alternative D)

There would be beneficial impacts to wildlife from proper management of soils, water, and vegetation resources. Implementation of Required Operating Procedures, stipulations, and project-specific requirements would reduce disturbance to wildlife habitats and would assist the recovery of habitat from permitted uses.

(2) Effects to Wildlife of Realty and Lands Actions (Alternative D)

Land Exchanges - Impacts to wildlife habitat would be the same as those discussed for Alternative B.

Withdrawals - Impacts to wildlife habitats from removing ANCSA 17(d)(1) withdrawals would be the same as those in Alternative B.

Rights-of-Way - Impacts to wildlife from Rights-of-Way would be the same as those for Alternative A; however, the proposed Carter Spit ACEC would be identified as an avoidance area for Rights-of-Way.

(3) Effects to Wildlife of Minerals (Alternative D)

Leasable Minerals. Under Alternative D, ANCSA 17(d)(1) withdrawals would be removed. Because of the constraints currently in place under these withdrawals, removal of the withdrawals could increase potential resource development and wildlife and habitat disturbing activities. Impacts to wildlife would be the same as under Impacts Common to All Alternatives.

Portions of the leasable lands in the Goodnews Block and the Bristol Bay area would be open to leasing, subject to seasonal and other minor constraints (included in project-specific requirements). In addition, Required Operating Procedures and Stipulations would be required. However, impacts to wildlife in all Alternatives would still occur, but potentially to a lesser degree.

Locatable Minerals. Impacts to wildlife of Locatable Minerals would be the same as for Alternative B, except that the proposed Carter Spit ACEC would be subject to more stringent Required Operating Procedures and project-specific requirements.

Salable Materials (Mineral Materials). Impacts to wildlife would be the same as for Alternative B, except the Carter Spit ACEC (62,862 acres) would be closed to mineral sales. This Alternative would benefit wildlife populations by protecting important riverine and coastal habitats.

(4) Effects to Wildlife of Off-highway Vehicles (Alternative D)

Under Alternative D, all lands would be designated as limited to OHV use, which requires vehicles to stay on existing trails whenever possible. A maximum vehicle weight of 2000 pounds would be designated. These restrictions would benefit wildlife by reducing the proliferation of trails and degradation of habitats, and would reduce the indirect impacts to wildlife of noise and disturbance, and wildlife abandonment from preferred habitats. In addition, OHV limitations in the proposed Carter Spit ACEC would be developed to meet the proposed objectives of the Special Management Area. These limitations would benefit wildlife by protecting riverine and coastal habitats in the ACEC.

(5) Effects to Wildlife of Recreation Experience Opportunities (Alternative D)

Impacts to wildlife would be the same as those discussed in Alternative C.

(6) Effects to Wildlife of Recreation - Special Recreation Management Areas (Alternative D)

Impacts to wildlife would be the same as those discussed in Alternative B.

(7) Effects to Wildlife from Visual Resource Management Effects on Wildlife (Alternative D)

Under Alternative D, portions of the planning area would be managed under VRM Class III up to 1 mile from certain rivers and National Conservation Units. All other BLM lands would be managed at VRM Class IV. This Alternative would offer some benefit to wildlife near areas where development is more restricted, but would still result in loss of habitat and restriction of movement to wildlife and could indirectly affect population distribution and productivity. This Alternative would offer less protection to wildlife than Alternative C, but more than Alternatives A and B.

(8) Effects to Wildlife from VRM in Special Management Areas (Alternative D)

Under Alternative D, lands in the Carter Spit would be managed under VRM Class III. This classification could result in less fragmentation of wildlife habitat and may indirectly affect population distribution, productivity and movements, and would benefit wildlife by conserving habitat within the Carter Spit ACEC. This Alternative would provide less wildlife habitat conservation than Alternative C, but more than Alternative A or B.

(9) Effects to Wildlife from Special Management Area Designations - Wild and Scenic Rivers (Alternative D)

Impacts to wildlife would be the same as in Alternative A.

(10) Effects to Wildlife from Special Management Area Designations -Area of Critical Environmental Concern (Alternative D)

Under Alternative D, the Carter Spit ACEC (62,862 acres) would be proposed. This designation would benefit wildlife populations in this area by preparing a Habitat Management Plan that would further plan to mitigate impacts from development and other resource uses.

6. Direct and Indirect Effects for Special Status Species: Fish, Wildlife, and Vegetation Species

Direct and Indirect Effects for Special Status Fish Species

There are no known Special Status fish species in the Bay planning area.

Direct and Indirect Effects for Special Status Wildlife Species

Proposed management of the following resources, resource uses or programs would have no anticipated effects on Special Status Animal Species: Cultural Resources, Paleontological Resources, Visual Resources, Forest Products, Fisheries Management, Wild and Scenic Rivers, Social and Economic Conditions, and Subsistence.

a) Direct and Indirect Effects to Special Status Wildlife Species Common to All Alternatives

(1) Effects to Listed Species (Common to All)

Four listed species are present or potentially present in the Bay planning area: *Numenius borealis*, the Eskimo curlew (extremely rare or extinct; has not been seen in the Bay planning area); *Polystricte stelleri*, Steller's eider; *Eumetopias jubatus*, Steller sea lion (there are no sea lion haulouts on BLM lands in the Bay planning area); and *Somateria fischeri*, spectacled eider. Of those, the Eskimo curlew is an "accidental species," or one that does not breed regularly or occur annually in western North America. Curlews are shorebirds that breed in tundra-covered mountainous areas in summer and winter on ocean beaches.

The Steller sea lion is not likely to be found on BLM lands in the Bay planning area. The only ocean beaches under BLM jurisdiction in the planning area are in Goodnews block, and there are no known sea lion haulouts on coastal BLM lands there.

The Steller's eider and the spectacled eider are diving ducks. They inhabit coastal tundra habitats during spring and fall migration. They spend much of their lives at sea. The Carter Spit area and the adjacent spits and wetlands in the Goodnews Block are important to the Steller's eider and the spectacled eider, which are present during spring and fall migration. The area provides important staging and tundra nesting, molting and brooding habitat (Larned 1998, Seppi 1997, Shaw et al. 2005) among the tundra lakes and ponds.

(2) Effects to Special Status Wildlife Species from Soil, Water, Air, and Vegetation (Common to all)

Wildlife Special Status Species would benefit from proper management of soil, water, air and vegetation resources in the planning area. Implementation of mitigation measures to protect these resources on a

project-specific basis would reduce disturbance to habitat of special status wildlife and would facilitate the recovery of habitat from permitted uses.

(3) Effects to Special Status Wildlife Species from Fire and Fire Management (Common to all)

Listed Species - Effects on Steller's and spectacled eiders are described in more detail in the Land Use Plan Amendment for Wildland Fire and Fuels Management for Alaska Environmental Assessment (BLM 2004). Both of these species are Federally listed as threatened.

Fire within the breeding habitat of either eider species could have negative effects on the breeding population. However, fire frequency in the wet tundra habitat of the coastal Bay planning area is very low, and the threat of wildland fires to the breeding population of Steller's and spectacled eider and their habitat is negligible. Since fire frequency is so low in these habitats, no fire suppression activity would be likely to occur on BLM-administered lands and there would be no impacts from suppression activities to eiders or their habitat. There is no designated critical habitat within the Bay planning area.

Candidate Species - Fire within the breeding habitat of Kittlitz's murrelet, which uses talus slopes of high mountain habitats for nesting, could have negative effects on the breeding populations. However, fire is rare in these mountainous habitats, and there is rarely adequate vegetation to burn on unstable rock falls and talus slopes. The threat of wildland fire to breeding Kittlitz's murrelet is negligible. Since fire frequency is so low in these habitats, no fire suppression activity would be likely to occur and there would be no impacts from suppression activities. Other than nesting, this bird inhabits ocean waters and bays, and so would not otherwise be impacted by fire or fire suppression activities.

BLM Sensitive Species - Some sensitive species would benefit from fire suppression that minimizes loss of individuals, populations, or habitats. However, fire suppression activities can also affect sensitive species through mortality, disturbance, displacement, and damage or alteration of key habitat components (BLM 2004b).

It is difficult to generalize impacts of fire on passerine birds due to the great variety of habitat requirements. Shrub communities often support the greatest number and diversity of passerine birds (Spindler and Kessel 1980, Kessel 1989). Shrub communities are maintained by periodic fires. Within forested areas, fire creates openings in the forest and provides snags used for nesting, perching, and foraging. Fire may cause direct impacts to birds when it occurs during the nesting season, killing nestlings and destroying nests. Raptors may benefit from fire due to increased populations of small mammals and birds in response to vegetative changes after fire. The timing of the benefit varies depending upon the type of prey favored by the raptor. Over the short-term, fires reduce cover available for prey species, making them more visible to hunting raptors and other predators.

Fire suppression activities also cause both direct and indirect impacts to wildlife. Wildlife habitat may be destroyed, fragmented, or degraded due to construction of fire breaks or use of OHVs. Small mammals may be killed by the use of mechanized equipment. Mitigation measures designed to reduce the impacts of suppression activities include limitations on the use of tracked, or off-road vehicles; measures to prevent the introduction of invasive or noxious plant species; establishment of riparian buffer zones; and rehabilitation of fire and dozer lines. These types of impacts are expected to be minimal within the planning area as most BLM-managed lands are well removed from the road system, minimizing the potential for the use of mechanized equipment.

Potential direct and indirect effects from fire management include:

- Mortality or injury of adults, young, or eggs from smoke inhalation, or crushing by vehicles or equipment used during fire management activities.
- Disturbance or displacement of individuals from smoke, noise, and other human activities associated with fire management operations. This disturbance or displacement may affect foraging, roosting, or reproductive behavior.
- Nest abandonment or mortality of young, resulting in the loss of one year's recruitment.
- Loss or conversion of key habitat components needed for nesting, foraging, roosting, or cover.

- Creation of key habitat components.
- Increased risk of predation associated with removal of cover.
- Changes in the quantity or quality of available forage and prey species.
- Long-term changes in habitat quality or quantity for nesting, roosting, foraging, or cover that affects the ability of a species continuing to occupy an area or facilitating the return of a species to its historic range.

(4) Effects to Special Status Wildlife Species from Livestock Grazing (Common to all)

Special Status wildlife species that are found or that have the potential to be found in the Bay planning area are birds, which are only present during spring and fall migration for feeding, molting and brooding, generally in the Goodnews Block of BLM-administered lands. Currently there are no livestock grazing or reindeer herding operations in the Bay planning area, and no interest has been expressed for decades. It is unlikely that this type of activity would be a source of impact. Should such activities take place, potential impacts might include trampling of vegetation, cratering and exposure of mineral soils by grazing animals, potential direct mortality of nestling birds or eggs of ground nesting species due to trampling by grazing animals, or by OHVs used in association with herding activities.

(5) Effects to Special Status Wildlife Species from Minerals (Common to all)

Locatable Minerals. Some mining exploration and development activity could occur under any Alternative. Potential impacts to Special Status wildlife would include temporary disturbance or displacement in very localized areas, temporary loss of habitat, long-term degradation of habitat, and possible direct mortality of nestling birds or eggs. These impacts would be minimal due to the low level of activity anticipated, and the temporary nature of the activity.

Mineral Materials. *Impacts from mineral material acquisition and disposal would be negligible under all Alternatives. Sufficient material sources exist on State and private lands located nearer to most communities than BLM-administered lands. One exception is mineral materials needed for oil and gas development. These impacts are discussed under fluid leasable minerals, Alternatives B, C, and D.*

(6) Effects to Special Status Wildlife Species from Recreation Management (Common to all)

Minor impacts to Special Status wildlife could occur from both commercial and non-commercial recreation activities under all Alternatives. The primary impacts would be temporary stress and displacement of individual animals due to recreational activities, or to recreation associated access such as aircraft overflight and landing in remote areas. In areas that are repeatedly used for camping sites, there may be minor, site-specific degradation of habitat. OHV use associated with commercial recreational activities could occasionally result in mortality of nestlings and eggs of ground nesting birds. Given the low to moderate level of recreational use on most BLM-managed lands within the planning area, these impacts would be minimal and would not have population level effects.

(7) Effects to Special Status Wildlife Species from Renewable Energy (Common to all)

Impacts to Special Status wildlife would be the same as those described under wildlife, common to all Alternatives. There is a potential for bird mortality due to collisions with wind turbines. Some of the avian mortality could involve Special Status Species, particularly if wind-generating facilities were located within breeding habitats for these species. Since BLM unencumbered lands in the Bay planning area are fairly remote from villages, use of BLM lands for development of such projects is unlikely during the life of this plan.

(8) Effects to Special Status Wildlife Species from Lands and Realty Actions (Common to all)

Upon completion of conveying BLM selected lands to the State and Native corporations, anticipated by 2010, only approximately 5% of lands in the Bay planning area will remain in BLM jurisdiction. These lands are generally remote, and the numbers and kinds of Realty actions that will be required would be limited under any Alternative. While there would be both direct and indirect impacts to Special Status wildlife under all Alternatives, including temporary displacement and disturbance during activities authorized under this program, those impacts would be expected to be low, and to affect a very small percentage of BLM-managed land in the planning area. Impacts would vary among species depending on the proposal, the species' range, life history, and habitat preferences.

b) Effects to Special Status Wildlife Species for Alternative A

(1) Effects to Special Status Wildlife Species from Soil, Water, Air, and Vegetation (Alternative A)

Impacts would be the same as they are today. Proposals would be managed on a case-by-case basis. Projects would have project-specific guidelines.

(2) Effects to Special Status Wildlife Species from Livestock Grazing (Alternative A)

Impacts would be the same as they are today. Proposals would be managed on a case-by-case basis. Projects would have project-specific guidelines.

(3) Effects to Special Status Wildlife Species from Minerals (Alternative A)

Leasable Minerals. No impacts to Special Status wildlife under this Alternative would occur because all BLM lands in the Bay planning area would remain withdrawn from Leasable Mineral entry under ANCSA 17(d)(1).

Locatable Minerals. Impacts to Special Status wildlife under this Alternative from locatable minerals would be similar to those for leasable minerals. Most of the BLM lands in the Bay planning area would remain withdrawn from Locatable Mineral entry under ANCSA 17(d)(1).

Salable Minerals. Impacts to wildlife would be the same as for Locatable Minerals. No impacts would be expected in areas withdrawn from mineral entry.

(4) Effects to Special Status Wildlife Species from Recreation Management (Alternative A)

There would be minor impacts to special status wildlife from both commercial and non-commercial recreation activities. The primary impacts would be temporary stress and displacement of individual animals due to recreational activities, or to recreation associated access, such as aircraft overflight and landing in remote areas. In areas that are repeatedly used for camping sites, there may be minor, site-specific degradation of habitat. OHV use associated with commercial recreational activities could occasionally result in mortality of nestlings and eggs of ground nesting birds. Recreational use of most BLM-managed lands within the planning area is believed to be low to moderate. The described impacts would be expected to be minimal and would not have population level effects.

(5) Effects to Special Status Wildlife Species from Travel Management (Alternative A)

The planning area would remain undesignated with regard to OHV use, and so the impacts would remain similar to today, with some possible increase in intensity should population increase. Currently effects from OHVs on BLM-administered lands is limited to areas immediately adjacent to villages, to areas between the Alagnak River and Lake Iliamna, and to portions of the Goodnews Block. Most access to BLM unencumbered lands is by aircraft or by boat. No vehicle weight limits would be recommended; however, off-road vehicles in use today on the remote BLM-administered lands in the Bay planning area

are 2,000 pounds GVWR. Impacts from heavier vehicles would not be expected during the life of this plan.

(6) Effects to Special Status Wildlife Species from Special Designations (Alternative A)

No ACECs or Wild and Scenic River designations would be proposed under this Alternative.

c) Effects to Special Status Wildlife Species for Alternative B

(1) Effects to Special Status Wildlife Species from Soil, Water, Air, and Vegetation Management (Alternative B)

There would be beneficial impacts to special status wildlife from proper management of soils, water, air, and vegetation resources. Implementation of Stipulations and Required Operating Procedures would reduce disturbance to special status wildlife habitats and assist in the recovery of habitat from permitted uses. Proactive management of vegetative resources would benefit Special Status wildlife. Vegetation would be managed to maintain a diversity of habitats. Proactive management to prevent introduction and spread of invasive and noxious plants would help maintain habitats in good condition.

(2) Effects to Special Status Wildlife Species from Livestock Grazing (Alternative B)

Impacts would be the same as discussed under Common to All Alternatives.

(3) Effects to Special Status Wildlife Species from Minerals (Alternative B)

Leasable Minerals

Under this Alternative, ANCSA 17(d)(1) withdrawals would be removed, and all unencumbered BLM lands would be open for mineral leasing. Potential impacts would be of several kinds:

Seismic Exploration - Seismic exploration would only occur in the Koggiling Block, in the south central portion of the planning area, during the life of this plan based on the Reasonable Foreseeable Development Scenario. This area includes habitat for the geese and the trumpeter swan, the eiders, the sea ducks, the gray-cheeked thrush, and the olive-sided flycatcher. In the event that seismic exploration occurs during the winter months, there would be no effect on these species as they are not present in the planning area at this time.

However, summer geophysical work, including field sampling would involve helicopter support and could have negative effects on these species depending on the location of the work in relation to their habitat. Summer seismic work, including aircraft overflights would have temporary and non-lethal effects on special status wildlife, the effects probably lasting less than an hour (BLM 2003b). Elevated activity and air traffic in the vicinity of large summer camps could result in minor impacts on both local and regional populations of these species. The Steller's eider, the spectacled eider, all but two of the other sea ducks, the geese, and the trumpeter swan are ground nesters in tundra habitats. The eggs and the nestlings could be susceptible to trampling or crushing. Depending on the nature of the effects and the nature and duration of behavioral changes caused by disturbance, such effects could be considered a "taking" under the Endangered Species Act for the listed species.

It is not known if lynx, a sensitive species, inhabit the Koggiling Creek block, which is largely a tundra environment. Isolated patches of forest along drainages may provide sufficient habitat for lynx, who seek boreal forest settings. Lynx have been observed at Brooks River in Katmai National Park, for example. Lynx may be temporarily disturbed or displaced by seismic activities, with reoccupation of the area after the exploration activities are complete.

Indirect impacts to special status wildlife from seismic operations may include degradation of habitat through impacts to soil and vegetation. These types of impacts would be minimized by implementation of the Stipulations and Required Operating Procedures, including limiting seismic exploration to the winter when many of these species are not present.

Exploratory Drilling for Oil and Gas - Based on the Reasonable Foreseeable Development Scenario for oil and gas, exploratory drilling would only be expected to occur in the Koggiling Block in the planning area, which may be utilized seasonally by migratory waterfowl, including the Federally- listed threatened Steller's eider and spectacled eider, and by a number of sensitive migratory waterfowl species, including the Tule white-fronted goose, the dusky Canada goose, isolated instances of the trumpeter swan (whose summer concentrations tend to be northeast of Koggiling Block) (Seppi 2006, Pers. Comm.), the king eider, the long-tailed duck, the black scoter, the surf scoter, and the red-throated loon. Other migratory waterfowl on the sensitive species list would be considered to be rare or accidental visitors to the Koggiling Block. Sensitive species of land birds that may be found in the Koggiling Block include the rusty blackbird, the gray-cheeked thrush, the olive-sided flycatcher, and the blackpoll warbler. The American peregrine falcon and the Arctic peregrine falcon, two sensitive species, might also be present in the Koggiling Block. All of these birds, if present, are in this area during spring through fall. Exploratory drilling in the Koggiling Block if carried out in the winter would not affect these species. Lynx, a possible year-round inhabitant of the Koggiling Block, may be temporarily disturbed or displaced by exploratory drilling, with reoccupation of the area after the exploration activities are complete.

Oil and Gas Development - Although construction would occur primarily during winter, development would bring year-round facilities and activities to the Koggiling Block in the planning area, which includes seasonal habitat for migratory waterfowl, including the Federally- listed threatened Steller's eider and spectacled eider, and for a number of sensitive migratory waterfowl species, including the Tule white-fronted goose, the dusky Canada goose, isolated instances of the trumpeter swan (whose summer concentrations tend to be northeast of Koggiling Block), the king eider, the long-tailed duck, the black scoter, the surf scoter, and the red-throated loon. Other migratory waterfowl on the sensitive species list would be considered to be rare or accidental visitors to the Koggiling Block. Sensitive species of land birds that may be found in the Koggiling Block include the gray-cheeked thrush, the olive-sided flycatcher, and the blackpoll warbler. The American peregrine falcon and the Arctic peregrine falcon, two sensitive species, might also be present in the Koggiling Block. All of these birds, if present, are in this area during spring through fall. Oil and gas development in the Koggiling Block would have the potential to affect these species directly and indirectly. Lynx, a shy creature and a possible year-round inhabitant of the Koggiling Block, would also be potentially affected. Potential sources of disturbance would be ground vehicles, humans on foot, and low-flying aircraft associated with oil development. Potential effects would include direct and indirect habitat loss. Direct loss of habitat would result from gravel mining and gravel deposition on the tundra for roads, pads, and airstrips. Indirect habitat loss could occur through reduced access caused by physical or behavioral barriers created by roads, pipelines, and other facilities.

The oil and gas development activities with the greatest potential for causing loss of habitat are gravel mining and placement (BLM 2005b). Roads and pads are constructed using gravel, and tundra covered by gravel would no longer be available for nesting, brood-rearing, or foraging for those tundra-nesting threatened and sensitive migratory waterfowl species listed above and others that use this habitat. This loss of habitat would continue for as long as the proposed development was in operation. If abandonment plans called for allowing gravel pads and roads to "bed" naturally, loss of habitat might extend considerably longer than the end of the operational life of the field. Under this Alternative, development of one gas discovery could affect approximately 1,280 acres in the Koggiling Block. Because of the density of migratory waterfowl use of this area, this potential loss of breeding, feeding and staging habitat for most species would likely result in some population effects. To provide perspective, there are 159,732 acres of unencumbered BLM land in the Koggiling Block, of which 48,230 acres or roughly 30%, are wetlands and open water (lakes, ponds, streams and rivers).

Steller's and spectacled eiders may use the Koggiling Block during spring migration and during fall migration for feeding, molting and staging. Currently Steller's eiders and spectacled eiders breed along the coastal fringe of the Yukon-Kuskokwim Delta, and so, while a few may breed and brood in the planning area, no impacts to eiders at a population level are anticipated.

Effects of Oil, Gasoline, or Diesel Spills - The Reasonable Foreseeable Development Scenario for Oil and Gas development in the planning area includes assumptions that only one field would be developed over the life of the plan, and it would be natural gas. Potential impacts related to this field would include potential associated mechanical equipment and storage facility spills (for example, fuel bladders). Impacts to special status species would be similar to those discussed under Wildlife, Effects of Spills in a previous section. Most of the BLM sensitive species occurring in the planning area are migratory birds that are only found in the area from spring through fall. The area where an oil or diesel spill might occur includes habitat for migratory waterfowl, including the Federally-listed threatened Steller's eider and spectacled eider, and for a number of sensitive migratory waterfowl species, including the Tule white-fronted goose, the dusky Canada goose, isolated instances of the trumpeter swan (whose summer concentrations tend to be northeast of Koggiling Block) (Seppi 2006, Pers. Comm.), the king eider, the long-tailed duck, the black scoter, the surf scoter, and the red-throated loon. Other migratory waterfowl on the sensitive species list would be considered to be rare or accidental visitors to the Koggiling Block. Sensitive species of land birds that may be found in the Koggiling Block include the gray-cheeked thrush, the olive-sided flycatcher, and the blackpoll warbler. The American peregrine falcon and the Arctic peregrine falcon, two sensitive species, might also be present in the Koggiling Block. All of these birds, if present, are in this area during spring through fall. The Canada Lynx might also be present in the Koggiling Block. Oil spills onto tundra, into freshwater, or into marine habitats could negatively impact these species. Birds may be oiled, causing feathers to lose their insulating ability, resulting in hypothermia. This effect would be more severe in fresh water and marine habitats than in tundra habitats. Birds could also suffer toxic effects from inhalation of hydrocarbon aromatics and from ingestion of oil from preening or oil contaminated foods (Hansen 1981). Oil contacting bird eggs could cause toxic effects to embryos (Patten and Patten 1979, Stickel and Dieter 1979).

