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SECTION 4D
DIRECT AND INDIRECT IMPACTS – ALTERNATIVE D

4D.1 INTRODUCTION

This section provides an analysis of the environmental consequences that would result from implementation of Alternative D CPAI Development Plan and Alternative D – FFD.

Alternative D excludes the construction of roads for access to production pads. Access to production pads would be by fixed-wing aircraft, helicopter, ice roads, or low ground pressure vehicle tundra travel. The pipeline crossing of the Nigliq Channel would be accomplished using HDD rather than a pipeline bridge. Pipelines would be built at a minimum height of 7 feet (measured at the VSMs). Power cables would be located on VSM-mounted cable trays. Exceptions to stipulations 39(d) and 41 of the Northeast National Petroleum Reserve-Alaska ROD would be required. For the purpose of analysis, Alternative D is presented as two sub-alternatives. Sub-Alternative D-1 includes gravel airstrips and access by fixed-wing aircraft and ice roads. Sub-Alternative D-2 includes gravel helipads and year-round access by helicopters, and winter access by fixed-wing aircraft to ice airstrips, and by vehicles on ice roads. All other project elements are common to both sub-alternatives.

Alternative D – FFD is also presented as two sub-alternatives. Sub–Alternative D-1 – FFD includes gravel airstrips and access by fixed-wing aircraft and ice roads. Sub-Alternative D-2 – FFD includes gravel helipads and access by helicopters, ice airstrips, and ice roads. All other project elements are common to both sub-alternatives.

4D.2 PHYSICAL CHARACTERISTICS

4D.2.1 Terrestrial Environment

4D.2.1.1 Physiography

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON PHYSIOGRAPHY

CONSTRUCTION PERIOD

The effects on physiography would result from changes to landforms by construction of production pads, airstrips, helipads and gravel mines. This alternative does not include interconnecting roads; rather, it uses airstrips or helipads at each pad location for transportation. The effects, however, are similar to those discussed in Section 4A.2.1 for Alternative A, because from a physiographic perspective the airstrip or helipad is essentially a large pad.

Areas that would experience direct physiographic impacts from gravel mining operations include approximately 51 acres under Sub-Alternative D-1 and 22 acres under Sub-Alternative D-2 (Section 4D.2.1.4). Areas that would experience direct physiographic impacts from placement of gravel on the tundra include 221 acres under Sub-Alternative D-1 and 71 acres under Sub-Alternative D-2 (Tables 2.4.4-1 and 2.4.4-5).

OPERATION PERIOD

Impacts during the operation period would be similar to those under Alternative A.

ABANDONMENT AND REHABILITATION

Upon abandonment, the impacts under Alternative D on physiography would be less than under Alternative A or any of the other alternatives because less gravel would be required. In addition, there would be very limited linear physiographical changes because roads, other than those to nearby airstrips or helicopter pads, would not be constructed under Sub-Alternatives D-1 and D-2. Changes in physiography would be concentrated at or near the gravel mine and production pads, where pads and airstrips may be left in place, raised above the surrounding landscape, or removed.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON PHYSIOGRAPHY

Areas that would experience direct physiographic effects from gravel mining operations include approximately 255 acres under Sub-Alternative D-1 – FFD, and 129 acres under Sub-Alternative D-2 – FFD. Areas that would experience direct physiographic impacts from placement of gravel on the tundra include 1,101 acres under Sub-Alternative D-1 – FFD, and 545 acres under Sub-Alternative D-2 – FFD.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON PHYSIOGRAPHY

Impacts to physiography would occur primarily during the construction period and result from changes to landforms by construction of production pads, access roads, airstrips, and mine sites. If not properly designed and constructed, these landform changes can adversely affect thermal stability of the tundra and hydrology through thermokarsting and increased ponding.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR PHYSIOGRAPHY

No measures have been identified to mitigate impacts to physiography under Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR PHYSIOGRAPHY

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.1.2 Geology

Plan Area geology is comprised of marine limestones and marine and deltaic sands and shales of Mississippian to mid-Creatceous age (Gyrc 1985b), mantled largely by Quaternary-aged fluvial and glaciofluvial sediments (Rawlinson 1993). Oil production efforts in the Plan Area target a Jurassic sandstone reservoir located in the Beaufortian Sequence (BLM 2003b). The impacts to geological resources under Alternative D – CPAI Development Plan and Alternative D – FFD are the same for both Sub-Alternative D-1 and Sub-Alternative D-2.

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON GEOLOGY

CONSTRUCTION PERIOD

Direct Effects

Drilling oil production wells at the five production pad locations (CD-3 through CD-7) would directly impact the physical integrity of reservoir and overlying bedrock by pulverization and fracture. The only surface bedrock identified in the Plan Area outcrops at the bend in the lower Colville River, upstream of Ocean Point (Mayfield et al. 1988b). Alternative D does not propose excavation activities in this area and would, therefore, not directly impact surface bedrock. The volume of rock impacted by drilling is insignificant compared to the total volume of bedrock within the Plan Area. Direct impacts to Plan Area bedrock during construction would produce no measurable effect and are considered negligible under this alternative.

Indirect Effects

No indirect effects are recognized for the construction period.

OPERATION PERIOD

Direct Effects

Annular disposal or injection of Class I and II wastes would directly impact the receiving bedrock via possible propagation of existing fractures, increase of pore space pressure, and alteration of pore space composition within an approximately 0.25-mile radius of the well (40 CFR 146.69 (b)). The volume of rock impacted by waste disposal is insignificant compared to the total volume of bedrock within the Plan Area. Direct impacts to Plan Area bedrock during operation would produce no measurable effect and are considered negligible under this alternative.

Production of petroleum hydrocarbons from subsurface reservoirs constitutes an irreversible and irretrievable commitment of resources. Direct impacts to petroleum hydrocarbon resources in the Plan Area would be major under this alternative.

Indirect Effects

No indirect effects are recognized for the operation period.

ABANDONMENT AND REHABILITATION

Geology will not be impacted by abandonment activities.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON GEOLOGY

Direct and indirect impacts incurred during construction and operation of Alternative D – FFD would be similar to those presented for Alternative D, but would be experienced over greater spatial and temporal extents. Direct impacts to Plan Area bedrock would remain negligible under Alternative D – FFD. Direct impacts to Plan Area petroleum hydrocarbon reserves would be major under Alternative D – FFD.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON GEOLOGY

Under either Alternative D or Alternative D – FFD, the irreversible and irretrievable commitment of petroleum hydrocarbon resources constitutes a major impact, however petroleum hydrocarbon production is the purpose of the applicant's proposed action. Impacts to bedrock under either alternative would be negligible.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR GEOLOGY

Mitigation of impacts to petroleum hydrocarbons would be in conflict with the purpose of the applicant's proposed action. Therefore no measures have been identified to mitigate impacts to geological resources under Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR GEOLOGY

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.1.3 Soils and Permafrost

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON SOILS AND PERMAFROST

Construction and operation of Sub-Alternatives D-1 and D-2 would involve impacts similar in type but different in magnitude to those presented for Alternative A in Section 4A.2.1.3. Compared to Alternative A, Sub-Alternative D-1 replaces the road network with airstrips; Sub-Alternative D-2 replaces the road network with helipads. Both Sub-Alternatives D-1 and D-2 propose to bury pipeline under the Nigliq Channel using HDD technology and run power cable in trays on pipeline VSMs, as opposed to constructing an overhead powerline. Except where noted, assumptions involved in the following calculations of soil and permafrost impacts do not differ from those presented in Section 4A.2.1.3. Removal of gravel cover upon abandonment under Alternative D would create substantially less impact on soils and permafrost than Alternative A, or any of the other alternatives, because there would be less gravel cover to remove (approximately 100 acres less under Sub-Alternative D-1 and approximately 200 acres less under Sub-Alternative D-2).

CONSTRUCTION PERIOD

Relative to Alternative A, Sub-Alternative D-1 would eliminate all roads except those connecting each production pad to its associated airstrip, thereby reducing the total road length from 26 to 2 miles. Reduction in road miles translates to a lesser need for fill, minimization of impacts associated with excavation of fill, fewer culverts and bridges, and increased length of ice roads. Under Sub-Alternative D-1, 1.8 million cy of fill would overlie approximately 221 acres of tundra. This footprint would be 20 acres less than that proposed under Alternative A. Despite the elimination of a road network, the Sub-Alternative D-1 footprint is comparable to the Alternative A footprint due to inclusion of larger, airstrips and storage pads at CD-4, CD-5, CD-6, and CD-7. Extraction of the gravel required for construction of Sub-Alternative D-1 would impact a total of 51 acres of tundra and would require a total of 52 acres of ice pad for stockpiling overburden.

Temporary ice roads and adjacent ice pads would cover approximately 1,872 acres of tundra over six winter seasons; this area is 423 acres more than that estimated under Alternative A. Ice road impacts would be greater than under Alternative A because ice roads must be rebuilt each winter to access production pad construction sites. The roadless scenario would eliminate the need for bridges and reduce the number of culverts required. Installation of 23 culverts and 3,121 VSMs for Sub-Alternative D-1 would disturb approximately 490 and 11,100 cy of soil, respectively. Impacts associated with tundra travel and water discharges to the tundra during the construction period are assumed to be of the same magnitude under Sub-Alternative D-1 as under Alternative A.

Relative to Alternative A, Sub-Alternative D-2 would eliminate all roads by expanding well production pads to include a helipad. The typical pad footprint proposed under Alternative A is approximately 9 acres; the well pad footprint under Sub-Alternative D-2 would be increased to 13 acres. Under Sub-Alternative D-2, 0.7 million cy of fill would overlie approximately 71 acres of tundra. This footprint would be 170 acres less than that proposed under Alternative A. Extraction of the gravel required for construction of Sub-Alternative D-2 would impact a total of 22 acres of tundra and would require a total of 22 acres of ice pad for stockpiling overburden at the ASRC Mine Site and at Clover. Temporary ice roads and adjacent ice pads would cover approximately 509 acres of tundra. Because the helicopters have limited cargo transport capabilities, all materials and equipment would have to be transported by low pressure vehicles during the winter tundra travel season. This restriction extends the construction season to 20 years and would likely require a greater cumulative amount of tundra travel, relative to Alternative A. Installation of 3,121 VSMs for Sub-Alternative D-2 would disturb approximately 11,100 cy of soil. Impacts associated with water discharges to the tundra during the construction period are assumed to be of the same magnitude under Sub-Alternative D-2 as under Alternative A.

Under Sub-Alternatives D-1 and D-2, HDD technology would be used to pass the pipelines under the Nigliq Channel. This procedure would require construction of ice pads at the pipe entrance and exit points, and on either side of the river, to stage drilling equipment and materials. Assuming that the entrance and exit pads are 10,000 by 150 feet and the staging pads are 300 by 300 feet, construction of the HDD crossing would require 73 acres of ice pad. The Nigliq Channel is 1,650 feet-wide when measured from the tops of its natural banks; assuming that the pipeline exit and entrance points are set back 350 feet from the natural bank to allow for channel migration and passage of wildlife (PN&D 2002b) the approximate crossing distance would be 2,350 feet. Assuming pipelines coming from CD-5 and the cathodic protection system can be nested so that only six bore holes are required and that the maximum bore hole diameter is 3 feet (PAI 2002a), the volume of soil disturbed for pipeline placement would be approximately 3,690 cy.

OPERATION PERIOD

Reduction of the road network would considerably minimize the indirect impacts associated with road travel and maintenance under Sub-Alternative D-1. Reduction of dust fallout and accumulations of plowed snow and sprayed gravel would minimize the thermal impacts to active layer soils and permafrost. The area of thermal impact calculated for Sub-Alternative D-1 is 459 acres; 693 acres less than that under Alternative A.

Elimination of the road network and utilization of helipads under Sub-Alternative D-2 would considerably minimize the indirect impacts associated with placement of fill on the tundra. The area of thermal impact calculated for Sub-Alternative D-2 is 105 acres; 1,047 acres less than that under Alternative A.

Due to the limited on-ground access between pads, it is likely that operation period impacts to soil and permafrost from summer and winter tundra travel would be greater under Sub-Alternatives D-1 and D-2. Impacts associated with transmission of warm reservoir fluids, sub-permafrost injection of waste, and accidental oil spills are assumed to be of the same magnitude for Sub-Alternatives D-1 and D-2 as under Alternative A.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SOILS AND PERMAFROST

Construction and operation of Sub-Alternative D-1 – FFD and Sub-Alternative D-2 – FFD would involve impacts similar in type, but different in magnitude and duration, to those presented for Alternative A – FFD (Section 4A.2.1.3). Sub-Alternatives D-1 and D-2 – FFD would replace the road network proposed under Alternative A – FFD with airstrips and helipads, respectively. Construction of Sub-Alternative D-1 – FFD would require the standard 20 years. However, construction of Sub-Alternative D-2 would require more than 100 years, due to the limited pad access.

CONSTRUCTION PERIOD

Relative to Alternative A – FFD, Sub-Alternative D-1 – FFD would eliminate all roads except those connecting each production pad to its associated airstrip. The length of airstrip access roads have not been estimated for Sub-Alternative D-1 – FFD. Reduction in road miles translates to a lesser need for fill, minimization of impacts associated with excavation of fill, and fewer culverts and bridges. Under Sub-Alternative D-1 – FFD, 8.9 million cy of fill would overlie approximately 1,101 acres of tundra. This footprint would be 161 acres less than that proposed under Alternative A – FFD. Despite the elimination of a road network, the Sub-Alternative D-1 – FFD footprint is comparable to the Alternative A – FFD footprint, due to inclusion of larger airstrips and storage pads at each HP.

Extraction of the gravel required for construction of Sub-Alternative D-1 – FFD would impact a total of 255 acres of tundra and would require a total of 264 acres of ice pad for stockpiling overburden; potential material source areas have not been identified. Temporary ice roads and adjacent ice pads would cover approximately 12,092 acres of tundra over 20 winter seasons. Ice road impacts under Sub-Alternative D-1 – FFD would encompass 9,517 more acres than those under Alternative A – FFD, because ice roads must be rebuilt each winter to access production pad construction sites. Reduction of road length would reduce the number of bridges required for construction of Sub-Alternative D-1 – FFD. Bridge locations have not been identified, and therefore the area of ice pads associated with bridge construction cannot be quantified. However, it is assumed the number of bridges required under Sub-Alternative D-1 – FFD would be considerably less than the number required under Alternative A – FFD. Installation of 14,405 VSMs for Sub-Alternative D-1 – FFD would disturb approximately 51,300 cy of soil.

Relative to Alternative A – FFD, Sub-Alternative D-2 – FFD would eliminate all roads by expanding well production pads to include a helipad. The typical pad footprint proposed under Alternative A – FFD would be approximately 9 acres; the well pad footprint under Sub-Alternative D-2 – FFD would be increased to 13 acres. Under Sub-Alternative D-2 – FFD, 4.5 million cy of fill would overlie approximately 545 acres of tundra. This footprint would be 716 acres less than that proposed under Alternative A – FFD. Extraction of the gravel required for construction of Sub-Alternative D-2 – FFD would impact a total of 129 acres of tundra and would require a total of 134 acres of ice pad for stockpiling overburden. Potential material source areas have not been identified for. Because helicopters have limited cargo transport capabilities, all materials and equipment must be transported by ice road or low pressure vehicles during the winter tundra travel season. Restricted access to HPs, and the need to rebuild ice roads each winter during construction, are expected to extend the construction period to more than 100 years. The required surface area of ice roads and pads under Sub-Alternative D-2 – FFD could not be estimated due to the unknown duration of its construction. Construction would likely require a greater cumulative amount of tundra travel relative to Alternative A – FFD, due to its extended period.

Both Sub-Alternatives D-1 and D-2 – FFD would require installation of 14,405 VSMs and would disturb approximately 51,300 cy of soil. Impacts associated with water discharges to the tundra during the construction period are assumed to be of the same magnitude under Sub-Alternatives D-1 and D-2 – FFD as those under Alternative A – FFD.

OPERATION PERIOD

Reduction in road miles under Sub-Alternative D-1 – FFD would minimize the indirect impacts associated with road travel and maintenance occurring during the operation period. Reduction of dust fallout and accumulations of plowed snow and sprayed gravel would minimize the thermal impacts to active layer soils and permafrost. The area of thermal impact calculated for Sub-Alternative D-1 – FFD is 1,737 acres; 3,925 acres less than that for Alternative A – FFD.

