

All mineral related activities occurring on BLM land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to submit Plan of Operations or Notice 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 Alternative B, ANCSA 17(d)(1) withdrawals would be revoked and 1,102,489 acres of BLM lands would be open to mineral entry. Any State- or Native-selected lands would be made available for locatable mineral entry if the selection is revoked or relinquished. Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. An additional 3,968 acres are closed to material entry due to Agency withdrawals. If all reasonable foreseeable future mineral activities were to occur in the planning area on BLM land, activities would occur in the Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasna 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 State-selected lands (due to Top Filing) 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 State-selected lands (due to Top Filing); 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 land, an estimated total of 115 acres could potentially be disturbed in the planning area. Total includes surface disturbance of 0 acres on BLM land, 50 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 land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to submit Plan of Operations or Notice 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.

c) Effects to Locatable Minerals for Alternative C

Under Alternative C, 1,064,313 acres of BLM lands would be open to locatable mineral activities due to lifting of ANCSA 17(d)(1) withdrawals. 3,968 acres are closed to material entry due to Agency withdrawals other than ANCSA 17(d)(1). Upon revocation of ANCSA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. The Carter Spit (61,251 acres) and the Bristol Bay (974,970 acres) ACECs would be proposed under Alternative C. Of these two areas, only the Carter Spit ACEC would retain ANCSA 17(d)(1) withdrawal, closing this area to mineral entry. Proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork Rivers (12,210 acres) would be closed to locatable mineral entry due to retention of ANCSA 17(d)(1) withdrawals.

Locatable mineral activity would still be allowed on existing pre-ANCSA 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 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 an estimated total of 43 acres could potentially be disturbed in the planning area on BLM, State- and Native-selected land. No disturbance would occur on BLM lands due to retention of ANCSA 17(d)(1) withdrawals in the Carter Spit ACEC and ANILCA 906(e) Top Filings.

All locatable mineral related activities occurring on BLM 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. All operations are required to meet applicable Federal and State air and water quality standards for permitting. Required Operating Procedures (Appendix A) would be applied to locatable mineral activities occurring on BLM lands.

d) Effects to Locatable Minerals of Alternative D

Under Alternative D, ANCSA 17(d)(1) withdrawals would be revoked and all segregated lands returning to BLM-management would be open for mineral entry. Approximately 1,102,489 acres of unencumbered BLM lands would be available for locatable mineral entry. The Carter Spit ACEC (36,220 acres) would be recommended under Alternative D and ANCSA 17(d)(1) withdrawals would be lifted, opening this area to mineral entry. Agency withdrawals (3,968 acres), would be 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 planning area on BLM land, activities would occur in the Goodnews Bay/Snow Gulch, Iliamna/Fog, Iliamna/Kvichak, Kasna Creek, Kijik Lake, and Pebble Copper areas.

Lode and placer mineral activities on BLM land are the same as discussed in Alternative B.

If locatable mineral activity were to occur on every existing operation, as allowable by present BLM authority on BLM land, an estimated total of 115 acres could potentially be disturbed in the planning area. Total surface disturbance includes: 50 acres on State-selected land, 47 acres on Native-selected land, and 18 acres on Native land (active Federal claims), no disturbance on BLM land. 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 land are subject to current BLM surface regulations as outlined in 43 CFR 3809. Operators are required to submit Plan of Operations or Notice 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.

Salable Minerals (Mineral Materials)

a) Effects to Salable Minerals for Alternative A

Approximately 1,163,594 acres of BLM lands are available for salable mineral activities. State- and Native-selected lands would be made available if their selections are revoked or relinquished. An additional 3,968 acres are closed to salable mineral activities due to Agency withdrawals. Large reserves of salable material exist on State and Native land and no disturbance of BLM land is anticipated due to the remote location of BLM lands. Activities would require approved mining and reclamation plans and compliance with constraints developed through project-specific NEPA analysis, and are subject to all Federal and State laws and regulations.

b) Effects to Salable Minerals for Alternative B

Approximately 1,102,488 acres of BLM lands are available for salable mineral activities. State- and Native-selected lands would be made available if their selections are revoked or relinquished. Upon lifting of ANCSA 17(d)(1) withdrawals, ANILCA 906(e) Top Filed land (61,105 acres) would become State-selected, closing this land to salable mineral activities. An additional 3,968 acres are closed to material sales due to Agency withdrawals. Large reserves of salable material exist on State and Native land and no disturbance of BLM land is anticipated. Activities would require approved mining and reclamation plans, compliance with Required Operating Procedures (Appendix A), and compliance with constraints developed through project-specific NEPA analysis, and are subject to all Federal and State laws and regulations.

c) Effects to Salable Mineral for Alternative C

Approximately 115,163 acres of BLM lands are available for the salable mineral activities. State- and Native-selected lands may be made available if their selections are revoked or relinquished. However, two areas, the proposed Carter Spit (61,251 acres) and Bristol Bay (974,970 acres) are recommended as ACECs and the proposed Wild River segments of the Alagnak, Goodnews mainstem, and Goodnews Middle Fork Rivers (12,210 acres) would be closed to salable mineral activities. An additional 3,968 acres are closed to salable mineral activities due to Agency withdrawals. Large reserves of salable material exist on State and Native land, and no disturbance of BLM land is anticipated except in the Koggiling Creek planning block to support leasable mineral activities. Salable mineral activities would require approved mining and reclamation plans, compliance with Required Operating Procedures (Appendix A), and compliance with constraints developed through project-specific NEPA analysis, and are subject to all Federal and State laws and regulations.

d) Effects to Salable Mineral of Alternative D

Approximately 1,100,654 acres of unencumbered BLM lands are available for salable mineral activities. State- and Native-selected lands would be made available if their selections are revoked or relinquished. The Carter Spit ACEC (36,220 acres) would be proposed and closed to salable mineral activities. An additional 3,968 acres area would be closed to salable mineral activities due to Agency withdrawals other than ANCSA 17(d)(1). No disturbance of unencumbered BLM land is anticipated from salable mineral activities due to the remote location of BLM lands and the more easily available locations of salable material on State and Native land. Activities occurring on unencumbered BLM lands would require

approved mining and reclamation plans, compliance with Required Operating Procedures (Appendix A), and compliance with constraints developed through project-specific NEPA analysis, and are subject to all Federal and State laws and regulations

7. Direct and Indirect Effects to 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 proposed. Because of the retention of ANCSA 17(d)(1) withdrawals on most BLM, very little resource development activity is anticipated under this Alternative. Consequently, there would be little effect to the resource values identified for the Bristol Bay and Carter Spit areas.

(2) Effects to Areas of Critical Environmental Concern for Alternative B

Under this Alternative, no ACECs would be proposed. Additionally, most ANCSA 17(d)(1) withdrawals would be recommended for revocation, thus opening most BLM lands to mineral leasing and location. The direct effects of resource development on the resource values associated with the Bristol Bay and Carter Spit areas are discussed in previous sections, particularly those discussing effects to Fish, Wildlife and Special Status Species.

(3) Effects to Areas of Critical Environmental Concern for Alternative C

Under Alternative C, the Carter Spit ACEC (61,251 acres) and the Bristol Bay ACEC (974,970 acres) would be proposed. In addition, Stipulations, ROPs, and additional requirements, determined through project-specific NEPA analysis, would provide protection of relevant and important values of these ACECs.

These two potential ACECs would be designated, based on relative and important resources values (43 CFR §1610.7-2). The values for each area are discussed in Chapter III and Appendix B. Management would result in limitations or restrictions placed on other resource uses and activities in order to prevent irreparable damage to the identified values. Management objectives of both ACECs, if proposed within the preferred alternative, would be described within the Bay RMP. Should the selected lands immediately adjacent to these proposed ACECs revert to BLM, they may be incorporated into the ACEC. This would be accomplished by a plan amendment following relative and important criteria in 43 CFR §1610.7-2.

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. Under Alternative C, ANCSA 17(d)(1) withdrawals would be retained for the Carter Spit ACEC (61,251 acres). This ACEC would remain closed to all mineral activities. The Carter Spit ACEC would be designated as a right-of-way avoidance area, OHV travel would be limited to designated roads and trails, closed to FLPMA leases, and would be unavailable for disposal. Applications for livestock grazing would be analyzed on a case-by-case basis, though no applications for grazing have been received nor does BLM expect to receive applications for grazing within the life of the Bay RMP.

Impacts to resources in the Carter Spit ACEC would be similar to Alternative A due to retention of ANCSA 17(d)(1) withdrawals and designation of a right-of-way avoidance area. The retention of ANCSA 17(d)(1) withdrawals would preclude mineral exploration and development, while designation of a right-of-way avoidance area would preclude road and pipeline construction. Precluding this type of development would prevent impacts to the natural environment, including; soil compaction, increased siltation of water

bodies, vegetative removal, degraded localized air quality resulting from dust and vehicle emissions, and disturbance to wildlife and special status species wildlife.

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 for leasable and locatable mineral activities. It would be closed to salable minerals and designated as a right-of-way avoidance area. OHV travel would be limited to designated roads and trails, closed to FLPMA leases, and would be unavailable for disposal. Applications for livestock grazing would be analyzed on a case-by-case basis, though no applications for grazing have been received nor does BLM expect to receive applications for grazing within the life of the Bay RMP. A fire management plan developed to protect lichen range for caribou would be developed for this ACEC.