A spill occurring in the spring to fall migrating, staging, breeding, molting season would have greater impact than a spill occurring during the winter when most of these species are on wintering grounds. However, lingering effects from a winter spill could impact birds during the following breeding season.

Steller's and spectacled eiders are believed to breed outside of the Koggiling Block of the Bristol Bay area, but likely migrate through the area. Although it is outside of their primary breeding area on the Yukon-Kuskokwim Delta, it is possible that a few Steller's or spectacled eiders breed in the area; however, they do move through the area during migratory seasons (Seppi 2006, Pers. Comm.), and so a few individual eiders could potentially be affected by a spill.

Locatable Minerals

Impacts would be the similar to those discussed under Impacts Common to All Alternatives. However, under Alternative B, ANCSA 17(d)(1) withdrawals would be removed and lands currently closed to locatable mineral exploration and development would be open. Based on the Reasonable Foreseeable Development Scenario for Locatable Minerals (RFD), two types of mining activity could take place in the Bay planning area, lode mineral exploration and development and placer mining. Should locatable mineral activity occur on every existing operation, an estimated total of 115 acres could potentially be disturbed in the Bay planning area, including 14 acres on BLM unencumbered land, 36 acres on State-selected land, 47 acres on Native-selected land, and 18 acres on active Federal claims on Native land. These existing operations are all small. While removal of the ANCSA 17(d)(1) withdrawals would open BLM unencumbered lands to the potential for more mineral exploration and development, it is most likely that should any placer mining projects occur they would occur at sites of existing operations, at locations where mineral deposits are already known to exist.

Lode Mineral Activities - Lode mineral activities in the Goodnews Bay area could occur on BLM unencumbered lands at Tatlignagpeke Mountain and at Mitlak Mountain within the life of this plan. The RFD suggests that the platinum group elements (PGE) content of Tatlignagpeke Mountain might be explored during the life of this plan, with disturbance on BLM unencumbered land projected sometime before 2026.

Additionally, lode activities could occur on Native-selected lands at the Wattamuse-Granite Lode property, in the Kasna Creek area at South Current Creek and Upper South Current Creek properties, in the Kijik Lake area at the Dicks Lode, Gull, and Kijik Mountain properties, and in the Pebble Copper area at Hill 1759. On State-selected lands, lode operations could occur in the Iliamna/Fog area at the Dutton, Easy, Karen, and Meadow properties.

While migratory waterfowl move through the Goodnews Bay corridor in very large numbers during migratory seasons and many of the species listed above can be found nesting on BLM lands in the Goodnews Block, they probably would be unlikely to be found in these mountainous areas. However, BLM sensitive species that might seek out this kind of habitat during breeding and nesting season are the rare Kittlitz's murrelet, the marbled murrelet and the harlequin duck, all of which are sea birds that nest inland at higher elevations. The sensitive American peregrine falcon and the arctic peregrine falcon might also be found in these areas.

Overall, projected lode mineral activities on BLM lands in the Bay planning area are not anticipated to have a population-level effect on any BLM Special Status animal species during the life of this plan.

Placer Mineral Activities - Placer mineral activities in the Goodnews Bay area could occur at the Barnum Creek, Domingo Creek, Faro Creek, and Jacksmith Creek Tributary on BLM unencumbered land, which could result in surface disturbance to a total of 14 acres of BLM unencumbered lands. Placer activities on selected land includes Slate Creek, which could result in disturbance to a total of 36 acres on selected land. Placer activities on the Arolik River, Malaria Creek, Snow Gulch, Tyrone Creek, and Wattamuse Creek in the Goodnews area, and lands in the Iliamna/Fog area and unnamed property west of Chekok on selected land could impact up to 47 acres of selected land. An additional 18 acres on active Federal claims on Native land could be disturbed on the Salmon River.

All locatable mineral related activities occurring on BLM-managed land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to have an approved Plan of Operations which contains site-specific guidelines as listed in the BLM-Alaska Required Operating Procedures. All operations are required to meet applicable Federal and State air and water quality standards for permitting. Placer mineral activities are not expected to have population-level effects on any BLM Special Status animal species during the life of this plan.

Salable Minerals (Mineral Materials)

Salable material (sand and gravel) activities on Federally administered surface/minerals and split estate are available for exploration and development unless specifically closed by Public Land Order (PLO). Approximately 1,176,269 acres of BLM unencumbered lands are available for the sale of mineral materials. Native-selected lands would be made available if their selections are revoked or relinquished. An additional 3,000 acres are closed to material sales due to withdrawals other than 17(d)(1).

As discussed in a previous section, sand and gravel would be needed for the construction of access roads and gravel pads should oil and gas exploration and development go forward in the Koggiling Block sometime in the future. Since the entire Bay planning area consists of glacial rubble, large reserves of salable material exist on State and Native land, much of it in greater proximity to villages and potential oil and gas project sites than BLM unencumbered lands. No disturbance of BLM unencumbered land is anticipated for this purpose during the life of this plan. Should BLM unencumbered land be judged to be the closer and more practical source of these materials for an oil and gas-related project, because the materials are so common, borrow pits can be selected carefully so as to avoid impacts to other resources.

Should they occur, mineral materials projects would require an approved Plan of Operations containing Required Operating Procedures based on site-specific resource concerns and would be subject to all BLM and State laws and regulations. No effects from mineral materials projects to BLM Special Status animal species are anticipated during the life of this plan.

(4) Effects to Special Status Wildlife Species from Recreation Management (Alternative B)

Impacts would be the same as discussed under Alternative A.

(5) Effects to Special Status Wildlife Species from Travel Management (Alternative B)

Impacts would be the same as discussed under Alternative A.

(6) Effects to Special Status Wildlife Species from Special Designations (Alternative B)

No special designations would be proposed under Alternative B.

d) Effects to Special Status Wildlife Species for Alternative C

(1) Effects to Special Status Wildlife Species from Soil, Water, Air, and Vegetation (Alternative C)

Impacts would be the same as discussed under Alternative A.

(2) Effects to Special Status Wildlife Species from Livestock Grazing (Alternative C)

Impacts would be the same as discussed under Alternative A.

(3) Effects to Special Status Wildlife Species from Minerals (Alternative C)

Leasable Minerals. Impacts to Special Status wildlife species from Leasable Mineral activities would be greater than in Alternative A, and would be similar to those in Alternative B. Based on the Reasonable Foreseeable Development Scenario, Leasable Mineral exploration and development would consist of one site, potentially located in the Koggiling Creek Block of BLM unencumbered land, for gas exploration and development. Development probably would not occur during the life of the plan. Because it is part of a proposed Area of Critical Environmental Concern, any project proposal for this location would include Stipulations, Required Operating Procedures, and project-specific requirements.

Locatable Minerals. Impacts to Special Status wildlife under this Alternative would be the same as discussed under Alternative B. However, based on the Reasonable Foreseeable Development Scenario, proposed projects would be expected to most likely occur on BLM unencumbered lands in the Goodnews Block, outside of the proposed Carter Spit ACEC. Two types of Locatable Mineral activity could occur, exploration and development of placer mines, and exploration and development of lode mines. No Special Status wildlife species would be expected to be affected by placer mining in the Goodnews Block; however, the Kittlitz's murrelet nests along most coastal regions from southwestern to western Alaska (Day et al. 1999). The scarcity of breeding records makes determination of exact breeding range difficult. Nesting habitat consists of unvegetated scree slopes or steep, rocky slopes. Nesting sites are most often inland, up to 16 miles from the coast (Kessel 1989). This species is sparsely distributed within the planning area. 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-administered lands in the Goodnews block. To date no Kittlitz's murrelets have been observed nesting in that area.

Salable Minerals. Impacts from Mineral Materials would be the least under Alternatives A and C. The Carter Spit and Bristol Bay ACECs would be closed to use of Salable Minerals. Additionally, because of the ready availability of mineral materials from State and Native corporation lands, it is unlikely that BLM-administered lands would be utilized for their extraction for oil and gas or other infrastructure-development projects. The Koggiling Block, potential site of future oil and gas development, is located in the proposed Bristol Bay ACEC. It would be closed to development of Mineral Materials, which would have to be brought in from lands other than BLM unencumbered lands in this area.

(4) Effects to Special Status Wildlife Species from Recreation Management (Alternative C)

Impacts would be the same as discussed under Impacts Common to All Alternatives.

(5) Effects to Special Status Wildlife Species from Travel Management (Alternative C)

Impacts to special status wildlife from OHV use and travel management would be similar to that discussed under Common to All Alternatives but would be fewer because the planning area would be designated as “limited” to designated roads and trails. Additional restrictions such as seasonal closures might be implemented within ACECs. The proposed Carter Spit ACEC and Bristol Bay ACEC could receive additional protection from OHV impacts.

(6) Effects to Special Status Wildlife Species from Lands and Realty (Alternative C)

Impacts would be the same as under Impacts Common to All Alternatives.

(7) Effects to Special Status Wildlife Species from Special Designations (Alternative C)

Designation of 1,052,065 acres as ACECs and proposing an additional 15,125 acres as Wild Rivers would provide additional protection of special habitats. Designation of the two ACECs would provide protection to the threatened Steller’s eider and spectacled eider and to the list of sensitive migratory birds that utilize the flyways that pass through the Goodnews Bay and Bristol Bay areas for feeding, resting, and molting during the spring and fall migrations, and some that use the areas for nesting and brooding.

Determination of three river segments as suitable for designation as wild under the WSR Act would provide some additional protection of habitats for Special Status Species using these habitats.

e) Effects to Special Status Wildlife Species for Alternative D

(1) Effects to Special Status Wildlife Species from Soil, Water, Air, and Vegetation (Alternative D)

Impacts would be the same as discussed under Impacts Common to All Alternatives.

(2) Effects to Special Status Wildlife Species from Livestock Grazing (Alternative D)

Impacts would be the same as discussed under Impacts Common to All Alternatives.

(3) Effects to Special Status Wildlife Species from Minerals (Alternative D)

Leasable Minerals. Impacts would be the same as discussed under Alternative C, except that no Bristol Bay ACEC would be proposed. However, the Koggiling Creek Block would be open to Leasable Mineral exploration and development subject to seasonal and other minor constraints as well as Stipulations and Required Operating Procedures.

Locatable Minerals. Impacts would be the same as discussed under Alternative C, except that no Bristol Bay ACEC would be proposed. Locatable Mineral projects would be expected to be outside of the proposed Carter Spit ACEC.

Salable Minerals. Impacts would be the same as discussed under Alternative B. The Carter Spit ACEC would be closed to Salable Minerals.

(4) Effects to Special Status Wildlife Species from Recreation Management (Alternative D)

Impacts from Recreation Management would be the same as discussed in Alternative C.

(5) Effects to Special Status Wildlife Species from Travel Management (Alternative D)

Impacts from Travel Management would be the same as discussed in Alternative C.

(6) Effects to Special Status Wildlife Species from Lands and Realty (Alternative D)

Impacts would be the same as discussed in Alternative B.

(7) Effects to Special Status Wildlife Species from Special Designations (Alternative D)

Impacts to Special Status wildlife would be similar to those discussed under Alternative C except that only one ACEC, the Carter Spit ACEC, would be proposed, and no rivers would be determined suitable. There would be less protection of waterfowl habitat on portions of the Alagnak and Goodnews rivers and in the Bristol Bay area.

Direct and Indirect Effects for Special Status Vegetation and Rare Vegetation Species

Proposed management of the following resources, resource uses or programs would have no anticipated effects on Special Status Plants: Cultural Resources, Paleontological Resources, Visual Resources, Forest Products, Renewable Energy, Lands and Realty Actions, Wildlife and Wildlife Habitat, Fisheries Management, Wild and Scenic Rivers, Social and Economic Conditions, and Subsistence.

a) Direct and Indirect Effects to Special Status Vegetation Species Common to All Alternatives

One BLM Sensitive Species of plant is located within the planning area, *Smelowskia pyriformis*, or pear-fruited smelowskia. It has been located in the western Alaska Range north of the planning area and in the southernmost Kuskokwim Mountains in the Goodnews Bay region (Drury and Rollins 1952; Hultén 1968; Murray 1981; Murray and Lipkin 1987; Parker 1994; Rollins 1993; Welsh 1974).

(1) Effects to Special Status Vegetation Species from Soil, Water, Air, and Vegetation (Common to all)

Special Status Species of plants would benefit from proper management of soil, water, air and vegetation resources in the planning area. Implementation of mitigation measures to protect these resources on a project-specific basis would reduce disturbance to habitat of special status plants and would facilitate the recovery of habitat from permitted uses.

(2) Effects to Special Status Vegetation Species from Wildlife (Common to all)

Special Status plants would benefit indirectly as a result of protecting wildlife habitats and mitigating impacts to wildlife habitat through the NEPA and permitting processes.

(3) Effects to Special Status Vegetation Species from Fire and Fire Management (Common to all)

It is unlikely for the Bay planning area that the issue of whether or not the smelowskia would benefit from fire suppression activities, or whether fire is a natural and beneficial part of the plant's natural history would arise. The known plants' habitat consists of isolated, steep, sparsely vegetated, unstable alpine scree from 2,000 to 5,500 feet in elevation. Wildland fires are uncommon in the Bay planning area, and fire is not likely to burn well on this type of unvegetated scree.

(4) Effects to Special Status Vegetation Species from Livestock Grazing (Common to all)

Although there is currently no form of livestock grazing in the Bay planning area, livestock grazing could be permitted on a case-by-case basis under all Alternatives. Livestock grazing has the potential to negatively impact special status plants. Depending on the type of grazing animal, either part of the plant or the entire plant including its roots could be removed. In addition, trampling of vegetation could occur. The degree of impact from livestock would depend not only on the number and class or type of animals but also the timing and duration of their presence in the area of special status plants. Because the plant lives on sparsely vegetated unstable alpine screes at higher elevations, some animals might not elect to graze there if better grazing opportunities were available.

(5) Effects to Special Status Vegetation Species from Leasable Minerals (Alternatives B, C, and D)

Oil, gas, and coalbed natural gas exploration are not expected to occur on BLM-managed lands in the Goodnews Bay area or in the Bristol Bay area at elevations between 2,000 and 5,500 feet during the life of this plan.

(6) Effects to Special Status Vegetation Species from Minerals (Alternatives B, C, and D)

Locatable Minerals. There is a low probability for BLM-managed lands in the Bristol Bay area and a low to moderate probability for BLM-managed lands in the Goodnews Bay area for locatable mineral exploration activities to take place at elevations between 2,000 and 5,500 feet asl during the life of this plan. Only one area of BLM unencumbered lands, Tatlignagepeke Mountain in the Goodnews Bay region, has both habitat for the smelowskia and known lode mineral occurrences, with elevations of as much as 2,500 feet.

Other locations in the Goodnews Bay region with potential habitat but no known mineral resources include Twin Mountain and Figure Four Mountain, in the proposed Carter Spit ACEC, and the southern half of Figure 4 Mountain, located just south of the proposed ACEC. An area of BLM unencumbered lands in the northeast Bristol Bay region with potential habitat but no known mineral resources is the Chekok Creek area, with elevations to 4,000 feet.

Existing and future locatable mineral activities have the potential to unfavorably impact Special Status plants and their habitat by stripping away the vegetative mat as part of mine site overburden, trampling or eliminating vegetation and compacting soils throughout the mine site area by development of social trails, roads, camp buildings, airstrips, and other temporary or semi-permanent mine associated infrastructure. Site-specific mitigation measures would be implemented.

Salable Minerals (Mineral Materials). *In a region of glacial deposits, including sand and gravel, quantities of materials are available on private lands, State-owned and selected lands, Native-owned and selected lands, and BLM unencumbered lands at sufficiently low elevations that it is doubtful the materials would be sought in the difficult terrain where the habitat of the smelowskia would be located.*

(7) Effects to Special Status Vegetation Species from Recreation Management (Common to all)

The sources of impacts to vegetation from commercial and non-commercial recreation activities would include hiking, aircraft landings at remote sites, occasional or repeated use of remote camp sites and associated social trails. Potential effects might include trampling and crushing of plants and disturbance or compaction of the soil. With respect to the Special Status plant the smelowskia and its habitat, the only potential effect might occur from hiking. However, the potential location of the plant on steep unconsolidated scree-covered slopes would present a hazard to hikers, who might elect other more favorable areas to hike. These plants also appear to inhabit areas as isolated, scattered individual plants. The likelihood of impacts from recreational activities in this lightly-populated, lightly-used region would be low, and would not have population level effects.

(8) Effects to Special Status Vegetation Species from Travel Management (Common to all)

Direct and indirect impacts to vegetation could occur from travel management and OHV use, including the potential to destroy the vegetation mat, compact soils, accelerate permafrost melt, and contribute to soil erosion. Higher, rockier terrain in remote areas, where the smelowskia and its habitat might be located, are becoming more accessible over time as OHVs become more sophisticated and powerful. However, the population and visitation in the Bay planning area in the more mountainous regions is low.

b) Effects to Special Status Vegetation Species for Alternative A***(1) Effects to Special Status Vegetation Species from Soil, Water, Air, and Vegetation (Alternative A)***

Special Status Species of plants would benefit from proper management of soil, water, air and vegetation resources in the planning area. Implementation of mitigation measures to protect these resources on a project-specific basis would reduce disturbance to habitat of special status plants and would facilitate the recovery of habitat from permitted uses.

(2) Effects to Special Status Vegetation Species from Wildlife (Alternative A)

Special Status plants would benefit indirectly as a result of protecting wildlife habitats and mitigating impacts to wildlife habitat through the NEPA and permitting processes.

(3) Effects to Special Status Vegetation Species from Fire and Fire Management (Alternative A)

It is unlikely for the Bay planning area that the issue of whether or not the smelowskia would benefit from fire suppression activities, or whether fire is a natural and beneficial part of the plant's natural history would arise. The known plants' habitat consists of isolated, steep, sparsely vegetated, unstable alpine screes from 2,000 to 5,500 feet in elevation. Wildland fires are uncommon in the Bay planning area, and fire is not likely to burn well on this type of unvegetated scree.

(4) Effects to Special Status Vegetation Species from Livestock Grazing (Alternative A)

Although there is currently no form of livestock grazing in the Bay planning area, livestock grazing could be permitted on a case-by-case basis under all Alternatives. Livestock grazing has the potential to negatively impact special status plants. Depending on the type of grazing animal, either part of the plant or the entire plant including its roots could be removed. In addition, trampling of vegetation could occur. The degree of impact from livestock would depend not only on the number and class or type of animals but also the timing and duration of their presence in the area of special status plants. Because the plant lives on sparsely vegetated unstable alpine screes at higher elevations, some animals might not elect to graze there if better grazing opportunities were available.

(5) Effects to Special Status Vegetation Species from Minerals (Alternative A)

Leasable Minerals. Under Alternative A, BLM-managed lands in the Bay planning area would be closed to oil and gas exploration under ANCSA 17(d)(1) withdrawals.

Locatable Minerals. Under Alternative A, most BLM-administered lands in the Bay planning area would be withdrawn from exploration and development under ANCSA 17 (d)(1).

Salable Minerals. In a region of glacial deposits, including sand and gravel, quantities of materials are available on private lands, State-owned and selected lands, Native-owned and selected lands, and BLM unencumbered lands at sufficiently low elevations that it is doubtful the materials would be sought in the difficult terrain where the habitat of the smelowskia would be located.

(6) Effects to Special Status Vegetation Species from Recreation Management (Alternative A)

Impacts would be the same as those discussed under Common to All Alternatives.

(7) Effects to Special Status Vegetation Species from Travel Management (Alternative A)

Direct and indirect impacts to vegetation could occur from travel management and OHV use under this Alternative, which allows unrestricted travel. These impacts include the potential to destroy the vegetation mat, compact soils, accelerate permafrost melt, and contribute to soil erosion. Higher, rockier terrain in remote areas, where the smelowskia and its habitat might be located, are becoming more accessible over time as OHVs become more sophisticated and powerful. However, the population and visitation in the Bay planning area in the more mountainous regions is low.

c) Effects to Special Status Vegetation Species for Alternative B

(1) Effects to Special Status Vegetation Species from Soil, Water, Air, and Vegetation Management (Alternative B)

Special Status Species of plants would benefit from proper management of soil, water, air and vegetation resources in the planning area through measures to protect one of the resources can conflict and negatively affect another, especially Special Status Vegetation Species. An example might be a project to re-establish native grasses on a stream bank, which may eliminate a Special Status Vegetation Species unless care is taken to protect it or, in some cases, the rehabilitation project may have to be forgone or delayed. Implementation of mitigation measures to protect these resources on a project-specific basis would reduce disturbance to habitat of special status plants and would facilitate the recovery of habitat from permitted uses.

(2) Effects to Special Status Vegetation Species from Wildlife (Alternative B)

Special Status plants should usually benefit indirectly as a result of protecting wildlife habitats and mitigating impacts to wildlife habitat through the NEPA and permitting processes.

(3) Effects to Special Status Vegetation Species from Fire and Fire Management (Alternative B)

Impacts would be the same as those discussed under Common to All Alternatives.

(4) Effects to Special Status Vegetation Species from Livestock Grazing (Alternative B)

Impacts would be the same as those discussed under Common to All Alternatives.

(5) Effects to Special Status Vegetation Species from Minerals (Alternative B)

Leasable Minerals. Oil, gas, and coalbed natural gas exploration are not expected to occur on BLM-managed lands in the Goodnews Bay area or in the Bristol Bay area at elevations between 2,000 and 5,500 feet during the life of this plan.

Locatable Minerals. There is a low probability for BLM-managed lands in the Bristol Bay area and a low to moderate probability for BLM-managed lands in the Goodnews Bay area for locatable mineral exploration activities to take place at elevations between 2,000 and 5,500 feet asl during the life of this plan. Only one area of BLM unencumbered lands, Tatlignagpeke Mountain in the Goodnews Bay region, has both habitat for the smelowskia and known lode mineral occurrences, with elevations of as much as 2,500 feet.

Other locations in the Goodnews Bay region with potential habitat but no known mineral resources include Twin Mountain and Figure Four Mountain, in the proposed Carter Spit ACEC, and the southern half of

Figure 4 Mountain, located just south of the proposed ACEC. An area of BLM unencumbered lands in the northeast Bristol Bay region with potential habitat but no known mineral resources is the Chekok Creek area, with elevations to 4,000 feet.

Existing and future locatable mineral activities have the potential to unfavorably impact Special Status plants and their habitat by stripping away the vegetative mat as part of mine site overburden, trampling or eliminating vegetation and compacting soils throughout the mine site area by development of social trails, roads, camp buildings, airstrips, and other temporary or semi-permanent mine associated infrastructure. Site-specific mitigation measures would be implemented through implementation of Required Operating Procedures.

Salable Minerals. In a region of glacial deposits, including sand and gravel, quantities of materials are available on private lands, State-owned and selected lands, Native-owned and selected lands, and BLM unencumbered lands at sufficiently low elevations that it is doubtful the materials would be sought in the difficult terrain where the habitat of the smelowskia would be located.