Elimination of the road network and utilization of helipads under Sub-Alternative D-2 – FFD would considerably minimize the indirect impacts associated with placement of fill on the tundra. The area of thermal impact calculated for Sub-Alternative D-2 – FFD is 459 acres; 5,203 acres less than that for Alternative A – FFD.

Operational period impacts associated with tundra travel, transmission of warm reservoir fluids, sub-permafrost injection of waste, and accidental oil spills are assumed to be of the same magnitude for Sub-Alternatives D-1 and D-2 – FFD, as those under Alternative A – FFD.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON SOILS AND PERMAFROST

Construction and operation of Alternative D and Alternative D – FFD would represent a lesser impact on soil and permafrost resources compared to Alternative A and Alternative A – FFD. Under Sub-Alternative D-1, 2,145 acres and 1.8 million cy of soil would be directly impacted compared to 1,757 acres and 2 million cy of soil estimated under Alternative A. Sub-Alternative D-2 would directly impact 602 acres and 0.7 million cy of soil. The percent of the total Plan Area that would be impacted by construction of Sub-Alternative D-1 is 0.2 percent; construction of Sub-Alternative D-2 would impact less than 0.1 percent of the Plan Area, which are inconsequential impacts.

Under Sub-Alternative D-1 – FFD, 13,457 acres and 8.9 million cy of soil would be directly impacted compared to 4,195 acres and 8.8 million cy of soil estimated under Alternative A – FFD. Construction of Sub-Alternative D-2 – FFD would directly impact 4,141 acres and 4.5 million cy of soil. Because the area overlain by ice roads and pads under Sub-Alternatives D-1 and D-2 – FFD is so large it is misleading to compare these totals to other alternatives. Under Alternative D and Alternative D – FFD, the placement of fill on the tundra represents the greatest direct impact to soil and permafrost; the thermal impacts associated with placement of fill on the tundra represent the greatest indirect impact. Due to their reduced footprints, it is assumed that the total impact on soil and permafrost resources associated with Sub-Alternative D-1 – FFD and Sub-Alternative D-2 – FFD would be considerably less than that under Alternative A – FFD.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SOILS AND PERMAFROST

Soil and permafrost systems could recover to their pre-impact state, but not without appropriate mitigation. Because impacts to soil and permafrost are generally unavoidable, mitigation aims to minimize the degree and magnitude of the action. Mitigation measures proposed for Alternative D and Alternative D – FFD are the same as those identified for Alternative A (Section 4A.2.1.3).

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SOILS AND PERMAFROST

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.1.4 Sand and Gravel

Once used, sand and gravel resources for construction of roads, production pads, or airstrips would only be available for re-use upon abandonment.

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON SAND AND GRAVEL

CONSTRUCTION PERIOD

The estimated gravel volume for Sub-Alternative D-1 and Sub-Alternative D-2 is 1.8 million cy and 0.7 million cy, respectively (Tables 2.4.4-1 and 2.4.4-5). Alternative D impacts to sand and gravel resources would be similar to, but less than, those identified for Alternative A.

OPERATION PERIOD

During the operation period, relatively small amounts of gravel are expected to be extracted from existing permitted mine sites for repair of road or pad embankments.

ABANDONMENT AND REHABILITATION

Sand and gravel impacts will be similar to those under Alternative A, though substantially less sand and gravel (approximately 10 percent less for Sub-Alternative D-1 and 65 percent less for Sub-Alternative D-2) would be available for re-use because less would need to be used during construction activities associated with this alternative.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SAND AND GRAVEL

Alternative D – FFD would use and build off of the same road network that would be constructed under Alternative D. Depicted in Figure 2.4.4-2, Alternative D – FFD is estimated to need 8.9 million cy for Sub-Alternative D-1, and 4.5 million cy for Sub-Alternative D-2.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON SAND AND GRAVEL

Once used, sand and gravel resources for construction of roads, production pads, or airstrips could only be available for re-use upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SAND AND GRAVEL

No measures have been identified to mitigate effects on sand and gravel resources under Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SAND AND GRAVEL

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.1.5 Paleontological Resources

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON PALEONTOLOGICAL RESOURCES

Under Alternative D, the effects on paleontological resources would likely be the same as those under Alternatives A, B, and C. Although gravel roads and associated vehicle bridges between pads are excluded under Alternative D, impacts to paleontological resources would be avoided because route surveys are required for all construction activities. Excavation of sand and gravel material could affect paleontological resources at the ASRC Mine Site and at Clover under the 51 acre mining footprint required for Sub-Alternative D-1, or the

22 acres required for Sub-Alternative D-2. As under Alternative A, drilling, placement of gravel pads and VSMs, and construction of pipeline bridges are very unlikely to affect paleontological resources.

Subsurface and surface disturbance resulting from HDD beneath the Nigliq Channel could affect paleontological resources. The estimated HDD distance is 1,200 feet, and the maximum depth would be below the active river channel. Disturbance would be limited to the annulus of the boring and the immediately surrounding soils permeated with drilling fluids. "Transition cellars," excavated through the active layer at the entry and exit points of the HDD segment, could also affect paleontological resources.

ABANDONMENT AND REHABILITATION

Paleontological resources will not be impacted by abandonment activities.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON PALEONTOLOGICAL RESOURCES

Under Alternative D – FFD, the mechanisms associated with impacts to paleontological resources would remain the same as those described under Alternative D, except that the intensity of the actions would increase because of the greater extent of the development. The primary potential cause of impacts would be ~255 acres of gravel excavation under Sub-Alternative D-1, or 129 acres under Sub-Alternative D-2. Approximately three gravel mine sites would be developed to provide the volume of construction material necessary for FFD. The location of the gravel mine sites for FFD is yet unknown, but could be in locations that would affect paleontological resources. It is likely that the additional sand and gravel mine sites would be situated in the vicinity of the Fish–Judy Creeks Facility Group and/or the Kalikpik–Kogru Rivers Facility Group. In addition, 1,101 acres could be covered by gravel during the construction of pads and airstrips under Sub-Alternative D-1, or 545 acres for pads and helipads under Sub-Alternative D-2.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON PALEONTOLOGICAL RESOURCES

Surface activities, such as construction of pad and airfield embankments, are not likely to affect paleontological resources. Impacts could result from those activities involving subsurface disturbance, such as sand and gravel mining. Fifty-one acres of sand and gravel would be excavated under Sub-Alternative D-1, and 22 under Sub-Alternative D-2. Under Sub-Alternative D-1 – FFD, 255 acres of sand and gravel would be extracted, and 129 under Sub-Alternative D-2 – FFD. This constitutes the greatest risk to paleontological resources. This "greatest risk" represents inconsequential impact potential to paleontological resources. Installation of VSMs would occur only after route surveys had been conducted, so important paleontological resources would be known and avoided.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR PALEONTOLOGICAL RESOURCES

No potential measures have been identified to mitigate impacts to paleontological resources under Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR PALEONTOLOGICAL RESOURCES

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.2 Aquatic Environment

4D.2.2.1 Water Resources

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON WATER RESOURCES

Alternative D would require the use of aircraft and ice roads instead of gravel, all-weather roads (Figure 2.4.4-1). The five production pads (CD-3 through CD-7) would be developed as stand-alone facilities with air and ice road access only. Airstrips would be required at each production pad. The only gravel, all-weather road segments to be constructed would be from the airstrips to the well pad at each production pad. All production pads would be located in the same places as proposed under Alternative A. However, pipelines would be routed more directly because there would be no roads for the pipeline placement to parallel. The frozen Nigliq Channel would serve as an ice bridge during the construction period and every few years during the operation period. The pipeline would cross under the Nigliq Channel using HDD access.

Abandonment and rehabilitation under this alternative would result in substantially less impacts to water resources compared to Alternative A. There would be no impacts to the Nigliq Channel associated with the removal of a pipeline or road bridge. There would be far less gravel to be removed and fewer miles of linear structures (roads and airstrips), particularly under Sub-Alternative D-2, and so less potential for erosion, sedimentation, or upslope impoundment.

GENERAL IMPACTS

In general, Alternative D and its sub-alternatives, would affect the same water resources (i.e., subsurface waters, lakes, creeks, rivers, and the nearshore environment) as those affected under Alternative A. The extent of the impacts would be substantially less because Alternative D would not have any gravel roads that would have to cross streams, and so culverts and bridges would not be required (except for one 40-foot bridge the CD-4–airstrip road, and possibly minor culverts on short airstrip access roads). Also, there would be fewer impacts to shallow subsurface waters due to reduced gravel supply requirements. Tables 4D.2.2-1 and 4D.2.2-2 provide summaries of potential Alternative D construction and operation impacts to water resources near CD-3, CD-4, CD-5, CD-6, and CD-7, including the airstrips/helipads and pipelines connecting the facilities (Section 4A.2.2.1). In general, impacts to water resources under Sub-Alternative D-1 are expected to be very similar to those under Sub-Alternative D-2.

CONSTRUCTION IMPACTS

As described in Sections 3.2.2.1 and 4A.2.2.1, groundwater resources in the North Slope are rare and primarily shallow, and brackish to saline sub-permafrost groundwater is non-potable. Deep groundwater injections are not expected to affect the quality or quantity of shallow groundwater.

Under Alternative D, the length of ice roads and the frequency of ice road construction would be greater than under Alternative A. Under Sub-Alternative D-1, the total demand for water from lakes over the 6-year construction period would increase about 23 percent relative to Alternative A. Under Sub-Alternative D-2, however, the total water demand would decrease by 77 percent during 2005 through 2011. Water demand during drilling and operations would increase during the later stages of Sub-Alternative D-2 as ice roads are built to the more distant production pads after 2011. Regardless of the selected alternative, water withdrawals should not impact lakes in the long-term (more than 1 year) due to sufficient natural annual recharge and the ability to spread out water extraction to other permitted lakes. Continued monitoring programs should be implemented to confirm that annual recharge is sufficient. Monitoring prior to and during construction should measure lake water levels over time and provide estimates of recharge and surplus volumes.

The potential of ice roads to affect water surface elevations, channel velocity, or to increase discharge during break-up have not been quantitatively evaluated for Alternative D. Based on hydrologic models used to evaluate

Alternative A, it is expected that ice roads would potentially alter the pathways and hydraulics of drainages as structures melt. Depending on the timing of melt and whether/how lake water is relocated to a different basin during road and bridge construction, discharge could potentially increase over natural levels, but not significantly.

A conceptual design for pipeline placement has been developed. It is expected that construction of the pipeline under Alternative D would impact water resources similarly to pipeline construction under Alternative A. The HDD crossing under the Nigliq Channel would result in increased ground disturbance and cuttings production, which could lead to increased soil erosion and sedimentation during break-up.

OPERATION IMPACTS

Compared to Alternative A, ice road construction during operations would be greater under Sub-Alternative D-1, and significantly greater under Sub-Alternative D-2. For both sub-alternatives, the water usage is expected to increase during the later years of the project. Nevertheless, impacts from water demands are expected to be similar to those under Alternative A ,due to sufficient annual recharge of lakes. Lake monitoring programs begun prior to and/or during construction should be continued through the operations phase. Impacts from the melting of ice roads during break-up would be similar to those during the construction period; the impacts would increase during the later year of the project, especially under Sub-Alternative D-2.

Overall, there would be fewer impacts to streams and rivers due to reduced roads, although the airstrip and pad structures would be slightly larger. The increased size of pads and airstrips would have a minor to negligible effect on water surface elevation and velocity, except in the direct vicinity of these structures. Although impacts to water resources from the HDD pipeline-crossing under the Nigliq Channel are not expected, detailed analyses of scour depth and bank migration studies would be required.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON WATER RESOURCES

Alternative D – FFD would construct the same number of production pads in the same locations as those under Alternative A – FFD, but all production pads would require airstrips because roads would not be built. Impacts to water resources from gravel roads and bridges, therefore, would be minimized. However, the demand for water would increase substantially (over 6 times more) in order to build the increased number of seasonal ice roads to support construction, drilling and operation activities. Pipeline alignments for this alternative are more direct than those under Alternative A because they would not follow road alignments.

Under Alternative D – FFD, although ice roads would be built at the same locations, water withdrawal volumes required for ice road construction would be slightly greater (about 3 percent) than under Alternative A – FFD. This is because ice roads would be required in several instances where gravel roads would already be in place. The annual water demand during operations, however, would be significantly greater for both Sub-Alternatives D-1 and D-2 – FFD, compared to Alternative A – FFD. For example, operational demands for Sub-Alternative D-1 – FFD would be approximately 1,984 million gallons (or 6,150 ac-ft) from 2011 to 2030, compared to only 36 million gallons under Alternative A – FFD. There are no projections for Sub-Alternative D-2 – FFD for the life of the project, but from 2011 to 2030 the operational water demand under Sub-Alternative D-2 – FFD would be 507 million gallons. This level would increase for over 100 years as more distant pads are constructed and put into operations. Table 4D.2.2-3 provides a summary of potential impacts to water resources under Alternative D – FFD.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON WATER RESOURCES

Compared to Alternative A, Sub-Alternative D-1 would involve higher demands for water resources because of more ice roads, but would have less potential for ice and storm surge and other hydraulic impacts because of limited, short gravel roads. More specifically, there would be fewer impacts to streams and rivers due to reduced road and pipeline crossings and fewer impacts to shallow subsurface waters due to reduced gravel

supply requirements. Sub-Alternative D-2 would have a much greater impact on the demand for water resources, because of the greater annual water demand to build ice roads. This demand would become greater during operations and the later years of the project. The impacts associated with Alternative D – FFD and its sub-alternatives would be similar to Alternative D's sub-alternatives, only that the cumulative effects to water resources would be proportionately greater.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR WATER RESOURCES

Some of the data needs and mitigation measures recommended for Alternative A are also applicable here. More specifically, those that relate to monitoring lakes prior to and during construction and operation, in addition to the general need to collect additional baseline data of lake and stream systems, as well a developing more detailed conceptual designs to help evaluate future monitoring requirements and to assess potential impacts.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR WATER RESOURCES

The effectiveness of the protective measures would be similar to that under Alternative A.