The use of ROPs and Stipulations will reduce impacts to the natural environment caused by mineral exploration and development, resulting from revocation of ANSCA 17(d)(1) withdrawals, in the proposed Bristol Bay ACEC. A more detailed description of impacts to natural resources resulting from mineral exploration and development is contained in the discussion on effects from leasable and locatable minerals. In addition, a Plane of Operation will be required for locatable mineral activities occurring in the ACEC, per 43 CFR 3809.11(c)(3), requiring detailed disturbance and rehabilitating planning.

(4) Effects to Areas of Critical Environmental Concern for Alternative D

Only the Carter Spit ACEC (36,220 acre) would be designated to provide protection of relevant and important values. Upon lifting of ANSCA 17(d)(1) withdrawals, ANILCA 906(e) Top Filed land (61,105 acres) would become State-selected. These Top Filed lands include Goodnews Bay/Snow Gulch area. These lands are immediately adjacent to the proposed Carter Spit ACEC. Should the selected lands immediately adjacent to the proposed ACEC revert to BLM, they may be incorporated into the ACEC. This would be accomplished by a plan amendment following relative and important criteria in 43 CFR §1610.7-2. The following site would be designated under this Alternative:

Carter Spit ACEC

This ACEC would be designated to provide protection to federally-listed migratory bird species. Additional impacts to fish, wildlife, vegetation, Special Status Species, and cultural resources under Alternative D are discussed in this chapter under each topic heading. ANSCA 17(d)(1) withdrawals would be revoked from the lands within the proposed ACEC boundary. This ACEC would be open to leasable and locatable mineral activities, closed to salable minerals, and designated as a right-of-way avoidance area. Lands within the Carter Spit ACEC would be closed to FLPMA leases, unavailable for disposal, and OHV travel would be limited to designated roads and trails. Applications for livestock grazing would be analyzed on a case-by-case basis, though no applications for grazing have been received nor does BLM expect to receive applications for grazing within the life of the Bay RMP.

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. Impacts of the various Alternatives on the quality and free-flow of water are described in the Soils, Water, Air, and Vegetation 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 B provides the Wild and Scenic River matrix used to determine the river segments' eligibility and suitability.

(1) Effects to Wild and Scenic Rivers for Alternative A

There is currently no Wild and Scenic River designation on BLM lands in the planning area. Under this Alternative, no rivers would be nominated. Because of the retention of ANCSA 17(d)(1) withdrawals under this alternative, resource development activities are anticipated to be limited.

(2) Effects to Wild and Scenic Rivers for Alternative B

Under this Alternative, no eligible rivers would be found suitable for designation.

(3) Effects to Wild and Scenic Rivers for Alternative C

Under Alternative C, all eligible rivers (Alagnak River (Wild/Recreational), the Goodnews River Mainstem (Wild), and the Goodnews River Middle Fork (Wild)) would be found suitable for designation (12,210 acres). This would provide maximum protection to the free-flowing characteristic of these rivers. 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.

(4) Effects to Wild and Scenic Rivers for Alternative D

Under Alternative D, no eligible rivers would be found suitable for designation.

8. Social and Economic Conditions

a) Effects to Social and Economic Conditions Common to All Alternatives

Proposed management of the following resources, resource uses or programs would have no anticipated effects on Social and Economic Conditions: Soil, Water, Air, and Vegetation Management, Visual Resources, and Renewable Energy.

(1) Effects to Social and Economic Conditions from Livestock Grazing (Common to All Alternatives)

No livestock grazing currently occurs under permit, nor has any interest been expressed in requesting livestock grazing authorization. Authorizations for grazing 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 planning area. Therefore, no effect on the regional economy is expected under any alternative.

(2) Effects to Social and Economic Conditions from Forest Products (Common to All Alternatives)

Individual and subsistence use of forest products is typical in the planning area. There is no commercial demand, few permits for individual use, and no expectation of change in the current pattern of use. The demand for forest products on BLM 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.

(3) Effects to Social and Economic Conditions from Recreation and Travel Management (Common to All Alternatives)

BLM issues approximately 4-6 special recreation use permits annually to commercial guides or outfitters using BLM land within the planning area. Very little visitor use or trip data is available. BLM assumes that 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. Although tighter management of OHVs is proposed under Alternatives C and D, reasonable access to subsistence resources will remain unaffected under all Alternatives.

(4) Effects to Social and Economic Conditions from Hazardous Materials Management (Common to All Alternatives)

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 sites become recognized that are near communities.

(5) Effects to Social and Economic Conditions from designation of Areas of Critical Environmental Concern (Common to All Alternatives)

The range of alternatives analyzed consider different ACEC designations, from no designations (Alternatives A and B) to two ACECs (alternative C) to one ACEC (alternative D). These designated areas affect economic conditions indirectly through the constraints that are identified for specific resource protection. These constraints may limit resource development and thus economic development to some extent. The effects to social and economic conditions from these designations are best expressed through their direct effect on mineral development. These effects are described below for each alternative under Effects to Social and Economic Conditions from Minerals.

(6) Effects to Social and Economic Conditions from Fisheries and Wildlife Management (Common to All Alternatives)

Chapter III of this document, in the section on Social and Economic conditions, emphasizes the role and importance of subsistence activities to the local economy. The importance of commercial fishing is also emphasized. These economic opportunities are largely dependent on high-quality fish and wildlife habitat. Within the range of alternatives presented in this analysis, BLM considers a varying range of resource development scenarios. Even under the most aggressive development scenario (Alternative B) there would be only 115 acres of disturbance from mining activity and the development of one gas field in the Koggiling block. The effects of these activities on fish and wildlife habitat and on subsistence are displayed in this Chapter under the respective resource categories. Under no alternative would the direct and indirect effects of development on BLM lands have a significant impact on subsistence opportunities or on the regional commercial fisheries or on the economic benefits derived from these activities.

b) Effects to Social and Economic Conditions for Alternative A

(1) Effects to Social and Economic Conditions from Mineral Activities (Alternative A)

Leasable. The area would be closed to mineral leasing due to ANSCA 17(d)(1) withdrawals. Therefore, management of BLM lands under this Alternative would not result in changes in the regional economy.

Locatable. Mining claims predating ANSCA are available to locatable mineral development. Mining activity is currently taking place only on some of these claims. Under Alternative A, no new mining activity would be likely to occur on BLM land due to ANSCA 17(d)(1) withdrawals. Therefore, management of BLM lands under this Alternative would not result in changes in the regional economy.

Salable. The area would be closed to mineral leasing due to ANSCA 17(d)(1) withdrawals. Therefore, management of BLM lands under this Alternative would not result in changes in the regional economy.

(2) 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 to the regional economy.

(3) Effects to Social and Economic Conditions from Wild and Scenic Rivers (Alternative A)

No river segments would be considered for inclusion to the National WSR system. Recreation opportunities and commercial operations associated with any eligible rivers would remain the same.

(4) Effects to Social and Economic Conditions from Recreation Management (Alternative A)

Recreation management would maintain the existing spectrum of opportunities. Only a slight increase in commercial Special Recreation Permits would be expected, consistent with current trends. There would be very little to no economic effect from this management.

c) Effects to Social and Economic Conditions Alternative B

(1) Effects to Social and Economic Conditions from Minerals Activities (Alternative B)

Leasable Minerals

Approximately 1,103,138 acres of BLM lands and any State- or Native-selected lands (820,627 acres) whose selection is relinquished or revoked, would be open to leaseable mineral activities.

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 be requested within approximately 40 miles east northeast of Dillingham.. Economic effects of a gas field will more likely impact the Dillingham area, and will be less likely to impact 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 planning 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, such as 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%) 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 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 an effect on local lodging and catering services, and could be a significant input to Dillingham's economy. Later construction and operations may have a lower effect on lodging and food service in Dillingham, but may increase transportation service requirements for materials barged or flown in from supplier locations outside the planning area. It is possible that 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 are 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 at 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 the exploration phase, increase during development, and drop during production phases. Workers will travel to the gas field from other parts of the United States (27%), other parts of Alaska (58%), and very few workers originating from the planning area (15%), based on comparisons drawn from the North Slope oil industry (Hadland 2005).

In addition, *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 4 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 of 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.

Under this scenario Government revenues may increase due to the potential amount of mining claim fees, rental fees, and possible production royalties.

Salable Minerals

Due to the location of BLM lands within the planning area, and the availability of these resources on State or private lands, development of salable mineral materials is expected only in conjunction with leasable mineral activities in the Koggiling Creek planning block. Development of salable minerals and the impacts to social and economic conditions to the region are incorporated into the discussion of leasable minerals.

(2) Effects to Social and Economic Conditions from Lands and Realty Actions (Alternative B)

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.

(3) Effects to Social and Economic Conditions from Wild and Scenic Rivers (Alternative B).

Same as Alternative A.

(4) Effects to Social and Economic Conditions from Recreation management (Alternative B)

This alternative would manage recreation opportunities towards a roaded natural experience. This recreation setting includes some rustic facilities in a largely natural setting. Managing for this experience would imply a higher level of recreational visitor use and consequently a higher level of commercial Special Recreation Permits. More commercial recreation opportunities could provide an economic benefit to local communities or villages in the planning area.

d) Effects to Social and Economic Conditions for Alternative C

(1) Effects to Social and Economic Conditions from Minerals

Leasable Minerals

Under Alternative C, 1,063,129 acres of BLM land within the planning area will be open to leasable mineral activities. ANSCA 17(d)(1) withdrawals will be lifted, with the exception of the proposed Carter Spit ACEC (61,251 acres) and proposed Wild River segments of the Alagnak, Goodnews and Goodnews

Middle Fork Rivers (12,210 acres). Additional Agency withdrawals (3,318 acres) would be closed to leasable mineral activities as described within specific PLOs. A 300 foot NSO buffer would be placed on either side of East and South Fork Arolik, Faro Creek, South Fork Goodnews River, and Klutuk Creek (Appendix A, ROP FW-6a and Oil and Gas Lease Stipulation 8) to protect riparian areas and soils adjacent to sensitive habitat for salmon and resident fish. According to the leasable RFD, gas operations are expected to take place within the Koggiling Creek planning block only. Because the described closures are not within the Koggiling Creek planning block, the effect on the regional economy from leaseable mineral development is expected to be the same as Alternative B.