(6) Effects to Special Status Vegetation Species from Recreation Management (Alternative B)

Impacts would be the same as those discussed under Alternative A.

(7) Effects to Special Status Vegetation Species from Travel Management (Alternative B)

Impacts would be the same as those discussed under Alternative A.

d) Effects to Special Status Vegetation Species for Alternative C

(1) Effects to Special Status Vegetation Species from Soil, Water, Air, and Vegetation Management (Alternative C)

Except under conditions discussed previously, Special Status Species of plants would benefit from proper management of soil, water, air and vegetation resources in the planning area. Implementation of Stipulations, Required Operating Procedures, and project-specific requirements in addition to mitigation measures to protect these resources on a project-specific basis would reduce disturbance to habitat of special status plants and would facilitate the recovery of habitat from permitted uses.

(2) Effects to Special Status Vegetation Species from Wildlife (Alternative C)

Special Status plants would benefit indirectly as a result of protecting wildlife habitats through Required Operating Procedures, Stipulations, and project-specific requirements as well as mitigating impacts to wildlife habitat through the NEPA and permitting processes. Additional protection would be provided through designation of two ACECs and nominating three river segments as Wild Rivers.

(3) Effects to Special Status Vegetation Species from Fire and Fire Management (Alternative C)

Impacts would be the same as those discussed under Common to All Alternatives.

(4) Effects to Special Status Vegetation Species from Livestock Grazing (Alternative C)

Impacts would be the same as those discussed under Common to All Alternatives.

(5) Effects to Special Status Vegetation Species from Minerals (Alternative C)

Leasable Minerals. Impacts would be the same as those discussed under Common to All Alternatives. Special Status vegetation species would benefit from Stipulations, Required Operating Procedures, and project-specific requirements.

Locatable Minerals. There is a low probability for BLM-managed lands in the Bristol Bay area and a low to moderate probability for BLM-managed lands in the Goodnews Bay area for locatable mineral exploration activities to take place at elevations between 2,000 and 5,500 feet asl during the life of this plan. Only one area of BLM unencumbered lands, Tatlignagpeke Mountain in the Goodnews Bay region, has both habitat for the smelowskia and known lode mineral occurrences, with elevations of as much as 2,500 feet.

Other locations in the Goodnews Bay region with potential habitat but no known mineral resources include Twin Mountain and Figure Four Mountain, in the proposed Carter Spit ACEC, and the southern half of Figure 4 Mountain, located just south of the proposed ACEC. An area of BLM unencumbered lands in the northeast Bristol Bay region with potential habitat but no known mineral resources is the Chekok Creek area, with elevations to 4,000 feet.

Existing and future locatable mineral activities have the potential to unfavorably impact Special Status plants and their habitat by stripping away the vegetative mat as part of mine site overburden, trampling or eliminating vegetation and compacting soils throughout the mine site area by development of social trails, roads, camp buildings, airstrips, and other temporary or semi-permanent mine associated infrastructure. Projects would implement Required Operating Procedures and site-specific mitigation measures.

Salable Minerals. Impacts would be similar to those discussed under Common to All Alternatives. The Carter Spit and Bristol Bay ACECs would be closed to Salable Minerals.

(6) Effects to Special Status Vegetation Species from Recreation Management (Alternative C)

Impacts would be the same as those discussed under Common to All Alternatives.

(7) Effects to Special Status Vegetation Species from Travel Management (Alternative C)

Impacts would be similar to those discussed under Common to All Alternatives. However, they would be less than in Alternative A or B. Under this Alternative, travel would be designated as “limited” to existing roads and trails.

e) Effects to Special Status Vegetation Species for Alternative D

(1) Effects to Special Status Vegetation Species from Soil, Water, Air, and Vegetation Management (Alternative D)

Impacts would be the same as those discussed under Alternative C.

(2) Effects to Special Status Vegetation Species from Wildlife (Alternative D)

Impacts would be the same as those discussed under Alternative C.

(3) Effects to Special Status Vegetation Species from Fire and Fire Management (Alternative D)

Impacts would be the same as those discussed under Common to All Alternatives.

(4) Effects to Special Status Vegetation Species from Livestock Grazing (Alternative D)

Impacts would be the same as those discussed under Common to All Alternatives.

(5) Effects to Special Status Vegetation Species from Minerals (Alternative D)

Leasable Minerals. Impacts would be the same as those discussed under Common to All Alternatives.

Locatable Minerals. Impacts would be the same as those discussed under Alternative C.

Salable Minerals (Mineral Materials). Impacts would be similar to those discussed under Alternative C. Carter Spit ACEC would be closed to Salable Minerals.

(6) Effects to Special Status Vegetation Species from Recreation Management (Alternative D)

Impacts would be the same as those discussed under Common to All Alternatives.

(7) Effects to Special Status Vegetation Species from Travel Management (Alternative D)

Impacts would be the same as those discussed under Alternative C.

7. Direct and Indirect Effects for Cultural Resources

a) Direct and Indirect Effects to Cultural Resources Common to All Alternatives

Both Federal undertakings and unauthorized uses have the potential to cause irreversible harm to cultural resources. BLM authorized undertakings will avoid impacts to cultural resources through project redesign or alternative siting. Unavoidable impacts from undertakings will be mitigated through data recovery investigations in accordance with the National Cultural Programmatic Agreement and the Alaska Protocol for Managing Cultural Resources. Unauthorized impacts will be addressed as feasible through monitoring, law enforcement investigation and public education efforts.

All undertakings occurring on BLM managed land are evaluated by a qualified cultural resources specialist. Because of budget, personnel, and seasonal constraints, level I inventories (literature searches) are a common practice. Level III (Class III) inventory (intensive on the ground survey) occurs when the potential for cultural resources is considered to be high or surface disturbance is likely. This is due to funding and accessibility issues as well as low resource development in this area. Therefore, the exact number, kind, and variability of cultural resources within the planning area are unknown. New cultural resources will continue to be found and evaluated for eligibility to the National Register of Historic Places as future inventories are completed. If significant sites are found they will be appropriately mitigated under Federal law and policy.

b) Direct and Indirect Effects to Cultural Resources for Alternative A

Under Alternative A, existing management practices would continue. Few impacts to cultural resources are anticipated from authorized activities due to the remoteness of most BLM-managed lands and the nature of most permitted activities. Currently the primary permitted activity in the planning area is Special Recreation Permits for big game guides, and these involve little potential for impacts. Other activities that have been authorized under current management included geophysical surveys, Plan of Operations for a platinum mine, rights-of-way for an existing power line and a gravel airstrip, leases for a trapping cabin, a gravel airstrip and a road, and film permits. These activities have happened infrequently, and to date significant conflicts with cultural resources have not occurred. There is some potential for impacts from unauthorized activities, but it is difficult to estimate the extent of this, as the cost of monitoring known sites is prohibitive and there has been no consistent attempt to track the condition of the resource in these remote areas.

The greatest impact from authorized activities occurs in the area of OHV use. Under Alternative A, there would be no travel restrictions for OHVs on BLM lands. As stated above most BLM lands are distant from

population centers; however, should activity increase in the future cultural resources could be adversely impacted.

c) Direct and Indirect Effects to Cultural Resources for Alternative B

Under Alternative B, there could be an increase in the potential for impacts to cultural resources. Development of both leasable and locatable minerals would result in substantial surface disturbance. With the Stipulations, Required Operating Procedures, and project-specific requirements, impacts to cultural resources should be avoided.

Exploration for leasable minerals involves little potential for impacts, assuming that final oil and gas leasing stipulation and operating procedures are similar to those currently used in the National Petroleum Reserve-Alaska. Exploration and development of oil is considered unlikely for the life of the plan, and based on the Reasonable Foreseeable Development Scenario for oil and gas, gas exploration and development would be limited to the Koggiling Block of BLM-managed lands. However, if it occurs, such development would probably result in surface disturbance that could pose a threat to cultural resources. However, BLM would have required inventory and appropriate mitigation in advance of allowing any on-the-ground development. In some areas, it is also possible that no cultural resources may be impacted by a development. Based on the Reasonable Foreseeable Development scenario, 720 acres would be disturbed by construction of well pads, utilities, pipelines and associated airstrips and roads for each project.

Some impacts to cultural resources can be anticipated from locatable mineral development under this Alternative. Historically, placer mines have occurred in the Goodnews Bay area of the plan and this area seems to have the most potential for future mineral discovery and development.

The greatest impact from authorized activities lies in the “open” designation for OHVs on BLM lands. BLM is presently drafting a memorandum on the subject of Section 106 and OHV designations. Such designations are subject to Section 106 compliance. As stated above most BLM lands are distant from population centers; however, should activity increase in the future cultural resources could be adversely impacted. Adverse impacts to cultural resources are anticipated from other resource uses such as erosion, looting and vandalism, but it is not possible to develop a reliable estimate of the probable extent of this impact. Increased monitoring of this activity would give more information about this problem and provide insights to a solution.

d) Direct and Indirect Effects to Cultural Resources for Alternative C

Impacts to cultural resources under Alternative C would be much the same as for Alternative B, although they would be expected to be fewer. A “limited” designation for OHVs under this Alternative would also provide beneficial impacts for cultural resources since OHV will be confined to existing trails. It would provide more flexibility to manage some types of potential impacts to cultural resources and to mitigate possible damage to cultural resources from OHV designations. Beneficial effects to cultural resources would also occur under this Alternative with the proposed Carter Spit ACEC, the proposed Bristol Bay ACEC, and within the proposed wild river segments of the Alagnak, Goodnews mainstream and Goodnews Middle Fork rivers.

e) Direct and Indirect Effects to Cultural Resources for Alternative D

Impacts to cultural resources under Alternative D would be much the same as for Alternative C. Beneficial effects to cultural resources would also occur because of a “limited” designation for OHVs as described in Alternative C, and since OHVs will be confined to existing trails. Beneficial effects to cultural resources would also occur under this Alternative with the proposed Carter Spit ACEC (52,863 acres).

8. Direct and Indirect Effects for Paleontological Resources

a) Direct and Indirect Effects to Paleontological Resources Common to All Alternatives

Federal undertakings and unauthorized uses have the potential to cause irreversible disturbance and damage to non-renewable paleontological resources. The BLM would mitigate impacts to significant paleontological resources from authorized uses through project redesign, specimen recovery or other appropriate mitigation. Geologic formations with exposures containing vertebrate and non-vertebrate fossils would be impacted from natural agents, unauthorized public collection, and vandalism. Given the little information we have about paleontological resources in most of the planning area, it is difficult to estimate the extent and nature of anticipated impacts.

b) Direct and Indirect Effects to Paleontological Resources for Alternative A

Under Alternative A there are no restrictions on OHVs. This could adversely impact paleontological resources.

c) Direct and Indirect Effects to Paleontological Resources for Alternative B

Under Alternative B, anticipated development associated with leasable and locatable minerals could have adverse impacts on paleontological resources.

Exploration and development of oil and gas is considered unlikely for the life of the plan; however, if it occurs, such development could result in surface disturbance that could pose a threat to paleontological resources. Based on the Reasonable Foreseeable Development scenario, 720 acres would be disturbed by construction of well pads, utilities, pipelines and associated airstrips and roads.

Some impacts to paleontological resources can be anticipated from locatable mineral development under this Alternative. Depending on the location of these mines and the methods utilized for stripping overburden, these operations could result in disturbance and destruction of paleontological materials. Historically, placer mines have occurred in the Goodnews Bay area of the plan and this area seems to have the most potential for future mineral discovery and development.

Little or no impact to paleontological resources is anticipated from other resource uses for the more isolated parcels in the planning area. A higher amount of impact to paleontological resources is anticipated in those parcels closer to inhabited areas from unauthorized OHV traffic.

Under Alternative B there is an “open” designation for OHVs. This could adversely impact paleontological resources. Other expected adverse impacts to paleontological resources would also stem from unauthorized uses and natural causes.

d) Direct and Indirect Effects to Paleontological Resources for Alternative C

Impacts to cultural resources under Alternative C would be much the same as for Alternative B, with the addition that beneficial impacts to paleontological resources would also occur because of a “limited” designation for OHVs since OHVs will be confined to existing trails. Beneficial impacts to paleontological resources may also occur under this Alternative with the proposed Carter Spit ACEC, the proposed Bristol Bay ACEC, and within the proposed wild river segments of the Alagnak, Goodnews mainstream and Goodnews Middle Fork rivers.

e) Direct and Indirect Effects to Paleontological Resources for Alternative D

Impacts to paleontological resources under Alternative D would be much the same as for Alternative B. Beneficial impacts to paleontological resources would also occur because of a “limited” designation for OHVs since OHVs will be confined to existing trails. Beneficial impacts to paleontological resources may also occur under this Alternative with the proposed Carter Spit ACEC (52,863 acres).

9. Direct and Indirect Effects for Visual Resource Management

In order to meet responsibilities to maintain the scenic values of public lands, BLM has been utilizing a Visual Resources Management (VRM) system that considers that different levels of scenic values require different levels of management, and that assessing scenic values and determining visual effects can be a subjective process. For this plan, assessments were collected from existing long-term staff and past VRM inventory reports. The inventory process is described in detail in BLM Handbook 8410-1 (BLM 1984).

a) Effects to Visual Resources Management Common to All Alternatives

(1) Effects to Visual Resources Management from Wildlife Management (Common to All Alternatives)

Under all Alternatives, Critical Habitat Areas for listed species across Alaska has, or is in the process of being determined for USFWS and NFMS T&E species. Critical Habitat Area designation may provide additional protection for visual resources located within the area by preventing or minimizing development activities.

(2) Effects to Visual Resources Management from Vegetation Management and Fires and Fuels Management (Common to All Alternatives)

Ninety-two percent of Alaska BLM-managed lands statewide are designated as Limited and Modified fire management option areas, meaning that naturally occurring fires are desired, but do have some constraints. Although direct loss of vegetation would occur from wildland fires, mechanical or manual treatments, and prescribed burns, the change to the existing landscape character would be considered relatively short-term. The impacts of wildland fire and fuels management will be few within the Bay planning area.

(3) Effects to Visual Resource Management from Forestry Management (Common to All Alternatives)

No commercial forestry is carried out within the Bay planning area. Therefore, no impacts to Visual Resource Management are anticipated within the foreseeable future.

(4) Effects to Visual Resource Management from Lands and Realty Management (Common to All Alternatives)

BLM is working to complete the conveyance of Native- and State-selected lands by 2009. Once these lands are conveyed, the entity would own both the surface and subsurface mineral rights, unless otherwise stipulated. Should BLM-managed lands be relinquished, the visual resources of those lands would likely be maintained at their current levels.

(5) Effects to Visual Resource Management from Leasable, Locatable, and Salable Minerals (Common to All Alternatives)

Mining and oil and gas leasing may have adverse effects on the visual resources of an area. If roads were authorized through Rights of Way associated with development on non-BLM-managed lands, or other development associated with mining or oil and gas leasing, there may be localized, but long-term impacts to the form, line, color, and texture of the visual landscape.

(6) Effects to Visual Resource Management from Renewable Energy (Common to All Alternatives)

Under all Alternatives, land available as potential renewable energy program sites would be evaluated on a case-by-case basis. Effects to visual resources associated with renewable energy programs are generally less severe in magnitude and extent relative to other development activities.

Wind, hydroelectric and solar power projects would affect visual resources in similar ways. These effects would largely result from construction activities, such as the creation of new utility corridors, access roads, and transmission lines, creating access opportunities to new visual resources, or modifying the existing landscape character. The magnitude and extent of these effects may vary for each project.

(7) Effects to Visual Resource Management from Socioeconomics (Common to All Alternatives)

The lives of many Alaskan residents are tied to the natural environment. While many of the BLM-managed lands within the Bay planning area are difficult to access and not located in proximity to communities, visual resources are utilized and valued in varying degrees by Alaska residents, as well as tourists. As the population within the Bay planning area continues to increase, there would be increasing pressure on the ability to maintain visual resources that can be closely tied to regional economies, recreational opportunities, employment, and quality of life issues for residents.

b) Effects to Visual Resource Management for Alternative A

(1) Effects to Visual Resource Management from Lands and Realty (Alternative A)

Access (Rights of Way) - There are no avoidance or exclusion areas identified within the Bay planning area under this Alternative. Rights of Way are typically used for communication sites, utility corridors, or for access to mining claims, timber resources, and conservation areas, and usually remain under BLM management. As growth and development continues in the Bay planning area, the need for ROWs for transportation and utility corridors would increase. Potential new access routes may change the existing form, line, color, and texture of the visual landscape. However, the number of annual ROW applications for the Bay planning area is extremely low, so any effects would be minimal.

Withdrawals - No withdrawal review would occur under this Alternative, and all existing withdrawals would stay in place. Because of the constraints in place under these withdrawals, there would be less potential for resource development and activities that would alter the visual landscape.

(2) Effects to Visual Resource Management by Leasable, Locatable, and Salable Minerals (Alternative A)

BLM lands in the Bay planning area may be subject to localized adverse effects on visual resources from existing mineral claims. Potential effects from mineral exploration and development are discussed above under Direct and Indirect Effects Common to All Alternatives. For BLM-administered lands, the likelihood of these effects occurring would be low to moderate for fluid minerals, and low for metalliferous metals given the mineral potential for BLM-managed lands.

(3) Effects to Visual Resource Management by Off-Highway Vehicles (Alternative A)

All lands within the Bay planning area would remain open for OHV use. The numbers of OHV trails throughout planning may stay the same or increase slightly within the next ten years. These trails

fragment the natural landscape, creating varying degrees of changes to the existing visual character of the area. Braided trail sections more than 200 feet wide have been documented in Alaska (Meyer 2004). Important viewpoints and visual resources that may have been previously inaccessible may become part of an expanding network of OHV trails, especially in areas of established moderate use, such as in the north and east Goodnews area.

(4) Summary of Effects to Visual Resource Management (Alternative A)

The management actions proposed under Alternative A would have a variety of effects on visual resources occurring on BLM-managed lands. Management would maintain any effects on visual resources at their current levels, although changes to the existing visual landscape would be expected with increases in regional populations. No VRM classes are established under this Alternative. As OHV use continues to go unmanaged, minimal adverse effects to BLM-managed visual resources may continue, primarily in area of Goodnews. Potential mineral exploration and development, and the creation of new Rights of Way both have the potential to adversely affect visual resources; however, any effects would likely be minimal based on current trends. Available information described in the sections above indicates that the adoption of the current management actions as described under Alternative A may have localized, adverse effects on visual resources.

c) Effects to Visual Resource Management for Alternative B

(1) Effects to Visual Resource Management from Lands and Realty (Alternative B)

Exchanges - Several parcels have been identified for exchange under this Alternative. However, due to the small, scattered nature of these parcels, any development or alterations in the visual landscape resulting from their sale would be minimal.

Acquisitions - Under Alternative B, the acquisition of lands and easements from willing landowners would be considered on a case-by-case basis. Easements provide access to lands managed by the NPS, USFS, or USFWS, and once lands are conveyed, the easement is managed by the respective agency. The visual quality of these easements would likely be maintained.

Access (Rights of Way) - There are no avoidance or exclusion areas identified within the Bay planning area under this Alternative. Rights of Way (ROWs) are typically used for communication sites, utility corridors, or for access to mining claims, timber resources, and conservation areas, and usually remain under BLM management. As growth and development continues in the Bay planning area, the need for ROWs for transportation and utility corridors would increase. Potential new access routes may change the existing form, line, color, and texture of the visual landscape. However, the number of annual ROW applications for the Bay planning area is extremely low, so any effects would be minimal.

(2) Effects to Visual Resource Management from Leasable, Locatable, and Salable Minerals (Alternative B)

Under this Alternative, localized adverse effects to Off Highway Vehicle (OHV) use may occur through Stipulations and Required Operating Procedures. There is low to moderate potential for oil and gas development and low potential for metalliferous mineral development on BLM lands in the foreseeable future. Any permitted or leasing activities would have to comply with guidelines outlined in the Stipulations and Required Operating Procedures, which would include protections for visual resources.

(3) Effects to Visual Resource Management from Off-Highway Vehicle Management (Alternative B)

All lands within the Bay planning area would be designated as "Open" under Alternative B. Because OHV use on BLM-managed lands is currently unrestricted, this management action would have similar effects as Alternative A. Increasing OHV trail creation and widening causes changes to the existing form, line,

color, and texture of the visual landscape. Important viewpoints and visual resources that may have been previously inaccessible may become part of an expanding network of OHV trails, especially in areas of established moderate use such as Goodnews Bay.

(4) Effects to Visual Resource Management from Wild and Scenic Rivers (Alternative B)

There would be no Wild and Scenic Rivers recommended for designation to the National System under Alternative B. Thus, the scenic quality of river segments within the Bay planning area would not be afforded additional protections, other than those outlined in the Stipulations and Required Operating Procedures.

(5) Summary of Effects to Visual Resource Management (Alternative B)

All lands under Alternative B would be managed as VRM Class IV, which would allow actions that make major modifications to the existing character of the landscape. OHV use would continue to be designated as Open on all lands within the Bay planning area, and may create changes in the existing landscape character and access to visual resources. Effects from Rights of Way, mining, and oil and gas developments may occur in the foreseeable future. Required Operating Procedures and Stipulations or other permit requirements around mineral exploration and development may contain protections for visual resources in specific locations. Available information described in the sections above indicates that effects would be on a localized scale, primarily in moderate OHV use areas, such as Goodnews Bay.

d) Effects to Visual Resource Management for Alternative C

(1) Effects to Visual Resource Management from Lands and Realty (Alternative C)

Access (Rights of Way) - The proposed Carter Spit ACEC and Bristol Bay ACEC would be identified as Special Management Areas. Projects would be designed to contain mitigation to limit impacts to biological resources. Impacts to the current visual landscape in this area would be minimized through stipulations proposed on major ground disturbing projects such as road building, which may impact the biological resources. Other areas requiring avoidance on a local level for its impacts on visual resource management would be identified on a case-by-case basis.

(2) Effects to Visual Resource Management from Leasable, Locatable, and Salable Minerals (Alternative C)

The level of development potential and overall effects for leasable, locatable, and salable minerals would be similar to that in Alternative B.

(3) Effects to Visual Resource Management from Off-Highway Vehicles (OHVs) (Alternative C)

Lands would be designated as limited to OHV use consistent with ADNR's *Generally Allowed Uses on State Land*, which require such actions as restricting use to existing trails whenever possible. Protections for visual resources, and limitations on OHV use would also be further refined within the proposed Carter Spit ACEC, Bristol Bay ACEC, and the nominated Wild Rivers. Limiting use within the Bay planning area may reduce adverse effects to visual resources relative to the current level of effects. Areas of low to moderate OHV use, the Goodnews Bay area, may feel the highest level of beneficial effects towards changing the existing landscape character.

(4) Effects to Visual Resource Management from Recreation (Alternative C)

Under Alternative C, no Special Recreation Management Areas would be proposed for designation. ACECs would be proposed for the Carter Spit and Bristol Bay areas. All resources would be managed to meet the objectives of the specific Special Management Area.

(5) Effects to Visual Resource Management from Wild and Scenic Rivers (Alternative C)

Under Alternative C, BLM would recommend three river segments for Wild and Scenic River designation, and would maintain the Outstandingly Remarkable Values of the river segments if they were designated in order to maintain their wild, scenic, or recreational classifications. This designation provides legal protections from adverse development and provides a mechanism for management of the rivers' resources. Further planning efforts along these river segments may contain permitting conditions that protect the scenic quality and existing visual landscape around the rivers.