TABLE 4D.2.2-1 POTENTIAL CONSTRUCTION PERIOD IMPACTS TO WATER RESOURCES (SUB-ALTERNATIVES D-1 AND D-2)

SUB-ALTERNATIVES D-1 AND D-2											
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS					ESTUARIES & NEARSHORE ENVIRONMENT	
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Ulamnigiaq Channel	Amayayak Channel	Sakoonang Channel	Colville River	Minor Streams	Colville River Delta Mouth	Harrison Bay
CD-3 AND VICINITY											
Gravel Road Segment to Airstrip	8	NI	NI	NI	NI	NI	NI	NI	NI	7	NI
Ice Roads	8	NI	10	10	2,3	NI	NI	NI	2,3	3	NI
Airstrip	8	NI	NI	NI	2,3,4,5,6,7,8	NI	NI	NI	NI	6	6
Pipeline Segment: CD-1 to CD-3	NI	NI	NI	NI	2,7	2,7	2,7	NI	2,7	6	NI
Production Pad	8	NI	NI	NI	2,3,4,5,6,7,8	2,3,4,5,6,7,8	2,3,4,5,6,7,8	NI	2,3,6	6	6
Underground Injection	NI	9	NI	NI	NI	NI	NI	NI	NI	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI
CD-4 AND VICINITY											
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel			Minor Streams		Harrison Bay	
Gravel Road Segment to Airstrip	8	NI	NI6	NI	NI			2,3,5,6,7		NI	
Ice Roads	8	NI	10	10	NI			2,3		NI	
40-foot Bridge			6		NI			2,3,4,5,6,7,8		NI	
Airstrip	8	NI	NI	1,3,5,6	NI			2,3,5,6,7		NI	
Pipeline Segment: CD-1 to CD-4	NI	NI	NI	NI	NI			2,7		NI	
Production Pad	8	NI	8	NI	NI			2,3,5,6,7		NI	
Groundwater Wells	9	9	NI	NI	NI			NI		NI	
CD-4 AND VICINITY											
Surfacewater extraction for potable and construction use	NI	NI	10	10	NI			NI		NI	

TABLE 4D.2.2-1 POTENTIAL CONSTRUCTION PERIOD IMPACTS TO WATER RESOURCES (SUB-ALTERNATIVES D-1 AND D-2) (CONT'D)

SUB-ALTERNATIVES D-1 AND D-2								
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS			ESTUARIES & NEARSHORE ENVIRONMENT
CD-5 AND VICINITY								
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Minor Streams		Harrison Bay
Gravel Road Segment: CD-5 to Airstrip	8	NI	NI	NI	NI	2,3,5,6,7		NI
Ice Roads	8	NI	10	10	2,3	2,3		NI
Airstrip	8	NI	NI	NI	NI	2,3,5,6,7		NI
Pipeline Segment: CD-2 to CD-5	NI	NI	NI	NI	2,3,5,6	2,7		NI
Production Pad	8	NI	8	NI	NI	2,3,5,6,7		NI
Culverts	NI	NI	NI	NI	NI	2,3,4,5,6,7		NI
Groundwater Wells	9	9	NI	NI	NI	NI		NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI		NI
CD-6 AND VICINITY								
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creek Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
Gravel Road Segment: CD-6 to Airstrip	8	NI	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	NI
Ice Roads	8	NI	10	10	2,3	2,3	2,3	NI
Airstrip	8	NI	NI	3,6	NI	2,3,5,6,7	2,3,5,6,7	NI
Pipeline Segment: CD-5 to CD-6	NI	NI	NI	NI	NI	2,7	2,7	NI
Production Pad	8	NI	8	NI	NI	2,3,5,6,7	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surfacewater extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

TABLE 4D.2.2-1 POTENTIAL CONSTRUCTION PERIOD IMPACTS TO WATER RESOURCES (SUB-ALTERNATIVES D-1 AND D-2) (CONT'D)

SUB-ALTERNATIVES D-1 AND D-2							
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS		ESTUARIES & NEARSHORE ENVIRONMENT
CD-7 and Vicinity							
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creeks Basin	Minor Streams	Harrison Bay
Gravel Road Segmentto Airstrip	8	NI	NI	NI	NI	2,3,4,5,6,7	NI
Ice Roads	8	NI	10	10	NI	NI	NI
Airstrip	8	NI	NI	3,4,5,6	NI	2,3,4,5,6,7	NI
Pipeline Segment: CD-6 to CD-7	NI	NI	NI	NI	2, ,7	2, 7	NI
Production Pad	8	NI	8	NI	NI	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI

Notes:
1 = Shoreline disturbance & thermokarsting
2 = Blockage of natural channel drainage
3 = Increased stages & velocities of floodwater
4 = Increased channel scour
5 = Increased bank erosion
6 = Increased sedimentation
7 = Increased potential for over banking (due to inundation or wind-generated wave run-up)
8 = Removal/compaction of surface soils/gravel and changes in recharge potential
9 = Underground disposal of non-hazardous wastes
10 = Water supply demand
NI = No Impact

TABLE 4D.2.2-2 POTENTIAL OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – CPAI DEVELOPMENT PLAN

SUB-ALTERNATIVES D-1 AND D-2											
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS					ESTUARIES & NEARSHORE ENVIRONMENT	
CD-3 AND VICINITY											
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Ulamnigiaq Channel	Tamayayak Channel	Sakoonang Channel	Colville River	Minor Streams	Colville River Delta Mouth	Harrison Bay
Gravel Road Segment to Airstrip	8	NI	NI	5,6	NI	NI	NI	NI	2,3,5,6,7	6,7	6
Ice Roads	8	NI	10	10	2,3	NI	NI	NI	2,3	3	NI
Airstrip	8	NI	NI	NI	2,3,5,6,7	NI	NI	NI	2,3,5,6,7	2,6	6
Pipeline Segment: CD-1 to CD-3	NI	NI	NI	NI	2,7	2,7	2,7	NI	2,7	6	NI
Production Pad	8	NI	NI	NI	2,3	2,3	2,3	2,3	2,3	6	6
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI
CD-4 AND VICINITY											
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel				Minor Streams	Harrison Bay	
Gravel Road Segment to Airstrip	8	NI	NI	NI	NI				2,3,5,6,7	NI	
Ice Roads	8	NI	10	10	NI				2,3	NI	
Pipeline Segment: CD-1 to CD-4	NI	NI	NI	NI	NI				2,7	NI	
Airstrip	8	NI	NI	NI	NI				2,3,5,6,7	NI	
Production Pad	8	NI	NI	NI	NI				2,3,5,6,7	NI	
40-foot Bridge	NI	NI	6	NI	NI				2,3,4,5,6,7	NI	
Groundwater Wells	9	9	NI	NI	NI				NI	NI	
Surfacewater extraction for potable and construction use	NI	NI	10	10	NI				NI	NI	

TABLE 4D.2.2-2 POTENTIAL OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – CPAI DEVELOPMENT PLAN (cont'd)

SUB-ALTERNATIVES D-1 AND D-2								
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS			ESTUARIES & NEARSHORE ENVIRONMENT
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel	Minor Streams		Harrison Bay
CD-5 AND VICINITY								
Gravel Road Segment to Airstrip	8	NI	NI	NI	NI	2,3,4,5,6,7		NI
Ice Roads	8	NI	10	10	2,3	2,3		NI
Airstrip	8	NI	NI	NI	NI	2,3,5,6,7		NI
Pipeline Segment: CD-2 toCD-5 (inlcuding HDD crossing)	NI	NI	NI	NI	2,3,4,5,6,7	2,7		NI
Production Pad	8	NI	NI	NI	NI	2,3,5,6,7		NI
Bridges/Culverts	NI	NI	NI	NI	NI	2,3,4,5,6,7		NI
Groundwater Wells	9	9	NI	NI	NI	NI		NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI		NI
CD-6 AND VICINITY								
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creeks Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
Gravel Road Segment to Airstrip	8	NI	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	NI
Ice Roads	8	NI	10	10	2,3	2,3	2,3	NI
Airstrip	8	NI	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	NI
Pipeline Segment: CD-5 to CD-6	NI	NI	NI	NI	2,3	2 7	2,7	NI
Production Pad	8	NI	NI	NI	NI	NI	2,3,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

TABLE 4D.2.2-2 POTENTIAL OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – CPAI DEVELOPMENT PLAN (cont'd)

SUB-ALTERNATIVES D-1 AND D-2							
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS		ESTUARIES & NEARSHORE ENVIRONMENT
	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Fish-Judy Creeks Basin	Minor Streams	Harrison Bay
CD-7 AND VICINITY							
Gravel Road Segmentto Airstrip	8	NI	NI	NI	NI	2,3,5,6,7	NI
Ice Roads	8	NI	10	10	2,3	2,3	NI
Airstrip	8	NI	NI	2,3,4,5,6	NI	2,3,5,6,7	NI
Pipeline Segment: CD-6 to CD-7	NI	NI	NI	NI	2,7	2,7	NI
Production Pad	8	NI	NI	NI	NI	2,3,5,6,7	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI

Notes:
1 = Shoreline disturbance & thermokarsting
2 = Blockage of natural channel drainage
3 = Increased stages & velocities of floodwater
4 = Increased channel scour
5 = Increased bank erosion
6 = Increased sedimentation
7 = Increased potential for over banking (due to inundation or wind-generated wave run-up)
8 = Removal/compaction of surface soils/gravel and changes in recharge potential
9 = Underground disposal of non-hazardous wastes
10 = Water supply demand
NI = No Impact

TABLE 4D.2.2-3 POTENTIAL CONSTRUCTION AND OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO

SUB-ALTERNATIVES D-1 AND D-2 – FFD SCENARIO														
	GROUNDWATER		LAKES		MAJOR & MINOR STREAM CROSSINGS								ESTUARIES & NEARSHORE ENVIRONMENT	
Colville River Facility Group	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes and Ponds	Large Deep Lakes	Nigliq Channel	Sakoonang Channel	Tamayayak Channel	Ulamnigiaq Channel	Elaktoveach Channel	Kupigruak Channel	Colville River	Minor Streams	Colville River Delta Mouth	Harrison Bay
HPS 4, 5, 7, 8, 12, 13, AND 14														
Gravel Road Segments: Production pads to airstrips	8	NI	NI	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	1,2	6	6
Ice Roads	8	NI	10	10	NI	NI	2,3	2,3	2,3	2,3	2,3	2,3	1,2,3,4, 5,6,7	6
Pipeline Segment: HP-4 to CD-4; HP-5 to CD-2; HP-7 to CD-3/1 pipeline; HP-12 to HP-7; HP-13 to HP-12; HP-14 to HP-12	NI	NI	NI	NI	2,7	2,7	2,7	2,7	2,7	2,7	2,7	2,7	2,7	NI
Production Pads: All CDs and HPs	8	NI	8	8	2,3	2,3	2,3	2,3	2,3	2,3	NI	2,3	2,3	NI
Airstrips: At all production pad locations	8	NI	8	8	2,3	2,3	2,3	2,3	2,3	2,3	NI	2,3	2,3	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

TABLE 4D.2.2-3 POTENTIAL CONSTRUCTION AND OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO (CONT'D)

SUB-ALTERNATIVES D-1 AND D-2 – FFD										
	Groundwater		Lakes		Major & Minor Stream Crossings					Estuaries & Nearshore Environment
Fish-Judy Creeks Facility Group	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes & Ponds	Large Deep Lakes	Fish Creek Basin	Inigok Creek Basin	Judy Creek Basin	Ublutuoch River Basin	Minor Streams	Harrison Bay
HPF-1 AND HPS 1, 2, 3, 6, 9, 10, 11, 15, 16, 17 AND 19										
Gravel Road Segments: From production pads to airstrips (see airstrips below)	8	NI	NI	NI	NI	NI	NI	NI	NI	NI
Pipeline Segment: HP-1 to CD-6/5; CD-7 to HP-2; HP-3 to CD-6/5; HP-6 to CD-5/6; HP-6 to HP-9; HP-10 to CD-7/HP-2 ; HP-9 to HP-11; CD-6 to HP-15; HPF-1 to HP-16; HP-16 to HP-17; HP-17 to HP-19	NI	NI	2,7	2,7	2, 7	2,7	2,7	2,7	2,7	NI
Production Pads: All HPs and HPFs	8	NI	NI	2,3	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	NI
Proposed Airstrips: CD-6 to HP-3; HP-6; HP-9 to HP-11; HP-15 to HP-17; HP-19; HPF-1	8	NI	NI	2,3	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	NI
Processing Facility: HPF-1	8	NI	NI	NI	NI	NI	2,3,	NI	NI	NI
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI	NI	NI

TABLE 4D.2.2-3 POTENTIAL CONSTRUCTION AND OPERATION PERIOD IMPACTS TO WATER RESOURCES UNDER ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO (cont'd)

SUB-ALTERNATIVES D-1 AND D-2 – FFD								
	Groundwater		Lakes		Major & Minor Stream Crossings			Estuaries & Nearshore Environment
Kalikpik-Kogru Rivers Facility Group	Shallow Groundwater	Deep Groundwater	Small Shallow Lakes And Ponds	Large Deep Lakes	Kalikpik River Drainage	Kogru River	Minor Streams	Harrison Bay
HPF-2 AND HPS 18, 20, 21, AND 22								
Gravel Road Segments: From production pads to airstrips (see airstrips below)	8	NI	2,3	2,3	2,3,4,5,6	NI	2,3,4,5,6	6
Ice Roads	8	NI	10	10	NI	2,3	2,3	NI
Pipeline Segment: HP-18 to HPF-1; HP-20 to HPF-2/HP-18 road; HP-21 to HPF-2; HP-22 to HP-21; HPF-2 to HP-18	NI	NI	NI	NI	2,7	2,7	2,7	NI
Production Pads: All HPs and HPFs	8	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	N6
Airstrips: HP-18; HP-18 to HP-22; HPF-2	8	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	6
Processing Facility: HPF-2	8	NI	NI	NI	2,3,5,6,7	2,3,5,6,7	2,3,5,6,7	6
Groundwater Wells	9	9	NI	NI	NI	NI	NI	NI
Surface water extraction for potable and construction use	NI	NI	10	10	NI	NI	NI	NI

Notes:
1 = Shoreline disturbance & thermokarsting
2 = Blockage of natural channel drainage
3 = Increased stages & velocities of floodwater
4 = Increased channel scour
5 = Increased bank erosion
6 = Increased sedimentation
7 = Increased potential for over banking (due to inundation or wind-generated wave run-up)
8 = Removal/compaction of surface soils/gravel and changes in recharge potential
9 = Underground disposal of non-hazardous wastes
10 = Water supply demand
NI =No Impact

4D.2.2.2 Surface Water Quality

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON SURFACE WATER QUALITY

CONSTRUCTION PERIOD

Total water withdrawal volumes required for ice road construction would be approximately the same as for the applicant's proposed action over the 5-year construction period, because ice roads would be built at the same locations as under Alternative A. There would be no change in the potential for ice roads to be routed across lakes, which could result in more incidences of reductions in dissolved oxygen concentrations. The estimated miles of ice roads required each year during construction vary from a minimum of 44 to a maximum of 78 under Sub-Alternative D-1 (Table 2.4.4-2) and from a minimum of 0 to a maximum of 55 under Sub-Alternative D-2 (Table 2.4.4-6).

The decrease in total gravel placed under this alternative would decrease the potential impacts to water quality from increased turbidity caused by erosion and sedimentation. Sub-Alternative D-1 would cover approximately 221 acres with gravel, and Sub-Alternative D-2 would cover 71 acres. The area of tundra potentially affected by thermokarst erosion (linked with gravel placement) would be equivalent to twice the area directly covered by gravel.

OPERATION PERIOD

Dust fallout from roads would not represent a threat to water quality, except for that from vehicle travel on access roads between production pads and airstrips. This alternative would include construction of less than 2 miles of gravel roads, which represents a decrease compared to Alternative A of 92 percent. This decrease means that most likely active flow regimes would be avoided, and thus water quality impacts from upslope impoundments, flooding, and erosion are much less likely.

ABANDONMENT AND REHABILITATION

Abandonment and rehabilitation under this alternative would result in substantially less impacts to water quality compared to Alternative A. There would be no impacts to the Nigliq Channel associated with removal of a pipeline or road bridge. There would be far less gravel to be removed and fewer miles of linear structures (roads and airstrips), particularly under Sub-Alternative D-2, and thus less potential for impacts associated with erosion, sedimentation, or upslope impoundment.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SURFACE WATER QUALITY

Ice road construction for Alternative D – FFD would require annual lake water withdrawals of up to 670 ac-ft of water under Sub-Alternative D-1 – FFD, and 270 ac-ft under Sub-Alternative D 2 – FFD.. The lengths of ice roads to be constructed would be higher under Sub-Alternative D-1 – FFD, compared to Alternative A, because they would be used for drill rig access to pads after initial construction activities were completed. Because the total estimated miles of ice roads constructed under Alternative D – FFD would be over four times higher than under Alternative A, there would be an increased chance that ice roads would be routed across lakes. This could result in additional incidences of reductions in dissolved oxygen concentrations (as described under Alternative A). The lengths of ice roads constructed each year would be much lower under Sub-Alternative D-2 – FFD, compared to Alternative A, due to the prolonged construction and operations schedule. This would greatly reduce the potential for impacts to water quality from reduced dissolved oxygen concentrations.

A decrease in total gravel under Sub-Alternatives D-1 and D-2 – FFD would decrease the potential impacts to water quality from increased turbidity caused by erosion and sedimentation. Sub-Alternative D-1 – FFD would cover approximately 1,101 acres covered with gravel. Sub-Alternative D-2 – FFD would cover 545 acres with

gravel. The area of tundra potentially affected by thermokarst erosion (linked with gravel placement) would be equivalent to twice the area directly covered by gravel.

Dust fallout from roads would not represent a threat to water quality, except for that from vehicle travel on access roads between production pads and airstrips. These gravel coverage estimates represent a decrease from Alternative A of 13 and 57 percent, respectively. The decrease in the total miles of gravel road and the associated increase of avoidance of active flow regimes would greatly reduce the potential for impacts to water quality from upslope impoundments

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON SURFACE WATER QUALITY

Alternative D proposes developing the production pads with access roads only by air, low pressure vehicles, and ice roads. Gravel would only be placed for construction of the production pads and the corresponding airstrips or helicopter pads. In comparison with Alternative A, under Sub-Alternatives D-1 and D-2 there would be potential impacts to surface water quality because of decreased gravel placement, but more potential impact because of increased water withdrawal for ice road construction (for Sub-Alternative D-1). Impacts would include:

- Increased miles of ice roads under Sub-Alternative D-1 compared to Alternative A, raising the chance that ice roads would be routed across lakes, and potentially affect dissolved oxygen concentrations
- Decreased area potentially affected by thermokarst erosion, compared to Alternative A, reducing impacts to water quality from increased turbidity caused by erosion and sedimentation
- Minimal potential for dust fallout and upslope impoundments because of the lack of roads, compared to Alternative A, resulting in a low potential for impacts to turbidity

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SURFACE WATER QUALITY

No mitigation measures have been identified for Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR SURFACE WATER QUALITY

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.3 Atmospheric Environment

4D.2.3.1 Climate and Meteorology

ALTERNATIVE D - CPAI DEVELOPMENT PLAN IMPACTS ON CLIMATE AND METEOROLOGY

CONSTRUCTION PERIOD

The construction impacts to climate and meteorology are the same as those discussed under Alternative A.