Locatable Minerals

ANSCA 17(d)(1) withdrawals will be lifted, with the exception of the proposed Carter Spit ACEC (61,105 acres) and proposed Wild River segments of the Alagnak, Goodnews and Goodnews Middle Fork Rivers (12,210 acres). Additional Agency withdrawals (3,968 acres) would be closed to locatable mineral activities as described within specific PLOs. Upon revocation of ANSCA 17(d)(1) withdrawals, Top Filings would attach to lands selected by the State under ANILCA 906(e). The lands would remain closed to mineral entry pursuant to 43 CFR § 2627.4 (b). The high locatable mineral occurrence potential area of Goodnews Bay/Snow Gulch, is Top Filed by the State under 906(e) of ANILCA. Economic opportunities would be slightly greater compared to Alternative A, due to the amount of expected development (43 acres) as discussed within the RFD for locatable minerals.

(2) Effects to Social and Economic Conditions from Lands and Realty Actions (Alternative C)

Impacts would be the same as Alternative B.

(3) Effects to Social and Economic Conditions from Wild and Scenic Rivers (Alternative C)

Under Alternative C, all eligible rivers (Alagnak River (Wild/Recreational), the Goodnews River Mainstem (Wild), and the Goodnews River Middle Fork (Wild)) would be found suitable for designation (12,210 acres). If these rivers were eventually designated as Wild and Scenic, visitor use and commercial recreation opportunities would increase, based on experience with other Alaskan Wild and Scenic Rivers. This could provide some economic opportunities for local communities or villages.

(4) Effects to Social and Economic Conditions from Recreation Management (Alternative C)

Same as Alternative A.

e) Alternative D

(1) Effects to Social and Economic Conditions from Minerals

Leasable Minerals

Most of the planning area (1,101,304 acres) would be open to mineral leasing, including the Carter Spit ACEC, due to lifting of ANSCA 17(d)(1) withdrawals. A 300-foot NSO buffer (Appendix A, ROP FW-6a and Oil and Gas Lease Stipulation 8) would be placed on either side of East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek. Agency withdrawals (3,318 acres) would be closed to leasable mineral activities. According to the leasable RFD, leasable mineral activities are expected to take place within the Koggiling Creek planning block only. Because the described closures are not within the Koggiling Creek planning block, the effect on the regional economy from leaseable mineral development is expected to be the same as Alternative B.

Locatable Minerals

Economic and social effects 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.

(3) Effect to Social and Economic Conditions from Wild and Scenic Rivers

Same as Alternatives A and B.

(4) Effects to Social and Economic Conditions from Recreation Management

Same as Alternatives A and C.

9. 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. Analysis of the effects to subsistence resources and opportunities is presented in the next section of this Chapter. Arguably, creation of jobs and income provide positive effects on the Native population, based on value perspectives.

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.

10. Subsistence

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

a) Effects to Subsistence Common to All Alternatives

(1) Effects to Subsistence from Climate Change (Common to All Alternatives)

The climate within the Bay planning area is described as maritime near the coasts, and more transitional farther inland. Current scientific evidence suggests that 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 subsistence uses, by expanding habitats for some species, and limiting habitat for other species, thereby altering the distribution and abundance of these resources, particularly those dependent on wetlands, tundra, shrub or closed forest habitats. Additional impacts may include alterations to caribou migration patterns and alterations in the abundance and timing of spawning anadromous fish species, which could have negative impacts to subsistence users.

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

Soils, Water, Vegetation and Air resources will be managed per BLM-Statewide Alaska Land Health Standards. In general, subsistence users throughout the planning area would benefit from efforts to protect soil, water, vegetation, and air resources. These resources contribute to a healthy ecosystem, which in turn benefits subsistence users by allowing fish stocks, wildlife populations and other renewable resources to remain healthy and obtain increased productivity.

(3) Effects to Subsistence from Fire and Fire Management (Common to All Alternatives)

Fire management has the potential to impact wildlife or wildlife habitat in a variety of ways which in turn could impact subsistence use if they: 1) depleted a subsistence resource population; 2) altered the range of a subsistence species away from the traditional use area; or 3) resulted in an easier route of access for non-subsistence users into subsistence use areas, increasing the potential for competition of the resource.

Impacts as a result of fire are expected to be minimal within the planning area, as fire has been and continues to be a normal part of the ecosystem. Mitigation measures designed to reduce the impacts of fire 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. Impacts as a result of suppression efforts are expected to be minimal, as most BLM lands are far from the road system, minimizing the use of mechanized equipment.

(4) Effects to Subsistence from Forestry Management (Common to All Alternatives)

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 spurs or temporary roads may be constructed to access parcels of timber in the future. If roads were constructed there could be localized impacts to subsistence due to alterations in habitat, wildlife migratory patterns, wildlife abundance and distribution. Direct habitat loss may also lead to wildlife displacement and habitat fragmentation, overall reducing the abundance of wildlife and plant species available for subsistence use. Currently, there is no commercial use of timber and no associated road construction activity on BLM lands within the planning area.

(5) Effects to Subsistence from Locatable and Salable Mineral Activities (Common to All Alternatives)

Locatable Minerals. Locatable mineral exploration and development may occur under every Alternative. Potential impacts to subsistence wildlife would include temporary displacement in localized areas; temporary and long term loss of habitat; long-term degradation of habitat; and direct mortality of small mammals or nestlings and brooding birds. In addition, mining activity may result in access constraints to

subsistence users, or cause an increase in competition for resources if miners took the opportunity to hunt. Both direct and indirect impacts may be reduced under all Alternatives with the implementation of mitigation measures developed during NEPA analysis of specific locatable mineral actions.

Salable Minerals. Mineral material disposal has both direct and indirect impacts on wildlife and their habitat, and therefore, has an impact on subsistence. In addition, mineral material activity may also result in access constraints to subsistence users, or cause an increase in competition for resources. However, these impacts would be very minimal under most alternatives, as sufficient material sources exist on private lands to meet the needs of most communities within the planning area and few mineral material disposal actions are anticipated.. Additional project-specific subsistence stipulations and ROPs created in response to the proposed activity, such as limitations in the timing or location of the proposed activity, would serve to minimize the potential impacts to subsistence users.

(6) Effects to Subsistence from Lands and Realty Management (Common to All Alternatives)

There would be both direct and indirect impacts to subsistence activities and resources from lands and realty actions under all Alternatives. Subsistence fish and wildlife species may be temporarily displaced or disturbed during activities authorized under this program and habitat may be destroyed or degraded. Additional project-specific subsistence stipulations and ROPs created in response to the proposed activity, such as limitations or directions regarding helicopter use, would serve to minimize the potential impacts. Land acquisitions and exchanges may benefit subsistence resources by consolidating land status and protecting important fish and wildlife habitats. Disposal actions may result in removal of habitat protection requirements or make lands unavailable for subsistence uses.

(7) Effects to Subsistence from Recreation Management (Common to All Alternatives)

There may be impacts to subsistence resources from both commercial and non-commercial recreation activities, including aircraft over flights, landing in remote areas, camping, and boating. The primary impacts to subsistence resources from recreation activities may be temporary stress or displacement from authorized activities on BLM-managed lands through a Special Recreation Permit. As stated in Chapter II, under all alternatives, BLM has the discretion to deny an application for a Special Recreation Permit, based on site-specific analysis, including an ANILCA section 810 analysis considering the impacts of the activity on subsistence. BLM has used this discretion in the recent past. In addition habitat degradation may result from trampling or removal of plant species. Under Alternative B, the ROS would be classified as "Roaded Natural" providing for rustic facilities. Impacts to subsistence resources and use within the planning area under this designation would be minimal. Project-specific subsistence stipulations and ROPs created in response the proposed activity, would serve to minimize potential impacts.

(8) Effects to Subsistence from Travel Management (All Action Alternatives B, C, D)

The noise and activity associated with OHV use can adversely affect subsistence wildlife both directly and indirectly. Direct effects include stress and displacement of animals, possibly to less suitable habitats, especially from important seasonal habitats (i.e. calving and insect relief areas). Stress and displacement may result in reduced productivity (ADF&G 1990). In Alternative B, the planning area would be designated as open to OHVs and allow cross country travel. Under Alternatives C, and D, BLM-managed lands would be designated as "limited" restricting OHV travel to designated roads/trails.

In addition, a 2,000-lb GVWR would be enforced on OHV use. ROPs and stipulations created in response to any proposed permitted activity, would serve to minimize potential impacts to subsistence use and resources.

b) Effects to Subsistence for Alternative A

Alternative A would continue present management practices and levels of resource use based on the existing Southwest MFP (BLM 1981), supplemented by direction contained in existing laws, regulation and policy. Few uses would be limited or excluded as long as they were consistent with State and

Federal laws. Activities would be analyzed through the NEPA process, including an ANILCA 810 evaluation, on a case-by-case basis, and any identified impacts from the proposed action to subsistence would be mitigated through appropriate consultation and stipulations.