(6) Summary of Effects to Visual Resource Management of Alternative C

Effects to visual resources from management proposed under Alternative C are likely to be concentrated in specific areas. BLM would designate all lands recommended as Wild and Scenic Rivers with a "wild" classification as VRM Class III. The proposed Carter Spit and Bristol Bay ACECs would be designated as VRM Class III. Changes in the existing landscape for these areas would be low and would not attract attention. All lands within the Bay planning area would be designated as "limited" to OHV use, following ADNR's *Generally Allowed Uses on State Lands*, which may provide changes in the visual setting in moderate OHV-use areas such as the Goodnews Bay area. Effects from Rights of Way, mining, oil and gas would likely be limited in extent; consequently only a small portion of visual resources on BLM-managed lands may be affected. Resources would receive further levels of protection through the development of activity plans, such as a Special Recreation Permit management plan for guides and transporters. Three river segments would also be recommended for Wild and Scenic River designation, which may place protections around the scenic values of these rivers. The majority of these actions would have beneficial effects on visual resources through increased protections and regulation efforts. Actions that may adversely affect the visual landscape may occur in the form of mining activities BLM-managed lands.

E) Effects to Visual Resource Management for Alternative D

(1) Effects to Visual Resource Management by Lands and Realty (Alternative D)

Access (Rights of Way) - The proposed Carter Spit ACEC would be identified as a Special Management Area. Projects would be designed to contain mitigation to limit impacts to biological resources. Impacts to the current visual landscape in this area would be minimized through stipulations proposed on major ground disturbing projects such as road building, which may impact the biological resources. Other areas requiring avoidance on a local level for its impacts on visual resource management would be identified on a case-by-case basis.

(2) Effects to Visual Resource Management by Leasable, Locatable, and Salable Minerals (Alternative D)

Under Alternative D, effects would be the same as discussed under Alternative B. Any effects to visual resources occurring on those lands would continue at current levels.

(3) Effects to Visual Resource Management by Off-Highway Vehicles (OHVs) (Alternative D)

Under Alternative D, OHV use on BLM-administered lands would be managed as described under Alternative C, designated as "limited" to OHV use. Because OHV use on BLM-managed lands is currently unrestricted (open), this management action would likely reduce OHV effects to the existing landscape character, especially in areas where activity planning has outlined further resource protection guidelines and objectives.

(4) Effects to Visual Resource Management by Recreation (Alternative D)

Management actions proposed under Alternative D are the same as those described under Alternative C. An ACEC would be designated in the Carter Spit area. In areas of moderate recreational use, the surrounding visual landscape plays an important part in the recreation experience. The area would be managed to meet the objectives of the specific Special Management Area.

(5) Effects to Visual Resource Management by Wild and Scenic Rivers (Alternative D)

There would be no Wild and Scenic Rivers recommended for designation to the National System under Alternative D. Thus, any special management actions to help protect scenic resources associated with identified river segments within the Bay planning area would not be afforded additional protections, other than those outlined in the Stipulations and Required Operating Procedures.

(6) Effects to Visual Resource Management Summary of Alternative D

Effects to visual resources from future management under Alternative D are likely to be concentrated in specific areas. The proposed Carter Spit ACEC would be managed as VRM Class III, where changes to the landscape character should be low, and should not be readily visible to the casual observer. BLM would designate all lands as “limited” to OHV use, following ADNR’s *Generally Allowed Uses on State Lands* (Appendix F), which may provide changes in the visual landscape. Effects from Rights of Way, mining, and oil and gas development may affect a portion of visual resources on BLM-managed lands. Resources would receive further levels of protection through the development of activity plans such as a Special Recreation Permit plan addressing guides and transporters. The majority of these actions would have beneficial effects on visual resources through increased protections and regulation efforts.

10. Direct and Indirect Effects for Recreation Management

a) Direct and Indirect Effects on Recreation Common to All Alternatives

Recreation use tends to be focused on existing trails accessible from small to moderate villages and communities. Soil compaction can lead to erosion, increased runoff, and potential flooding. Trail construction and use may lead to changes in soil compaction and erosion. Also, trails on ridge tops and steep slopes tended to have higher amounts of erosion (Meyer 2002). Concentrated camping can lead to soil compaction and actual loss of topsoil. Long-term camping increases both the level of soil compaction as well as the size of the spatial footprint of effects on soil.

In areas of moderate to substantial recreational foot and/or vehicle traffic, soil compaction may occur and increase the amount of impervious surface within a watershed. Impervious surfaces can lead to increases in runoff potential and downstream flooding, particularly during storm events. Sensitive riparian areas, such as lakeshores and stream banks, are especially susceptible to increased tramping and soil compaction from camping, foot traffic, and vehicles. Reduced viability and rooting capacity of the riparian vegetation can in turn reduce stream bank stability and increase erosion. The effect of soil compaction is generally more severe on moist or clay-rich soils and with higher incidents of use. Discharge from two-stroke snowmachine engines can lead to pollutant deposition on snow, and wash into surface and groundwater (Meyer 2002).

b) Direct and Indirect Effects on Recreation for Alternative C

An ACEC would be designated in the Carter Spit and Bristol Bay areas. All resources would receive further levels of protection through the development of activity plans in various areas. Soil resources may receive indirect beneficial effects through the limiting of development activities.

c) Direct and Indirect Effects on Recreation for Alternative D

An ACEC would be designated in the Carter Spit area. All resources would receive further levels of protection through the development of activity plans in various areas. Soil resources may receive indirect beneficial effects through the limiting of OHV use or development activities.

11. Direct and Indirect Effects for Travel Management

a) Direct and Indirect Effects for Travel Management Common to all Alternatives

Off Highway Vehicle (OHV) trails may compact soil and adversely affect water resources in areas of high use. As the soil is compacted, it begins to absorb less water, thereby increasing runoff potential. Substantial runoff during storm events can result in downstream flooding. The generation of ruts and puddles can alter surface drainage, and extensive OHV use can create progressively larger ruts and further decrease soil strength and water holding capacity. Off-highway vehicle use in wetland areas and around stream banks and lakeshores can result in erosion, destruction of aquatic habitat, increased stream sedimentation, and changes to stream channel morphology (USDA 2005; USDA 2006; Sinnott 1990; Weeden 1978; Abele et al. 1984). Under all Alternatives, OHV use may adversely affect water quality as a result of fuel leaks, chemical spills, and increased littering. Deposition pollutants on snow, particularly from two-stroke engine discharge, can wash into surface and ground water and degrade water quality (Meyer 2002). Excessive use areas can result in increased erosion and sedimentation, and subsequent sediment load in receiving waters. OHV trails, especially the designation of new ones in otherwise unvisited areas, have the potential to damage important cultural and paleontological resources either directly by OHVs running over and damaging them, or indirectly by bringing in more people, leading to the potential for increased vandalism to sites. Trail designation should take into account valuable resources that may be impacted by establishing a trail through that location. The resource protection that designation allows and provides should be taken into account.

b) Direct and Indirect Effects for Travel Management for Alternative A

Under Alternative A, there are no OHV designations in place within the Bay planning area. As currently managed, OHV use is allowed on all terrain, including sensitive habitats such as wetlands, near fish-bearing streams, and possibly through areas that support sensitive species. OHV use may cause some minor, localized adverse effects on water quantity and quality through soil compaction, increased levels of erosion and sedimentation, or the alteration of surface drainage patterns across scattered parcels throughout the planning area. In areas of moderate use, such as the Goodnews Block and the Alagnak Block, clear water streams that are adjacent to or feeding into the rivers can be affected without appropriate management of OHVs if use increases.

The use of OHVs is often detrimental to soil and leads to compaction and degradation (USDA 2005; USDA 2006). OHV use damages soils when the type and level of use exceed the capacity of the soil to resist impact. The capacity of a soil to resist impact varies depending on textural class, moisture level, and other environmental factors, but the processes by which soils are affected are generally the same. OHV use destroys soils through both the mechanical impact from surface traffic and the indirect impact from hydraulic modifications, soil transport, and deposition.

The level of effect from OHV use is a function of the natural resilience of the soil and the intensity of trail use. In a healthy situation, a natural balance is maintained between soils resilience and use. This leads to OHV use without soil damage, although on sites with wet, unstable, and sensitive soils, that natural equilibrium hangs precariously and is easily upset. Depending on the type of soil and its condition, even light levels of trail use can have environmental consequences. Once soils on trails have reached the degradation level that they make it difficult for OHV use, riders pioneer a new route across virgin

landscape and the sequence begins anew. Depending on the amount of snow on the ground, these effects can occur in winter as well as summer (Meyer 2002).

c) Direct and Indirect Effects for Travel Management for Alternative B

All lands within the Bay planning area would be designated as “open” to OHV use. Because there are currently no OHV designations on BLM-managed lands within the Bay area, use occurs over all terrain and habitat types. Therefore, the potential adverse effects under this Alternative would be the same as described under Alternative A, although the management decision to allow unrestricted OHV use on all lands may increase the duration and/or magnitude of adverse effects on water resources, especially in areas of moderate use.

d) Direct and Indirect Effects for Travel Management for Alternative C

Lands will be designated as limited to OHV use consistent with ADNR’s *Generally Allowed Uses on State Land* (Appendix F), which require such actions as restricting use to existing trails whenever possible. Limitations on OHV use would also be further refined within the proposed Carter Spit and Bristol Bay ACEC management plans. The effects to soil from OHV use under Alternative C would likely be less than those under the currently unrestricted management directive. The decrease in effects to soils would be especially pronounced in areas of previously low to moderate use.

e) Direct and Indirect Effects for Travel Management for Alternative D

Under Alternative D, OHV use on BLM-administered lands would be managed as described under Alternative C, except that limitations on OHV use would be further refined within the proposed Carter Spit ACEC management plan. All lands under this Alternative would be designated as “limited” to OHV use. Limiting use within the Bay planning area may reduce adverse effects to water resources relative to the current level of effects. Areas of moderate high OHV use may feel the highest level of beneficial effects on water resources if use is limited, presuming that any area that might be designated for open OHV use in this area sufficiently guards against effects to water resources.

D. Resource Uses

1. Forest Products

Currently there is no forest products program on BLM lands in the Bay planning area and, due to a lack of available timber suitable for commercial use or sale, no forest products projects are anticipated within the life of this plan. Commercial logging is not likely to occur in the reasonably foreseeable future in the planning area due to low timber volume, low productivity, unsuitability of the timber for commercial use or sale, scattered locations of timber stands, and long distances involved in timber transport.

2. Livestock and Reindeer Grazing

a) Effects to Livestock and Reindeer Grazing Common to All Alternatives

Effects to livestock and reindeer grazing would be the same under all Alternatives. Proposed management of the following resources/resource uses/programs would have no anticipated impacts to livestock grazing: Air Quality, Cultural Resources, Paleontological Resources, Visual Resources, Forest Products, Mineral Materials, Renewable Energy, Lands and Realty Actions, Wild and Scenic Rivers, and Public Safety.

(1) Effects to Grazing from Soil Resources Management (Common to All)

Livestock and reindeer grazing proposals would be evaluated on a case by case basis. Depending on proposed class and age of livestock, seasons of use, numbers and locations; application of grazing suitability of vegetative communities criteria, proper forage plant use factors, grazing suitability of topography criteria, grazing management systems, ROPs, stipulations and mitigation to protect soils from erosion, degradation and conversion from grazing may be required to protect fragile soils, soil structure, soil productivity and soil cover.

(2) Effects to Grazing from Water Resources Management (Common to All)

Livestock and reindeer grazing proposals would be evaluated on a case by case basis. Depending on proposed class and age of livestock, seasons of use, numbers and locations standardized field site evaluation and application of grazing suitability of vegetative communities criteria, proper forage plant use factors, grazing suitability of topography criteria, determine carrying capacity, grazing management systems, ROPs, stipulations and mitigation to protect soils from erosion, degradation and conversion from grazing may be required to protect water and water related resources including wetlands, riparian vegetation, fish and wildlife habitat, subsistence uses, stream bank integrity, water quality, instream flow, and Federal water rights.

(3) Effects to Grazing from Cultural Resources Management (Common to All)

Livestock and reindeer grazing proposals would be evaluated on a case by case basis. Depending on proposed grazing related structures and infrastructure, class and age of livestock, seasons of use, numbers and locations standard field inspections and cultural resource clearance and mitigation or protection requirements may be implemented to comply with laws concerning antiquities and paleontology resources and sites.

(4) Effects to Grazing from Vegetation Management (Common to All)

Livestock and reindeer grazing proposals would be evaluated on a case by case basis. Depending on proposed grazing related structures and infrastructure, class and age of livestock, seasons of use, and numbers and locations of livestock, there could be a number of requirements for operation. These might include requiring one or more of the following: a field site evaluation; application of grazing suitability criteria for vegetative communities and proper forage plant use factors; the use of grazing management systems; and implementation of protection practices for sensitive plant species, wetland and fragile tundra and other fragile vegetative communities, subsistence plant gathering traditional use areas, and targeted species of subsistence plants. The potential for introduction and damaging proliferation of invasive and noxious plants can be high with livestock grazing practices and specific monitoring and control/compliance measures may be required. There is a potential for lost or abandoned livestock to become feral and to be the source of local impacts to vegetative communities and other ecosystem components. Trespass and removal actions may be necessary.

(5) Effects to Grazing from Fish and Wildlife Management (Common to All)

Livestock and reindeer grazing proposals would be evaluated on a case by case basis. Depending on proposed grazing related structures and infrastructure, class and age of livestock, seasons of use, and numbers and locations of animals, some of the following requirements could be imposed: a complete site evaluation; implementation of wildlife forage allocations and other measures to maintain wildlife habitat; development of grazing systems; application and enforcement of stipulations to protect fish migration, spawning and rearing habitats, and key life function wildlife habitats such as nesting, brooding, staging, molting, and parturition areas, winter ranges, breeding ranges, and migration routes. Further modification of grazing use may be necessary to protect subsistence uses and users from alterations in fish and wildlife abundance, distribution, movement and subsistence user access. Subsistence uses of predators

for fur and other craft materials may require maintenance of healthy populations of large predators such as brown bear, black bear, wolf and wolverine, which would also utilize livestock as prey.

The high value of salmon related commercial fishing in the region may require placing restrictions on grazing to protect spawning, rearing, and migratory habitats for salmon and to maintain water quality, temperature and riparian protection of stream banks/channels/spawning beds. This may restrict open range grazing by some classes of livestock.

Disease transmission between wildlife and livestock could limit successful livestock grazing without added vaccination and other measures. Alaska protocols for quarantine and other disease control related measures may need to be installed for BLM lands. For example, brucellosis is widespread in wild ungulates in the Bay planning area. Insects from both the standpoint of harassment and disease transmission may also require greater measures to insure successful livestock grazing and to avoid impacts to production of waterfowl and other wildlife.

(6) Effects to Grazing from Special Status Species Management (Common to All)

Special Status wildlife species that are found or that have the potential to be found in the Bay planning area are birds, which are primarily only present during spring and fall migration for feeding, molting and resting, and occasionally for nesting and brooding, especially in the Goodnews Block of BLM-administered lands. Currently there are no livestock grazing or reindeer herding operations in the Bay planning area, and no interest has been expressed for decades. In the future, there may be a requirement for species and habitat protection that could alter grazing opportunities, practices, or use.

(7) Effects to Grazing from Fire and Fire Management (Common to All)

Potential effects of fire and fire management on livestock and reindeer grazing would involve the removal by wild land fire all or a portion of annual forage resources allocated to livestock or reindeer. Existing growing season forage production and availability would be eliminated by a fire. A minimum of two post-fire growing seasons are required for forage plants to recover vigor and production to tolerate resumption of livestock and reindeer grazing, depending on rainfall and other factors. Any range improvements, structures, or facilities would be vulnerable to damage or destruction from a wildland fire. Grazing permit holders would be responsible for fire protection of their facilities, including line cabins, corrals, and fences. Livestock could be vulnerable to injury and mortality resulting from wildland fire.

(8) Effects to Grazing from Recreation Management (Common to All)

Recreation management could impact grazing uses by interference from commercial and public recreation uses that may conflict in time or place with livestock operations. Incidental and accidental mortality of livestock or reindeer could occur when livestock or reindeer are mistaken for harvestable wildlife and animals available for subsistence use. Damage to livestock facilities from recreational or commercial users of BLM lands may occur. There is a potential for aircraft hazing or running livestock in the Bay planning area due to the high levels of aircraft use for access and for other uses. Increased infrastructure development such as roads would increase public, subsistence user, and commercial user access to livestock use areas and would increase management intensity for permit holders.

(9) Effects to Grazing from Subsistence (Common to All)

In the event that livestock or reindeer grazing would be authorized there is a potential for livestock to be taken by subsistence users participating in subsistence activities. It is likely that reindeer would be harvested, being mistaken for caribou.

(10) Effects to Grazing from Social and Economic Conditions (Common to All)

Current and projected socio-economic conditions have potential impacts to livestock and reindeer grazing management. Prevailing subsistence lifestyles and lack of robust cash economies in the region make it

clear that residents of the Bay planning area are dependent upon wild plant, fish and wildlife resources. Constraints for grazing activities in order to maintain soils, vegetation and other ecosystem components; maintain the Federal rural resident subsistence priority; and keep subsistence uses in traditional use areas, as well as in important subsistence fish and wildlife habitat, may increase costs to livestock operators and limit local marketing for livestock products.

3. Direct and Indirect Effects to Minerals

Leasable Minerals

a) Effects to Leasable Minerals for Alternative A

There are no active oil and gas leases in the planning area and no oil and gas leasing would occur under Alternative A. BLM-managed lands within the planning area would remain closed. It is assumed that no leasing would occur as appropriate NEPA analysis must be completed and approved before Federal oil and gas lease sales can occur. Leasing may take place without a land-use plan in the event of drainage of oil and gas resources from adjacent development. Additionally, no withdrawal review would occur and all 17 ANCSA (d)(1) withdrawals would remain in place, pending future legislation or unrelated management direction. Therefore, under this Alternative no oil and gas exploration and development would occur, rendering these resources unavailable for future generations.

b) Effects to Leasable Minerals for Alternative B

Under Alternative B, all existing ANCSA 17(d)(1) withdrawals would be revoked to allow increased opportunities for mineral exploration and development, pending Native and State conveyances.

Approximately 2,499,941 million acres (1,327,671 selected) of the BLM-administered lands within the planning area would be open to mineral entry subject to the ROPs and Stips. There would be no restriction under this Alternative for seasonal closures or no surface occupancy. Additionally, stipulations #6 and #7 would not be applicable under this Alternative. Withdrawals, excluding the ANCSA 17(d)(1), would close approximately 3,999 acres to leasing. Closing this acreage would preclude oil and gas exploration and development, rendering these resources unrecoverable.

Given the few restrictions impose/d on this Alternative, it would likely be the most supportive to oil and gas activity.

c) Effects to Leasable Minerals for Alternative C

Under Alternative C, withdrawals would be maintained or recommended for 1,067,190% acres including two ACECs (Bristol Bay, Carter Spit) and on proposed Wild River segments of the Alagnak River, Goodnews River, Goodnews River Middle Fork. These withdrawals would eliminate areas that possess geologic potential for oil and gas resources. Additional closures would come from State and Native land selections which have a segregation against oil and gas leasing and would only be open if retained in long-term Federal ownership.

Approximately 1,432,752 acres (57%) of the BLM-administered lands within the planning area would be open subject to the ROPs and Stips. All of these lands are State-selected or Native-selected, leaving no lands available for leasing unless portions of the selected lands are retained in long-term Federal ownership.

Acreage available subject to minor (seasonal) constraints is roughly 1,768,450 acres (71%) with 773,767 acres on selected lands. To protect caribou habitat on identified aggregation areas, oil and gas exploration and development activities will be closed from May 20 through August 15. An additional closure to protect calving caribou will restrict exploration and development activities from May 1 through

June 15. Lands under seasonal closure will be dependant upon the location and size of caribou aggregation.

Approximately 2,355 acres (>1%) of the planning area would be open to leasing subject to major constraints (No Surface Occupancy). Areas subject to NSO include a 300 foot buffer on either side of the East and South Fork Arolik River, Faro Creek, and South Fork Goodnews River. This region, the Goodnews Block, is not projected to be oil or gas-bearing, based on current knowledge. Oil and gas development in an NSO area could require directional drilling to extract hydrocarbon resources. Should areas with major constraints occur beyond the technically feasible reach for directional drilling, some hydrocarbon resource may be rendered unrecoverable. Product price fluctuations may require premature abandonment that would decrease the recoverability of the resource and potentially create an irretrievable incremental loss of resources. This is not likely with an NSO area composed of a 300 foot buffer around select sensitive streams. However, an NSO buffer of any width could potentially limit exploration and development. For example, if an exploration target was determined to be within the NSO zone, the added cost of directional drilling could render the project uneconomical, and therefore miss the discovery. Additionally, if a shallow target pool were previously defined through geophysical exploration, it could be technically unfeasible for an operator to directionally drill such a reservoir. Consequently, these resources would be unavailable for future generations.

Oil and gas leasing closures exist on withdrawals other than ANCSA 17(d)(1)s that make up approximately 3,999 acres (>1%). Existing ANCSA 17(d)(1) withdrawals totaling 15,125 acres (>1%) would be proposed to be maintained on proposed wild river segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork until Congressional action could be completed. None of these river segments are located in the Koggiling Block, the area projected to be most likely to have oil and gas reserves. Remaining ANCSA 17(d)(1) withdrawals would be revoked or modified to allow for oil and gas exploration and development, pending Native and State conveyances. The acreage closed would preclude oil and gas exploration and development, rendering these resources unrecoverable.

It is unlikely that these constraints on less than 1% of BLM-administered lands judged to be of low potential for oil and gas would deter oil and gas exploration and development in higher potential areas under this Alternative.

d) Effects to Leasable Minerals for Alternative D

Under Alternative D, existing ANCSA 17(d)(1) withdrawals would be revoked or modified to allow for increased opportunities for oil and gas exploration and development, pending Native and State conveyances. This Alternative would not close any lands, but rather would implement an adaptable management approach. Oil and gas activities would be subject to timing restrictions and the guidelines list in the Required Operating Procedures and Stipulations.

Approximately 1,447,877 acres (59%) of the BLM-administered lands within the planning area would be open to leasable mineral activities subject to the Required Operating Procedures and Stipulations. Of that amount, 1,176,629 acres are selected.

Acreage available subject to minor (seasonal) constraints is roughly 1,768,450 acres (71%) with 773,767 acres on selected lands. To protect caribou habitat on identified aggregation areas, oil and gas exploration and development activities would be closed from May 20 through August 15. An additional closure to protect calving caribou would restrict exploration and development activities from May 1 through June 15. These closures would be dependant upon the actual location of caribou aggregation. These constraints would limit exploration and development during specific time periods and increase recovery costs.

There would be no lands identified under this Alternative subject to No Surface Occupancy (NSO).

There are no oil and gas leasing closures proposed. Existing withdrawals other than ANCSA 17(d)(1) make up approximately 3,999 acres (>1%). Closing this acreage would preclude oil and gas exploration and development, rendering these resources unrecoverable.

Leasable oil and gas potential does exist for the leasing of oil and gas on BLM-managed lands. Exploration and development would proceed at the level described in the Reasonably Foreseeable Development Scenario under the *Analysis Assumptions and Guidelines* for leasable minerals. Should Federal leasing take place, the BLM-Alaska State Office would assume lease administration responsibilities and oversight of field operations.