OPERATION PERIOD

The operational impacts to climate and meteorology are the same as those under Alternative A, although additional aircraft flights would occur from operation of additional airstrips, and far less road vehicle traffic would occur. These changes, however, would not alter the overall impacts from GHG.

ABANDONMENT AND REHABILITATION

Abandonment and rehabilitation impacts under this alternative would be similar to those under Alternative A, although, if gravel is to be removed, more abandonment activities would occur in the concentrated area of the production pads and associated airstrips. Therefore, while GHG emissions would still be minor, they would occur for a somewhat longer period than under Alternative A.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON CLIMATE AND METEOROLOGY

The impacts to climate and meteorology are the same as those under Alternative A – FFD (Section 4A.2.3), except aircraft and helicopter flights would replace road traffic as mobile sources of GHG.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON CLIMATE AND METEOROLOGY

The impacts are the same as those under Alternative A.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR CLIMATE AND METEOROLOGY

No mitigation measures have been identified.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR CLIMATE AND METEOROLOGY

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.3.2 Air Quality

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON AIR QUALITY

Alternative D excludes the construction of roads for access to production pads. Access to production pads would be by fixed-wing aircraft or helicopter. Table 4D.2.3.2-1 shows emissions per LTO cycle from a typical Twin Otter business turboprop aircraft, utilizing the USEPA's AP-42 emission factors for mobile sources for gas turbine engines specific to a Pratt Whitney PT6A-27 engine (USEPA 1985).

CONSTRUCTION PERIOD

Air impacts from construction of Alternative D would be similar to those under Alternative A, except that the amount of fugitive dust could be reduced because there would be less gravel used, especially under Sub-Alternative D-2. Additionally, air emissions would increase due to an increased number of flights.

OPERATION PERIOD

Air quality impacts would be about the same under this alternative as under Alternative A. However, Alternative D would require additional equipment and infrastructure at each roadless production pad (for example, pickup truck, vacuum truck, hot oil truck, slickline unit, rig truck, front end loader, air compressor, heaters, bleed tank, shelters, and chemical storage). Depending upon their size and utilization, air quality could be affected more than under other alternatives.

Mobile source emissions from aircraft and helicopters would occur during the operational period of Alternative D, in lieu of emissions that would occur from use of the gravel roads.

TABLE 4D.2.3-1 CRITERIA POLLUTANT EMISSIONS FROM AIRCRAFT FLIGHTS, PER LTO CYCLE UNDER SUB-ALTERNATIVE D-1

CONSTRUCTION PHASE[a]	AIRCRAFT FLIGHTS (LTO)/ MO, ONE-WAY[b]	CO TONS/YEAR	NO_X TONS/YEAR	HC TONS/YEAR	SO_X TONS/YEAR
Winter 2004/05	70	0.251	0.029	0.178	0.006
Summer 2005	240	0.861	0.099	0.610	0.021
Winter 2005/06	60	0.215	0.025	0.153	0.005
Summer 2005	470	1.692	0.188	1.175	0.040
Winter 2006/07	70	0.251	0.029	0.178	0.006
Summer 2007	290	1.040	0.120	0.737	0.025
Winter 2007/08	50	0.179	0.021	0.127	0.004
Summer 2008	770	2.761	0.319	1.958	0.066
Winter 2008/09	50	0.179	0.021	0.127	0.004
Summer 2009	0	0	0	0	0
Winter 2009/10	50	0.179	0.021	0.127	0.004
Summer 2010	635	2.277	0.263	1.615	0.054
Winter 2010/11	45	0.162	0.018	0.113	0.004
DRILLING PHASE					
Winter 2005/06	90	0.323	0.037	0.229	0.008
Summer 2006	40	0.143	0.017	0.102	0.003
Winter 2006/07	90	0.323	0.037	0.229	0.008
Summer 2007	40	0.143	0.017	0.102	0.003
Winter 2007/08	90	0.323	0.037	0.229	0.008
Summer 2008	75	0.269	0.031	0.191	0.006
Winter 2008/09	90	0.323	0.037	0.229	0.008
Summer 2009	40	0.143	0.017	0.102	0.003
Winter 2009/10	90	0.323	0.037	0.229	0.008
Summer 2010	75	0.269	0.031	0.191	0.006
Winter 2010/11	90	0.323	0.037	0.229	0.008
OPERATIONS PHASE					
Summer 2006	56	0.202	0.022	0.140	0.005
Winter 2006/07	24	0.086	0.010	0.061	0.002
Summer 2007	56	0.202	0.022	0.140	0.005
Winter 2007/08	24	0.086	0.010	0.061	0.002
Summer 2008	80	0.286	0.033	0.203	0.007
Winter 2008/09	32	0.115	0.013	0.081	0.003
Summer 2009	80	0.288	0.032	0.200	0.007
Winter 2009/10	32	0.115	0.013	0.081	0.003
Summer 2010	128	0.461	0.051	0.320	0.011
Winter 2010/11	48	0.173	0.019	0.120	0.004

Source: USEPA 1985

Notes:

Emissions were calculated for a DeHavilland Twin Otter turboprop aircraft (USEPA Class P2), Pratt & Whitney Model PT6A-27. Emissions factors are a composite of Table II-1-3 and Table II-1-5 in the source document, consisting of the following: 1) typical duration in minutes for civil aircraft LTO cycles at large congested metropolitan airports, based on taxi/idle out, takeoff, climbout, approach, taxi/idle (Table II-1-3); and 2) engine power settings for typical LTO commercial cycles by percentage thrust or horsepower (Table II-1-5).

[a] Summer = May through September; Winter = October through April

[b] One-way aircraft flights given are average (low-high) monthly estimates. One-way aircraft flights were used, in lieu of separate round trips, because flights could be linked from one pad to another. Summer/winter seasons that have no projected aircraft flights for that phase were not included.

ABANDONMENT AND REHABILITATION

Impacts from abandonment and rehabilitation would be similar to those under Alternative A—short-term and transient.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON AIR QUALITY

Construction and operational impacts would be the same as under Alternative A. Particulate emissions would potentially occur from gravel airstrip construction in lieu of gravel road construction. Nevertheless, winter construction would mitigate particulate emissions. Air quality would be impacted by aircraft takeoffs and landings at the airstrips and helipads, depending upon the number of aircraft flights per month.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON AIR QUALITY

The impacts under Alternative D are the same as those under Alternative A, with aircraft emissions occurring throughout drilling and operational phases, not just construction.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR AIR QUALITY

Air quality impacts, including fugitive dust, from the project would be limited through the permitting process, which ensures that no significant new air pollution sources contribute to a deterioration of the ambient air quality. Mitigation measures for limiting fugitive dust would include vehicle washing, covering of stockpiled material, ceasing construction during wind events, and the use of chemical stabilizers. These measures may vary for the frozen season and non-frozen season. Dust may be reduced by utilizing sealing agents and chip-seal on pads and runways. Watering of dust-prone areas would also reduce dust associated with the project.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR AIR QUALITY

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.2.3.3 Noise

ALTERNATIVE D – CPAI DEVELOPMENT PLAN NOISE IMPACTS

CONSTRUCTION PERIOD

The noise impacts from construction of Alternative D would be similar to those under Alternative A (see in Section 4A.2.3.3), except that the construction of gravel roads would be replaced with construction of gravel airstrips and helipads.

OPERATION PERIOD

Aircraft and helicopter noise at all drilling and production pads would occur in lieu of vehicular traffic noise (except at CD-3, which would be equipped with an airstrip under Alternative A) and would be louder but less frequent than under Alternative A.

ABANDONMENT AND REHABILITATION

Noise impacts would be similar to those associated with construction (minus drilling noise) under Alternative A. The level of impact would be less than construction under Alternative D if gravel fill is not removed.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO NOISE IMPACTS

The primary difference in noise impacts under Alternative D – FFD compared to Alternative A is that they are generated by aircraft, rather than road vehicles. Noise from the helicopters under Sub-Alternative D-2 – FFD is substantially different from that of airplanes. Helicopter noise is detectable for about 30 seconds at 1,300 feet, and is noisier but more short-term than other aircraft. The overall noise impact from the addition of helicopters under Sub-Alternative D-2 – FFD, could be less than under Alternative A, which does not rely on helicopters.

ALTERNATIVE D – SUMMARY OF NOISE IMPACTS (CPAI AND FFD)

The noise impacts under Alternative D are the same as those under Alternative A.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR NOISE

No potential mitigation measures have been identified for Alternative D nor Alternative D – FFD.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR NOISE

The effectiveness of the protective measures would be similar to that under Alternative A.

4D.3 BIOLOGICAL RESOURCES

4D.3.1 Terrestrial Vegetation and Wetlands

4D.3.1.1 Alternative D – CPAI Development Plan Impacts on Terrestrial Vegetation and Wetlands

The project design would minimize the facility footprints to reduce the loss of vegetation and habitat from gravel placement and associated indirect impacts. Biologists, geologists, facilities and reservoir engineers worked together combining information from waterbird distribution maps and wildlife habitat maps based on physical features (surface landforms, soil types, vegetation types) to locate facilities in drier habitats avoiding impacts to aquatic, Nonpatterned Wet Meadow, Patterned Wet Meadow, and Moist Sedge-Shrub Meadow habitats preferred by many waterbirds (CPAI 2004a). Figure 4D.3.1-1 and Figure 4D.3.1-2 show vegetation and habitat potentially affected, and Tables 4D.3.1-1, 4D.3.1-2, 4D.3.1-3, and 4D.3.1-4 summarize the area of vegetation classes and habitat types affected under the CPAI Development Plan Alternative D. Differences in impacts between Sub-Alternatives D-1 and D-2 are called out when necessary. Terrestrial vegetation and wetlands impact calculation methods for CPAI's Alternatives A through F are described in Section 4A.3.1.1. All impacts under Alternative D would be to wetlands. Key wetland habitats correlated to those identified in the Northeast National Petroleum Reserve-Alaska Final IAP/EIS ROD (BLM and MMS 1998b) are described in Section 3.3.1 and identified in Tables 4D.3.1-2 and 4D.3.1-4. Oil spills, should they occur, would also directly or indirectly affect vegetation and wetlands in the Plan Area. The impacts of oil and chemical spills and the potential for spills in the Plan Area are described in Section 4.3.

See Section 2.7 (Table 2.7-1) for a comparison of impacts to tundra habitats in the Plan Area among alternatives.

CONSTRUCTION PERIOD

The construction period includes gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling.

GRAVEL PADS, ROADS, AND AIRSTRIPS

Under Sub-Alternative D-1, a total of approximately 221 acres of vegetation would be covered with gravel for the construction of pads (well pads and storage pads) and airstrips (195 acres) and approximately 3.7 miles of spur roads (25 acres) (Tables 4D.3.1-1 and 4D.3.1-2). Sub-Alternative D-2 would affect approximately 70 acres of tundra vegetation for the construction of well pads and helipads (Table 4D.3.1-3 and Table 4D.3.1-4). In addition to impacts from roads, pads, and an airstrip, approximately 1.2 acres of vegetation would be lost under Alternative D (Sub-Alternatives D-1 and D-2) for the construction of a boat launch ramp and access road at CD-4 and a floating dock and access road at CD-3 as described in Section 2.3.8. Gravel facilities would be constructed and maintained to hold their designed dimensions; however, some gravel slumping from side-slopes could occur, which could potentially increase the impact area by approximately 16 percent (assuming a maximum increase from a 2H:1V to a 3H:1V sideslope). The type of impact from gravel slumping could range from direct loss of tundra vegetation to an alteration of vegetation communities depending on the thickness of gravel sloughed onto adjacent tundra. These potential impacts are included in the indirect impact area calculations from dust, gravel spray, snow drifts, impoundments, and thermokarst discussed below. Vegetation classes and habitat types lost under Sub-Alternative D-1 due to gravel placement are summarized in Tables 4D.3.1-1 and 4D.3.1-2, respectively. Vegetation classes and habitat types lost under Sub-Alternative D-2 due to gravel placement are summarized in Tables 4D.3.1-3 and 4D.3.1-4, respectively.

Proposed gravel sources would be the same as those described under Alternative A. Gravel extraction for the construction of Sub-Alternatives D-1 and D-2 would result in a permanent loss of approximately 51 acres and 22 acres, respectively, of tundra habitat while the mine sites are active and an alteration from tundra to aquatic habitat when the gravel sites are reclaimed. The vegetation and habitat types affected by gravel extraction would be the same as those described under the CPAI Development Plan Alternative A.

The type of impacts from gravel facilities and mining and mitigation measures identified for these impacts would be the same as those described under CPAI's Development Plan Alternative A. Abandonment of roads, pads, and airstrips is discussed in Section 2.3.

DUST FALLOUT FROM ROADS

Under Alternative D potential impacts from dust fallout would be greatly reduced compared to all other CPAI Development Plan alternatives because of the fewer miles of road (or no roads under Sub-Alternative D-2) that would be built. Under Alternative D, potential indirect impacts from dust fallout, gravel spray, snow accumulation, thermakarst, and impoundments are expected to occur within 164 feet (50 meters) of gravel facilities as described under CPAI's Development Plan Alternative A. This would result in alteration of about 459 acres and 105 acres, respectively, of tundra vegetation for Sub-Alternatives D-1 and D-2. Tables 4D.3.1-1, 4D.3.1-2, 4D.3.1-3, and 4D.3.1-4 summarize the surface area by vegetation and habitat types within this impact area for each sub-alternative. The type of impacts from dust and associated mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

TABLE 4D.3.1-1 CPAI SUB-ALTERNATIVE D-1 – SUMMARY OF SURFACE AREA (ACRES) OF VEGETATION CLASSES AFFECTED

VEGETATION CLASSES	COLVILLE RIVER DELTA							THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)						TOTALS FOR SUB-ALTERNATIVE D-1
	DIRECT IMPACTS					INDIRECT IMPACTS	TOTALS FOR DELTA	DIRECT IMPACTS				INDIRECT IMPACTS	TOTALS FOR THE NPR-A	
	Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal		Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Dust, Moisture Regime, & Thermal		
Water	0.2			0.2	<0.1	5.5	5.9							5.9
Riverine Complex														
Fresh Grass Marsh														
Fresh Sedge Marsh												1.4	1.4	1.4
Deep Polygon Complex				5.3		10.0	15.3							15.3
Young Basin Wetland Complex								2.1	4.3			17.0	23.5	23.5
Old Basin Wetland Complex											2.0	5.6	7.6	7.6
Wet Sedge Meadow Tundra	16.2	25.0	5.0	34.0	0.1	183.8	264.1	0.2	8.0	0.2	7.9	32.5	48.8	312.9
Salt-killed Wet Meadow														
Halophytic Sedge Wet Meadow						0.8	0.8							0.8
Halophytic Grass Wet Meadow														
Moist Sedge-Shrub Tundra	0.3			0.3		5.1	5.7	3.1	1.0	0.9	7.7	35.7	48.5	54.2
Tussock Tundra								1.6	23.7	13.9	53.8	140.1	233.1	233.1
Dryas Dwarf Shrub Tundra														
Cassiope Dwarf Shrub Tundra								0.1				0.7	0.8	0.8
Halophytic Willow Dwarf Shrub Tundra														
Open and Closed Low Willow Shrub	1.2	0.5		0.1	0.9	15.7	18.4		0.7			1.6	2.3	20.7
Open and Closed Tall Willow Shrub														
Dune Complex														
Partially Vegetated					0.2	2.6	2.8							2.8
Barrens	<0.1					0.7	0.7							0.7
Total Area	17.9	25.5	5.0	39.9	1.2	224.1	313.6	7.3	37.8	15.0	71.4	234.5	366.0	679.6