(1) Effects to Subsistence from Minerals Activities (Alternative A)

Leasable Minerals. Alternative A would retain all ANCSA 17(d)(1) withdrawals, thus preventing mineral leasing on BLM lands.

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 pre-ANCSA claims exist on BLM lands where some mining may take place or continue. These operations and any future proposals for locatable minerals activities would be subject to review through the administration of Plans of Operations. Measures to maintain the integrity of subsistence resources and use would be identified and required as part of the individual mine operating plan. This analysis assumes disturbance of 23 acres of BLM-managed and Native (Federal claims) lands under this alternative, mostly from placer mining operations (BLM, 2006). Effects to subsistence from locatable mineral activities would be as described under “Effects Common to All Alternatives”. Under Alternative A, impacts to subsistence would be less than Alternatives B and D, but similar to Alternative C due to the amount of acres estimated to be disturbed.

Salable Minerals No impacts would be expected in areas withdrawn from mineral entry and this analysis assumes no salable mineral activities on BLM lands for this alternative (BLM 2006).

(2) Effects to Subsistence from Recreation Management (Alternative A)

Under Alternative A, the ROS classification would remain classified as Semi-Primitive Motorized and both commercial and non-commercial recreation would continue to be managed to maintain existing conditions.. Consequently, no areas would be identified for commercial or non-commercial use limits, and impacts to subsistence resources and uses associated with these activities would be identified through the NEPA process required for each permit request. Under Alternative A, impacts to subsistence would be the same as discussed under impacts associated with “Effects Common to All Alternatives.”

(3) Effects to Subsistence from Travel Management (Alternative A)

Impacts to subsistence resources and uses would be the same as discussed under impacts “Common to All Action Alternatives.” Under Alternative A, there would be no travel management restrictions and no OHV weight limits. Cross country travel would be allowed everywhere on BLM lands within the planning area. The degree of potential impacts to subsistence would be both positive and negative. The lack of travel restrictions would allow increased access, but has the potential to cause degradation of habitat, from excessive OHV use.

(4) Effects to Subsistence from Special Designations (Alternative A)

No special designations are proposed under this alternative.

(5) Effects to Subsistence from Lands and Realty Management (Alternative A)

Impacts to subsistence from lands and realty actions (use authorizations and land disposals) would be similar to that discussed in effects “Common to All Alternatives.” Alternative A anticipates a low level of resource development and consequently fewer land use authorizations and rights-of-way applications than other alternatives.

ANCSA 17(d)(1) withdrawals. This alternative would retain withdrawals, thus preventing most new mineral leasing or location. Impacts to subsistence associated with mineral development would be minimized.

b) Effects to Subsistence for Alternative B

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

Land Exchanges. 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 creating greater competition for subsistence resources. Once under private ownership, these lands are not protected by Federal regulations or policy concerning resource or habitat protection. 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.

Withdrawals. ANCSA 17(d)(1) withdrawals would be recommended for revocation under this Alternative. Because of the constraints currently in place under these withdrawals, revocation of the withdrawals could increase potential resource development and subsistence wildlife may be disturbed during activities. Associated impacts to subsistence resources would be expected from mineral exploration and development and infrastructure development. Activity level proposals would be handled on a case-by-case basis, and would be subject to Required Operating Procedures and Stipulations.

Rights-of-Way. This alternative anticipates the most applications for rights-of-way associated with resource development activities. These would include roads or pipelines associated with mineral development. Impacts to subsistence from these activities are described under impacts "Common to All Alternatives". More impacts to subsistence from rights-of-way would be expected under this alternative than under alternatives A, C, or D.

(2) Effects to Subsistence from Minerals Activities (Alternative B)

Leasable Minerals. Under Alternative B, ANCSA 17(d)(1) withdrawals would be lifted and leasable mineral activities would be allowed on 1,103,138 acres of BLM lands. Year around subsistence resource distribution, abundance, movement and associated seasonal harvest activities could be affected by leasable mineral activities.

Other activities associated with leasable mineral activities that have the potential to impact subsistence uses are: helicopter-supported activities, access and facilities (pipelines, production water treatment units, separation ponds, electric lines, buildings, storage facilities etc), construction and OHV use. Although these activities can be a hindrance and an annoyance, it does not create a substantial barrier between communities and subsistence resources.

Potential impacts from leasable mineral development and associated infrastructure are greater than for exploration, given the permanent and year-round nature of operations. If a development were to occur in the calving area of the MCH, or if infrastructure was constructed in such a way as to impede movements of the herd to important seasonal aggregation sites (i.e. calving and post calving aggregations, insect-relief habitat, and breeding or winter ranges) then there could be considerable impacts to this important subsistence resource. However, for the purposes of this planning effort, the reasonable foreseeable development scenario indicates six exploratory wells and one developmental gas field could be constructed in the Koggiling Creek planning block under this alternative. Additionally, roads, docks, and even remote airstrips constructed to aid production may serve as potential inroads for additional local subsistence user accessibility to resources as well as non-local hunters and fishermen, which could lead to increased competition for resources in the area. Under Alternative B, impacts to subsistence from leasable mineral activities would be greater compared to Alternative A. Though the Koggiling Creek planning block is available for leasable mineral activities under Alternatives C and D, the use of seasonal restrictions to protect caribou, applied through ROPs would impact subsistence less compared to Alternative B.

Locatable Minerals. Under Alternative B, ANCSA 17(d)(1) withdrawals would be lifted and locatable mineral activities would occur and may potentially increase compared to Alternative A. Potential impacts

to subsistence resources and use would be similar to that discussed within “Common to All Alternatives,” though increased acreage would be available for mineral activities. Surface disturbance under this alternative is presumed to be a total of 115 acres from locatable mineral activities (BLM, 2006). Under Alternative B, impacts to subsistence resources and uses would be similar to Alternative D, but less compared to Alternatives A and C due the amount of acreage estimated for locatable mineral activities.

Salable Minerals. Under Alternative B, ANSCA 17(d)(1) withdrawals would be lifted and saleable mineral activities could occur on BLM lands. Impacts to subsistence resources and use would be similar to that discussed within “Common to All Alternatives”, Due to the remote locations of BLM lands within the planning area it is presumed salable mineral activities would only occur in support of leasable mineral activities in the Koggiling Creek planning block. Under Alternative B, impacts to subsistence resources and uses would be greater than Alternatives A, C, and D. Though the Koggiling Creek planning block is anticipated to have salable mineral development under Alternatives B, C, and D, the use of seasonal restrictions applied through ROPs, in Alternatives C, and D, would create less impacts on subsistence resources, primarily caribou.

(3) Effects to Subsistence from Recreation Management (Alternative B)

Under Alternative B, the ROS classification would be classified as Roaded Natural and both commercial and non-commercial recreation would continue to be managed on a case-by-case basis. Management for a Roaded Natural recreation experience implies an increase in recreation users over existing levels. Additional recreation use, both casual and commercial, could result in a greater degree of impacts to subsistence resources. No areas would be identified for commercial or non-commercial use limits, and impacts to subsistence resources and uses associated with these activities would be identified through the NEPA process required for each Special Recreation Permit request. Under Alternative B, impacts to subsistence would be the same as discussed under impacts associated with “All Action Alternatives” but would occur to a greater degree than under any other alternative.

(4) Effects to Subsistence from Special Designations (Alternative B)

No special designations would be proposed under this Alternative.

(5) Effects to Subsistence from Travel Management (Alternative B)

Same as Alternative A.

c) Effects to Subsistence from Alternative C

(1) Effects to Subsistence from Realty and Lands Actions (Alternative C)

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

Withdrawals. Under this alternative, ANCSA 17(d)(1) withdrawals would be maintained on proposed Wild River segments on the Alagnak, Goodnews mainstem and Goodnews Middle Fork (12,210 acres) and within the Carter Spit ACEC (61,251 acres). Conservation of these areas would benefit subsistence resources by protecting important habitats.

Rights-of-Way. Impacts to subsistence resources and uses from Rights-of-Way would be the same as described under impacts “Common to All Alternatives” but would occur to a lesser degree. The proposed Bristol Bay and Carter Spit ACECs would be identified as avoidance areas. Restricting or stipulating Rights-of-Way within these ACEC would minimize impacts to important subsistence wildlife habitats and protect federally-listed migratory bird species, harvested for subsistence purposes, from impacts described in “Common to All Alternatives.”

(2) Effects to Subsistence of from Leasable, Locatable, and Salable Minerals (Alternative C)

Leasable Minerals. Under Alternative C, ANCSA 17(d)(1) withdrawals would be revoked, opening 1,063,129 acres of BLM lands to mineral entry. ANCSA 17(d)(1) withdrawals would be retained on eligible/suitable Wild Rivers (12,210 acres) including the Alagnak, Goodnews and Goodnews Middle Fork Rivers and within the proposed Carter Spit ACEC (61,251 acres). The retention of these withdrawals would prohibit mineral leasing within these areas. A NSO would be established within 300 feet of the East and South Fork Arolik River, Faro Creek, South Fork Goodnews River and Klutuk Creek. Consequently, under this alternative there is less land available for mineral leasing compared to Alternatives B or D. However, this analysis predicts the development of one gas field in the Koggiling Creek planning block. Potential impacts to subsistence from such a development are the same as those discussed under Alternative B.