Locatable Minerals

a) Effects to Locatable Minerals for Alternative A

Under the No Action Alternative 1,023,523 acres of BLM managed land in the Bay planning area are currently closed to mineral entry either by ANCSA 17 (d)(1) withdrawals or by State or Native selection. Approximately 152,746 acres are currently open for mineral entry. An additional 3,999 acres are closed to mineral entry due to withdrawals other than ANCSA 17(d)(1). At the time conveyances are completed (2010) all segregated land returning to BLM-management would be open for mineral entry. Currently locatable lode mineral activity is occurring at the Iliamna Project, D Block and Iliamna Project, H Block locations on State-selected land and placer activity on the Arolik River on Native-selected land and the Salmon River (active Federal mining claims) on Native land. All current active Federal and State mining claims and 2005 APMA's are in the Bonanza Creek, Goodnews Bay/Snow Gulch, Iliamna/Kvichak, Kemuk, Pebble Copper, Platinum, and Shotgun Hills areas. Current mineral activities would occur in the Iliamna/Kvichak and Platinum areas.

If locatable mineral activity were to occur on every active Federal mining claim, as allowable by present BLM authority on BLM-managed land, an estimated total of 23 acres (5 lode and 18 placer) could potentially be disturbed in the Bay planning area on State-selected and Native land. No disturbance would occur on BLM unencumbered or Native-selected land. Under this Alternative no further disturbance would be anticipated until the conveyance process is completed. Future mineral activities could be expected to occur on those lands returning to BLM management.

All mineral related activities occurring on BLM-managed land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to submit Plan of Operations which contains stipulations based on site-specific resource concerns. All operations are required to meet applicable Federal and State air and water quality standards for permitting.

b) Effects to Locatable Minerals for Alternative B

Under the Development Alternative all future mineral activities would be allowed in the Bay planning area as all ANCSA 17(d)(1) withdrawals would be repealed and all segregated lands returning to BLM management would be open for mineral entry. Approximately 1,176,269 acres of BLM unencumbered lands would be available for locatable mineral entry. Selected lands would be made available for locatable mineral entry if the selection is revoked or relinquished. An additional 3,999 acres are closed to mineral entry due to withdrawals other than ANCSA 17(d)(1). If all reasonable foreseeable future mineral activities were to occur in the Bay planning area on BLM-managed land, activities would occur in the Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasma Creek, Kijik Lake, and Pebble Copper areas.

Lode mineral activities in the Goodnews Bay/Snow Gulch area would occur at the Tatlignagpeke Mountain and Mitlak Mountain properties on BLM unencumbered land and Wattamuse-Granite Lode property on Native-selected land. Lode activities in the Iliamna/Fog area would occur at the Dutton, Easy,

Karen, and Meadow properties on State-selected land and the Duryea and Ground Hog properties on Native-selected land. Lode activities in the Iliamna/Kvichak area would occur on the Iliamna Project, D Block; Iliamna Project, H Block; and LSS 1-3 properties on State-selected land. Lode activities in the Kasna Creek area would occur at the South Current Creek and Upper South Current Creek properties on Native-selected land. Lode activities in the Kijik lake area would occur at the Dicks Lode, Gull, and Kijik Mountain properties on Native-selected land. Lode activities in the Pebble Copper area would occur at the Hill 1759 property on Native-selected land.

Placer activities in the Goodnews Bay/Snow Gulch area would occur at the Barnum Creek, Domingo Creek, Faro Creek, and Jacksmith Creek Tributary on BLM unencumbered land; the Slate Creek property on State-selected land; and the Arolik River, Malaria Creek, Snow Gulch, Tyrone Creek, and Wattamuse Creek properties on Native-selected land. Placer activities in the Iliamna/Fog area would occur at the Unnamed (west of Chetok) property on Native-selected land. Placer activities in the Kijik lake area would occur at the Bertha M. property on Native-selected land.

If locatable mineral activity were to occur on every existing operation, as allowable by present BLM authority on BLM-managed land, an estimated total of 115 acres could potentially be disturbed in the Bay planning area. Total includes surface disturbance of 14 acres on BLM unencumbered land, 36 acres on State-selected land, 47 acres on Native-selected land, and 18 acres on Native land (active Federal claims). Depending upon the results of conveyances, some of this locatable mineral activity may occur on land owned by the State and Native corporations. Due to the small size of the existing operations as well as the short period of operation there would be a minor impact on the local air and water quality.

All locatable mineral related activities occurring on BLM-managed land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to have an approved Plan of Operations which contains site-specific guidelines as listed in the BLM-Alaska Required Operating Procedures. All operations are required to meet applicable Federal and State air and water quality standards for permitting.

c) Effects to Locatable Minerals of Alternative C

Under the Conservation Alternative limited future locatable mineral entry would be allowed on lands retained in BLM management in the Bay planning area. Given the current land status, approximately 1,071,189 acres of BLM unencumbered lands would be closed to locatable mineral entry. Only 152,746 acres would be open to locatable mineral entry. 3,999 acres are closed to material entry due to withdrawals other than ANCSA 17(d)(1). Two areas, the Proposed Carter Spit (62,863 acres) and the Proposed Bristol Bay (989,202 acres) are recommended as ACECs and the proposed wild river segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork rivers (15,125 acres) would be closed to locatable mineral entry.

However, locatable mineral activity would still be allowed on existing “grandfathered” Federal mining claims within the Bay planning area. Active Federal lode mining claims occur at the Iliamna Project, H Block property in the Iliamna/Kvichak area on BLM unencumbered and State-selected land. Active Federal placer mining claims occur on the Salmon River in the Platinum area on Native land. Locatable mineral activity may also occur on lands within the planning area that are conveyed to the State and Native corporations.

If locatable mineral activity were to occur on every active Federal mining claim, as allowable by present BLM authority on BLM-managed land, an estimated total of 23 acres (5 lode and 18 placer) could potentially be disturbed in the Bay planning area on BLM unencumbered, State-selected, and Native land. Under this Alternative no further disturbance would be anticipated as land returning to BLM-management would be included into existing or future withdrawals that would be closed to mineral entry. Due to the

small size of the existing and future anticipated operations, as well as the short yearly period of operation, there would be a minor impact on the local air and water quality.

All locatable mineral related activities occurring on BLM-managed land are subject to current BLM surface regulations as outlined in 43CFR 3809. Operators are required to have an approved Plan of Operations which contains site-specific guidelines as listed in the BLM-Alaska Required Operating Procedures. All operations are required to meet applicable Federal and State air and water quality standards for permitting.

d) Effects to Locatable Minerals of Alternative D

Under the Development Alternative all future locatable mineral activities would be allowed in the Bay planning area as all ANCSA 17(d)(1) withdrawals would be repealed and all segregated lands returning to BLM-management would be open for mineral entry. Approximately 1,176,269 acres of BLM unencumbered lands would be available for locatable mineral entry. Approximately 62,863 acres would be considered for one ACEC (Carter Spit) and subject to more stringent Required Operating Procedures. An additional 3,999 acres are closed to material entry due to withdrawals other than ANCSA 17(d)(1). If all reasonable foreseeable future mineral activities were to occur in the Bay planning area on BLM-managed land, activities would occur in the Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasma Creek, Kijik Lake, and Pebble Copper areas.

Lode and placer mineral activities on BLM-managed land are the same as discussed in Alternative B - Development.

If locatable mineral activity were to occur on every existing operation, as allowable by present BLM authority on BLM-managed land, an estimated total of 115 acres could potentially be disturbed in the Bay planning area. Total includes surface disturbance of 14 acres on BLM unencumbered land, 36 acres on State-selected land, 47 acres on Native-selected land, and 18 acres on Native land (active Federal claims). Depending upon the results of conveyances, some of this locatable mineral activity may occur on land owned by the State and Native corporations. Due to the small size of the existing operations as well as the short period of operation there would be a minor impact on the local air and water quality.

All locatable mineral related activities occurring on BLM-managed land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to have an approved Plan of Operations which contains site-specific guidelines as listed in the BLM-Alaska Required Operating Procedures. All operations are required to meet applicable Federal and State air and water quality standards for permitting.

Salable Minerals (Mineral Materials)

a) Effects to Mineral Materials for Alternative A

Salable material (sand and gravel) activities on Federally administered surface/minerals and split estate are available for exploration and development unless specifically closed by Public Land Order (PLO). Approximately 1,176,269 acres of BLM unencumbered lands are available for the sale of mineral materials. State-selected and Native-selected lands would be made available if their selections are revoked or relinquished. An additional 3,999 acres are closed to material sales due to withdrawals other than ANCSA 17(d)(1). Large reserves of salable material exist on State and Native land and no disturbance of BLM unencumbered land is anticipated. Activities would require an approved Plan of Operations containing stipulations based on site-specific resource concerns and are subject to all BLM and State laws and regulations.

b) Effects to Mineral Materials for Alternative B

Salable material (sand and gravel) activities on Federally administered surface/minerals and split estate are available for exploration and development unless specifically closed by Public Land Order (PLO). Approximately 1,176,269 acres of BLM unencumbered lands are available for the sale of mineral materials. State- and Native-selected lands would be made available if their selections are revoked or relinquished. An additional 3,999 acres are closed to material sales due to withdrawals other than ANCSA 17(d)(1). Large reserves of salable material exist on State and Native land and no disturbance of BLM unencumbered land is anticipated. Activities would require an approved Plan of Operations containing Required Operating Procedures based on site-specific resource concerns and are subject to all BLM and State laws and regulations.

c) Effects to Mineral Materials for Alternative C

Salable material (sand and gravel) activities on Federally administered surface/minerals and split estate are available for exploration and development unless specifically closed by Public Land Order (PLO). Approximately 1,176,269 acres of BLM unencumbered lands are available for the sale of mineral materials. State-selected and Native-selected lands would not be made available if their selections are revoked or relinquished. However, two areas, the Proposed Carter Spit (62,863 acres) and the Proposed Bristol Bay (989,202 acres) are recommended as ACECs and the proposed wild river segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork rivers (15,125 acres) would be closed to the sale of mineral materials. An additional 3,999 acres are closed to mineral material sales due to withdrawals other than ANCSA 17(d)(1). Large reserves of salable material exist on State and Native land and no disturbance of BLM unencumbered land is anticipated. Activities would require an approved Plan of Operations containing Required Operating Procedures based on site-specific resource concerns and are subject to all BLM and State laws and regulations.

d) Effects to Mineral Materials of Alternative D

Salable material (sand and gravel) activities on Federally administered surface/minerals and split estate are available for exploration and development unless specifically closed by Public Land Order (PLO). Approximately 1,176,269 acres of BLM unencumbered lands are available for the sale of mineral materials. State-selected and Native-selected lands would be made available if their selections are revoked or relinquished. However, one exception in the Bay planning area would be closed to material sales, the Proposed Carter Spit ACEC containing 62,863 acres. An additional 3,999 acres are closed to material sales due to withdrawals other than ANCSA 17(d)(1). Large reserves of salable material exist on State and Native land and no disturbance of BLM unencumbered land is anticipated. Activities would require an approved Plan of Operations containing Required Operating Procedures based on site-specific resource concerns and are subject to all BLM and State laws and regulations.

4. Special Designations

a) Areas of Critical Environmental Concern

(1) Effects to Areas of Critical Environmental Concern for Alternative A

There are currently no ACECs in the planning area. Under this Alternative, no ACECs would be created; therefore, there would be no impacts to them.

(2) Effects to Areas of Critical Environmental Concern for Alternative B

Impacts would be the same as those discussed under Alternative A.

(3) Effects to Areas of Critical Environmental Concern for Alternative C

Alternative C would propose the application of special management provisions to 1,052,065 acres (approximately 4%) of the planning area. Management identified under Stipulations, Required Operating Procedures, and project-specific requirements would provide protection of relevant and important values of these ACECs. The following sites would be designated under this Alternative:

- Carter Spit ACEC
- Bristol Bay ACEC

These two potential ACECs would be designated based on resource values and the need for special management beyond standard provisions to protect relevant and important values, values of which for each area are discussed in Chapter III and Appendix A. Management would result in limitations or restrictions placed on other resource uses and activities in order to prevent irreparable damage to the identified values. In both cases, habitat management plans would be written. The area would be subject to Stipulations, Required Operating Procedures, and project-specific requirements and conditions such as seasonal restrictions. Except for Alternative A, retaining ANCSA 17(d)(1) withdrawals, this Alternative provides the most protection to fish and wildlife habitat.

Carter Spit ACEC

Impacts to fish, wildlife, vegetation, Special Status Species, and cultural resources under Alternative C are discussed in this chapter under each topic heading, beginning on page 4-22. This ACEC would remain open to mineral leasing and location, would be closed to salable minerals (mineral materials: sand and gravel), designated as a right-of-way avoidance area, closed to livestock grazing, OHV travel limited to designated roads and trails, closed to FLPMA leases, and would be unavailable for disposal. Should the selected lands immediately adjacent to this ACEC revert to BLM, they will be incorporated into the ACEC.

Bristol Bay ACEC

Impacts to fish, wildlife, vegetation, Special Status Species, and cultural resources under Alternative C are discussed in this chapter under each topic heading. This ACEC would remain open to mineral leasing and location, would be closed to salable minerals (mineral materials: sand and gravel), designated as a right-of-way avoidance area, closed to livestock grazing, OHV travel limited to designated roads and trails, closed to FLPMA leases, and would be unavailable for disposal. Should the selected lands immediately adjacent to this ACEC continue under BLM management, they will be incorporated into the ACEC. Impacts from commercial recreation could be reduced by placing limitations on the number of special recreation use permits issued. A fire management plan developed to protect lichen range for caribou would support one of the purposes for this ACEC.

(4) Effects to Areas of Critical Environmental Concern for Alternative D

Alternative D could result in special management provisions being applied to an estimated 62,863 acres (less than 1%) of the planning area providing protection of relevant and important values. BLM managed lands in one area would be designated as an ACEC. After conveyances are complete, selected lands remaining in BLM ownership would be incorporated into the existing ACEC. The following site would be designated under this Alternative:

- Carter Spit ACEC

This area would be designated based on resource values and the need for special management beyond standard provisions to protect relevant and important values (Chapter III and Appendix A). Management would result in limitations or restrictions placed on other resource uses and activities in order to protect identified values and to prevent irreparable damage to the identified values. A habitat management plan

would be developed for the ACEC. The area would be subject to Stipulations, Required Operating Procedures, and project-specific requirements and conditions such as seasonal restrictions.

Carter Spit ACEC

Impacts to fish, wildlife, vegetation, Special Status Species, and cultural resources under Alternative C are discussed in this chapter under each topic heading, beginning on page 4-14. This ACEC would remain open to mineral leasing and location, would be closed to salable minerals (mineral materials: sand and gravel), designated as a right-of-way avoidance area, closed to livestock grazing, OHV travel limited to designated roads and trails, closed to FLPMA leases, and would be unavailable for disposal. Should the selected lands immediately adjacent to this ACEC remain in long-term BLM administration, they will be incorporated into the ACEC.

b) Wild and Scenic Rivers

Wild and Scenic River areas are not essentially natural resources or resource uses, but represent statutory decisions to protect certain resources or uses over a long period of time. For this reason, impacts of various Alternatives to proposed Wild and Scenic River areas should be examined by looking at the impacts to resources and uses described elsewhere in this chapter.

The most basic characteristics of a wild and scenic river are its free-flowing nature and its unpolluted waters. Impacts of the various Alternatives on the quality and free-flow of water are described in the Air Quality, Soil and Water Resources section of this chapter.

Seven outstandingly remarkable values were identified for the eligible river areas: Free-flowing nature and water quality, scenery, subsistence use, prehistory and history, recreational use, fish habitat, and wildlife habitat. Each of these values has a corresponding section in this chapter where an assessment of potential impacts may be found. Appendix A provides the Wild and Scenic River matrix used to determine the river segments' eligibility.

(1) Effects to Wild and Scenic Rivers Common to All Alternatives

The three river areas described as eligible will be managed---to the extent possible using BLM discretionary authority---to protect the outstandingly remarkable values identified until a final decision is made on the suitability or non-suitability of these rivers as additions to the National Wild and Scenic River System.

(2) Effects to Areas of Critical Environmental Concern for Alternative A

There are currently no Wild and Scenic Rivers designated on BLM-administered lands in the planning area. Under this Alternative, no rivers would be nominated.

(3) Effects to Areas of Critical Environmental Concern for Alternative B

No Wild and Scenic Rivers would be nominated under this Alternative.

(4) Effects to Areas of Critical Environmental Concern for Alternative C

Under Alternative C, three river segments would be proposed for Wild and Scenic River Designation: the Alagnak River (Wild/Recreational), the Goodnews River Mainstem (Wild), and the Goodnews River Middle Fork (Wild) (15,125 acres). This would provide maximum protection to water quality and free-flow, as the BLM would gain additional authority to review Federal authorizations for water resources projects, and would be mandated to protect the outstandingly remarkable values of designated rivers. ANCSA 17(d)(1) withdrawals would be retained until Congress had an opportunity to act on the proposal.

(5) Effects to Areas of Critical Environmental Concern for Alternative D

Under Alternative D, no Wild and Scenic Rivers would be proposed.

5. Social and Economic Conditions

a) Effects to Social and Economic Conditions Common to All Alternatives

(1) Effects to Social and Economic Conditions from BLM Expenditures (Common to All)

Income generated by BLM expenditures in the planning area, including expenses for field operations, services, and personnel are expected to remain similar to current contributions, or increase slightly, across all Alternatives.

(2) Effects to Social and Economic Conditions from Livestock Grazing (Common to All)

No livestock grazing currently occurs under permit, nor has any interest been expressed in requesting livestock grazing authorization. The only anticipated grazing uses might be incidental use associated with recreational and commercial use of pack animals for hunting, fishing, and other back country recreation. Authorizations for grazing by pack animals will be examined on a case-by-case basis. No requests for reindeer grazing permits are anticipated. There are no current reindeer grazing authorizations within the Bay planning area. Therefore, no effect on the regional economy is expected under any Alternative.

(3) Effects to Social and Economic Conditions from Forest Products (Common to All)

Individual and subsistence use of forest products is typical in the planning area. There is virtually no commercial demand, few permits for individual use, and no expectation of change in current pattern of use. The demand for forest products on BLM administered land within the plan area is not expected to change in the foreseeable future. Therefore, the effect on the regional economy is very low for all Alternatives.

(4) Effects to Social and Economic Conditions from Recreation Management, Travel Management, and Special Designations

BLM issues approximately 6 annual special recreation use permits to commercial guides or outfitters using BLM administered or Public Land inside the planning area. Little visitor use or trip data is available. BLM assumes access to the planning area for commercial or public recreation is largely provided by local businesses.

OHV management will not have economic effects on the area. Access to subsistence resources will remain unaffected under all Alternatives.

(5) Effects to Social and Economic Conditions from Hazardous Materials Management

The BLM management actions proposed under all Alternatives for hazardous or solid wastes may have localized, beneficial effects on socioeconomic resources through prevention measures and mitigation practices as site become known that are near known communities.

b) Effects to Social and Economic Conditions for Alternative A

(1) Effects to Social and Economic Conditions from Leasable Minerals (Alternative A)

The area would be closed to mineral leasing. Therefore, management under this Alternative would not result in changes in the regional economy.

(2) Effects to Social and Economic Conditions from Locatable Minerals (Alternative A)

A small portion of the planning area is currently open to mineral location, and would be open under Alternative A. The ANCSA Section (d)(1) withdrawals, State, and Native selections segregate most of the land, preventing new mineral entry. Mining activity is currently taking place only on claims predating ANCSA and selections. Planning decisions would not limit mining on existing claims.

Under this Alternative, no new mining activity would be likely to occur on BLM managed land. Therefore, management under this Alternative would not result in changes in the regional economy.

(3) Effects to Social and Economic Conditions from Lands and Realty Actions (Alternative A)

FLPMA permits, leases, and sales would continue to be processed on a case by case basis. There is no record of previous FLPMA sales. No disposal or exchange activity would be allowed under this Alternative. Therefore, management under this Alternative would not result in changes in the regional economy.

c) Effects to Social and Economic Conditions Alternative B

(1) Effects to Social and Economic Conditions from Minerals (Alternative B)

Most of the planning area (2,499,941 acres) would be recommended for opening to mineral leasing. Leasing would occur after ANCSA (d)(1) withdrawal orders were modified, and after segregated land either was conveyed or was returned to the public domain when land conveyances are complete.

Leasable Minerals

Revenues - Long term gas prices must be over \$12.45 per Mcf to encourage production where a gas pipeline must be constructed to deliver product to Dillingham (Craig 2004). This is based on current costs. Leases may be offered as early as 2010 and exploration may begin during the period 2010 to 2014. Leases are most likely to lie approximately 40 miles east northeast of Dillingham in this scenario. Economic effects of a gas field will more likely result within the Dillingham area, and less likely to result in change in the remainder of the planning area.

Bonus bids in the Alaska Peninsula Area wide 2005 oil and gas lease sale of state land brought the State of Alaska \$1,268,121 in revenue. State leases covered about 213,000 acres in this sale. The total area in the Koggiling Creek Block of unencumbered land is 159,732 acres. Bonus bids are expected to be lower for an offering here. The State of Alaska transfers part of its share of bonus bids to boroughs, for example, in 1998 following the NE NPRA lease sale. (DOI, 2003) However, the likely location of a lease sale is not within an organized borough in the planning area.

Rent is charged for lease acreage until it produces oil or gas and thereafter royalty. The Federal government charges \$1.50/acre for the first five years and \$2.00/acre for the second five years of a typical 10 year lease. Rents are split with the State in the same manner as royalties. 1,404,000 of 5,816,919 acres offered were leased in the 1998 NW NPRA sales, for example.

Royalties will be based on 12.5% of the well head value of gas and be split between the State (90 percent) and Federal government 10%. The State received a total of approximately \$1.755 billion from rents, bonus bids, and royalties statewide during calendar year 2005.

Property tax may be assessed by the state and shared with a borough. The scenario used and analyzed in this EIS predicts development outside of existing boroughs in the planning area. Therefore, even if the state assesses property tax it will not go directly to a local government.

Employment and Income - Crew estimates presented in BLM's Reasonably Foreseeable Development Scenario (RFD) for Leasable Minerals estimate manpower requirements for gas exploration and related activities. Seismic testing is predicted to begin in the period 2010 . Crews will range from 20 to 50 workers. These workers may be based in a central location, or may be based in a field camp, as is often the case in other parts of Alaska where remote operations occur.

All other activities would occur in 2014 or later. Drilling would require 17 to 34 workers. Production would require 19 to 73 workers. Construction of a 3 inch diameter steel transmission pipeline would require 21 to 34 workers.

It is assumed that development activities would be based from a camp located on one of the gravel pads associated with development and production. Camp operations would require 10-20 additional workers in trades or laborers during set up, and catering services indicated in the following tables during operation.

Direct and indirect impact to the central location during exploration would include effect on local lodging and catering services, and could be a significant input to an economy such as Dillingham. Later construction and operations may have a lower effect on lodging and food service in Dillingham, but may increase transportation service requirements for material barged or flown from supplier locations outside the planning area. It is possible all direct and indirect input in the Dillingham area would be new jobs, though temporary and paralleling the project timeline. Tables 4.3 through 4.6 show direct employment under a camp scenario. Direct employment includes catering service at camp facilities, which is not included in the BLM RFD labor requirement. Therefore, the figures in preceding paragraphs will be lower than shown in the tables. Indirect employment would likely occur in Dillingham, at hotels and in the transportation sector. This is estimated as 2 to 12 jobs during the life of the project. Personal income derived from the project would be most likely to result in the construction, service, and transportation sectors.