Notes: Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.
Calculation methods are described in text in Section 4A.3.1.1.
Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

TABLE 4D.3.1-2 CPAI SUB-ALTERNATIVE D-1 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED

HABITAT TYPE	COLVILLE RIVER DELTA							THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)						TOTALS FOR SUB-ALTERNATIVE D-1
	DIRECT IMPACTS					INDIRECT IMPACTS	TOTALS FOR DELTA	DIRECT IMPACTS				INDIRECT IMPACTS	TOTALS FOR THE NPR-A	
	Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal		Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Dust, Moisture Regime, & Thermal		
Open Nearshore Water														
Brackish Water														
Tapped Lake with Low-water Connection						<0.1								
Tapped Lake with High-water Connection						0.6	0.6							0.6
Salt Marsh*						0.8	0.8							0.8
Tidal Flat*														
Salt-killed Tundra*														
Deep Open Water without Islands*				0.2		1.0	1.2							1.2
Deep Open Water with Islands or Polygonized Margins*						0.1	0.1							0.1
Shallow Open Water without Islands						0.1	0.1							0.1
Shallow Open Water with Islands or Polygonized Margins														
River or Stream	0.2				<0.1	3.7	3.9							3.9
Aquatic Sedge Marsh												1.4	1.4	1.4
Aquatic Sedge with Deep Polygons				5.3		10.0	15.3							15.3
Aquatic Grass Marsh*														
Young Basin Wetland Complex*								2.1	4.3			17.0	23.5	23.5
Old Basin Wetland Complex*											2.0	5.6	7.6	7.6
Riverine Complex*														
Dune Complex														

TABLE 4D.3.1-2 CPAI SUB-ALTERNATIVE D-1 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED (CONT'D)

HABITAT TYPE	COLVILLE RIVER DELTA							THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)						TOTALS FOR SUB-ALTERNATIVE D-1
	DIRECT IMPACTS					INDIRECT IMPACTS	TOTALS FOR DELTA	DIRECT IMPACTS				INDIRECT IMPACTS	TOTALS FOR THE NPR-A	
	Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal		Spur Roads	Well Pads	Storage Pads	Airstrip Runway & Apron	Dust, Moisture Regime, & Thermal		
Nonpatterned Wet Meadow	2.4	7.7		4.1		35.1	49.3	<0.1	7.6		0.2	14.6	22.4	71.7
Patterned Wet Meadow	13.8	17.3	5.0	29.9	0.1	148.7	214.8	0.2	0.5	0.2	7.7	17.9	26.4	241.2
Moist Sedge-Shrub Meadow	0.3			0.3		5.1	5.7	3.1	1.7	0.9	7.7	37.3	50.8	56.5
Moist Tussock Tundra								1.6	23.7	13.9	53.8	140.1	233.1	233.1
Riverine Low and Tall Shrub*														
Upland Low and Tall Shrub														
Upland and Riverine Dwarf Shrub*								0.1				0.7	0.8	0.8
Riverine or Upland Shrub*	1.2	0.5		0.1	0.9	15.6	18.3							18.3
Barrens (riverine, eolian, or lacustrine)	<0.1				0.2	3.4	3.6							3.6
Artificial (water, fill, peat road)														
Total Area	**17.9**	**25.5**	**5.0**	**39.9**	**1.2**	**224.1**	**313.6**	**7.3**	**37.8**	**15.0**	**71.4**	**234.5**	**366.0**	**679.6**

Notes:

Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.

Calculation methods are described in text in Section 4A.3.1.1

Columns may not sum to exact numbers in the total row because of rounding, particularly when habitat types have impacts of <0.1.

* Represents key wetland habitats that were correlated to Bergman et al. (1977) habitats and riparian shrub habitats identified as key wetlands in the Northeast National Petroleum Reserve-Alaska Final IAP/EIS ROD (BLM and MMS 1998b).

TABLE 4D.3.1-3 CPAI SUB-ALTERNATIVE D-2 – SUMMARY OF SURFACE AREA (ACRES) OF VEGETATION CLASSES AFFECTED

VEGETATION CLASSES	COLVILLE RIVER DELTA					THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)				TOTALS FOR SUB-ALTERNATIVE D-2
	DIRECT IMPACTS			INDIRECT IMPACTS	TOTALS FOR DELTA	DIRECT IMPACTS		INDIRECT IMPACTS	TOTALS FOR THE NPR-A	
	Well Pads	Helipad	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal		Well Pads	Helipad	Dust, Moisture Regime, & Thermal		
Water			<0.1	2.6	2.6					2.6
Riverine Complex										
Fresh Grass Marsh										
Fresh Sedge Marsh										
Deep Polygon Complex										
Young Basin Wetland Complex						4.3		5.0	9.3	9.3
Old Basin Wetland Complex										
Wet Sedge Meadow Tundra	25.0	2.6	0.4	36.7	64.6	8.0	2.2	19.5	29.7	94.3
Salt-killed Wet Meadow										
Halophytic Sedge Wet Meadow										
Halophytic Grass Wet Meadow										
Moist Sedge-Shrub Tundra						1.0		3.5	4.5	4.5
Tussock Tundra						23.7	1.7	24.5	49.9	49.9
Dryas Dwarf Shrub Tundra										
Cassiope Dwarf Shrub Tundra										
Halophytic Willow Dwarf Shrub Tundra				0.8	0.8					0.8
Open and Closed Low Willow Shrub	0.5		0.9	7.7	9.1	0.7		1.6	2.3	11.4
Open and Closed Tall Willow Shrub										
Dune Complex										
Partially Vegetated			0.2	2.6	2.8					2.8
Barrens				0.7	0.7					0.7
Total Area	**25.5**	**2.6**	**1.5**	**51.1**	**80.6**	**37.8**	**3.9**	**54.1**	**95.8**	**176.4**

Notes:
Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.
Calculation methods are described in text in Section 4A.3.1.1.
Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

TABLE 4D.3.1-4 CPAI SUB-ALTERNATIVE D-2 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED

HABITAT TYPES	COLVILLE RIVER DELTA					THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)				TOTALS FOR SUB-ALTERNATIVE D-2
	DIRECT IMPACTS			INDIRECT IMPACTS		DIRECT IMPACTS		INDIRECT IMPACTS		
	Well Pads	Helipad	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal	TOTALS FOR DELTA	Well Pads	Helipad	Dust, Moisture Regime, & Thermal	TOTALS FOR THE NPR-A	
Open Nearshore Water										
Brackish Water										
Tapped Lake with Low-water Connection				<0.1						
Tapped Lake with High-water Connection				0.6	0.6					0.6
Salt Marsh*				0.8	0.8					0.8
Tidal Flat*										
Salt-killed Tundra*										
Deep Open Water without Islands*										
Deep Open Water with Islands or Polygonized Margins*										
Shallow Open Water without Islands										
Shallow Open Water with Islands or Polygonized Margins										
River or Stream			<0.1	2.0	2.0					2.0
Aquatic Sedge Marsh										
Aquatic Sedge with Deep Polygons										
Aquatic Grass Marsh*										
Young Basin Wetland Complex*						4.3		5.0	9.3	9.3
Old Basin Wetland Complex*										
Riverine Complex*										
Dune Complex										
Nonpatterned Wet Meadow	7.7	1.1		14.3	23.1	7.6	1.3	11.4	20.3	43.4
Patterned Wet Meadow	17.3	1.5	0.4	22.4	41.5	0.5	0.9	8.1	9.4	51.0
Moist Sedge-Shrub Meadow						1.7		5.1	6.8	6.8
Moist Tussock Tundra						23.7	1.7	24.5	49.9	49.9
Riverine Low and Tall Shrub*										
Upland Low and Tall Shrub										

TABLE 4D.3.1-4 CPAI SUB-ALTERNATIVE D-2 – SUMMARY OF SURFACE AREA (ACRES) OF HABITAT TYPES AFFECTED (CONT'D)

HABITAT TYPES	COLVILLE RIVER DELTA					THE NPR-A (WESTERN BEAUFORT COASTAL PLAIN)				TOTALS FOR SUB-ALTERNATIVE D-2
	DIRECT IMPACTS			INDIRECT IMPACTS		DIRECT IMPACTS		INDIRECT IMPACTS		
	Well Pads	Helipad	Boat Launches, Dock, & Access Roads	Dust, Moisture Regime, & Thermal	TOTALS FOR DELTA	Well Pads	Helipad	Dust, Moisture Regime, & Thermal	TOTALS FOR THE NPR-A	
Upland and Riverine Dwarf Shrub*										
Riverine or Upland Shrub*	0.5		0.9	7.7	9.1					9.1
Barrens (riverine, eolian, or lacustrine)			0.2	3.3	3.5					3.5
Artificial (water, fill, peat road)										
Total Area	**25.5**	**2.6**	**1.5**	**51.1**	**80.6**	**37.8**	**3.9**	**54.1**	**95.8**	**176.4**

Notes:
Spur Roads are airstrip and/or well pad access roads that branch off of the primary road.
Calculation methods are described in text in Section 4A.3.1.1
Columns may not sum to exact numbers in the total row because of rounding, particularly when habitat types have impacts of <0.1.
* Represents key wetland habitats that were correlated to Bergman et al. (1977) habitats and riparian shrub habitats identified as key wetlands in the Northeast National Petroleum Reserve-Alaska Final IAP/EIS ROD (BLM and MMS 1998b).

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative D-1, a total of about 294 miles of ice roads would be built for construction-related activities over the life of the project, resulting in a maximum of approximately 1,425 acres of vegetation disturbed. This is a maximum case scenario that assumes the ice roads would be built in a different location each year. The actual surface area disturbed would likely be much less, especially if ice roads are overlapped in subsequent years to minimize the areal extent of impacts. Ice roads placed for the construction of gravel roads and pipeline would follow adjacent to the road/pipeline routes and would tend to affect the same vegetation and habitat types (Tables 4D.3.1-1 and 4D.3.1-2). Mitigation measures for ice roads would be the same as those described under CPAI Development Plan Alternative A.

Under Sub-Alternative D-2, a total of about 55 miles of ice roads would be built for construction-related activities from 2005 through 2011, resulting in a maximum of approximately 267 acres of vegetation disturbed. This is a maximum case scenario that assumes the ice roads would be built in a different location each year.

In addition to ice roads, ice pads would be used as staging areas during pipeline construction. Under Alternative D, approximately 68 acres of vegetation would be disturbed by ice pad staging areas for the construction of the pipeline. Ice pads would also be used to stockpile overburden material associated with gravel mining at Clover; 52 acres for Sub-Alternative D-1 and 22 acres for Sub-Alternative D-2. Ice pads also would be constructed at each end of proposed road bridges to stage equipment for bridge installation. The area of the ice pad would vary with the size of the bridge installation and equipment needs; however, given the number of road bridges proposed under Alternative D and assuming the maximum pad size would be 800 feet by 800 feet surrounding the abutment structure at each end of a bridge (Section 2.3), then a maximum of 29 acres of vegetation would be affected by ice pads for bridge construction ice pads required for work pads and equipment staging for HDD pipeline crossing of the Nigliq Channel would result in an alteration of about 73 acres of tundra vegetation (PAI 2002a). Ice pads could also be built for storage of drill rigs and other equipment at remote production pads.

Because of the decreased miles of gravel roads that would be constructed under Alternative D, far less snow would need to be plowed than under all other CPAI Development Plan alternatives. This would result in decreased alteration to vegetation from snow stockpiles.

The type of impacts from ice roads, ice pads, and snow stockpiles and mitigation measures identified to minimize these impacts would be the same as those described under CPAI's Development Plan Alternative A.

OFF-ROAD TUNDRA TRAVEL

Development and operation of oil facilities in the Plan Area could require access across tundra. Such access could be necessary to respond to spills or other emergencies, conduct pipeline maintenance and repair, facilitate ice road construction, or transport supplies and equipment to roadless development sites. The types of impacts to vegetation from off-road travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Because of the mostly roadless design of Alternative D, this alternative would presumably have the greatest effect on tundra vegetation from off-road travel. Sub-Alternative D-2 proposes winter-only drilling and therefore would likely have less off-road tundra travel than Sub-Alternative D-1, which proposes summer ground access by low-ground-pressure vehicles. Off-road tundra travel impacts under Alternative D would be most similar to those of Alternative B, greater under Alternative A, and would be much greater than for Alternative C where all pads and most of the pipeline would be accessible by road.

IMPOUNDMENTS AND THERMOKARST

Indirect impacts from dust fallout, gravel spray, snow accumulation, impoundments, and thermokarst associated with roads, pads, and airstrips are expected to occur within 164 feet (50 meters) of gravel facilities as described under CPAI's Development Plan Alternative A. Tables 4D.3.1-1, 4D.3.1-2, 4D.3.1-3, and 4D.3.1-4 summarize the surface area of disturbance by vegetation classes and habitat types within this impact area. The types of impacts from impoundments and thermokarst and associated mitigation measures are described under CPAI

Development Plan Alternative A. Habitat alteration resulting from impoundments and thermokarst would be less extensive under Alternatives B and D because of the mostly roadless designs. Alternative C could potentially affect the greatest amount of vegetation because it proposes the most miles of road. The potential of Alternative A for impoundment and thermokarst impacts would be slightly less than that of Alternative C.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts from the disruption of cross-drainage and interception of sheet flow and associated mitigation measures are described under Alternative A. Habitat alteration resulting from interception of natural water flow by gravel roads and pads would be less extensive under Alternatives B and D because of the mostly roadless designs. The greatest area of vegetation would potentially be affected by Alternative C because it proposes the most miles of road. The potential for cross-drainage and water flow impacts in Alternative A would be slightly less than that of Alternative C.

AIR POLLUTION

Project construction would cause a localized and temporary impact on air quality. The sources of air pollution during the construction period are described under CPAI Development Plan Alternative A. These sources are not expected to produce sufficient levels of pollutants to adversely affect vegetation. Air Quality mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

PIPELINES

Given the maximum diameter of VSM borings and the projected number to be constructed under Alternative D, about 0.4 acre of vegetation would be lost to VSM installation. The vegetation and habitat types affected would depend on the exact location of the VSMs, which are generally spaced at 55 to 65 foot intervals. The elevated pipeline design would reduce impacts to vegetation and habitat types.

Under CPAI Development Plan Alternative D, the pipeline crossing of the Nigliq Channel would be accomplished using HDD. This would result in a loss of about 85 square feet of tundra vegetation, assuming a maximum boring diameter of 3 feet and a total of six boring holes at each end of the channel (PAI 2002a).

POWER LINES

Under Alternative D, power lines would be mounted on cable trays on pipeline VSMs and would not affect vegetation.

OPERATION PERIOD

The operation period includes continued drilling and day-to-day operations and maintenance once production has begun.

GRAVEL PADS, ROADS, AND AIRSTRIPS

Additional vegetation losses following construction could occur during the operational period during maintenance (such as snow removal) of gravel pads and airstrips or if flood events wash out portions of pads and deposit gravel on tundra. The impacts of these activities/events are described under CPAI Development Plan Alternative A. Vegetation impacts resulting from maintenance of gravel facilities and wash-outs would be less extensive under Alternatives B and D because of the mostly roadless designs. The greatest area of vegetation would potentially be affected by Alternative C because it proposes the most miles of road. The impacts from maintenance of gravel roads and washouts in Alternative A would likely be slightly less than in Alternative C.

DUST FALLOUT FROM ROADS

During the operation period, effects of dust from roads, pads, and airstrips are expected to be realized within the 164-foot impact zone. The effects of dust on vegetation are described in the Construction Period section above. Tables 4D.3.1-1, 4D.3.1-2, 4D.3.1-3, and 4D.3.1-4 summarize the surface area of disturbance by vegetation classes and habitat types within this impact area.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative D-1, ice roads and an ice bridge would be needed every few years during the operational period to support well workovers and other drilling activities. A total of about 92 miles of ice roads would be constructed for facility operations over the life of the project, resulting in a maximum of approximately 446 acres of vegetation disturbed. This is a maximum case scenario that assumes the ice roads would be built in a different location each year. The actual surface area disturbed would likely be much less, especially if ice roads are overlapped in subsequent years to minimize the areal extent of impacts. Mitigation measures for ice roads would be the same as those described under CPAI Development Plan Alternative A. Ice pads would not likely be needed during operations.

Under Sub-Alternative D-2, a total of about 50 miles of ice roads would be constructed for drilling and facility operations during 2005 through 2011, resulting in approximately 242 acres of vegetation disturbed. This is a maximum-case scenario that assumes the ice roads would be built in a different location each year.