Locatable Minerals. The effects to subsistence from locatable mineral activities would be similar to those discussed in Alternative B but smaller in scope. Twenty-three acres of disturbance is expected from locatable mineral activities under this Alternative on State-selected and Native lands. Segments of eligible/suitable Wild Rivers (12,210 acres) including the Alagnak, Goodnews and Goodnews Middle Fork Rivers of the Alagnak River, the mainstem of the Goodnews River, and the Goodnews Middle Fork, and the proposed Carter Spit ACEC (61,251 acres) would retain ANCSA 17(d)(1) withdrawals precluding these areas from mineral entry while allowing subsistence use. Conservation of these areas would benefit subsistence resources by protecting important habitats.

Salable Minerals. Impacts to subsistence would be similar to those in Alternative B but smaller in scope because 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 salable mineral activities. This Alternative would provide protection to subsistence resources by minimizing the amount of acreage available for salable mineral activities.

(3) Effects to Subsistence from Recreation (Alternative C)

Under Alternative C, the entire recreation area setting would be managed as ROS classes primitive, semi-primitive, and semi-primitive motorized. Impacts to subsistence resources would be the same as those described under Alternative A.

(4) Effects to Subsistence from 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 2,000 pounds would be proposed. These restrictions would benefit subsistence resources by reducing proliferation of trails resulting in degradation of habitats, and would reduce the indirect impacts to wildlife created by noise and disturbance, which can cause abandonment from preferred habitats.

(5) Effects to Subsistence from Special Designations (Alternative C)

Wild and Scenic Rivers. Under Alternative C, segments of the Alagnak, Goodnews mainstem and Middle Fork Goodnews rivers would be proposed for inclusion to the National WSR system. ANCSA 17(d)(1) withdrawals would be retained, closing these river corridors to mineral activities. These actions would be beneficial to subsistence resources by protecting riparian habitats from disturbance from resource development activities and by providing undisturbed wildlife habitats to riparian species. A Wild and Scenic River nomination or subsequent designation may result in increased visitation on nominated river segments. Increased visitation may stress or displace subsistence resources within riparian corridors due to increased noise from humans and boat and aircraft traffic. Competition for resources may result due to increases in non-subsistence hunting and fishing.

Areas of Critical Environmental Concern. Under Alternative C, the Carter Spit ACEC (61,251 acres) and the Bristol Bay ACECs (974,970 acres) would be proposed. This would benefit subsistence resources by providing increased protection to wildlife habitat in this area by the following measures:

- Requiring Plans of Operations for any mining operation, even those less than five acres (43 CFR 3809.11).
- Managing the area as a rights-of-way avoidance area, thus avoiding potential impacts from road or pipeline construction.
- Developing a transportation plan that identifies specific designated trails for OHV use, thus preventing unauthorized stream crossings, trail proliferation, and associated negative impacts subsistence resources habitats.
- ANCSA 17(d)(1) withdrawals would be retained and seasonal constraints to protect the Steller's eider would be developed in the Carter Spit ACEC.

d) Effects to Subsistence from Alternative D

(1) Effects to Subsistence from Realty and Lands Actions (Alternative D)

Land Exchanges. Impacts to subsistence resources would be the same as those discussed for Alternative B.

Withdrawals. Impacts to subsistence resources 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 B; however, the proposed Carter Spit ACEC (36,220 acres) would be identified as an avoidance area for Rights-of-Way. This would benefit subsistence wildlife and habitat by reducing the potential of impacts resulting from road or pipeline development in the area.

(2) Effects to Subsistence from Mineral Development (Alternative D)

Leasable Minerals. Under Alternative D, ANCSA 17(d)(1) withdrawals would be revoked and 1,101,304 acres of BLM lands would be open to leasable mineral activities. A 300-foot "No Surface Occupancy" area on either side of the East and South Fork Arolik, Faro Creek, South Fork Goodnews River, and Klutuk Creek would be proposed. There would be slightly less land available for mineral leasing compared to Alternative B, but more than Alternatives A and C. However, this analysis predicts the development of one gas field in the Koggiling Creek planning block. Potential impacts to subsistence use and resources from leasable mineral activities would be similar to those discussed under Alternative B, with the exception that under Alternative D, Stipulations that contain seasonal constraints for protection of caribou would be applied (Appendix A, Stipulations 5 and 6).

Locatable Minerals. This analysis predicts potential mining development and disturbance on 115 acres from both placer and lode mining (BLM, 2006). This disturbance is expected to occur entirely on State-selected, due to ANILCA 906(e) Top Filings, and Native (Federal mining claim) lands.

Impacts to subsistence and subsistence resources from this level of development would be the same as for Alternative B. At this level of anticipated development and with the application of ROPs in mining Plans of Operations, impacts to subsistence uses and subsistence resources may be significant in the immediate area associated with locatable mineral activities. Within the Carter Spit ACEC, Plans of Operation would be required for any operation (43 CFR 3809.11). This would have the effect of minimizing small-scale exploratory or development activities and would enable BLM to work with the operator in the Plan of Operation to apply ROPs for protection of resources.

Salable Materials. Impacts to subsistence resources would be the similar to Alternative B, except the Carter Spit ACEC (36,220 acres) would be closed to salable mineral activities. This ACEC designation

would benefit subsistence uses and subsistence resources by protecting important riparian and coastal habitats, located within the ACEC boundary.

(3) Effects to Subsistence from Recreation (Alternative D)

Under Alternative D, the entire recreation area setting would be managed as ROS classes primitive, semi-primitive, and semi-primitive motorized. Impacts to subsistence resources would be the same as those described under Alternative A.

(4) Effects to Subsistence from Off-highway Vehicles (Alternative D)

Under Alternative D, 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. Impacts would be similar to that discussed in Alternative C.

(5) Effects to Subsistence from Special Designations (Alternative D)

There would be no Wild and Scenic River nominations under this alternative. This would result in more acres available for resource development. Effects to subsistence resources from anticipated resource development under this alternative are discussed in the topics above.

Under Alternative D, the Carter Spit ACEC (36,220 acres) would be designated. This would benefit subsistence resources by providing increased protection to wildlife habitat in this area by the following measures:

- Requiring Plans of Operations for any mining operation, even those less than five acres (43 CFR 3809.11).
- Managing the area as a rights-of-way avoidance area, thus avoiding potential impacts from road or pipeline construction.
- Developing a transportation plan that identifies specific designated trails for OHV use, thus preventing unauthorized stream crossings, trail proliferation, and associated negative impacts.
- Seasonal constraints to protect federally-listed, subsistence authorized, migratory bird species would be developed (Appendix A, ROP SS 1b).

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's implementing regulations (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 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 has 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** – The Cook Inlet region is generally considered as the birthplace of commercial oil and gas production in Alaska. Oil was discovered in the Swanson River oil field in 1957, which provided an important catalyst for the Alaska statehood in 1959. After statehood, a competitive leasing program was established. 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/sluice-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).

On Jan. 9 President Bush lifted the moratorium on oil and gas leasing in the North Aleutian planning area, an area that includes the outer continental shelf of Alaska's Bristol Bay and the southeastern corner of the Bering Sea. The president's action should enable the U.S. Minerals Management Service to include two North Aleutian lease sales in its 2007 to 2012 leasing program. (<http://www.gov.state.ak.us/archive.php?id=54&type=1>)

- **Alaska Peninsula and Nushagak Peninsula Oil and Gas Leasing Program** – On March 17, 2004, ADNIR, 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 ADNIR 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** - ADNIR 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-managed lands. At

that time, 213,120 acres were leased, none of which were within the planning area. Interest was limited to Port Moller and vicinity, on the lower Alaska Peninsula approximately 200 miles south of the planning area. According to ADNRC 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, seven Annual Placer Mining Applications (APMA) and Annual Hardrock Exploration Application (AHEA) were submitted for Locatable Mineral projects located within the Bay planning area. Four lode exploration applications and three placer mining applications were filed (AK DNR 2005). APMA's 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 land at this time.
- **Pebble 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 copper-gold-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 Gold Corporation 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 was 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).

In 2006 Northern Dynasty Minerals, LTD. conducted comprehensive drilling, base-line environmental and socioeconomic studies to support Federal and State project permit applications. A total of 74,000 feet of core drilling was done with emphasis on determining the overall size and grade of the Pebble East deposit discovery made in 2004. This drilling extended the north-south strike length to over 7,000 feet in which the grades consistently exceed 1% copper equivalent.* The deposit is still open ended to the north and south across a width exceeding 4,000 feet. The discovery of the Pebble East has boosted the inferred mineral resource at the deposit by nearly 90%. This deposit is richer than the Central Zone, but lies at depth would be mined by underground methods.

As of February 2007 the Pebble Deposit has inferred resources, at a 1.0% copper equivalent cutoff, of:

1.4 billion **tonnes grading 1.29% copper equivalent, containing 24.6 billion pounds of copper, 20.9 million ounces gold, and 1.2 billion pounds of molybdenum.

Northern Dynasty has stated that the combined resources at the Pebble Deposit constitute one of the most significant metal accumulations in the world. In 2007 the company plans to focus efforts on Pebble East with an estimated 250,000 feet of drilling to further expand the resource and upgrade the classification of known mineralization (Northern Dynasty news releases, January 23 and February 20, 2007)

*Copper equivalent ($CuEQ = Cu\% + (Au \text{ g/t} \times 12.86/22.05) + (Mo\% \times 132.28/22.05)$)

**tonnes = metric tons.

- **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 Corporation 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 project was 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 a 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 waiting for funding (ADOT&PF 2005).
- **Near-Term Recommendations for Community Linkages** – In the 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 permit 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 Soils, Water Resources, Vegetation and Air Quality

(1) Cumulative Effects to Air, Vegetation, Soils, and Water from Minerals

Past and Present Effects to Soils and Vegetation

Past and present 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. Weeds may become more prevalent, along with erosion from seasonal breakup, ice scouring, wave action, and high flow events. 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.