Table 4.3. Potential Seismic Manpower Requirements for Proposed Yukon Flats Oil and Gas Development (Adapted from Doyon 2004)

Position	2D Seismic	3D Seismic
Supervisor and Co. Rep	3	4
Surveyors	8	16
Drilling Crew	15	20
Recording Crew	18	25
Catering	4	6
Total	48	71

Table 4.4. Potential Drilling Manpower Requirements for the Proposed Activity in This Planning Scenario (adapted from Doyon 2004)

Position	Number
Supervisors/Tool Pushers	2-4
Rig Crews	6-14
Welders, Electricians, Mechanics & Roustabouts	3-6
Drilling Services	6-10
Catering	6
Total	23-40

Table 4.5. Potential Production Operations Manpower Requirements for the Proposed Activity in This Planning Scenario (adapted from Doyon 2004)

Position	Number
Production Supervisors	2-4
Production Operations	10-50
Roustabouts	5-12
Support Services such as Mechanics, Electricians	2-7
Catering	6
Total	25-79

Table 4.6. Potential Pipeline Construction Manpower Requirements for the Proposed Activity in This Planning Scenario (adapted from Doyon 2004)

Position	Number
Project Management	1-2
Welders & Helpers	10-15
General Laborers	5-7
Support Services such as Mechanics, Electricians	5-10
Catering	6
Total	25-40

Bristol Bay area oil and gas industry employment and income will vary from low levels during exploration phase (2010 to 2014) increase during development and drop during production phases. Workers will travel to the gas field from other parts of the United States (27%) and from other parts of Alaska (58%), with very few workers originating from the planning area (15%), based on comparisons drawn from the North Slope oil industry. (Hadland 2005)

Continuing, the Interim Report *The Economic Multiplier* shows that in rural areas the multiplier has a value only a little more than one (ISER 2005). Most goods and services purchased by businesses and households in small towns come directly from larger trade centers outside the local market. In this instance, sources are outside the planning area. The Institute of Social and Economic Research at the University of Alaska in Anchorage estimates that in rural census areas in Alaska it would take \$15 or more of purchasing power flowing into the region to produce \$1 of income in a support business within the region itself. According to the report, additional spending would generate more support wages in Dillingham than the same amount of spending in Bristol Bay Borough.

The effect of the employment and income on the United States is negligible.

Locatable Minerals. The revocation of all ANCSA Section 17 (d)(1) withdrawals would allow new mineral entry. Under this Alternative one to three new placer operations could begin over the life of the plan. Up to 15 new seasonal jobs at mining locations may be created, adding income of \$150K to \$250K per annum to the regional economy.

Exploration for resources leading to lode mine potential will begin to occur over the life of the plan. From four to 40 new seasonal jobs may be created in various stages of exploration. In initial exploration, one or

more small crews consisting of two well qualified geologists and two lesser qualified assistants would receive an average of \$300 per day for approximately six months work. Work would be conducted from small field camp(s) with all supplies shipped to location using commercial air transport, and all local transportation by helicopter on contract. Using these assumptions, each crew could receive about \$216,000 for 180 days seasonal employment. This is the most likely scenario for the period 2010-2015.

If potential lode resources are located, additional employment may result as exploration to define a deposit continues. Additional capital and labor will be required to drill, sample, and process findings. This scenario indicates spending may increase by a factor of ten in later stages of exploration or assessment of resources. Primary labor resources will continue to be imported from outside the planning area. Depending upon location of activity, a field camp may still be required, with little use of local lodging.

A large portion of wages will be paid to workers who do not live in the region, and much of the capital investment will occur outside the region. The effect to the regional economy is expected to be low. As development begins, the likelihood of local resource utilization, lodging and air taxi service, and participation by local labor is likely to increase.

No revenues would result to the state or Federal government under this scenario.

(2) Effects to Social and Economic Conditions from Lands and Realty Actions

FLPMA permits, leases, and sales would continue to be processed on a case by case basis. Effect of future disposal or land exchange proposals may be assessed when the value of specific parcels is determined. BLM is unlikely to act until land conveyance to the State of Alaska, ANCSA Native Corporations, and Native Allottees is complete. At that time BLM may attempt to consolidate land management responsibilities.

d) Effects to Social and Economic Conditions for Alternative C

(1) Effects to Social and Economic Conditions from Minerals

Leasable Minerals

Most of the planning area (2,488,815 acres) is open to mineral leasing. The effect on the regional economy is expected to be the same as Alternative B.

Locatable Minerals

Impacts would be the same as Alternative A.

(2) Effects to Social and Economic Conditions from Lands and Realty Actions

Impacts would be the same as Alternative B.

e) Alternative D

(1) Effects to Social and Economic Conditions from Minerals

Leasable Minerals

Most of the planning area (2,499,941 acres) is open to mineral leasing. The effect on the regional economy is expected to be similar to Alternative B.

Locatable Minerals

Impacts would be the same as Alternative B.

(2) Effects to Social and Economic Conditions from Lands and Realty Actions

Impacts would be the same as Alternative B.

6. Environmental Justice

The Alutiiq, Athabascan, and Central Yup'ik Native people, recognized minorities in the planning area, engage in a particularly subsistence based economy. It is characterized by high unemployment in the cash-based economy, low labor force participation, and relatively low income where the cost of living is very high. Therefore, activities restricting subsistence practices, access, and resources will certainly affect a large segment of the local population. Arguably, creation of jobs and income provide positive effects on the Native population.

Activities not associated with mineral extraction or oil and gas activities likely to occur in the Planning Area would primarily be transitory in nature, of short duration, and highly localized. Under all Alternatives the effects of recreation, and forestry, lands and realty actions, and grazing would be similar. Activities could temporarily divert, deflect, or disturb subsistence species from their normal patterns. These activities could alter the availability of subsistence species in traditional harvest areas, which could in turn affect harvest patterns by requiring hunters to travel further in pursuit of resources. Increased travel distances would result in greater expenditures for fuel and equipment, and increased wear and tear on equipment. Consequently, there could be an effect on the subsistence hunting activities of local minority populations as a result of these activities. The effect would be likely minor, short term, and highly localized.

Alternatives B, C, and D would allow oil and gas activities in areas formerly unavailable for leasing. Year-round activities could increase the amount of area affected, increase the duration of effects, and spread the effects where development occurs in the Planning Area. Disturbances caused by development under Alternatives B, C, and D would be potentially greater or more likely than under the No Action Alternative. Mining of locatable minerals under Alternatives B or D would not be likely to adversely affect local people since small placer operations would be seasonal and of short duration. Mineral exploration will have little effect on the local populations as employees and supplies will originate outside the planning area.

7. Subsistence

The potential of initiation of gas exploration and development, continuation and possible expansion of locatable mineral exploration and development, and development of infrastructure in the form of connecting roads, bridges, and supporting infrastructure for commercial development, taken together they would have cumulative impacts on caribou, moose, brown bear, some migratory waterfowl, and anadromous and freshwater fish in the planning area. Consequently, subsistence would also be affected, as all communities within the planning area rely on caribou, moose, and anadromous fish as their primary sources of protein.

Privatization of State and Native corporation lands would have the potential to negatively affect wildlife, wildlife habitat, and subsistence use by opening up areas to private development.

Development of regional connecting roads within the planning area would have the potential to negatively affect wildlife, wildlife habitat, and subsistence. These impacts would include habitat fragmentation, increased access into wildlife habitats, increased disturbance impacts, increased potential for mortality (road kills) and possible alteration of behavior or movement patterns of wildlife. If the proposed road(s) linked small or regional communities to the already existing road system within Alaska, then increased

competition for subsistence resources would likely result, as non-local hunters would be able to more readily access the area. Currently, access for non-local hunters is primarily by airplane or by boat. This may also result in an increase in visitor traffic and recreational use of the area, causing additional impacts to wildlife.

Small roads that connect communities within the planning area may aid subsistence users in accessing their traditional harvest areas. However, they may also concentrate hunting efforts along the road corridor, depleting resources from the immediate area, and potentially altering harvest from currently-used traditional harvest areas.

E. Cumulative Effects

1. *Methods*

The National Environmental Policy Act (NEPA) and its implementing guidelines require an assessment of the proposed project and other projects that have occurred in the past, are occurring in the present, or are likely to occur in the future, which together may have cumulative impacts that go beyond the impacts of the proposed project itself. According to the Act (40 CFR Sec. 1508.7 and 1508.25[a][2]):

A **cumulative impact** is the impact on the environment that results from the incremental impact of the action when added to the other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. In addition, to determine the scope of environmental impact statements, agencies shall consider cumulative actions, which when viewed with other proposed actions have cumulatively significant impacts and should therefore be discussed in the same impact statement.

The analysis of cumulative impacts is a four-step process that follows guidance provided in Considering Cumulative Effects under NEPA (CEQ 1997).

- **Specify the class of actions whose effects are to be analyzed.** Activities allowed under the RMP and advances in technology are considered in the analysis. The assumptions and scenarios used by the resource specialists in the analysis of the cumulative impacts include those identified for the planning area in Analysis Assumptions beginning on page 4-3.
- **Designate the appropriate time and space domain in which the relevant actions occur.** For some resources and uses, the area of which an effect could be felt would be the “footprint,” but for others the effect may extend well beyond that area. For example, noise effects to wildlife can extend beyond the footprint of the development. For purposes of this analysis, the spatial domain for past, present, and reasonably foreseeable activities is primarily the planning area. However, this document also considers effects to resources that could occur outside of the planning area, primarily to migratory birds and mammals. Due to the difficulty of predicting advances in technology and the need for oil and gas very far into the future, the analysis period which most of the cumulative effects analysis is focused, is 50 years into the future.
- **Identify and characterize the set of receptors to be assessed.** The set of receptors assessed in the cumulative effects analysis are the physical, biological, and human systems discussed in Chapter III.

- **Determine the magnitude of effects on the receptors and whether those effects are accumulating.** The potential extent of the total cumulative effects (e.g., number of animals and habitat affected, jobs and revenues created or lost), and how long the effects might last (e.g., population recovery time, duration of income flows) are estimated to determine the magnitude of effects that could accumulate for each resource. Where possible, the assessment of effects on a resource is based on quantitative analysis (e.g., number of miles of gravel constructed; number of animals killed). However, many effects are difficult to quantify, and a qualitative assessment of effects is made.

2. Activities Considered in the Cumulative Case

The following are past, present, and reasonably foreseeable future actions on Federal lands and non-Federal lands within the planning area or outside of the planning area. Actions outside the planning area include those that could contribute to cumulative effects on resources within the planning area.

a) Past Development

- **History of Oil and Gas Exploration** - To date, oil and gas exploration has been limited to 26 onshore wells and 2 offshore wells in the Bristol Bay region, an area comprising about 40,000 square miles (Magoon et al. 1996). None of the wells were drilled in the planning area, nor have any produced oil or gas in commercial quantities.
- **First Lease Sales** - The State of Alaska first made land available for oil and gas leasing in the Bristol Bay area in the 1960s. Sales #2 and #5 resulted in the leasing of five isolated tracts in Nushagak Bay and on the Alaska Peninsula (State of Alaska 2005). A total of 476,824 acres were leased. In 1961 Pure Oil Company received a contract from the State of Alaska to drill three wells in the Nushagak Bay area. The project was abandoned when Pure Oil Company failed in an attempt to land a drilling rig in the area due to icing conditions (State of Alaska 1961).
- **Historic Wells** - The North Aleutian COST #1 well (1983) and the Amoco Becharof #1 well (1985) were drilled in the Aleutian Islands region. The North Aleutian COST #1 well was drilled offshore by ARCO into the Bear Lake Formation, which exhibited good reservoir properties. Approximately 33 feet of coal was also found (Reifenstuhl and Finzel 2005).

Becharof #1, the nearest well on the Alaska Peninsula to the planning area boundary is located approximately 30 miles south of the boundary. It was drilled in 1985 by the Amoco Petroleum Company. Significant gas shows were encountered in Tertiary rocks (Reifenstuhl and Brizzolara 2004).

- **Cook Inlet Basin Oil and Gas** - Alaska's first commercial oil production came from discoveries in Cook Inlet. In 1959, the State of Alaska established a competitive leasing program. Since then over 5.6 million acres of State land have been leased in 40 State oil and gas lease sales in the Cook Inlet region. Prior to Statehood in 1959 the Federal government conducted non-competitive lease sales. About 67,000 acres of the non-competitive Federal leases remain active in the Cook Inlet basin. One competitive Federal lease has been issued to date: a 400-acre parcel. In 1960, annual production rose to 600,000 bbls, and peaked at 83 million bbls in 1970. Industry-related developments include a Unocal ammonia-urea plant in Nikiski, the first oil refinery developed by Tesoro in 1969 near Kenai, and a liquid natural gas (LNG) plant in Nikiski in 1969.
- **History of Locatable Mineral Production** - Known mineral deposits within the Bay planning area that have seen historical production include one deposit of placer platinum, placer gold, and one small mercury lode deposit. Placer platinum mining has historically occurred on the Salmon River near the Goodnews Mining Camp and associated side drainages including Dowery Creek, Squirrel Creek, and Clara Creek. Between 1928 through 1982 an estimated 646,312 troy ounces of platinum were mined from these drainages. Early open cut mining was conducted by draglines/slucice-boxes in the side

drainages. In 1937 a large bucket-line dredge was brought in to mine the Salmon River which operated through 1982.

- Placer gold mineralization has been identified and mined in the past but these operations were small and have been inactive for many years. Placer gold mining has occurred in the headwaters of the Arolik River and the Wattamuse/Slate Creek area, north of Goodnews Bay; at Trail Creek, a tributary of the Togiak River; at American Creek, north of Naknek Lake; and at Portage Creek and Bonanza Creek, north of Port Alsworth. The largest gold placer operation occurred around Wattamuse Creek and associated drainages, where between 1917 through 1947 an estimated 30,041 troy ounces of gold were mined (BLM, 2005 AMS).
- Mercury was discovered at the Redtop Mercury Mine, located on Marsh Mountain north of Dillingham. Production occurred from 1952 to 1959 with a total of approximately 100 flasks (Hudson, 2001a OFR 01-192). Several abandoned mine projects have been conducted at the Redtop Mercury Mine during the last decade, including hazardous waste removal of the retort and contaminated soil at the Redtop Millsite along the Wood River. Additionally, dynamite demolition, and a closure of the main underground adit have occurred at the associated mine site on top of Marsh Mountain (BLM 2005).
- **Omnibus Roads** - Three Omnibus roads were constructed in the Bay planning area.

b) Present and Reasonably Foreseeable Future Development

- **Commercial Fishing** - Commercial fishing in Bristol Bay continues as the key economic driver in the region. Residents in every village in the region participate in the fishery, with members of every community holding set net and drift net limited entry permits.
- **The Oil Industry** - Oil provides approximately 85% of the State of Alaska income, Permanent Fund Dividends to residents, and has resulted in infrastructure development in the Bristol Bay Region.
- **Oil and Gas in Bristol Bay Basin** - Offshore drilling is currently off limits following a 1996 presidential moratorium; however, directional drilling from onshore is authorized (State of Alaska 2004). The moratorium on offshore drilling is in effect until June 30, 2012, but can be revoked by the President prior to that date (Sherwood et al. 2006).
- **Alaska Peninsula and Nushagak Peninsula Oil and Gas Leasing Program** - On March 17, 2004, ADNOR, Lake and Peninsula Borough, Bristol Bay Borough, and Aleutians East Borough signed a Memorandum of Understanding (MOU) in support of oil and gas lease sales and licensing of State land in the Bristol Bay and Alaska Peninsula regions. Similar MOUs were already in place between the ADNOR and the Aleut Corporation and the Bristol Bay Native Corporation (State of Alaska 2004).
- **Oil and Gas Exploration Licensing Near Dillingham** - The multi-agency coordination resulted in the State of Alaska initiating an Exploration Licensing area near Dillingham, which originally totaled 329,113 acres, only applicable for lands owned by the State (State of Alaska 2004). Bristol Shores, LLC, the primary interested licensee, was granted a license but let it lapse. In June 2005, Bristol Shores applied for a new license application for a reduced area consisting of 20,154 acres on the east side of Nushagak Bay, south of Dillingham (Petroleum News 2005) with the intent of conducting initial exploration. Currently there is no proposed or pending license in the Bristol Bay license area. Commercial oil finds are unlikely, but the area may contain up to 1 tcf of natural gas (Loy 2004).
- **Oil and Gas Lease Sales** - ADNOR held an oil and gas lease sale October 26, 2005, offering 1,047 tracts of 5.8 million acres within the Alaska and Nushagak peninsulas (Decker 2005). Lands offered within the planning area include the lower Nushagak Peninsula and the southern portion of land extending from south of Ekuk eastward to the Kvichak River delta (State of Alaska 2005). About 510,000 acres lie within the Bay planning area boundary, none of which are BLM administered lands. At that time, 213,120 acres were leased, non of which were within the planning area. Interested was

limited to Port Moller and vicinity, on the lower Alaska Peninsula approximately 200 miles south of the planning area. According to ADNR the next sale for the Alaska Peninsula is scheduled for February 2007 (State of Alaska 2006).

- **Cook Inlet Basin Leasables-** The Cook Inlet basin is currently the only commercially producing oil and gas region in southern Alaska. Between 1997 and 2001 Cook Inlet natural gas production remained relatively stable at an average of 213 Bcf per year.
- **Locatable Mineral Exploration in the Bay Planning Area -** During 2005, the last complete year of information, 7 APMAs and AHEAs were submitted for Locatable Mineral projects located within the Bay planning area. Four lode exploration applications and 3 placer mining applications were filed (AK DNR 2005). APMAs are currently being submitted for 2006.
- **Lode and Placer Exploration -** Lode exploration projects include the Big Chunk, Kamishak Project, Pebble Copper, and Shotgun/Mose projects located on State land. One placer mining project on the Arolik River is located on Native-selected land and one location at Salmon River Bench is located on Native land. One placer mining operation on State land includes the Syneeva Creek (Northern Bonanza). There are no lode or placer mining activities on BLM unencumbered land at this time.
- **Pebble Copper Mine Project -** State lode mining claims are located on the Big Chunk (BC), FUR, GDH, KAK, Pebble Copper, Pebble South, 25 Gold: Sill, 37 Skarn, and 38 Porphyry properties. The Pebble gold-copper-molybdenum-silver deposit is located in the Lake and Peninsula Borough, just north of Frying Pan Lake and 18 miles northwest of Iliamna. The exploration and planning phase of this project is likely to continue for several years, and provides income for lodge and hotel owners in Iliamna as well as jobs for locals.

In 2004, Northern Dynasty Minerals, Ltd. began a program to collect engineering, environmental, and socioeconomic data required for completion of a Bankable Feasibility Study and submission of permit applications for the Pebble Copper Mine. New finds in 2005 have delayed the permit application submission timeline. Production is not expected to begin before 2010 (Northern Dynasty Minerals Ltd. 2005).

In conjunction with the mining project, ADOT&PF is examining the feasibility of constructing a 75 mile road from the Pebble Copper mine site to a port site at Iniskin Bay or Williamsport. Draft reconnaissance engineering started in July 2004, and final reconnaissance engineering was to be completed in 2005 (ADOT&PF 2004).

- **Big Chunk (BC) Project -** Liberty Star conducted a comprehensive exploration project to evaluate copper-gold deposits on state mining claims adjacent to the Pebble Copper Mine deposit (Alaska Minerals Commission 2005).
- **Locatable Mineral Claim Staking -** Mining claims have been staked throughout the Bay planning area for both lode and placer deposits. Extensive claim staking has historically occurred in the Bonanza Hills, Kemuk, Kvichak, Pebble Copper, Shotgun Hills, Sleitat Mountains, Snow Gulch, and Red Top areas. As of January 2005 there were a total of 257 Federal claims covering approximately 10,280 acres and as of December 2005 there were a total of 5,824 State claims and no State prospecting sites covering a total of approximately 232,960 acres (BLM, 2005).
- **Bonanza Creek Area -** State placer mining claims are located on Bonanza Creek and Syneeva Creek. State lode mining claims are located on the Bonanza Hill and Bonanza property.
- **Goodnews Bay/Snow Gulch Area -** State placer mining claims are located on the Arolik River.
- **Iliamna/Kvichak Area -** Federal and State lode mining claims are located on the Iliamna Project, H Block property. State lode mining claims are located on the Iliamna Project, D Block and LSS properties.

- **Kemuk Mountain Area** - State lode mining claims are located on the Kemuk and NAP properties.
- **Platinum Area** - Federal placer mining claims are located on the Salmon River Bench property.
- **Shotgun Hills Area** - State lode mining claims are located on the Shot, Shotgun/Mose, and Win properties.
- **Exploration and Development Activities Bonanza Creek Area** - There are no identified exploration projects reported in the Bonanza Creek area as of 2004 (Szumigala and Hughes, 2005). One APMA placer mining project was submitted for Syneeva Creek for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Goodnews Bay/Snow Gulch area** - There are no identified exploration projects reported in the Goodnews Bay/Snow Gulch area as of 2004 (Szumigala and Hughes, 2005). One APMA placer mining project was submitted for the Arolik River for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Iliamna/Fog Area** - There are no identified exploration projects reported in the Iliamna/Fog area as of 2004 (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Iliamna/Kvichak Area** - Detailed geophysical survey and core drilling was completed in 2004 on the Iliamna Project H Block by Geocom Resources Inc. Over 3,303 feet of core drilling was completed at four locations outlining a 2,296 by 4,921 foot gold, copper, and molybdenite mineralized zone. At their Iliamna Project, D Block additional geophysical studies were conducted to delineate drill targets (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Kasma Creek Area** - There are no identified exploration projects reported in the Kasma Creek area as of 2004 (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Kemuk Mountain Area** - There are no identified exploration projects reported in the Kemuk Mountain area as of 2004 (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Kijik Lake Area** - There are no identified exploration projects reported in the Kijik Lake area as of 2004 (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Recent Exploration and Development Activities Pebble Copper Area** - Three properties had extensive exploration activities conducted during 2004; Pebble Copper, Big Chunk (BC), and Pebble South. Northern Dynasty Minerals, LTD. conducted comprehensive drilling, base-line environmental and socioeconomic studies to support Federal and State project permit applications. Also, Northern Dynasty conducted site testing and engineering studies for a bankable feasibility study which will be started in 2005. In-fill drilling to upgrade resources to measured and indicated status and to finalize pit design as conducted. During 2004, more than 157,614 feet of core drilling in 227 holes was completed, in-fill drilling totaled 101,539 feet in 122 holes, metallurgical and process drilling totaled 21,335 feet in 26 holes, geotechnical drilling totaled 32,502 feet in 70 holes, and exploration drilling totaled 13,815 feet in 9 holes. A new higher-grade, laterally extensive gold, copper, and molybdenite "East Zone" was discovered on the east side of the "Central Zone" of Pebble Copper. Mineralization has been discovered to a depth of 2,379 feet, and extends beyond to an unknown depth. More extensive drilling was conducted during 2005. This deposit would be mined by underground methods and is richer than the Central Zone (Szumigala and Hughes, 2005).

Liberty Star Gold Corporation conducted exploration activities on the Big Chunk (BC) property, abutting the northwest corner of the Pebble Copper claims. Airborne magnetic survey, geologic, geochemical, space imagery, and aeromagnetic studies identified 21 anomalous areas. Geological sampling, mapping, and diamond drilling activities were conducted during 2004 (Szumigala and Hughes, 2005).

Full Metal Minerals, Ltd. conducted exploration activities on the Pebble South property, abutting the south side of the Pebble Copper claims. A geological sampling program, geophysics and ground magnetic studies were completed in 2004. Eleven anomalous areas were identified with two high priority targets identified; the Boo and TYP properties (Szumigala and Hughes, 2005).

Two AHEA exploration projects were submitted for the Big Chunk (BC) and Pebble Copper projects for 2005 (AK DNR, 2005).