As during the construction period, snowdrifts or plowed snow would accumulate on tundra adjacent to roads, production pads, and airstrips. Impacts would be similar to those discussed above in the Construction Period section.

OFF-ROAD TUNDRA TRAVEL

Some off-road tundra travel would continue during the operational period to respond to spills or other emergencies, to conduct pipeline maintenance and repair, to facilitate ice road construction, or to transport supplies and equipment. See the Construction Period discussion above for potential impacts.

IMPOUNDMENTS AND THERMOKARST

Although there is a potential for some habitat loss and alteration to occur from thermokarst and the creation of impoundments during the operational period of the project, these impacts are more likely to be initiated during construction. Therefore, the factors causing vegetation loss and alteration are discussed above in the Construction Period section.

CROSS-DRAINAGE AND WATER FLOW

Disruption of cross-drainage and interception of sheet flow may continue to cause impacts to vegetation during the operational phase of this project. These impacts are initiated during the construction period and are discussed above.

AIR POLLUTION

Air pollution levels would increase during operations with the ACX upgrade of existing APF-1 and increased emissions from traffic, drilling equipment, and well servicing and production equipment. However, this increase is not expected to generate levels of pollutants that would adversely affect vegetation. Air quality impacts from emissions from well servicing and drilling equipment would be intermittent and localized. Air quality mitigation measures would be the same as those described under CPAI Development Plan Alternative A.

PIPELINES

Pipeline operation would not cause vegetation losses or alteration. However, occasional large-scale pipe repairs that may be required during the thawed season could result in additional tundra damage from equipment needed to conduct the repair work. Tundra travel is discussed above. Additionally, indirect impacts discussed above in the Construction Period section, associated with snow drifting and shading, would continue to occur during the operational period. Effects of pipeline spills on tundra are described in Section 4.3.

POWER LINES

No additional vegetation impacts would occur from power lines during the operational period.

ABANDONMENT AND REHABILITATION

Impacts of abandonment on vegetation and wetlands under Alternative D would be similar in nature to that for Alternative A. However, because there would be less gravel cover (200 acres less under Sub-Alternative D-1 and 170 acres less under Sub-Alternative D-2) established at construction, the alteration in the vegetation and wetlands that could occur at abandonment, whether gravel is left in place and revegetated or revegetation follows removal of gravel, would be correspondingly less.

4D.3.1.2 Alternative D – Full-Field Development Scenario Impacts on Terrestrial Vegetation and Wetlands

In addition to the impacts of CPAI Development Plan Sub-Alternative D-1, under the FFD scenario for Sub-Alternative D-1 approximately 1,101 acres of tundra vegetation would be covered with gravel fill for the construction of pads (well pads, HPF pads, and storage pads) and airstrips. Approximately 1,737 acres of vegetation would be indirectly affected by dust, gravel spray, snowdrifts, impoundments, and thermokarst under FFD Sub-Alternative D-1. In addition to the impacts of CPAI Development Plan Sub-Alternative D-2, under the FFD scenario for Sub-Alternative D-2 approximately 545 acres of tundra vegetation would be covered with gravel fill for the construction of well pads, HPF pads, and helipads. Approximately 459 acres of vegetation would be indirectly affected by dust, gravel spray, snowdrifts, impoundments, and thermokarst under FFD Alternative D-2. The effects of FFD on terrestrial vegetation and wetlands would depend on the location and extent of development in specific locations within each facility group. Table 4D.3.1-5 and Table 4D.3.1-6 summarize the estimated areas of vegetation classes affected under FFD Alternatives D-1 and D-2, respectively. Impact calculation methods for FFD are described in Section 4A.3.1.2. The type of direct and indirect impacts to vegetation related to gravel fill; dust fallout from roads; ice roads and snow stockpiles; off-road tundra travel; impoundments and thermokarst; cross-drainage and water flow; air pollution; pipelines; and power lines in the three facility groups (Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups) and proposed mitigation measures would be the same types as those described under CPAI Development Plan Alternative A.

COLVILLE RIVER DELTA FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to the impacts of CPAI Development Plan Sub-Alternative D-1, under the FFD scenario for Sub-Alternative D-1 approximately 272 acres of tundra vegetation would be lost in the Colville River Delta Facility Group for the construction of pads (hypothetical production pads HP-4, HP-5, HP-7, HP-8, HP-12, HP-13, and HP-14; and storage pads) and airstrips (Table 4D.3.1-5). The dominant vegetation class in the vicinity of the Colville River Delta is Wet Sedge Meadow Tundra.

In addition to the impacts of CPAI Development Plan Sub-Alternative D-2, under the FFD scenario for Sub-Alternative D-2 approximately 183 acres of tundra vegetation would be lost in the Colville River Delta Facility

Group for the construction of hypothetical production pads HP-4, HP-5, HP-7, HP-8, HP-12, HP-13, and HP-14; and helipads (Table 4D.3.1-6).

The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described previously for CPAI Development Plan Alternative A.

Gravel extraction for the hypothetical FFD Sub-Alternative D-1 and D-2 would result in the destruction of approximately 255 acres and 129 acres of tundra vegetation, respectively. Specific gravel sources for the hypothetical FFD scenario have not been identified. The development process of any future gravel source would include planning, design, permitting, temporary staging areas, removal of overburden, blasting and excavation of gravel, and an approved rehabilitation plan. Analysis of impacts and appropriate mitigation measures would be examined before approval of future mine sites

DUST FALLOUT FROM ROADS

Under FFD Sub-Alternatives D-1 and D-2, indirect impacts, including dust impacts, are expected to occur within 164 feet (50 meters) of gravel facilities as described in CPAI Development Plan Alternative A (Section 4A.3.1.1), resulting in alteration of about 499 acres and 126 acres, respectively, of tundra vegetation in the Colville River Delta Facility Group (Table 4D.3.1-5 and Table 4D.3.1-6). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative D-2 – FFD Scenario, approximately 478 miles of ice roads would be constructed in the Colville River Delta Facility Group, affecting approximately 2,318 acres of vegetation. The maximum area in the Colville River Delta Facility Group covered by ice roads in a single year would be 931 acres, with an average of 394 acres per year.

Under Sub-Alternative D-2 – FFD Scenario, approximately 145 miles of ice roads would be constructed in the Colville River Delta Facility Group, affecting approximately 703 acres of vegetation. The maximum area in the Colville River Delta Facility Group covered by ice roads in a single year would be 262 acres, with an average of 117 acres per year.

As with Alternative D – CPAI Development Plan, ice pads would be used as staging areas during pipeline construction, to stockpile overburden material associated with gravel mine sites, for equipment staging areas for bridge installation, and for storage of drill rigs and other equipment at remote production pads. The types of impacts to vegetation associated with ice roads and pads and associated mitigation measures would be the same as those described above under CPAI Development Plan Alternative A.

The types of impacts to vegetation associated with snow stockpiles would be the same as those described above under CPAI Development Plan Alternative A, although the construction of more gravel facilities under the FFD scenario would result in potential increased impacts to vegetation.

OFF-ROAD TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under FFD Sub-Alternative D, the surface area affected would be expected to increase because of the increased length of pipeline, and number of remote facilities that could require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

TABLE 4D.3.1-5 FFD SUB-ALTERNATIVE D-1 FFD SCENARIO– SUMMARY OF VEGETATION IMPACTS FROM PADS, AIRSTRIPS, APRONS, AND STORAGE PADS

VEGETATION CLASSES	COLVILLE RIVER DELTA		DIRECT IMPACTS	INDIRECT IMPACTS	FISH-JUDY CREEKS		DIRECT IMPACTS	INDIRECT IMPACTS	KALIKPIK-KOGRU RIVERS		DIRECT IMPACTS	INDIRECT IMPACTS
	ACRES (%) IN COLVILLE RIVER DELTA		GRAVEL (ACRES)	DUST & THERMAL (ACRES)	ACRES (%) IN FISH-JUDY CREEKS		GRAVEL (ACRES)	DUST & THERMAL (ACRES)	ACRES (%) IN KALIKPIK-KOGRU RIVERS		GRAVEL (ACRES)	DUST & THERMAL (ACRES)
Riverine Complex	0	(0.0%)	0.0	0.0	30	(0.1%)	0.4	0.6	0	(0.0%)	0.0	0.0
Fresh Grass Marsh	56	(0.3%)	0.7	1.3	278	(0.6%)	3.6	5.4	49	(0.3%)	0.7	1.1
Fresh Sedge Marsh	3	(0.0%)	<0.1	0.1	3,343	(7.5%)	43.7	65.2	1,483	(8.8%)	21.7	32.7
Deep Polygon Complex	550	(2.6%)	7.0	12.7	4,833	(10.9%)	63.2	94.2	1,493	(8.9%)	21.9	32.9
Young Basin Wetland Complex	0	(0.0%)	0.0	0.0	2,013	(4.5%)	26.3	39.2	721	(4.3%)	10.6	15.9
Old Basin Wetland Complex	0	(0.0%)	0.0	0.0	1,261	(2.8%)	16.5	24.6	0	(0.0%)	0.0	0.0
Wet Sedge Meadow Tundra	9,494	(44.1%)	120.1	220.0	9,856	(22.1%)	129.0	192.1	6,533	(39.0%)	95.8	144.2
Salt-killed Wet Meadow	1,633	(7.6%)	20.7	37.8	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Sedge Wet Meadow	1,210	(5.6%)	15.3	28.0	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Grass Wet Meadow	32	(0.1%)	0.4	0.7	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Moist Sedge-Shrub Tundra	782	(3.6%)	9.9	18.1	4,318	(9.7%)	56.5	84.1	0	(0.0%)	0.0	0.0
Tussock Tundra	139	(0.6%)	1.8	3.2	14,936	(33.5%)	195.4	291.1	5,452	(32.5%)	79.9	120.3
Dryas Dwarf Shrub Tundra	29	(0.1%)	0.4	0.7	238	(0.5%)	3.1	4.6	0	(0.0%)	0.0	0.0
Cassiope Dwarf Shrub Tundra	0	(0.0%)	0.0	0.0	395	(0.9%)	5.2	7.7	284	(1.7%)	4.2	6.3
Halophytic Willow Dwarf Shrub Tundra	8	(0.0%)	0.1	0.2	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Open and Closed Low Willow Shrub	1,929	(9.0%)	24.4	44.7	520	(1.2%)	6.8	10.1	1	(0.0%)	<0.1	<0.1
Open and Closed Tall Willow Shrub	0	(0.0%)	0.0	0.0	172	(0.4%)	2.3	3.4	0	(0.0%)	0.0	0.0
Dune Complex	0	(0.0%)	0.0	0.0	902	(2.0%)	11.8	17.6	185	(1.1%)	2.7	4.1
Partially Vegetated	1,183	(5.5%)	15.0	27.4	412	(0.9%)	5.4	8.0	154	(0.9%)	2.3	3.4
Barrens	4,487	(20.8%)	56.8	104.0	1,030	(2.3%)	13.5	20.1	411	(2.5%)	6.0	9.1
Totals	**21,536**	**(100.0%)**	**272.4**	**499.0**	**44,537**	**(100.0%)**	**582.7**	**868.0**	**16,768**	**(100.0%)**	**245.8**	**370.0**

Notes:
Calculation methods are described in text in Section 4A.3.1.2.
Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

TABLE 4D.3.1-6 FFD SUB-ALTERNATIVE D-2 – SUMMARY OF VEGETATION IMPACTS FROM PADS AND HELIPADS

VEGETATION CLASSES	COLVILLE RIVER DELTA		DIRECT IMPACTS	INDIRECT IMPACTS	FISH-JUDY CREEKS		DIRECT IMPACTS	INDIRECT IMPACTS	KALIKPIK-KOGRU RIVERS		DIRECT IMPACTS	INDIRECT IMPACTS
	ACRES (%) IN COLVILLE RIVER DELTA		GRAVEL (ACRES)	DUST & THERMAL (ACRES)	ACRES (%) IN FISH-JUDY CREEKS		GRAVEL (ACRES)	DUST & THERMAL (ACRES)	ACRES (%) IN KALIKPIK-KOGRU RIVERS		GRAVEL (ACRES)	DUST & THERMAL (ACRES)
Riverine Complex	0	(0.0%)	0.0	0.0	30	(0.1%)	0.1	0.2	0	(0.0%)	0.0	0.0
Fresh Grass Marsh	56	(0.3%)	0.5	0.3	278	(0.6%)	1.4	1.4	49	(0.3%)	0.4	0.3
Fresh Sedge Marsh	3	(0.0%)	<0.1	<0.1	3,343	(7.5%)	16.4	17.3	1,483	(8.8%)	12.6	9.1
Deep Polygon Complex	550	(2.6%)	4.7	3.2	4,833	(10.9%)	23.7	25.0	1,493	(8.9%)	12.7	9.2
Young Basin Wetland Complex	0	(0.0%)	0.0	0.0	2,013	(4.5%)	9.9	10.4	721	(4.3%)	6.1	4.4
Old Basin Wetland Complex	0	(0.0%)	0.0	0.0	1,261	(2.8%)	6.2	6.5	0	(0.0%)	0.0	0.0
Wet Sedge Meadow Tundra	9,494	(44.1%)	80.8	55.5	9,856	(22.1%)	48.4	50.9	6,533	(39.0%)	55.6	40.1
Salt-killed Wet Meadow	1,633	(7.6%)	13.9	9.6	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Sedge Wet Meadow	1,210	(5.6%)	10.3	7.1	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Halophytic Grass Wet Meadow	32	(0.1%)	0.3	0.2	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Moist Sedge-Shrub Tundra	782	(3.6%)	6.7	4.6	4,318	(9.7%)	21.2	22.3	0	(0.0%)	0.0	0.0
Tussock Tundra	139	(0.6%)	1.2	0.8	14,936	(33.5%)	73.3	77.1	5,452	(32.5%)	46.4	33.5
Dryas Dwarf Shrub Tundra	29	(0.1%)	0.2	0.2	238	(0.5%)	1.2	1.2	0	(0.0%)	0.0	0.0
Cassiope Dwarf Shrub Tundra	0	(0.0%)	0.0	0.0	395	(0.9%)	1.9	2.0	284	(1.7%)	2.4	1.7
Halophytic Willow Dwarf Shrub Tundra	8	(0.0%)	0.1	<0.1	0	(0.0%)	0.0	0.0	0	(0.0%)	0.0	0.0
Open and Closed Low Willow Shrub	1,929	(9.0%)	16.4	11.3	520	(1.2%)	2.6	2.7	1	(0.0%)	<0.1	<0.1
Open and Closed Tall Willow Shrub	0	(0.0%)	0.0	0.0	172	(0.4%)	0.8	0.9	0	(0.0%)	0.0	0.0
Dune Complex	0	(0.0%)	0.0	0.0	902	(2.0%)	4.4	4.7	185	(1.1%)	1.6	1.1
Partially Vegetated	1,183	(5.5%)	10.1	6.9	412	(0.9%)	2.0	2.1	154	(0.9%)	1.3	0.9
Barrens	4,487	(20.8%)	38.2	26.3	1,030	(2.3%)	5.1	5.3	411	(2.5%)	3.5	2.5
Totals	**21,536**	**(100.0%)**	**183.3**	**126.0**	**44,537**	**(100.0%)**	**218.6**	**230.0**	**16,768**	**(100.0%)**	**142.8**	**103.0**

Notes:
Calculation methods are described in text in Section 4A.3.1.2.
Columns may not sum to exact numbers in the total row because of rounding, particularly when vegetation classes have impacts of <0.1.

IMPOUNDMENTS AND THERMOKARST

Indirect impacts from dust and changes to moisture or thermal regimes associated with roads, pads, and airstrips are expected to occur within 164 feet (50 meters) of gravel facilities, as described under CPAI's Development Plan Alternative A. Table 4D.3.1-5 and Table 4D.3.1-6 summarize the surface area of disturbance by vegetation class within this impact area for each facility group. The types of impacts to vegetation associated with thermokarst and ponding and the proposed mitigation measures for these impacts would be the same as those described above under CPAI Development Plan Alternative A.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with disruption of cross-drainage and interception of sheet flow would be the same as those described previously for CPAI Development Plan Alternative A. These impacts from cross-drainage and water flow would be greatest in the vicinity of the Colville River Delta because of unstable flow regimes and ocean-induced storm surges. Gravel placement could potentially disturb sheet flow in the spring and could affect local moisture regimes. Alteration of sediment disposition patterns during flood events may occur due to obstructions from gravel facilities. These changes may result in alteration of vegetation succession and long-term alteration of habitat types.