Cumulative Effects to Soils and Vegetation

Leasables. Based on findings presented in "Present and Reasonably Foreseeable Future Development," limited on-shore oil and gas development would occur on non-BLM lands within this planning period. Therefore, the direct and indirect effects to soils and vegetation presented for each alternative, which include the development of a gas field in the Koggiling block under Alternatives B, C, and D, are an adequate analysis of the cumulative effects of mineral leasing on soils and vegetation.

Locatables. Based on the Reasonably Foreseeable Development Scenario for Locatable and Salable Minerals (BLM, 2006), the following acres of total surface disturbance on non-BLM lands could occur from mining:

- There is expected to be a very high amount of reasonable foreseeable future locatable lode mineral activity in the Pebble Copper area. Future exploration, development, and lode and placer mining activities are expected to continue at eleven lode locations on State land. During the next 20 years mineral related lode activities would result in a disturbance of 6,450 acres for lode exploration and development activities in the Pebble Copper area; 6,400 acres would be a result of activities at the Pebble Copper property.
- There is expected to be a high amount of reasonable foreseeable future locatable lode and placer mineral activity in the Shotgun Hills area. Future exploration, development, and lode and placer mining activities are expected to continue at three lode operations: at the Shot, Shotgun/Mose, and Win properties and one placer operation on the King Salmon River. During the next 20 years mineral related activities would result in a disturbance of 1,311 acres in the Shotgun Hills area; 1,310 acres for lode exploration and 1 acre of placer exploration on State land.
- There is expected to be a moderate to high amount of reasonable foreseeable future locatable lode and placer mineral activity in the Platinum area. During the next 20 years mineral related activities would result in a disturbance of 56 acres in the Platinum area; 10 acres for lode exploration and 46 acres of placer exploration on Native land.
- Other smaller placer and lode developments are anticipated on non-BLM lands throughout the planning area.

These numbers, combined with the highest projected numbers of surface disturbance on BLM lands (115 acres under alternatives B and D) from mining disturbance, total 7,996 acres of projected reasonably foreseeable surface disturbance for all lands within the planning area. Based on the direct and indirect effects described in this Chapter, this represents a significant impact to soils directly disturbed by mining operations. However, the cumulative projected disturbed acreage of 7,996 represents only .03 percent of the total acres in the planning area. Reclamation on both State and BLM lands prescribed in Plans of Operations would help to restore soils and vegetation to pre-mining productivity.

Past and Present Effects to Water

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, 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 activities 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

Leasables. Based on findings presented in "Present and Reasonably Foreseeable Future Development," limited on-shore oil and gas development would occur on non-BLM lands within this planning period. Therefore, the direct and indirect effects to soils and vegetation presented for each alternative, which include the development of a gas field in the Koggiling block under Alternatives B, C, and D, are an adequate analysis of the cumulative effects of mineral leasing on water resources.

Locatables. 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).

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. 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 following is a cumulative analysis of the effects and estimated quantity and quality of produced water disposed on the surface and estimated amount of surface water needed, by locatable mineral potential areas within the planning area:

Goodnews Bay/Snow Gulch area: Lode exploration at the Tatlignagpeke Mountain and Miltak Mountain locations on State-selected land and the Wattamuse-Granite Lode location on Native-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Water use for placer mining on Barnum Creek, Domingo Creek, Faro Creek, Jacksmith Creek tributary, and Slate Creek on State-selected land; and on the Arolik River, Malaria Creek, Snow Gulch, Tyone Creek, and Wattamuse Creek locations on Native-selected land would be limited to the amount put

through a gravity separation process (500 gallons per minute, possibly recycled; 38 million gallons based on seven working hours each of 180 days), for surface disposal of non-recycled water. An additional 9,000 to 18,000 gallons would be required for domestic purposes annually at each location, but disposal must meet applicable Federal and State water quality standards for permitting.

Iliamna/Fog area: Lode exploration at the Dutton, Easy, Karen, and Meadow locations on State-selected land and the Duryea and Ground Hog locations on Native-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Water use for placer mining on Unnamed (west of Chetok) on Native-selected land would be limited to the amount put through a gravity separation process (500 gallons per minute, possibly recycled; 38 million gallons based on seven working hours each of 180 days), for surface disposal of non-recycled water. An additional 9,000 to 18,000 gallons would be required for domestic purposes annually at each location, but disposal must meet applicable Federal and State water quality standards for permitting.

Iliamna/Kvichak area: Lode exploration at the Iliamna Project, D Block; Iliamna Project H, Block; and LSS 1-3 locations on State-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Kasna Creek area: Lode exploration at the South Current Creek and Upper South Current Creek locations on Native-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Kemuk Mountain area: No lode or placer mineral activities will occur on BLM, State-selected, or Native-selected land. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Kijik Lake area: Lode exploration at the Dick's Lode, Gull, and Kijik Mountain locations Native-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Water use for placer mining at the Bertha M. location on Native-selected land would be limited to the amount put through a gravity separation process (500 gallons per minute, possibly recycled; 38 million gallons based on seven working hours each of 180 days), for surface disposal of non-recycled water. An additional 9,000 to 18,000 gallons would be required for domestic purposes annually at each location, but disposal must meet applicable Federal and State water quality standards for permitting.

Pebble Copper area: Lode exploration at the Hill 1759 location on Native-selected land may result in some surface disposal of water required for drilling and short term camp facilities. Other disposal options are sometimes available, such as injection to a subsurface reservoir or removal from the location; otherwise, it may be locally disposed after appropriate treatment for contaminants. Operations would be required to meet applicable Federal and State water quality standards for permitting.

The proposed Pebble mining project is located within the planning area on lands managed by the State of Alaska. This site is located in the headwaters of North Fork and South Fork Koktuli River. Each of these

rivers converges to connect with the Mulchatna River, to the Nushagak River, and eventually draining into Nushagak Bay. Though no BLM lands exist within the Kaktuli River watershed, Native-selected lands exist within the lower Mulchatna River and large blocks of BLM and State- and Native-selected lands exist throughout the Nushagak River drainage (not bordering the Nushagak River). Pollutant discharges emitted from the proposed Pebble mine would be expected to meet State and Federal water quality regulations for the North Fork and South Fork Kaktuli Rivers. Additional contributions of pollutants throughout the watershed, all meeting water quality discharge standards, may cumulatively exceed water quality standards. Potential waste water discharge occurring from activities on all lands within the greater Nushagak River drainage would be managed by the State of Alaska.

Platinum area: Water use for placer mining at the Salmon River location on Native land would be limited to the amount put through a gravity separation process (500 gallons per minute, possibly recycled; 38 million gallons based on seven working hours each of 180 days), for surface disposal of non-recycled water. An additional 9,000 to 18,000 gallons would be required for domestic purposes annually at each location, but disposal must meet applicable Federal and State water quality standards for permitting.

Shotgun Hills area: No lode or placer mineral activities will occur on BLM, State-selected, or Native-selected land. Operations would be required to meet applicable Federal and State water quality standards for permitting.

All of the mineral activities in the Shotgun/Mose area are located on State land.

Sleitat Mountain area: No lode or placer mineral activities will occur on BLM, State-selected, or Native-selected land. Operations would be required to meet applicable Federal and State water quality standards for permitting.

Other cumulative impacts to water

Leaky underground storage containers may provide contamination to ground water resources which may ultimately contribute to surface water contamination. 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 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 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

In addition to water quality impacts, consumptive uses of water for industrial and municipal purposes may impact surface and/or ground water supplies. Impacts from consumptive uses may include altered in-stream flow regimes and alterations or degradation of riparian vegetation.

Hydrocarbon Contamination

With reference to Table 4.7, a number of contaminated sites already exist in the planning area. The greatest concentration is in and around King Salmon. It is related to historic activities at the King Salmon Air Force Base and the King Salmon Airport. Red Fox Creek, located near King Salmon on State land, is the only EPA/Alaska DEC recognized impaired (for hydrocarbons) water body within the planning area. The aquifer in this area has also been affected, but it is not known to what extent the contaminants are hydrocarbons. The size and depth of this aquifer has not been mapped.

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 planning area during the life of this plan, the potential for 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 will not be repeated here.

Past and Present and Cumulative Effects to Air Resources

Past and present effects of air quality impacts may result from the emissions of hydrocarbons and by-products of combustion. Airborne particulates from fire, mining activities, OHV use, and road construction may cumulatively result in both long-term localized and short-term regional impacts to air quality and potential water quality from atmospheric deposition. 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.

The proposed Pebble mine is a large project that may provide an opportunity for air quality degradation from mining operations, infrastructure development, and access/road development. Proposed road construction for support of Pebble mining operations intersects Native-selected lands. Any permitted activities occurring on BLM lands during time of road construction will provide cumulative impacts to air quality.

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.

Adherence to Required Operating Procedures, Stipulations and project-specific requirements, limitations on OHV use, and activity planning for BLM lands would protect air resources and keep impacts from a minor to moderate level. The fact that there is no forestry program, and based on a reasonably foreseeable projection of low level mineral development and low to moderate recreation use on BLM lands within the 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 Recreation

Direct and indirect effects as described in this chapter from Recreation on BLM lands, combined with the effects on other lands, would not have a significant impact on Soil, Water, Vegetation, or Air resources in the planning area. This assumption is based on the fact that recreation use throughout the planning area, on all lands, is dispersed. Recreation opportunities are not easily accessible in the planning area; consequently recreation use levels are relatively stable and are expected to remain that way.