- **Exploration and Development Activities Platinum Area** - There are no identified exploration projects reported in the Platinum area as of 2004 (Szumigala and Hughes, 2005). One APMA placer mining project was submitted for the Salmon River for 2005 (AK DNR, 2005).
- **Exploration and Development Activities Shotgun Hills Area** - TNR Gold Corp. conducted geological and geochemical exploration programs during 2004. This resulted in acquiring 14,080 acres of new State mining claims. The claims follow a north-south trend from the Main Shotgun Zone and are called the Shot, King, and Winchester areas. New drill targets for 2005 were identified along this zone as well as more extensive drilling of the Main Zone. One AHEA exploration projects were submitted for the Shotgun/Mose project for 2005 (AK DNR, 2005).
- **Sleitat Mountain Area** - There are no identified exploration projects reported in the Sleitat Mountain area as of 2004 (Szumigala and Hughes, 2005). No APMA or AHEA exploration projects were submitted for 2005 (AK DNR, 2005).
- **Construction of the Wood River Bridge** - The Alaska Department of Transportation and Public Facilities (ADOT&PF), with the Federal Highway Administration, have made an Environmental Assessment and Finding of No Significant Impact for the proposed construction of the Wood River Bridge in Alaknagik. The bridge is currently in the design phase, with construction to begin in late 2007 or in 2008 (ADOT&PF 2005).
- **Iliamna Airport Improvements** - The ADOT&PF began study of ways to improve the Iliamna airport in 2005, including identifying improvement options, preparing engineering and environmental reports, and completing a master plan that outlines short-term (5 years), intermediate (10 years), and long-term (20 year) airport improvements (ADOT&PF 2005).
- **Manokotak Airport Improvements** - The ADOT&PF with the Federal Aviation Administration is proposing improvements to Manokotak Airport in Manokotak. Improvements include expanding the runway, surfacing the entire facility, providing adequate area for snow storage, constructing an apron and taxiway system, installing an airport lighting system and precision approach path indicators and runway end identification lighting, adding two snow removal equipment storage building bays, and extending overhead electrical lines to the new facility. A draft Environmental Assessment was published in July, 2005 (ADOT&PF 2005; FAA 2005).
- **Proposed Naknek River Bridge and Aviation Operations Improvements** - The proposed ADOT&PF project would entail a bridge spanning the Naknek River and connecting the three communities of the Bristol Bay Borough, South Naknek, Naknek, and King Salmon. The bridge would tie into the existing Omnibus road that connects Naknek and King Salmon. A bridge would influence aviation use patterns and the priority of aviation operations and improvements at the individual airport facilities, some of which had been identified by 2005 and were awaiting funding (ADOT&PF 2005).

- **Near-Term Recommendations for Community Linkages** - In its Transportation Plan, the ADOT&PF recommends five community linkage projects, three of which are in or immediately adjacent to the Bay planning area: Williamsport-Pile Bay roadway improvements; Iliamna-Nondalton road improvements and bridge construction connection; and Dillingham-Aleknagik road improvements and bridge construction connection (ADOT&PF 2005).
- **ADOT&PF Recommendations for Port and Harbor Improvements** - One recommended set of port improvements is Williamsport navigation improvements and dock facility and Pile Bay dock and boat launch facility. While this is outside the Bay planning area, it is seen as providing an intermodal complement to key transportation infrastructure, some of which would probably be within the planning area (ADOT&PF 2005).
- **ADOT&PF Marked Winter Trail System** - Provides a system of trail markers that permits safe travel by snowmachine between Bristol Bay communities during the winter months (ADOT&PF 2005).

c) Speculative Development

- **ADOT&PF Corridor Delineation** - The purpose of corridor delineation is to recognize the patterns of existing travel and desired travel in the region and to establish and protect the surface transportation “highways” that would best serve the region’s long term social and economic infrastructure needs. The Transportation Plan identifies four primary corridors, three of which are in or immediately adjacent to the Bay planning area: Cook Inlet to Bristol Bay corridor; Alaska Peninsula corridor and Dillingham/Bristol Bay corridor (ADOT&PF 2005). It is possible that all or segments of these projects may be completed during the life of this plan.
- **ADOT&PF “Triggers” for Planning** - ADOT&PF’s Transportation Plan recommends a series of triggers for re-evaluation of lower-priority projects that could lead to their development within the 20-year period considered by the plan (ADOT&PF 2005). This is dependent on such factors as a dramatic increase in population and increased demand from the economic sector.

3. Resources

a) Cumulative Effects to Air Quality, Vegetation, Soils, and Water Resources

(1) Cumulative Effects to Air, Vegetation, Soils, and Water from Minerals

Cumulative effects to soil and vegetation resources would largely result from surface disturbing activities that degrade the vegetative cover, compact soils, and expose ice-rich permafrost soils causing thermokarst erosion and subsidence. Wetland soils, stream bank soils and vegetation, and lakeshore soils and vegetation would be particularly vulnerable due to the increased possibility of additional vegetation loss, weed invasions, and erosion from seasonal breakup ice scouring and wave action. Thermokarst erosion could also result from the cumulative effect of seismic and exploration activity when less than ideal snow conditions expose tussock tundra to surface disturbance during winter months. Habitat maintenance and enhancement through adherence to the Required Operating Procedures, Stipulations, and project-specific requirements would normally reduce the unnecessary long-term disturbance to soils.

Past and present events and actions that have affected fresh water resources within and adjacent to the Bay planning area have included climate change, mining activities, transportation projects and transportation-related accidents, military activities, industrial and domestic activities and related disposal of hazardous materials, and construction of facilities. Climate change could affect annual precipitation amounts. Future reasonably foreseeable development activities associated with transportation projects

and mineral exploration may have adverse effects on water quality, although this would depend upon the location and area of activity. Mineral exploration and development can substantially decrease water supply in local aquifers, alter drainage patterns, and degrade the water quality in receiving waters.

Cumulative effects to water resources from oil and gas exploration, development, and production in the planning area and the greater Southwest Alaska region could result from:

- Disturbance of stream banks or lake shorelines from oil and gas operations and the possible subsequent melting of permafrost.
- Temporary blockage of natural channels and floodways during construction of roads and pipelines that would result in the disruption of drainage patterns.
- Increased erosion and sedimentation in rivers and lakes.
- The removal of water from lakes for dust abatement for roads and pads.
- Increased use of the tundra for both oil and gas and non-oil and gas related activities.
- An increased number of seismic surveys.
- Removal of gravel from riverine pools and lakes.

Cumulative effects to water from placer mining, including small informal projects may include deposition of concentrations of arsenic and mercury (Mueller and Matz 2002).

The cumulative case assumes exploration and development for all of the planning area. The planning area is comprised of several distinct watersheds or drainages that do not extend into adjacent areas outside the Bay planning area boundary. Therefore, activities involving surface water that are taking place outside the planning area would not be expected to directly impact water resources within the planning area; however, activities affecting surface water within the planning area could also have an effect downstream and in the bays the waterbodies empty into. Additionally, water resources in aquifers which may extend beyond planning area boundaries could be affected by activities polluting or drawing from surface or underground water sources.

The State of Alaska DEC Division of Spill Prevention and Response provides records for contaminated sites and leaking underground storage tanks for communities within the Bay planning area that have the potential to affect water, soil, and vegetation. Table 4.7 probably does not represent a comprehensive list of all such sites in the Bay planning area. It is probable that many sites have not yet been identified.

Table 4.7. State of Alaska DEC Division of Spill Prevention and Response Contaminated Sites by Community (ADEC 2006)

Community	Number of Contaminated Sites Identified	Number of Leaking Underground Storage Tanks Identified
King Salmon	49	9
Naknek	2	3
South Naknek	0	0
Iliamna	12	3
Nondalton	2	0
Pedro Bay	1	0
Manokotak	1	0
Aleknagik	1	0
Clark's Point	0	0
Dillingham	4	8
Ekwok	0	0
Goodnews Bay	0	0
Platinum	1	0
Igiugig	0	0
Kokhanok	0	0
Koliganek	1	0
Levelock	0	0
New Stuyahok	0	0
Newhalen	2	0
Port Alsworth	0	0
Portage Creek	0	0
Togiak	0	0
Twin Hills	1	0
Quinhagak	2	0

Cumulative air quality impacts may result from the emissions of hydrocarbons and byproducts of combustion. These impacts may be regionally additive (e.g., increased concentrations of specific pollutants) or synergistic (e.g., chemical reactions that form ozone), and could degrade air quality. Ambient air quality in the Goodnews Bay - Bristol Bay region is relatively pristine.

Arctic haze is a phenomenon resulting from elevated concentrations of fine particulate matter found over the Arctic, primarily in winter and spring. Scientists believe that most of the pollutants contributing to Arctic haze are from combustion sources in Europe and Asia. Particulates from burning coal include mercury, arsenic, chromium, and selenium; those from oil combustion contain nickel and vanadium (AMAP 1997). It is not known to what extent local sources in Alaska contribute to Arctic haze in the southwest Alaska region. No major degradation of air resources as a result of any of the proposals in this plan is expected during the life of the plan.

Cumulative effects to water from placer mining, including small informal projects may include deposition of heavy metals, including concentrations of arsenic and mercury (LaRoche et al. 2006; BLM 2006; Hunerlach et al. 1999; Alpers and Hunerlach 2005; Allan 1995). A problem that has been identified is determining whether the source of the heavy metal is the mining operation, or whether it occurs naturally in the environment (Mueller and Matz 2002).

Adherence to Required Operating Procedures, stipulations and project-specific requirements, limitations on OHV use, and activity planning for BLM-administered lands would protect water resources and keep impacts to a minor to moderate level. The fact that there is no forestry program, and based on a reasonably foreseeable projection of a low level of mineral development and low to moderate recreation use on BLM-managed lands within the Bay planning area during the life of this plan, the contribution to cumulative effects on soil, water, air, and vegetation resources from these activities is projected to be low.

(2) Cumulative Effects to Air, Vegetation, Soils, and Water from Lands and Realty Actions

Privatization of State or Native corporation lands has the potential to open up areas to private development. After the land conveyance process is completed, BLM would seek to consolidate remaining unencumbered lands through land exchanges. The anticipated level of development would remain low during the life of this plan.

(3) Cumulative Effects to Air, Vegetation, Soils, and Water from Oil and Fuel Spills

With reference to Table 4.7, a number of contaminated sites already exist in the Bay planning area. The greatest concentration is in and around King Salmon, and is related to historic activities at the King Salmon Air Force Base and the King Salmon Airport. The aquifer has been affected, but it is not known to what extent the contaminants are hydrocarbons, and how far this particular aquifer reaches.

Because there have been no oil and gas exploration or development activities in the planning area, there have been no spills related to these activities. Other types of oil and fuel spills, if they have occurred, have been small, and have occurred in conjunction with other small-scale activities, generally taking place in and around the villages. Due to the minor degree of potential for oil and gas exploration and development in the Bay planning area during the life of this plan, the potential for Locatable mineral development-related oil or fuel spills to occur is considered to be low during the life of this plan. Effects to air, vegetation, soils and water would be the same as described in Section II.b. Direct and Indirect Effects for Air Quality, Soils, Vegetation and Water, and so will not be repeated here.

b) Cumulative Effects to Fish and Wildlife Resources

(1) Cumulative Effects to Fisheries and Aquatic Habitat

With reference to the previous discussion, future development activities associated with transportation projects and mineral exploration may have adverse effects on drainage patterns and aquatic habitat, although this would depend upon the location and area of activity. Naturally occurring events may also lead to the destruction of fish habitat; however, these events are unpredictable and often localized. Should BLM continue to allow OHV use to go unrestricted, adverse effects to fish habitat could continue through changes in drainage patterns and degradation of water quality.

(2) Cumulative Effects to Wildlife

The effects of initiating oil, gas, and locatable mineral exploration and development and development of supporting infrastructure, including ADOT&PF carrying out plans to connect portions of the planning area to the larger urban centers of Alaska would have cumulative impacts on wildlife, including caribou from the Northern Alaska Peninsula and Mulchatna caribou herds, moose, brown bears, and migratory waterfowl in all of the blocks of BLM unencumbered lands. Depending on the location of development, these impacts could include short or long-term disturbance to caribou calving habitat, insect relief habitat, migratory routes and winter range; disruption of caribou movements; stress and disturbance impacts to caribou during all seasons of the year; and possible reductions in herd productivity and recruitment. Cumulative impacts would be fewer under Alternatives A and C. Under Alternative A, no oil, gas, or locatable mineral development would occur beyond current activities. Under Alternative C, oil, gas, and locatable development could occur but only under certain conditions, and two areas would be managed as Areas of Critical Environmental Concern designations.

Development of connecting transportation corridors would open the planning area to additional hunters, thereby increasing access to caribou, moose, brown bears, black bears, and other sports and subsistence animals and habitat. Other impacts would include habitat fragmentation, increased disturbance impacts, increased potential for mortality (road kills) and possible alteration of behavior or movement patterns of wildlife. Construction of major road projects within the life of the plan would be dependent upon social and economic conditions and it is not clear which of these projects would be completed within the life of

this plan. Those projects connecting two or three local communities are farther along in planning than those proposing to connect the Bristol Bay area with Anchorage, for example.

Should oil, gas, or locatable mineral projects go forward during the life of the plan, temporary and/or long-term influxes of people could be expected, increasing the hunter pool and affecting wildlife species, especially big game animals. The activities with the greatest potential for cumulative effects to wildlife are mineral development in the Bristol Bay region and attendant infrastructure development, which would likely occur in sensitive habitat areas for the Mulchatna caribou herd, moose, brown bears, and migratory waterfowl species.

c) Cumulative Effects to Special Status Species

(1) Special Status Plants

Only one Special Status plant species is known to occur on BLM lands in the Bay planning area. The widely scattered nature of special status plant populations and incomplete knowledge of their distribution and range complicate efforts to predict cumulative impacts. However, current and potential increased levels of mining and mineral leasing development on State and private lands, combined with the potential for such development on BLM-managed lands could result in cumulative adverse effects on special status plants and habitats over the long term. Dispersed recreation activities, including gradual increases in amounts and frequency of Off Highway Vehicle travel, remote landing sites for bush aircraft, temporary campsites, and hiking may have minor adverse and cumulative impacts to sensitive plants and habitats on BLM-managed lands; however, it is unlikely that anything other than lode mining in the Goodnews Bay block would affect the sensitive *Smelowskia pyriformis*, or pear-fruited smelowskia. Tatlignagepeke Mountain has both habitat for the smelowskia and known lode mineral occurrences.

(2) Special Status Fish

There are no known Special Status fish species in the Bay planning area.

(3) Special Status Wildlife

The widely scattered nature of special status wildlife populations and incomplete knowledge of their distribution and range complicate efforts to predict cumulative impacts. Potential increased levels of all types of mineral exploration and development on State, Native corporation, and BLM lands could result in cumulative, adverse effects on Steller's eider and their habitats over the long term. The exploration and development of one gas field in the Koggiling Block during the life of this plan under Alternative B, C, or D would result in minimal addition to cumulative impacts to these species due to the transient nature of their presence in this part of the planning area.

d) Cumulative Effects to Fire Management and Ecology Resources

Under the current fire management strategies being implemented across the planning area there are few if any anticipated cumulative impacts on BLM-managed lands. Wildland fire management is accomplished on an interagency basis and across administrative boundaries.

e) Cumulative Effects to Paleontological Resources

Cumulative effects to significant paleontological resources, such as attrition from weather, trail use, or permitted activities in the planning area could occur. Activities such as development on non-BLM managed lands could affect the resource on BLM lands.

f) Cumulative Effects to Cultural Resources

Cumulative impacts to cultural resources could occur through incremental degradation of the resource base from a variety of sources which reduce the information and interpretive potential of historic and prehistoric properties, or which affect traditional cultural values important to Native Alaskans. Much of the anticipated development within the planning area would occur on nonfederal lands that are not covered by Federal cultural resource laws. As a result, there could be losses to the regional resource base that could potentially limit management options within the planning area. Fire is a natural process that could damage some types of cultural resources.

g) Visual Resources

Continued development of Off-Highway Vehicle trails, roads, mining activities and associated infrastructure development, and wildland and prescribed fire could lead to changes to existing visual resources by altering basic visual elements of form, line, color, and texture at the landscape level. These changes will influence the design of similar projects on adjacent BLM lands where repeating these basic elements is an objective of the visual resource management class. However, the VRM Class is not likely to change during the life of this plan.

4. Resource Uses

a) Cumulative Effects to Forest Products

There currently is no forest products program due to a lack of forests, lack of trees appropriate for commercial market, remoteness of the few trees that are located on BLM administered lands in the planning area, and lack of infrastructure to transport trees to market. It is unlikely that the situation will change during the life of this plan; therefore, there would be no impacts to a forest products program.

b) Cumulative Effects to Livestock Grazing

Currently there are no livestock anywhere in the Bay planning area, and no interest has been shown for decades. Livestock grazing could occur on a case-by-case basis by permit under any of the Alternatives. Management changes implemented on BLM-managed lands by this plan would therefore have few cumulative impacts on grazing.

c) Cumulative Effects to Minerals

Leasable Minerals. The cumulative impacts to oil and gas resources would be the removal of the resources by producing wells on leases with the fewest restrictions and lowest operating costs. Production of oil and natural gas from one geologic reservoir would not affect the recovery of oil and/or natural gas from other geologic reservoirs. The production of natural gas and oil is a beneficial irrevocable commitment of the resource as the produced natural gas or oil no longer would be available for future use. The amount of oil, gas, or heat produced would vary depending on the number of wells drilled in the field and the ability to recover the resource.

The cumulative impact to Federal leases would be a reduction in lease value resulting from the application of stipulations and regulations. The cumulative impacts to lease developments would result from a reduction in wells drilled on leases encumbered with stipulations, an increase in wells drilled on leases with minimal constraints, and an increase in operating costs because of land use decisions, lease stipulations, and regulations. Restrictions on Federal leases could impact the leasing and development of adjacent non-Federal leasable minerals. If an exploration company cannot put a block of leases together because of restrictions on Federal leasable minerals, the private or State minerals may not be leased or

developed either. Leasing of Federal minerals on the other hand, could encourage the leasing of private or State minerals.

Oil and natural gas activities could be located in parts of planning area where other mineral resources are mined or potentially could be mined. However, the production of oil and natural gas resources is not expected to be a significant impact on other mineral resources within the planning area. A potential conflict exists between coal and CBNG. Should coal resource development precede CBNG development in a specific area, the biogenic gas would be displaced. Similarly, if CBNG were to occur first, coal development would be delayed which could affect economics. The long-term aerial extent of the Reasonably Foreseeable Development Scenario (RFD) (e.g., the acreage affected) for petroleum activities is small relative to the planning area. After abandonment of the facilities and wells, exploitation of the other minerals still can occur.

Cumulative impacts would be greatest under Alternatives B and D as no leasing will occur in Alternative A, and leasing would be less in Alternative C. Under Alternatives B, C and D, larger acreages of fluid mineral estate would be made available due to the revocation of ANCSA (d)(1) withdrawals. However, exploration and development are not readily anticipated on BLM lands as indicated by the low and very low development potential assigned to the resource locations in the RFD. Lands with the greatest resource potential are in ownership by other entities or on State or Native selected lands. In the case of selected lands, mineral activity will be delayed by segregation until the ownership status can be finalized. If conventional or coalbed resource development were to occur, the market would likely be local as indicated in the RFD.

Roads resulting from mineral exploration and development or community support would add infrastructure to a region largely without cost and could increase interest in exploration on BLM lands by reducing logistics costs. However, these types of benefits to industry could be offset by restrictions. An area on the cusp of showing economic development could become non-profitable by imposing restrictive guidelines. This would result in the displacement of mineral activities to adjacent landowners.

Locatable Minerals. Impacts to the Locatable Minerals program that are individually minor may cumulatively reduce exploration and production of commodities from public lands. Factors that affect mineral extraction and prospecting include, but are not limited to, permitting and permitting delays, regulatory policy, public perception and concerns, travel management, transportation, mitigation measures, proximity to sensitive areas, low commodity prices, taxes, and housing and other necessities for workers. BLM has no control over many of these issues. Most result in additional costs and/or permitting delays that could individually or cumulatively add additional costs to projects.

Public land with no access could reduce the amount of mineral exploration and development that may occur. Mineral resources in other ownership may not be developed if the adjacent public lands are withdrawn from mineral entry. The deposit may not be economically feasible to develop if it crosses multiple ownerships and only a portion is available for development.

Overall, Alternative A would be the most restrictive to mineral developments. Existing ANCSA 17(d)(1) withdrawals, specific to closure to mineral entry, would be retained. The next most restrictive would be Alternative C, which would revoke ANCSA 17(d)(1) withdrawals but would recommend two Areas of Critical Environmental Concern and propose three Wild and Scenic River segments.

Salable Minerals (Mineral Materials). Under Alternative C the closure of two ACECs to sale/permit of mineral materials would essentially close all BLM unencumbered lands in the planning area to mineral materials development and production.

d) Cumulative Effects to Travel Management, Off-Highway Vehicles, and Recreation Management

The planning area currently provides and would continue to provide a diversity of recreation experiences, regardless of the Alternative selected. The greatest influence on recreation experience within the

planning area is the use of Off-Highway Vehicles (OHVs). Without management and some limitations on OHV use, the general trend in OHV-accessible topography, is for recreation experiences to trend toward semi-primitive motorized and roaded natural experiences. However, most of the planning area is dominated by steep topography, wetlands, dense vegetation, and remote settings with no road infrastructure, making it inaccessible to most OHVs unless they are flown in to a destination. These areas provide for primitive and generally inaccessible recreation experiences except by aircraft or by boat, regardless which Alternative is selected.

e) Cumulative Effects to Renewable Energy

No cumulative impacts to renewable energy are anticipated under any Alternative.

f) Cumulative Effects to Special Designations

(1) Areas of Critical Environmental Concern

A wide range of cumulative effects could occur to the variety of resources intended to benefit from designation of one or two Areas of Critical Environmental Concern in Alternatives C and D. These impacts would derive mostly from actions that are not guided by BLM management decisions. Management within certain ACECs could be significantly diminished by cumulative impacts should numerous development projects occur either inside or immediately outside the boundaries of the ACEC.

(2) Wild and Scenic Rivers

No cumulative impacts to the Wild and Scenic Rivers are anticipated under any Alternative.

g) Cumulative Effects to Social and Economic Conditions

The onshore and offshore oil industry in and near Prudhoe Bay is anticipated to decline. An authoritative source, DOE's Energy Information Administration (U.S. Dept. of Energy, 2001a), projects North Slope oil production to decline from 1.084 million barrels per day (MMbpd) in 2005 to 0.208 MMbpd in 2034. This decline encompasses oil exploration, development, and production and associated direct employment.

Associated indirect employment in Southcentral Alaska, Fairbanks, and the North Slope Borough (NSB), and revenues to the Federal, State, and NSB governments are also anticipated to decline. Fluctuations in Alaska's economy from 1975-1995 directly tracked fluctuations in oil prices and other industry factors (McDowell Group, Inc., 1999b). Even though the Alaskan economy currently is not nearly as dependent on the oil sector as it was in the mid-1980's (when a major crash in the Alaska economy occurred), additional oilfield development in any region would generate employment, economic opportunity, and benefits to the cash economy of Alaska.

The effects below are expressed (in most cases) in annual averages for the sake of simplicity. However, the effects generally would be higher in the early years and lower in latter years, corresponding to the decline in production.

Cumulative effects have been addressed in other recent documents, including the Northwest National Petroleum Reserve-Alaska IAP/FEIS (USDOI 2003), and in the Alpine Final Development Plan FEIS (USDOI 2004). These are herein incorporated by reference and summarized in this section.

(1) Impacts to State and Local Revenues

Oil & gas development in other parts of the state would generate additional revenue to the Boroughs, the state of Alaska, and the Federal government.