AIR POLLUTION

No additional processing facilities would be built in the Colville River Delta area under FFD Alternative D. However, the increased traffic and equipment associated with the production pads and airstrips would potentially cause greater increased air pollution. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

In addition to the impacts from CPAI Development Plan Alternative D, a total of approximately 2.0 acres of vegetation would be lost to VSM installation under the FFD scenario for Alternative D, of which about 0.4 acre would occur in the Colville River Delta Facility Group. The vegetation and habitat types affected would depend on the exact location of the VSM which are generally spaced at 55 to 65 foot intervals. The types of impacts to vegetation associated with snow drifting or shading from the aboveground pipelines would be the same as those described previously for CPAI's Development Plan Alternative A.

POWER LINES

Under FFD Alternative D, power lines would be placed on cable trays on pipeline VSMs and would not cause any additional disturbance to vegetation.

FISH-JUDY CREEKS FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to the impacts of CPAI Development Plan Sub-Alternative D-1, under the FFD scenario for Sub-Alternative D-1 approximately 583 acres of tundra vegetation would be lost in the Fish-Judy Creeks Facility Group for the construction of pads (a processing facility; well pads HP-1, HP-2, HP-3, HP-6, HP-9, HP-10, HP-11, HP-15, HP-16, HP-17, and HP-19; and storage pads) and airstrips (Table 4D.3.1-5). The dominant vegetation classes in the Fish-Judy Creeks Facility Group area are *Dryas* Tundra and Wet Sedge Meadow Tundra.

In addition to the impacts of CPAI Development Plan Sub-Alternative D-2, under the FFD scenario for Sub-Alternative D-2 approximately 219 acres of tundra vegetation would be lost in the Fish-Judy Creeks Facility

Group for the construction of a processing facility; well pads HP-1, HP-2, HP-3, HP-6, HP-9, HP-10, HP-11, HP-15, HP-16, HP-17, and HP-19; and helipads (Table 4D.3.1-6).

The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described above under CPAI Development Plan Alternative A.

DUST FALLOUT FROM ROADS

Under FFD Sub-Alternatives D-1 and D-2 indirect impacts, including dust impacts, are expected to occur within 164 feet (50 meters) of gravel facilities as described in CPAI Development Plan Alternative A (Section 4A.3.1.1), resulting in alteration of about 868 acres and 230 acres, respectively, of tundra vegetation in the Fish-Judy Creeks Facility Group (Table 4D.3.1-5 and Table 4D.3.1-6). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

Impacts from road dust under FFD Alternative D would be similar in type to those described for the CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative D-1 – FFD Scenario, approximately 1,294 miles of ice roads would be constructed in the Fish-Judy Creeks Facility Group, affecting approximately 6,274 acres of vegetation. The maximum area in the Fish-Judy Creeks Facility Group covered by ice roads in a single year would be 1,047 acres with an average of 627 acres per year.

Under Sub-Alternative D-2 – FFD Scenario, approximately 409 miles of ice roads would be constructed in the Fish-Judy Creeks Facility Group, affecting approximately 1,983 acres of vegetation. The maximum area in the Fish-Judy Creeks Facility Group covered by ice roads in a single year would be 422 acres, with an average of 198 acres per year.

OFF-ROAD TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under FFD Alternative D, the surface area affected would be expected to increase because of the increased length of pipeline and number of remote facilities that could require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

IMPOUNDMENTS AND THERMOKARST

The types of impacts to vegetation associated with thermokarst and ponding, and the proposed mitigation measures for these impacts, would be the same as those described above under CPAI Development Plan Alternative A. The construction of more gravel facilities under the FFD scenario could potentially result in increased impacts and alteration of vegetation communities from thermokarst and ponding. These impacts are expected to occur within the 164-foot impact zone as described in CPAI Development Plan Alternative A (Section 4A.3.1.1). Tables 4D.3.1-5 and 4D.3.1-6 summarize the potential surface area of disturbance by vegetation class within this impact area for each facility group.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with the disruption of cross-drainage and interception of water flow would be the same as those described under CPAI Development Plan Alternative A, although the construction of more gravel facilities under the FFD scenario could potentially cause increased impacts to vegetation communities from disturbance of local water flow.

AIR POLLUTION

The construction of an additional processing facility in the Fish-Judy Creeks Facility Group would result in a localized increase in air pollution levels. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

Under the FFD scenario for Alternative D, approximately 1.1 acres of vegetation would be lost in the vicinity of the Fish-Judy Creeks Facility Group by VSM placement. The types of impacts to vegetation associated with snow drifting or shading from pipeline placement would be the same as those described above under the CPAI Development Plan Alternative A.

POWER LINES

Under FFD Alternative D, power lines would be placed on cable trays on pipeline VSMs and would not cause any additional disturbance to vegetation.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

GRAVEL PADS, ROADS, AND AIRSTRIPS

In addition to the impacts of CPAI Development Plan Sub-Alternative D-1, under the FFD scenario for Sub-Alternative D-1 approximately 246 acres of tundra vegetation would be lost in the Kalikpik-Kogru Rivers Facility Group for the construction of pads (a processing facility; production pads HP-1, HP-2, HP-3, HP-6, HP-9, HP-10, HP-11, HP-16, HP-17, HP-18, and HP-19; and storage pads) and airstrips (Table 4D.3.1-5). The dominant vegetation classes in the Kalikpik-Kogru Rivers Facility Group area are Tussock Tundra and Sedge/Grass Meadow.

In addition to the impacts of CPAI Development Plan Sub-Alternative D-2, under the FFD scenario for Sub-Alternative D-2 approximately 143 acres of tundra vegetation would be lost in the Kalikpik-Kogru Rivers Facility Group for the construction of a processing facility; production pads HP-1, HP-2, HP-3, HP-6, HP-9, HP-10, HP-11, HP-16, HP-17, HP-18, and HP-19; and helipads (Table 4D.3.1-6).

The types of disturbances and impacts to vegetation associated with gravel fill placement would be the same as those described above under CPAI Development Plan Alternative A.

DUST FALLOUT FROM ROADS

Under FFD Sub-Alternatives D-1 and D-2 indirect impacts, including dust impacts, are expected to occur within 164 feet (50 meters) of gravel facilities as described in CPAI Development Plan Alternative A (Section 4A.3.1.1), resulting in alteration of about 370 acres and 103 acres, respectively, of tundra vegetation in the Kalikpik-Kogru Rivers Facility Group (Table 4D.3.1-5 and Table 4D.3.1-6). The types of impacts to vegetation and mitigation measures associated with dust fallout would be the same as those described previously for CPAI Development Plan Alternative A.

ICE ROADS, ICE PADS, AND SNOW STOCKPILES

Under Sub-Alternative D-1 – FFD Scenario, approximately 713 miles of ice roads would be constructed in the Kalikpik-Kogru Rivers Facility Group, affecting approximately 3,457 acres of vegetation. The maximum area in the Kalikpik-Kogru Rivers Facility Group covered by ice roads in a single year would be 975 acres, with an average of 864 acres per year.

Under Sub-Alternative D-2 – FFD Scenario, approximately 160 miles of ice roads would be constructed in the Kalikpik-Kogru Rivers Facility Group, affecting approximately 776 acres of vegetation. The maximum area in the Kalikpik-Kogru Rivers Facility Group covered by ice roads in a single year would be 325 acres, with an average of 194 acres per year.

TUNDRA TRAVEL

The types of impacts from off-road tundra travel and associated mitigation measures would be similar to those described under CPAI Development Plan Alternative A. Under FFD Alternative D, the surface area affected would be expected to increase because of the increased length of pipeline, roads, and number of remote facilities that may require off-road tundra travel for emergencies, pipeline maintenance and repair, ice road construction, or supply transport.

IMPOUNDMENTS AND THERMOKARST

The types of impacts to vegetation associated with thermokarst and ponding and the proposed mitigation measures for these impacts would be the same as those described above under CPAI Development Plan Alternative A. Under FFD Alternative D, the construction of more gravel facilities would result in increased impacts and alteration of vegetation communities from thermokarst and ponding. These impacts are expected to occur within 164 feet (50 meters) of gravel facilities as described in CPAI Development Plan Alternative A. Tables 4D.3.1-5 and 4D.3.1-6 summarize the potential surface area of disturbance by vegetation class within this impact area for each facility group.

CROSS-DRAINAGE AND WATER FLOW

The types of impacts to vegetation associated with the disruption of cross-drainage and interception of water flow would be the same as those described above under CPAI Development Plan Alternative A, although the construction of more gravel facilities under FFD Alternative D would cause increased impacts to vegetation communities from disturbance of local water flow.

AIR POLLUTION

The construction of an additional processing facility in the Kalikpik-Kogru Rivers Facility Group would result in a localized increase in air pollution levels. This increase is not expected to generate levels of pollutants that would adversely affect vegetation.

PIPELINES

Under the FFD scenario for Alternative D, approximately 0.5 acre of vegetation would be lost in the Kalikpik-Kogru Rivers Facility Group from VSM placement. The types of impacts to vegetation associated with snow drifting or shading from pipeline placement would be the same as those described above under the CPAI Development Plan Alternative A.

POWER LINES

Under FFD Alternative D, power lines would be placed on cable trays on pipeline VSMs and would not cause any additional disturbance to vegetation.

4D.3.1.3 Alternative D – Summary of Impacts (CPAI and FFD) on Terrestrial Vegetation and Wetlands

Vegetation maps cover the entire Plan Area, and detailed wildlife habitat maps are available for the entire area affected by CPAI's proposed Alternative D (Figure 4D.3.1-2). Vegetation classes and wildlife habitat types are cross-referenced in Table 3.3.1-3. Summary of impacts are presented as percentages of available vegetation

type or habitat class within the Colville River Delta or the National Petroleum Reserve-Alaska portions of the Plan Area. Wildlife habitat mapping covers 100 percent of the Colville River Delta, 24 percent of the National Petroleum Reserve-Alaska portion of the Plan Area, and 37 percent of the total Plan Area.

SUB-ALTERNATIVE D-1

Impacts from CPAI Development Plan Sub-Alternative D-1 to vegetation and habitat types are summarized in Table 4D.3.1-1 and Table 4D.3.1-2, respectively. Impacts from FFD Sub-Alternative D-1 are summarized in Table 4D.3.1-5.

Under CPAI Sub-Alternative D-1, approximately 272 acres of tundra vegetation would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines; and 2,501 acres would be altered or disturbed by ice roads and pads, dust, snow accumulation, and changes to thermal or moisture regimes; combined representing less than one percent of the Plan Area (Table 4D.3.1-1 and Table 4D.3.1-2).

In the Colville River Delta portion of the Plan Area, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (264 acres lost or altered; 0.7 percent of available in the area) and Patterned Wet Meadow habitat (215 acres lost or altered; 0.8 percent of available in the area). In the National Petroleum Reserve-Alaska portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (233 acres lost or altered; 0.1 percent of available in the area) and Moist Tussock Tundra habitat (233 acres lost or altered; 0.5 percent of available mapped habitat in the area) (Table 4D.3.1-1 and Table 4D.3.1-2).

Under CPAI Sub-Alternative D-1, key wetland habitats that would be lost or altered in the 146,637 acre Colville River Delta are: riparian shrubland (18 of 7,575 acres); aquatic grass marsh (0 of 369 acres); deep open lakes (1.3 of 7,810 acres); basin-complex wetlands (0 of 2 acres); and coastal wetlands (0.8 of 29,022 acres). Key wetland habitats that would be lost or altered in the 175,153 acres mapped in the National Petroleum Reserve-Alaska are: riparian shrubland (0.8 of 4,741 acres); aquatic grass marsh (0 of 501 acres); deep open lakes (0 of 22,374 acres); basin-complex wetlands (31 of 16,297 acres); and coastal wetlands (0 of 36 acres) (Table 4D.3.1-2). Thus, impacts to all key wetland types, including those that contain *Arctophila* and *Carex aquatilis*, will be minor.

Under FFD Sub-Alternative D-1, approximately 1,356 acres of tundra vegetation (less than one percent of Plan Area) would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines; and 13,829 acres (about 1.4 percent of the Plan Area) would be altered or disturbed by ice roads, dust, and changes to thermal or moisture regimes (Table 4D.3.1-5). Habitat types were not assessed for FFD because habitat mapping does not cover the entire Plan Area (Figure 3.3.1.3-1) (Jorgenson et al. 2003c).

SUB-ALTERNATIVE D-2

Impacts from CPAI Development Plan Sub-Alternative D-2 to vegetation and habitat types are summarized in Table 4D.3.1-3 and Table 4D.3.1-4, respectively. Impacts from FFD Sub-Alternative D-2 are summarized in Table 4D.3.1-6.

Under CPAI Sub-Alternative D-2, approximately 93 acres of tundra vegetation would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines; and 784 acres would be altered or disturbed by ice roads and pads, dust, snow accumulation, power line trenching, and changes to thermal or moisture regimes; combined representing less than one percent of the Plan Area (Table 4D.3.1-3 and Table 4D.3.1-4).

In the Colville River Delta portion of the Plan Area, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (65 acres lost or altered; 0.2 percent of available in the area) and Patterned Wet Meadow habitat (42 acres lost or altered; 0.2 percent of available in the area). In the National Petroleum Reserve-Alaska portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (50 acres lost or altered; less than 0.1 percent of available in the area) and Moist Tussock Tundra habitat (50 acres lost or altered; 0.1 percent of available mapped habitat in the area) (Table 4D.3.1-3 and Table 4D.3.1-4).

Under CPAI Sub-Alternative D-2, key wetland habitats that would be lost or altered in the 146,637 acre Colville River Delta are: riparian shrubland (9.1 of 7,575 acres); aquatic grass marsh (0 of 369 acres); deep open lakes (0 of 7,810 acres); basin-complex wetlands (0 of 2 acres); and coastal wetlands (0.8 of 29,022 acres). Key wetland habitats that would be lost or altered in the 175,153 acres mapped in the National Petroleum Reserve-Alaska are: riparian shrubland (0 of 4,741 acres); aquatic grass marsh (0 of 501 acres); deep open lakes (0 of 22,374 acres); basin-complex wetlands (9.3 of 16,297 acres); and coastal wetlands (0 of 36 acres) (Table 4D.3.1-4). Thus, impacts to all key wetland types, including those that contain *Arctophila* and *Carex aquatilis*, will be minor.

Under FFD Sub-Alternative D-2, approximately 674 acres of tundra vegetation (less than one percent of the Plan Area) would be lost by gravel fill and extraction associated with roads, pads, airstrips, and gravel mines; and 3,921 acres (less than one percent of the Plan Area) would be altered or disturbed by ice roads, dust, and changes to thermal or moisture regimes (Table 4D.3.1-6). Habitat types were not assessed for FFD because habitat mapping does not cover the entire Plan Area (Figure 3.3.1.3-1) (Jorgenson et al. 2003c).

4D.3.1.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Terrestrial Vegetation and Wetlands

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.1).

4D.3.1.5 Alternative D – Effectiveness of Protective Measures for Terrestrial Vegetation and Wetlands

The effectiveness of the protective measures would be similar to Alternative A.

4D.3.2 Fish

Aspects of Alternative D (Figure 2.4.4-1) that are different from Alternative A but are relevant to potential impacts on fish include elimination of gravel roads for access to production pads; HDD to install the pipeline under the Nigliq Channel (rather than a pipeline bridge over the channel); and installation of power lines on the pipeline VSMs (eliminating the need for power poles). Because the Alternative D pipeline route is the same as that in Alternative A, the potential impacts of the two alternatives would, with minor exceptions (e.g., the CD-4 pad-airstrip road), be in the same geographic areas. Because Alternative A does not include a road to CD-3, impacts and mitigation relating to alteration and loss of habitat, obstruction of fish passage, and increased human access described for Alternative A apply here.

Because there are no roads connecting the sites, Alternative D includes aircraft landing areas at or near each production pad, with two variants: Sub-Alternative D-1 would construct an airstrip near each of the five production pads, with a gravel road connecting each airstrip to the production pad it services; and Sub-Alternative D-2 would include a helipad at each of the five production pads. Most of the potential impacts to fish from Sub-Alternatives D-1 and D-2 would be identical or nearly so. Therefore, unless otherwise indicated, the discussion below applies to both sub-alternatives.