(4) Cumulative Effects to Air, Vegetation, Soils, and Water from Travel Management

Alternatives A and B would not attempt to limit OHV use on BLM lands. Under these management scenarios, OHV use on all lands would continue unmanaged, which would result in a gradual extension of impacts as described in direct and indirect effects. Effects would include vegetation removal and compaction, soil compaction and shearing, soil subsidence where permafrost is present, trail braiding, and very localized increases of sedimentation at stream crossings. Because of the remote nature of the BLM lands in the planning area and limited amount of OHV use, these impacts cumulatively would not cause significant water quality degradation, alteration of drainage systems, or habitat damage.

Alternatives C and D would limit OHV use on BLM lands. This in combination with any OHV management on other lands would decrease the level of negative impacts described above.

b) Cumulative Effects related to Climate Change

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

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

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

Regional environmental changes are observed to be impacting the entire Bay planning area, including coastal areas. Another predicted result of climate change is a shift in vegetation. Projections are that the amount of tundra would shrink to its lowest extent in at least the last 21,000 years (ACIA 2004). Mosses and lichens are among the groups expected to decline as warming increases (ACIA 2004). The timeframe of these shifts will vary. Where suitable soils and other conditions do not exist, changes are likely a century away. However, significant changes in Arctic communities over the past few decades have already been documented (Sturm et al. 2001). The reduced sea ice along Alaska's coasts and a rising sea level are rapidly eroding the coastal soil. These are natural processes, but should be monitored on BLM-managed lands for effects on a wide variety of resources.

Changes in permafrost and resulting changes in lakes due to global climate change may negatively affect waterfowl. Shrinking pond surface areas could become a common feature in the discontinuous permafrost regions as a consequence of warming climate and thawing permafrost (Yoshikawa and Hinzman 2003).

Because climate change must be viewed from a global perspective, the magnitude of emissions potentially contributed by any proposed activities in the planning area need to be viewed in that context. Activities associated with oil and gas or mineral exploration and development, recreation, or prescribed burning would produce some greenhouse gases. The incremental contribution of greenhouse gases from the proposed alternatives in the planning area would be minor when compared to global greenhouse gas contributions. The Required Operating Procedures (Appendix A) allow for changes in project design in response to changing environmental conditions.

c) Cumulative Effects to Fisheries

(1) Cumulative Effects to Fisheries and Aquatic Habitat from Minerals Activities

Leasable. Based on findings presented in Reasonably Foreseeable Future Development, limited on-shore oil and gas development would occur on non-BLM lands within this planning period. Therefore, the direct and indirect effects to fisheries presented for each alternative, which include the development of a gas field in the Koggiling block under Alternatives B, C, and D, are an adequate analysis of the cumulative effects of mineral leasing on fish and fish habitat.

Locatable. Direct and indirect effects to fisheries and aquatic habitat from locatable mineral development are discussed earlier in this Chapter. This analysis presents a range of alternatives for locatable mineral development on BLM-managed lands. Alternatives B and D anticipate the most development, estimated at 115 acres of surface disturbance. BLM's Reasonably Foreseeable Development Scenario (RFD) describes anticipated surface disturbance on an additional 7,881 acres on State or Native lands within the planning area. Cumulative effects to fisheries would be dependent on the exact location of the anticipated development and the type of mining that would occur. The RFD for locatable minerals projects the greatest level of surface disturbance to be in the Pebble Copper and Shotgun Hills areas, mostly on State lands. These areas are projected to be mined using open pit methods, which generally include the mine pit, overburden and waste rock piles, tailings impoundment, a mill and facilities location, and associated roads. Remote Alaskan sites may include an employee camp, electrical generation plant, airfield, marine terminal, and road between the mill and the terminal that may be some distance.

In general, loss of riparian vegetation associated with such a mining operation would likely cause accelerated stream bank soil erosion resulting in impacts to water quality. Excessive sedimentation could cover fish eggs, resulting in die-off. This die-off of eggs could have population impacts to fisheries. Chemical pollution of aquatic habitat can have significant impacts to fisheries, particularly in anadromous fish populations. The impacts of multiple, small inputs of chemical pollution may be compounded further downstream. Spawning fish, though only for a short time, may be exposed to chemical pollution even though no pollutant concentrations are found in their destination water bodies. A longer exposure of time may result for species whose spawning grounds are impacted by pollutants, resulting in deformities, kills, or bioaccumulation of contaminants. Effects of water withdrawal from lakes and rivers for industrial uses may be intensified by climate change.

A continuation of current water and land use practices by private, State, and other Federal agencies would continue to affect fish habitat within the planning area. Higher intensity mineral development or exploration on lands upstream from BLM lands within a watershed could continue to be a concern due to sediment and water quality issues that influence the quality of fish habitat downstream from the source.

A large open pit mine such as those anticipated for the Copper Pebble and Shotgun Hills areas on State lands could have significant direct and indirect impacts to fish habitat in specific streams. Cumulatively, the anticipated surface disturbance on BLM lands, even under the most aggressive development scenarios under Alternatives B and D, would have little effect compared to the direct and indirect effects on State lands.

(2) Cumulative Effects to Fisheries from Travel Management

Alternatives C and D manage Off Highway Vehicles more intensely by limiting them to existing or designated trails and by implementing a 2,000-lb weight limit. Direct and indirect effects of these actions on fisheries and aquatic habitats are described earlier in this chapter. Cumulatively, OHV use on private or State lands in the area, if unmanaged, could result in localized adverse effects to fisheries and aquatic habitats, particularly at stream crossings.

Under Alternatives A and B, OHVs would be left unmanaged, allowing trail proliferation and associated impacts to fisheries to continue. This in combination with OHV use on private or State lands in the area, could result in significant localized adverse effects to fisheries and aquatic habitats.

d) Cumulative Effects to Wildlife

(1) Cumulative Effects to Wildlife from Minerals Activities, Travel Management, and Recreation

Future leasable mineral activities projected for the Koggiling Creek Planning Block, current and potential locatable mining within the Goodnews Bay/Snow Gulch and on State and Native managed lands throughout the planning area, combined with hunting, and climate change would have cumulative impacts on caribou. Depending on the location of development, these impacts could include: short or long-term disturbance to caribou insect relief habitat and migratory routes; disruption of caribou movements; stress and disturbance impacts to caribou during all seasons of the year; and possible reductions in herd productivity. Because caribou population size fluctuates naturally over time, it is difficult to determine if effects are accumulating at the population level, or just reflect natural shifts in population numbers.

Any new development as considered under Alternatives B, C, and D in combination with projected mineral development on State and Native lands, would result in additive impacts to caribou herds. If significant activity occurred within the calving grounds or crucial insect relief habitat, these impacts could be significant).

Within the Goodnews Bay/Snow Gulch area, much of the land is ANILCA 906(e) Top Filed land (61,105 acres) by the State, meaning it becomes State-selected land upon lifting of ANSCA 17(d)(1) withdrawals. Selected lands are segregated from mineral entry and leasing until such time as the lands are relinquished or conveyed. Therefore, no new mineral activities would occur over the short-term. If conveyed, mineral exploration or development could be authorized by the new land owner. According to the RFD for locatable minerals, 23 acres of disturbance is expected under Alternatives A, 43 acres in Alternative C, while 115 acres of disturbance is anticipated under Alternatives B and D, none of which would occur on unencumbered BLM lands. Some BLM lands may see increases in wildlife species due to mineral development on State and Native lands and a low occurrence with a less likely development scenario for BLM lands. This could potentially occur due to locatable mineral activities associated with the Pebble/Copper, Kemuk Mountain, and Goodnews/Snow Gulch areas.

Development of connecting transportation corridors would open the planning area to additional hunters, thereby increasing the duration of habitat fragmentation and 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 leasable 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.

e) 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 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 potentially increased levels of mining and mineral leasing development on State and private lands, combined with the potential for such development on BLM lands, could result in cumulatively 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 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. Tatlignagpeke Mountain has both habitats for the smelowskia and known lode mineral occurrences.

(2) Special Status Fish

There are no known Special Status fish species in the 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. Potentially 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 eiders and their habitats over the long term. The exploration and development of one gas field, six exploratory wells (each disturbing approximately six acres), one seismic survey every five years (total of 250 miles) in the Koggiling creek planning block under Alternatives 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.

f) 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 lands. Wildland fire management is accomplished on an interagency basis and across administrative boundaries.

g) 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 non-Federal 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.

h) Cumulative Effects to Paleontological Resources

Cumulative impacts to paleontological resources in the planning area could result from development on non-BLM lands as well as BLM lands, and from natural agents and unauthorized uses throughout the area.

i) Visual Resources

Continued development of Off-Highway Vehicle trails, roads, mining activities and associated infrastructure development, and wildland or 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 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 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, irreplaceable 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 the 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 effect 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 ANSCA 17(d)(1) withdrawals, specific to closure to mineral entry, would be retained. The next most restrictive would be Alternative C, which would revoke ANSCA 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 a majority of BLM lands in the planning area to mineral materials development and production.

c) Cumulative Effects to Travel Management and Recreation

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 of which Alternative is selected. Under Alternative C, river segments would be proposed for WSR inclusion. As a result, recreation opportunities could increase within the area of these rivers.

d) Cumulative Effects to Renewable Energy

No cumulative impacts to renewable energy are anticipated under any Alternative.

e) 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, such as mineral development on State or Native lands adjacent to designated ACECs. 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. Under all actions, Alternatives B, C, and D, ANSCA 17 (d)(1) withdrawals would be lifted and all ANILCA 906(e) Top Filed land adjacent to the proposed Carter Spit ACEC would become State-selected, closing these lands to new mineral activities until conveyance occurs or selection becomes relinquished. Once an action is

taken regarding the land status of Top Filed lands, new mineral activities could be authorized which may impact water, vegetation, wildlife, Special Status Wildlife, and subsistence within the proposed Carter Spit ACEC.