Other developments in the Planning Area resulting from forestry, recreation, grazing, and mining are considered to have little cumulative economic effect.

In 2001 State operating budget was \$4.3 billion, and 2001 Federal receipts of all types of \$1.7 trillion.

(2) Impacts to Employment and Personal Income

The cumulative gains in direct employment would include additive jobs in oil & gas exploration, development, and production, plus oil-spill cleanup activities. The direct employment would generate indirect and induced employment and associated personal income for all the workers. The cumulative effects are projected to generate additive employment and personal income increases as follows (USDOl 2004):

In addition to the North Slope workers who reside in Southcentral Alaska and Fairbanks, additional workers commute to residences outside the State. As much as 30% of the North Slope workforce in the classification of oil and gas workers commutes to locations outside the State. However, the workers commuting to residences outside the State would not generate economic effects of indirect and induced employment or expenditure of income in the State and would have a negligible effect on the economy of the rest of the U.S. Total NSB employment exclusive of oil workers in 1998 was 4,651. The projected employment for workers on the North Slope residing in Southcentral Alaska and Fairbanks is in comparison to 1998 NSB employment in mining (assumed to be all oil employment) of 4,753. Of these, 70 percent (3,329) reside in the rest of Alaska outside the NSB, primarily in Southcentral Alaska and Fairbanks. Employment projections can also be compared to the total number of workers in Southcentral Alaska and Fairbanks in 2002 (284,000).

Aggregate personal income in 1999 was \$200 million for the NSB and \$13.2 billion for Southcentral Alaska and Fairbanks.

h) Cumulative Effects to Environmental Justice

Alaska Natives are the predominant residents of southwestern Alaska, the area potentially most affected by activities under Alternative B, C, and D and other activities associated with cumulative projects in Alaska. Effects on Alaska Natives could occur because of their reliance on subsistence foods, and potential effects could impact subsistence resources and harvest practices. Potential cumulative effects from noise, disturbance, and oil spills on subsistence resources and harvest practices and socio-cultural patterns would focus on communities throughout the planning area.

It is acknowledged that cumulative socio-cultural impacts have occurred on the North Slope and that regional culture has undergone a noticeable change. The influx of money from wage employment has added benefits and raised the standard of living, but has also given rise to an array of social pathologies, including increased alcoholism. In southwest Alaska, arguably, the commercial fishing industry has long since had similar effects.

Expanded oil and gas development in Alaska, on both Federal and State leases, would expand the extent of disturbance effects on subsistence species and harvest patterns. While each individual project would likely be a small incremental increase, the cumulative effect would eventually become more repressive to the subsistence lifestyle. In addition to potentially diverting, deflecting, or disturbing subsistence species, oil and gas development could affect subsistence harvest by causing subsistence hunters to avoid certain areas because of concerns about firearm safety, and perhaps for aesthetic reasons. Southwestern Alaska still has vast undisturbed areas, yet the subsistence hunting environment continues to change in response to increased visitation and development.

Transportation facilities and activities would also contribute to cumulative effects to subsistence resources and, consequently, to the Native population. Any new permanent road connection in southwestern Alaska would also facilitate development, use, and visitation.

Contamination and oil spills could affect the food chain in the area of development and subsistence harvest. If this were experienced, the effects would fall largely on indigenous people.

i) Cumulative Effects to Subsistence

Exploration and development of a gas field, development of infrastructure, and exploration and development of Locatable minerals in the planning area would be the three most important sources of cumulative impacts to wildlife habitat and subsistence resources the residents of the planning area depend on, as well as the cumulative changes to the existing mixed subsistence-cash economy which most residents participate in. Cumulative effects to subsistence would come as a consequence of those cumulative effects noted for fish, wildlife, and vegetation resources, discussed above.

F. Irreversible and Irrecoverable Commitment of Resources

Only those programs or resources that would have irreversible or irretrievable commitment of resources are included here.

1. Resources

a) Air Quality, Soil, Water, and Vegetation Resources

The reasonably foreseeable activities that would cause irreversible or irretrievable commitment of soil, water, and vegetation resources (habitat) would be large scale oil and gas development, placer mining, lode mining, the material site operations required for these large ventures, and certain kinds of infrastructure development. These activities would be likely to occur under Alternatives B, C, and D. These activities all require extensive material site excavation for gravel sources from road, pad, and airstrip construction. Impacts include irreversible loss of vegetation (ground cover) and habitat, soil compaction, soil erosion, thermokarst erosion, stream diversions, impoundments, and increased sediment runoff. These impacts would likely persist for the duration of the development, which once constructed, would continue for the foreseeable future. These impacts could be mitigated but not entirely removed. Pre-impact botanical and habitat inventories and associated habitat mitigation would minimize but would not eliminate these harmful impacts to vegetation and habitat.

b) Fish and Wildlife Management

(1) Fish

Actions that alter an aquatic community sufficiently to change the potential of a particular stream could represent an irreversible or irretrievable commitment of resources. The only reasonably foreseeable activity that would occur within the range of Alternatives considered would be placer mining or lode mining, which would be more likely to occur under Alternatives B, C, and D.

(2) Wildlife

Under Alternatives B, C, and D some irretrievable and irreversible loss of wildlife habitat could occur from the placement of gravel for oil and gas infrastructure, road construction, and other development-related surface disturbing activities. Loss of wetland habitat occupied by waterfowl and shorebirds could be particularly important. In most cases, alternate habitats would be available adjacent to development, and any habitat loss would have a minor effect.

c) Special Status Species

(1) *Special Status Plants*

Irreversible impacts to the special status plant, *Smelowskia pyriformis*, or pear-fruited smelowskia, could occur should lode mineral exploration or development occur on Tatlignapeke Mountain. Under Alternatives B, C, and D, lode mining could occur.

(2) *Special Status Wildlife*

Under Alternatives B, C, and D, some irretrievable and irreversible loss of habitat could occur from placement of gravel infrastructure for oil and gas facilities in the Koggiling Block, potential habitat for Steller's eider and spectacled eider habitat. While the eiders probably would not be nesting or brooding, they would use the area for eating, resting, and molting as they migrate through the area. Alternative habitat would likely be available in areas adjacent to proposed development. The density of eiders in Koggiling Block may be low. Habitat loss of this type would be considered to have a minor effect on eiders at the population level.

Should gas facilities be developed, Steller's and spectacled eider mortality could result from collisions with vehicles or structures during the life of the gas field. A loss of an individual eider would be irretrievable, but would not affect eiders at the population level.

d) Fire Management and Ecology

Areas that are in the Critical, Full, or Modified Management Options have the potential to lose key ecosystem components due to fire exclusion and move from condition class 1 to condition class 2 or 3. Based on desired conditions for land use and resources objectives, these conditions may be mitigated through fuel management projects or a change in management option. If the areas were not treated, fire size and severity could increase, life and property could be lost, and resources could be adversely impacted.

e) Cultural Resources

Mitigation through data recovery investigations at archaeological sites would recover information pertinent to current research concerns, but would also permanently remove the resource from future research and interpretive use, which would constitute an irretrievable and irreversible commitment of these resources. Any management actions that cause the inadvertent destruction of a cultural resource or make them susceptible to illegal collection could lead to the loss of these resources and would also be an irretrievable and irreversible commitment of these resources. Wildland fire may damage some types of cultural resources.

f) Paleontological Resources

Mitigation through data recovery investigations at significant paleontological sites would recover information pertinent to current research concerns, but would also permanently remove the resource from future research and interpretive use. This would constitute an irretrievable and irreversible commitment of these resources. Any management actions causing the inadvertent destruction of a paleontological resource or make them susceptible to illegal collection could lead to the loss of these resources and would also be an irretrievable and irreversible commitment of these resources. There would continue to be impacts on paleontological resources associated with unauthorized activities such as OHV use, dispersed recreation, and illegal collecting.

g) Visual Resources

Activities identified in this planning area under all Alternatives by direct, indirect and cumulative effects analysis may affect the visual resources within the planning area by the changes in the existing landscape character. Actions by the following activities may affect visual resources: OHV use, timber harvest, mining activities, exploration, recreation, infrastructure and industrial development, research projects, and activities on privately owned land. These activities may adversely affect the visual resources, and in some cases may be irreversible and irretrievable.

2. Resource Uses

a) Livestock and Reindeer Grazing

Currently there is no livestock program. In the unlikely event of a livestock or reindeer proposal, loss of native forage to invasive species, although not necessarily permanent, would be an irretrievable loss of the resource because of the number of years needed to restore native vegetation. The incremental degradation of rangeland within the planning area from the effects of climate change, over-utilization, and the spread of invasive plant species could be an irreversible loss of the resource.

b) Minerals

Leasable Minerals. The production of oil and gas results in the irretrievable and irreversible loss of those natural, non-renewable resources. Most, if not all, surface disturbance and use can be restored through proper reclamation techniques.

Locatable Minerals. The removal of minerals from public lands results in the irretrievable and irreversible loss of those non-renewable natural resources, and their extraction causes potentially irreversible impacts to the natural environment and to the subsistence resources and habitat upon which residents of the region depend. However, this extraction may produce a short-term positive impact to a few residents of the region by providing them with a cash income. Most surface disturbances from Locatable Minerals extraction can be restored via reclamation techniques.

Mineral Materials. The extraction of mineral materials from the natural environment within the planning area would be an irreversible and irretrievable commitment of those extracted mineral material resources. All impacts identified in prior sections are insignificant for mineral materials as the forecast need is negligible, and can be mitigated.

c) Renewable Energy

Lands developed for renewable energy projects would no longer be available for various other purposes.

d) Lands and Realty Actions

Lands transferred out of public ownership generally stay in private hands unless they are subsequently acquired for a public purpose. The right-of-way avoidance areas proposed in Alternatives C and D would limit the issuance of new rights-of-way in these locations.

3. Social and Economic Conditions

a) Social and Economic Conditions

Small increases in employment and personal income would occur over the life of gas field exploration, development, and operation activities. Employment in oil and gas related activities represent a loss of opportunity for workers to pursue employment in other fields. Investment by the lessees and operators in oil and gas exploration and development activities in the planning area represents a loss of opportunity to invest those monies elsewhere. Revenue increases to the State and Federal Governments occurring during production years would result in the irreversible and irretrievable commitment of those revenues. Development would result in new infrastructure that would be removed at the end of production.

b) Environmental Justice

Long-term population and productivity effects to the Mulchatna Caribou Herd from oil and gas development in calving and critical insect-relief areas could produce irreversible and irretrievable effects to the herd and to the subsistence caribou hunt to most villages in the planning area.

4. Subsistence

Exploration and development of a gas field, development of infrastructure, and exploration and development of Locatable minerals in the planning area would be the three most important sources of irretrievable loss of wildlife habitat and subsistence resources to the residents of the planning area, as well as the potentially irreversible changes to the existing mixed subsistence-cash economy which most residents participate in. One of the sources of this change would include loss of opportunity to participate in subsistence activities due to participation in the cash economy. Since participation in subsistence, sharing and eating subsistence foods have meaning well beyond the economic aspects of the practice, the individual's physical, social, and spiritual well-being could be affected.

G. Unavoidable Adverse Impacts

Unavoidable adverse impacts are either impacts that remain following the implementation of mitigation measures or impacts for which there are no mitigation measures. Some unavoidable adverse impacts occur as a result of proposed management under one or more Alternatives. Others are a result of public use of BLM-managed lands. Only those programs or resources that would have unavoidable adverse impacts are included here.

1. Resources

a) Air Quality and Soil and Water Resources

Unavoidable adverse impacts to soil and water occur from road construction and material site excavation. Gravel roads, airstrips, and pads destroy soil structure through compaction and thermokarst erosion (where extensive permafrost exists), block natural drainage patterns, create stream flow diversions, impoundments, and increase sediment runoff that impairs water quality. By limiting the length of the roads and requiring that all permanent facilities have an approved drainage plan, a reduction in adverse impacts from project and related infrastructure development is possible but not unavoidable (Walker et al. 1987). Limiting development on floodplains and wetlands would assist compliance with regulations that direct Federal agencies to minimize the destruction, loss, or degradation of floodplains and wetlands.

b) Vegetation

While recognized as a natural part of northern ecosystem, occasional large, intense wildland fires will temporarily destroy vegetation and priority habitats such as lichen-rich plant communities that caribou are dependent upon. Recovery would be expected, but not always within the life of the plan. Scarring of the landscape could also result from unauthorized cross-country travel. If climate change occurs the effects of fires will be essentially permanent.

c) Fish and Wildlife

(1) Fish

Unavoidable direct disturbance to aquatic and riparian habitat would require many years (25-50+) to rehabilitate to healthy functioning condition. Therefore, most of the habitat disturbed in the next 20 years would be additive to that lost in the past (at sites of previous placer mining). Some of the mining, especially placer mining, may take place on previously worked claims. This would result in setting back aquatic/riparian recovery by the number of years between the previous and future operation.

Ground water drawdown and associated impacts to surface waters and nearby wetlands can be a serious concern in some areas. The impacts resulting from ground water drawdown could last for many decades. The aquifer may take many decades to recharge and may result in continued stream flow reduction. This could potentially affect seeps and springs that provide thermal refugia in both summer and winter.

The removal of streamside riparian-wetland vegetation during mining would result in loss or degradation of aquatic habitat until proper functioning condition could be reestablished. In general, the time required for riparian-wetland areas to attain proper functioning condition would be dictated by natural processes and may require decades to centuries before it approximates the structure and function of the original aquatic habitat (NCSU 1998; BLM and Montana Dept. of Environ. Quality 1996; BLM 1988).

Natural erosion processes, unauthorized travel, and permitted land use activities may increase sedimentation into fish-bearing streams with possible adverse effects. A summary of potential sources of effects, as discussed in an earlier section follows. Many of these can be controlled through use of Required Operating Procedures, project specific requirements, and mitigation of effects:

- Surface mining activities can increase erosion and accelerate sediment production and input into nearby streams and lakes.
- Mine development may also alter the natural input rate of organic matter and nutrients to aquatic systems.
- Surface mining operations may disrupt surface and ground water flow patterns.
- Mining operations have the potential to release pollutants to surface waters and ground water, the deposition of contaminants into soils, and the eventual incorporation of pollutants into plant and animal tissue.
- Both water and soil contamination may be harmful to riparian-wetland vegetation and ultimately to fish.
- Placer mining inherently degrades or completely destroys channel features and riparian habitat, resulting in increased erosion and sedimentation. As a result, new channels are often straighter, have a higher gradient, and consequently have more energy than the natural channel; new channels often lack the diversity of habitats and cover components that enhance the quality of habitat in natural channels.
- Mining activities, placer operations in particular, may lead to a loss of riparian-wetland vegetation. Riparian-wetland vegetation has a significant influence on the stability of uplands and certain stream types. Changes in the composition, vigor, and density of riparian vegetation can result in changes in sediment input from uplands, stream shade, and protection from instream erosional processes, terrestrial insect habitat, and the contribution of detritus and structural components to the stream

channel. Water quality and esthetic values are also affected by disturbance to riparian-wetlands (Rosgen 1996).

- The altering of surface hydrology often results in stream conditions that are no longer suitable to species or life stages of fish and other aquatic organisms that occurred before disturbance. (Swanston 1991; Hicks and others 1991; National Research Council 1992; Strouder and others 1997).
- The current state of knowledge of suction dredging and its impacts on aquatic resources suggests that the practice could be either detrimental or beneficial, depending on site-specific use by aquatic organisms and physical habitat limitations. Suction dredging has been shown to locally reduce benthic (bottom dwelling) invertebrates (Thomas 1985; Harvey 1986) and cause mortality to early life stages of fish due to entrainment by the dredging equipment (Griffith and Andrews 1981).
- Suction dredging may destabilize spawning and incubation habitat, remove large roughness elements important for forming pool habitat and governing the location and deposition of spawning gravels (Harvey and Lisle 1998).
- Suction dredging may increase suspended sediment, decreasing the feeding efficiency of sight-feeding fish (Barrett and others 1992); reducing living space by depositing fine sediment (Harvey 1986); and causing fish to avoid certain habitats (Roelofs 1983).
- Suction dredging may temporarily improve fish habitat by creating deep pools or by creating more living space by stacking large unembedded substrate (Harvey and Lisle 1998).
- Invertebrates and periphyton rapidly recolonize small patches of new or disturbed substrate in streams as long as the area of disturbance is not so widespread as to limit the number of organisms to recolonize (Griffith and Andrews 1981; Thomas 1985; Harvey 1986).
- Dredge tailings may increase spawning sites in streams lacking spawning gravel or streams that are armored by substrate too large to be moved by fish (Kondolf and others 1991).
- In some cases the reduction in the feeding efficiency of fish may be offset by reduced visibility and the corresponding reduced risk of predation at moderate levels of suspended sediment (Gregory 1993).
- Bridges, culverts, and low-flow crossings can interfere with stream bedload (substrate) movement, migrations to spawning, feeding, rearing, and overwintering sites if improperly designed.
- Surface mining and road placement effects may include diverting or eliminating flow from small tributaries that connect lakes or connect lakes and rivers. Fish species found in the planning area that move between these habitat types are vulnerable to impact. Potential loss of migratory capacity could stress or kill these fish if they are unable to migrate to food-rich habitat in the summer, reach spawning areas, or move into overwintering habitat.

These sources of unavoidable impacts would be expected to be related to placer mining in localized areas on BLM unencumbered lands in the Goodnews Block during the life of this plan. They are expected to be moderate to significant in their effects, except where Required Operating Procedures, project-specific requirements, and mitigation are applied.

(2) *Wildlife*

Some disturbance and disruption of wildlife under all Alternatives, and some habitat alterations from mineral development under Alternatives B, C and D are unavoidable. Displacement or reduced habitat use by wildlife are likely to be local (within one-half to 2 ½ miles of development or activity). Disturbance and displacement from most activities occurring in the planning area except for Locatable Mineral exploration or development activities would be short-term (a few hours to a few weeks). Disturbance and displacement due to mineral development would be long-term and would persist over the life of the development. Most unavoidable adverse impacts to wildlife, being short-term and localized, would not substantially affect populations.

d) Special Status Species

(1) *Special Status Plants*

One BLM Special Status Species of plant is located within the planning area, *Smelowskia pyriformis*, or pear-fruited smelowskia. It has been located in the western Alaska Range north of the planning area and in the southernmost Kuskokwim Mountains in the Goodnews Bay region (Drury and Rollins 1952; Hultén 1968; Murray 1981; Murray and Lipkin 1987; Parker 1994; Rollins 1993; Welsh 1974). This plant prefers higher elevations and rocky, scree-covered mountain slopes, and so is not likely to be affected by wildland fires. However, it is found on BLM-administered land in an area where lode minerals are present, and so it could be affected by the development of those minerals during the life of the plan. The degree of impact would depend on the extent and type of mineral operation. The fact that the plant was observed to grow in scattered locations would provide some advantage to its survival at the population level in this case.

(2) Special Status Fish

There are no Special Status Fish species in the Bay planning area.

(3) Special Status Wildlife

Unavoidable adverse impacts to Special Status Species of wildlife would be similar to those discussed under wildlife. Under Alternatives B, C, and D some disturbance to spectacled and Steller's eiders and other bird species by routine activities associated with oil and gas exploration and development would be unavoidable. Effects would include temporary disturbance such as displacement of incubating females from nests or broods, or disturbance of feeding, molting and migrating birds. Eiders could habituate to some disturbances or move to alternate habitats for foraging, nesting, and brood-rearing. Lease Stipulations, Required Operating Procedures, and project-specific requirements would effectively mitigate many of the effects of disturbance to spectacled and Steller's eiders, but some impacts could be unavoidable. Some eider habitat could be permanently lost due to construction of oil and gas related facilities, as discussed previously. Most disturbances of endangered and threatened species associated with routine activities would be minimized or avoided through compliance with mitigation measures developed through the Section 7 consultation process.

e) Fire Management and Ecology

Large landscape-scale high severity fires would be unlikely to occur within the planning area. However, should the current warming and drying trend continue, such fires could occur in portions of the planning area within the life of the plan. Fire suppression activities pose an unavoidable risk to other resources, and have the potential to be high impact and long-term in nature. The use of heavy mechanical equipment on the ground surface could cause severe soil erosion and increase silt load into streams and rivers, as well as damage to or loss of cultural resources.

f) Cultural Resources

While measures are in place to identify threats to cultural resources and prioritize management actions, some impacts would be unavoidable. Wildland fire could damage some types of cultural resources. There would continue to be impacts to cultural resources from dispersed recreation activities, OHV use, vandalism, and other types of activities not authorized by the BLM. Natural processes such as erosion and natural decay or deterioration could also result in unmitigated damage to cultural resources.

g) Paleontological Resources

While measures are in place to identify threats to significant paleontological resources and prioritize management actions, some impacts would be unavoidable. Natural processes such as erosion and natural decay or deterioration result in unmitigated damage to paleontological resources and probably are the most common kinds of threats to these resources in this planning area. The other type of threat to these resources are human impacts from dispersed recreation activities, OHV use, vandalism, and other types of activities not authorized by the BLM.

h) Visual Resources

Natural disasters or wildland fires would be an agent of change for visual resources, and could have unavoidable, adverse impacts to visual resources values at the landscape scale. These impacts may be relatively short-term, except in the instance of environmental change, where the vegetation would have no chance of recovery.

2. Resource Uses

a) Forest Products

The future of forest products in the Bay planning area may provide even fewer opportunities than at present should the current warming and drying trend continue, and current insect infestations worsen. Other unavoidable effects in this case would include additional standing dead and fallen timber and the potential for larger, more intense wildland fires. There may be an increase in other types of drought-resistant vegetation in the place of existing forests. Alteration of forest habitat from placer mine development would result in long-term loss of trees in limited areas.

b) Recreation Management

Changes in the amount of recreational visitation and associated duration and patterns of use could result in increased conflicts between users and unanticipated changes in resource conditions. These resource conditions may include declines in fish and game resources through over harvest and environmental degradation from increased localized use.

c) Travel Management

Regardless of the Alternative, access to public lands will become more complex as Native corporation entitlements are met. As public lands become private lands, net access is lost even if BLM reserves 17(b) easements.

d) Renewable Energy

Mitigation measures would reduce the potential of bird strikes on wind turbines, but would not eliminate the possibility of incidents entirely.

3. Social and Economic Conditions

Economic effects of oil and gas leasing, exploration, development, and production in the planning area may be considered positive effects by many people. Increases in employment opportunity and potential personal income would occur over the life of the exploration, development, and production activities. Revenue increases to the State and Federal Governments would occur during production years. However, these increases would be short-term (less than 30 years). They would occur only for the duration of the activities. Development activity would establish infrastructure that could enhance the future productivity of oil and gas exploration, development, and production.

4. Environmental Justice

The Environmental Justice Executive Order includes consideration of potential effects to Native subsistence activities. The only substantial source of potential unavoidable environmental justice related effects on Native communities from oil and gas exploration and development in the Planning Area would

occur from displacement of caribou as a result of exploration and development in calving or insect relief areas. The Native communities throughout southwest Alaska harvest caribou from the Mulchatna Caribou Herd. Noise and disturbance from routine activities would be unavoidable, but not expected to produce disproportionate, high adverse Environmental Justice impacts on the Alaskan Native minority populations in any community.

5. Subsistence

Unavoidable adverse impacts that would affect fish and wildlife would also affect subsistence. They include sedimentation of fish-bearing streams by natural erosion, unauthorized travel, alteration of habitat, and temporary or permanent localized disturbance and/or displacement of subsistence species. These unavoidable impacts are not expected to be significant during the life of this plan, and would not substantially affect populations or access to resources by the subsistence user.