(2) Wild and Scenic Rivers

No cumulative impacts to the rivers considered for Wild and Scenic River designation are anticipated under any Alternative. The determination of suitability for these rivers is a BLM determination and analyzed within the range of alternatives. Direct and indirect effects to these river areas have already been discussed in other portions of this chapter.

f) Cumulative Effects to Social and Economic Conditions

The global salmon industry will eventually affect the salmon industry in Bristol Bay. Salmon harvests have remained relatively stable in the last thirty years, but the value has decreased. Data reported in the Alaska Economic Trends article, The Global Salmon Industry (Gilbertson 2003) show decreasing value of salmon harvest. Although the fishery is healthy in Bristol Bay, it is forecast that participation in commercial fishing may drop in future years. The global salmon farming industry is displacing wild caught fish. Local and statewide revenue and employment in this industry may weaken as a result. Fish tax collected by the borough(s) could diminish.

The recreation industry will continue to be a positive input into the local and state economy. Recent studies report spending on recreation of over \$90 million in 2005, and fulltime equivalent employment of over 1,300 persons. (Duffield, 2007) The McDowell Group reported statewide effects of tourism including total direct and indirect spending of \$2.6 billion, employment 30,700 direct and indirect jobs, and \$640 million in total direct and indirect visitor related earnings. McDowell, 2006)

Pebble Prospect is the significant mineral potential in exploration in the Bristol Bay region. The McDowell Group reported that Pebble provided 441 jobs to Alaska, including 21% local hire and 26% native hire. (McDowell, 2006) Although the Pebble mine is not yet licensed, income and employment for regional and state individuals and businesses are likely to continue. Mining activity in other parts of Alaska, continues to provide jobs, and revenue, as well as other benefits by agreement. A construction labor force of up to 2000 is forecast for Pebble.

Oil and Gas may be explored and developed in Bristol Bay Basin, either offshore, on the Alaska Peninsula or Nushagak Peninsula. There is state licensed activity on the Alaska Peninsula. This will add employment and income to the state, and eventually could involve local residents. The Lake and Peninsula or Aleutians East Boroughs may be able to collect revenue either from distribution of state revenues or from property tax.

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 (MM bpd) in 2005 to 0.208 MM bpd in 2034. This decline encompasses oil exploration, development, production and associated direct employment.

Employment for oil workers on the North Slope is projected to decline from recent numbers. Total NSB employment exclusive of oil workers in 1998 was 4,651. 1998 NSB employment in mining (assumed to be all oil employment) was 4,753 workers. Of these, 70% (3,329) reside in the rest of Alaska outside the NSB, primarily in Southcentral Alaska and Fairbanks. The total of all workers in Southcentral Alaska and Fairbanks in 2002 was 284,000. 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 work force, classified as 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.

Without new oil and gas development, 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. From 1975-1995, Alaska's fluctuations in economy directly tracked fluctuations in oil prices and to 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.

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 work force, classified as 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).

Cumulative effects of oil and gas development and production are addressed in other recent documents, including the Northwest National Petroleum Reserve-Alaska IAP/FEIS (USDOJ 2003), and in the Alpine Final Development Plan FEIS (USDOJ 2004). These are herein incorporated by reference.

BLM management of mineral resources, including oil and gas leasing, and metaliferous mineral exploration, recreation resources, and fisheries is not expected to contribute to cumulative effects to the regional economy. Only potential exploration for natural gas, prospectively near Dillingham, and a small amount of additional placer or lode mining, likely near Goodnews Bay, is expected to contribute to employment and income in the planning area.

g) 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.

h) Cumulative Effects to Subsistence

In combination with current locatable mineral activities, climate change, and population increases within the region of the planning area, the lifting of ANSCA 17(d)(1) withdrawals under Alternatives B, C, and D may contribute additional impacts to subsistence resources and uses. Under Alternatives B and D, 115 acres are expected to be disturbed from locatable mineral activities, as well as 36 acres for six natural gas wells and 20 acres of salable mineral mining for support of leasable mineral activities within the Koggiling Creek planning block. This possible development scenario on BLM lands, combined with reasonably foreseeable mineral development on State and private lands (7,881 acres of potential surface disturbance) will impact subsistence within the areas associated with these activities. This includes the areas known to be used by the Mulchatna Caribou Herd (MCH). As a result, subsistence would also be impacted, as all communities within the planning area rely on the caribou, including the MCH, as their primary source of terrestrial meat.

Privatization of State or 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 roads within the planning area would have the potential to negatively affect wildlife, and thus impact 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 existent road system within Alaska, then increased competition for subsistence resources would likely result, as non-local hunters would be able to access the area with little effort. This may also result in an increase in tourist 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, thus depleting resources from the area, and potentially altering harvest from currently used traditional harvest areas.

In summary, mineral development, privatization of land, and development of regional infrastructure would have cumulative impacts on subsistence. These activities have the potential to negatively affect wildlife and thus subsistence. Development of regional infrastructure such as roads, may improve access for non-local hunters, increasing competition for subsistence resources.

Under all alternatives, BLM would consider issuance of additional Special Recreation Permits for outfitter/guides or transporters on a case-by-case basis. BLM has the discretion to deny application for such permits, based on an analysis of the impacts of such activities to subsistence resources and uses. Number of Special Recreation Permits issued for BLM lands in the planning area has been stable. BLM does not permit outfitter/guiding activity on State or private lands or within National Parks or Wildlife refuges. Cumulatively, increasing and unlimited numbers of outfitter/guides or transporters, either on State, private, other Federal, or BLM lands, could have a significant impact on subsistence resources or access to subsistence resources through increased competition.

F. Irreversible and Irretrievable 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, Soils, Water, and Vegetation Resources

The reasonably foreseeable activities that would cause irreversible or irretrievable commitment of soil, water, and vegetation resources (habitat) would be leasable, locatable, or salable mineral activities. These activities would be likely to occur under Alternatives B and D. This commitment level of resources is anticipated to be small in scale and only impact the immediate area. Large volumes of water withdrawn from rivers/streams may have watershed level impacts. 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 activities that would occur within the range of Alternatives considered would be leasable, locatable, and salable mineral activities. These activities would be more likely to impact fisheries under alternative B, in which ANSCA 17(d)(1) withdrawals would be lifted and no NSO buffers and ACECs would be proposed. Alternative D would propose NSO within 300 feet of the East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek (Appendix A, Stipulations and ROPs) to protect riparian habitat and fishery resources. Alternative A would result in less irreversible and irretrievable commitment of fishery resources.

(2) Wildlife

Under all Alternatives, some irretrievable and irreversible loss of wildlife habitat could occur from 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. Impacts would be less under Alternatives A and C, while Alternative B does not propose 300 foot NSO buffers for the East and South Fork Arolik, Faro Creek, South Fork Goodnews River and Klutuk Creek and the Carter Spit ACEC compared to Alternative D.

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.

(2) Special Status Wildlife

Irreversible impacts to the Special Status Wildlife Species would likely occur under Alternative B compared to Alternatives A, C, and D. Alternative C proposes the Carter Spit ACEC to provide added protection to federally-listed migratory bird species.

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 resource objectives, these conditions may be mitigated through fuel management projects or a change in management options. 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 result in irreversible and irretrievable impacts to visual resources through degradation of soils and vegetation. This degradation is more likely under Alternative B.

2. Resource Uses

a) 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 result 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.

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.

b) Renewable Energy

Lands developed for renewable energy projects would no longer be available for various other purposes.

c) 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. The subsistence caribou hunt by most villages in the planning area could be affected as well.

4. *Subsistence*

Exploration and development of leasable, locatable, and salable 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 lands. Only those programs or resources that would have unavoidable adverse impacts are included here.

1. Resources

a) 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 ecosystems, 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.

c) Fish and Wildlife

(1) Fish

Unavoidable direct disturbance to aquatic and riparian habitat would require many years (25-50+) to rehabilitate to a 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 and surface water drawdown and associated impacts to nearby wetlands resulting from leasable and locatable mineral development can be a serious concern in some areas. The impacts resulting from drawdown of water resources could last for many decades, though not likely, considering anticipated development scenarios and precipitation rates within the planning area. This could potentially affect seeps and springs that provide thermal refugia in both summer and winter.

Unauthorized travel and permitted land use activities may increase sedimentation into fish-bearing streams with possible adverse effects. Many impacts can be reduced through use of Required Operating Procedures and project-specific mitigation requirements.

These sources of unavoidable impacts would be expected to be related to placer mining in localized areas on BLM 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 can occur under all Alternatives. 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 leasable and locatable mineral activities, would be short-term (a few hours to a few weeks). Disturbance and displacement due to mineral development could be long-term and could 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 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 Steller's eiders and other bird species by routine activities associated with locatable mineral activities, would be unavoidable. These impacts would be more common under Alternative B due to the combination lifting ANSCA 17(d)(1) withdrawals and no proposed Carter Spit ACEC. 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. Lease Stipulations, Required Operating Procedures, and project-specific requirements would effectively mitigate many of the effects of disturbance to Steller's eiders, but some impacts could be unavoidable. Some eider habitat could be permanently lost due to construction of leasable mineral 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 is human impact 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 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 resulting from environmental degradation.

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 potentially unavoidable Environmental Justice related to 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, highly 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.