As in Alternative A, the primary concern in the Plan Area is maintaining winter habitat. Maintaining suitable feeding and spawning areas and access to these areas, which are often in different geographic locations; water withdrawal; alteration of flow patterns; release of contaminants during the life of the project; and the impacts of oil spills are likewise of concern.

Impacts of and measures to prevent, control, and mitigate spills are addressed in Section 4.3. Further, that section includes an assessment of the effects of the project on marine fish and habitats. Normal construction and operation impacts for this alternative would not be expected to have measurable impacts on Harrison Bay and nearshore Beaufort Sea environments and biota. Most impacts are to freshwater and migratory species and impacts will be similar on all freshwater and migratory species.

4D.3.2.1 Alternative D – CPAI Development Plan Impacts on Fish

CONSTRUCTION PERIOD

Airstrips, pipelines, and pads would be constructed during winter, and well-drilling operations could occur year-round. If construction were to occur in high-density spawning and overwintering areas or during summer in migratory corridors, it could affect a relatively large number of freshwater and migratory fish. Potential impacts of construction under those conditions would include degradation or loss of overwintering habitat, partially blocked access to and from summer feeding areas and wintering areas, and siltation in or near these habitats. The scope of such impacts may range up to spawning failure and/or fish mortality.

WATER WITHDRAWAL

The main potential impact of construction on fish would be from water withdrawal to support construction of drill pads, airstrips, and pipelines. Water would be needed for building ice roads along the proposed pipeline route and for camp operations. In addition to water withdrawal, CPAI would use frozen lakes for ice chips. Details of the effects of water withdrawal on fish are as described for Alternative A (Section 4A.3.2). Lakes that have been identified as potential winter water sources for ice road construction and other uses are shown in Table 4A.3.2-1. Figure 3.3.2.2-1 shows the fish-bearing lakes in the Plan Area and indicates which contain fish that are not resistant to the low dissolved oxygen concentrations that could result from water withdrawal; the depths of those lakes relative to Alternative D are shown in Figure 4D.3.2-1.

Best management practices would be implemented during water withdrawals. CPAI would monitor each water withdrawal to ensure winter water use does not exceed permit limits and that water quality standards are met. In addition, large and deep lakes would be targeted as water sources to allow a margin of safety for maintaining sufficient water volumes to minimize impacts on fish. Shallow lakes that do not contain fish also would be used as water sources before they freeze. No impacts to fish are expected if CPAI adheres to the water withdrawal permit conditions.

GRAVEL MINING

To provide road and pad material, gravel will be mined at locations to be determined. Details are described for Alternative A (Section 4A.3.1.1), but gravel needs for Alternative D will be much less than for Alternative A. Furthermore, the gravel needs for Sub-Alternative D-1 (airstrips) would be greater than those for Sub-Alternative D-2 (helipads). If gravel-mining activities occur outside overwintering or spawning areas, little or no adverse effects to fish would be expected. A mitigation that may yield long-term benefits after project completion is conversion of the gravel pits to fish habitat (Section 4A.3.1.1).

PIPELINES

The pipeline crossing the Nigliq Channel would be installed by HDD. This would avoid impacts to the Nigliq Channel unless there were an inadvertent release of drilling mud.

Other water crossings would be sufficiently short that they would cross the watercourses on VSMs and in-stream work would not be required. Impacts from construction of these pipeline bridges are generally as described in Section 4A.3. If in-stream piers are required, sediment/turbidity plumes could result as described in Section 4A.3 under Bridges. Given that construction activities would be in the winter and overwintering habitats would be largely avoided, it is expected that pipeline construction under Alternative A would have no measurable effect on arctic fish populations in the Plan Area.

PADS, ROADS, AND AIRSTRIPS

Lakes M9622 and MC7911 (Figure 4D.3.2-1) are frequently flooded, as are perched lakes to the north and south of the proposed CD-4 airstrip. Both are sufficiently deep (about 20 feet) to provide significant overwintering

habitat. Broad whitefish and least cisco have been documented to reside in both of these lakes, with humpback whitefish and round whitefish also in Lake MC7911. CD-6 would be in the Fish Habitat LUEA described by the Northeast National Petroleum Reserve-Alaska Final IAP/EIS (BLM and MMS 1998a) and ROD (BLM and MMS 1998b).

Otherwise, construction of pads, roads, and airstrips is likely to have no measurable adverse effect on arctic fish populations because construction is scheduled to occur in winter in low-diversity areas sparsely inhabited by large fish and not during times when migratory fish are moving to and from freshwater habitats. Further, construction has been designed to minimize siltation effects and impacts on fish passage.

Gravel placed for production pads, roads, and airstrips could eliminate some fish habitat. The pads might be somewhat larger than in Alternative A because they would not have year-round road access so would need more room for storage of equipment and supplies. However, because there would be no inter-pad road system, the amount of gravel required and in turn the amount of habitat eliminated would be far less than that for Alternative A. The CD-4 pad-airstrip road would place gravel over some small, shallow wetland ponds that would not contain fish during winter but might support ninespine sticklebacks in summer.

BRIDGES

There likely would be a 40-foot road bridge over the Sakoonang Channel on the CD-4 pad-airstrip-road. This is expected to completely span the watercourse, and it would be installed in winter when the water would be frozen and no fish would be present. Therefore, no effects on fish are anticipated to result from bridge construction at this site.

A bridge over an existing pipeline is proposed very near CD-4 because this does not involve a water crossing, no impacts to fish are expected.

CULVERTS

Culverts are not proposed for Alternative D. However, Alternative D would have no road, so the impacts of a road and culvert crossing of Lake L9324 (Figure 4D.3.2-1) would not occur. Should any culverts be installed on pad-airstrip roads, potential construction impacts (e.g., sedimentation resulting from bottom disturbance and gravel) would be similar to those described for Alternative A (Section 4A.3).

BOAT RAMPS AND DOCKS

Construction of boat ramps and docks, should any be needed for spill response purposes, may have in-stream impacts similar to those of bridge construction.

POWER LINES

Power lines would be installed on the pipeline VSMs; pipeline construction impacts to fish are addressed above.

HUMAN ACCESS

The availability of the ice roads during winter construction would increase human access to the Ublutuoch River, the Fish Creek drainage, and the Colville River Delta. Increased fishing pressure may result.

OPERATION PERIOD

PIPELINES

The normal operation of the pipelines should have only negligible effects on fish habitat or fish movement corridors. Fish habitat would not be lost or altered by the presence of VSM-mounted pipes. Because most

planned maintenance and repair activities would occur in the frozen season to allow ground access to pipelines, little impact would be expected.

Should urgent repairs be needed when the ground is not frozen, impacts to fish habitat may result from vehicles accessing the repair site(s). Such vehicular access for emergency maintenance would necessitate traveling over unfrozen tundra; however, impacts to fish would still be expected to be minimal and short term (e.g., minor sedimentation as low-ground-pressure vehicles pass through drainages).

PADS, ROADS, AND AIRSTRIPS

The absence of roads in this alternative reduces impacts on fish to only those associated with the pads and airstrip. The main exception is the airstrip and road associated with CD-4 which could redirect flow and thus alter habitat and fish movements in that area. Alteration of drainage patterns on a landscape scale would not be a concern in Alternative D compared to Alternative A with its extensive road system.

Otherwise, the nature of operational impacts would be the same as those for Alternative A (Section 4A.3). Maintenance of road surfaces at or near water crossings could increase the amount of suspended sediments, resulting in degradation of water quality and fish habitat.

Ice roads would have to be made during construction and drilling and every few years during operations, including an ice bridge across the Nigliq Channel each winter. Construction of an ice road or an airstrip on fish overwintering areas could cause freezing to the bottom and form a barrier to water circulation if state requirements to maintain fish passage are not met. This would result in reduced dissolved oxygen levels. Further, erosion and runoff from gravel pads, airstrips, and roads could cause sedimentation in water bodies, resulting in smothering of physical habitat, avoidance, reduced feeding, and lessened tolerance to disease. CPAI would remove snow from the road surface to minimize runoff, road erosion, and tundra silting during the spring-melt.

BRIDGES

The only bridge in Alternative D would be the Sakoonang Channel Bridge near CD-4 (Figure 2.4.4-1). No impacts to fish would be expected from this bridge.

CULVERTS

No culverts have been proposed for Alternative D. Should any be proposed, they would be designed to maintain adequate water flow and fish passage. Downstream channel morphology changes would be a concern with any culvert crossing of a watercourse. Potential culvert failure could block downstream flow and obstruct fish movement. These impacts are discussed in more detail in Section 4A.3.

HUMAN ACCESS

Because it is a roadless development scenario, Alternative D has the least potential of any of the alternatives to increase human access into the development area. Winter ice roads could facilitate access to remote areas (Ublutuoch River, Fish Creek, and Judy Creek) and thus may increase winter fishing pressure.

It is possible that the project might create a limited number of new jobs, which may attract new residents from Barrow or other North Slope villages to reside permanently in Nuiqsut and use local fishery resources. The expected small magnitude of the potential increase in subsistence users that would be attributable to the development makes it unlikely that there would be adverse effects on the subsistence fishery. Furthermore, the project would not increase fishing competition between residents and local non-residents because CPAI has agreed to apply a no-fishing/hunting policy to non-resident workers.

ABANDONMENT AND REHABILITATION

While fish in the Nigliq Channel could be impacted by low dissolved oxygen levels due to suspension of oxygen-demanding materials during removal of the pipeline bridge, Alternative D would impact fish less during abandonment and rehabilitation than any other alternative chiefly because so few miles of road are built.

4D.3.2.2 Alternative D – Full-Field Development Impacts on Fish

The hypothetical FFD design for Alternative D is along the same alignment as that of Alternative A. The number of production pads and processing facilities proposed is the same as described for Alternative A. Therefore, potential impacts to fish would be in the same geographic areas as those for Alternative A. The differences are that there are no roads in Alternative D, each facility has a corresponding airstrip or helipad. This is the least obtrusive of all the FFD designs.

Types of impacts of future development in the Plan Area generally would be of a similar nature to those described above for the five-pad CPAI proposal (Section 4D.3.2.1). However, development on the scale postulated will, depending on precise siting, destroy or alter fish habitat substantially more than CPAI's five-pad proposal. Overwintering, rearing, migration, and spawning habitats would be affected but to a far lesser extent than for Alternative A because there would be no inter-pad road system. In particular, there would be no concerns about landscape-scale drainage alterations as in Alternative A (Section 4A.3).

Periodic ice road construction might promote winter access to remote areas and thus increase winter fishing pressure at overwintering sites. However, the lack of an inter-pad road network (such as that in Alternative A) suggests that this would be on a scale far less than for Alternative A. Conversely, some traditional users of the area may choose other locations to avoid industrial activity altogether.

Withdrawal of fresh water necessary to support this scale of infrastructure development, plus well drilling, should not affect fish if withdrawals are done in compliance with permit restrictions. The cumulative effects of this FFD scenario are expected to be similar to effects from current developments. Future mitigation measures are expected to be successful based on the impacts of previous projects to fish habitat.

The following subsections summarize concerns specific to facility groups.

COLVILLE RIVER DELTA FACILITY GROUP

In the Colville River Delta, seven new production pads are hypothesized. Of particular note are production pads HP-12 and HP-13 on the eastern side of the outer Delta, which are in vicinity of the commercial (Helmericks) fishery as well as subsistence fisheries. Spills, addressed in Section 4.3, would be a major concern of these two hypothetical facilities.

No roads are hypothesized in this part of the Plan Area except short pad-airstrip roads. Pipelines would be constructed over several major watercourses including the Elaktoveach Channel, Kupigruak Channel, Tamayayak Channel, and the main stem of the Colville River. In-stream construction activities at these water bodies would have the potential to cause impacts as described in Section 4D.3.2.1.

FISH-JUDY CREEKS FACILITY GROUP

Eleven new pads plus one new processing facility in the Fish Creek watershed (including Judy Creek and the Ublutuoch River) are hypothesized.

Several facilities would be situated in sensitive areas as designated by the BLM and MMS (1998a): HP-1, HP-16, HP-17, and HPF-1 in the Fish and Judy creek drainages and HP-11 near the Colville River. Fish habitats in these drainages are important for spawning, migration, rearing, and overwintering for anadromous and resident

species. This may affect subsistence users who do not like to fish near development, especially industrial sites. Spills, addressed in Section 4.3, would be a major concern when facilities are placed in sensitive areas.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

Four new pads and one new processing facility in the Kalikpik-Kogru river drainages are hypothesized. Only minor impacts from pad and airstrip installation would be expected.

4D.3.2.3 Alternative D – Summary of Impacts (CPAI and FFD) on Fish

Construction impacts are considerably reduced under Alternative D because no roads are proposed, and there would be no instream activities at the Nigliq Channel which would be crossed by HDD (barring a release of drilling muds into the Channel).

In summary, this alternative is expected to have the lowest level of construction impacts of all the alternatives in regard to alteration and loss of fish habitat, obstruction of fish passage, and increased human access to fish resources. Similarly, the need for mitigation would be reduced.

Within the Plan Area, the primary impacts of concern are those that affect winter habitat, as well as those affecting feeding and spawning areas and access to these areas. Water withdrawal for winter construction, if not limited, could create overcrowding and reduce the available pool of dissolved oxygen in a water body, with fish mortality a possible result. Permit limits on amounts of water withdrawn are set to avoid such impacts.

Construction of pads, roads, and pipelines is likely to have no measurable adverse effect on arctic fish populations. Construction of ice roads or airstrips on fish overwintering areas could cause freezing to the bottom and block fish movement if state requirements to maintain fish passage are not met. Ice roads could facilitate increased human access to fish overwintering areas, potentially increasing subsistence fishing pressures.

Gravel mining would most likely have direct impacts if it were to occur within the floodplains of rivers. Sedimentation from erosion could affect fish and other aquatic organisms by interfering with respiration and vision and by smothering benthic habitat.

Release of contaminants over the project duration and the impacts of oil spills are important concerns to fish resources; these issues are addressed in Section 4.3.

The potential impacts described above, should they occur, are likely to be localized and temporary and thus would have no significant effects on fish populations in general within and adjacent to the Plan Area. Given the total amount of construction proposed, the collective effects of development and production would have some effect on fish and fish habitats in the region. Whether those effects are measurable and distinguishable from naturally occurring population perturbations is unknown. Minor shifts in habitat or population integrity, especially if they are of a temporary nature, could reasonably be absorbed by the ecosystem. Furthermore, careful planning, appropriate engineering specification and design, and rigorous safety measures should minimize impacts and ensure the reproductive sustainability of stocks overall. Localized impacts could pose a more serious threat to localized stocks (e.g, within a single drainage) if they were to occur in or near prime spawning, nursery, or overwintering sites. Continued monitoring of fisheries resources is vital for evaluating the long-term stability of the region. Monitoring and mitigation plans should be finalized and ready to address any signs that development may be having a truly detrimental effect on local fish populations.

ESSENTIAL FISH HABITAT

This alternative would have the least potential for adverse impacts on salmon EFH because no gravel roads of consequence would be necessary, and the pipeline would be run under the Nigliq Channel using HDD methods rather than over the channel via a bridge. The potential impacts from Alternative D to fish in general are

described in Section 4D.3. See Section 4.3 for a discussion of the potential for oil releases to occur in an under-channel pipeline.

As is the case with the other alternatives, because the Plan Area represents marginal habitat for salmon populations, the probability of affecting EFH from a species and commercial perspective is minimal under both the Alternative D – CPAI Development Plan and FFD Scenario.

4D.3.2.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Fish

1. At project completion, gravel mines should be converted to fish habitat, if practicable.

2. Ice roads and airstrips should avoid fish overwintering areas where possible, and in all cases maintain fish passage.

3. For the HDD pipeline crossing of the Nigliq Channel, CPAI should provide a plan, subject to the review and approval of the AO, that includes (1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction; (2) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and (3) a contingency plan for crossing the water body or wetland in the event the directional drill is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

4. CPAI should continue fish monitoring studies in the Plan Area to ensure that the health of regional and locally important fish stocks is maintained. CPAI's mitigation plan should include remedial measures to be taken should monitoring detect adverse impacts due to the project.

4D.3.2.5 Alternative D – Effectiveness of Protective Measures for Fish

The effectiveness of the protective measures would be similar to Alternative A. In addition to those measures in Alternative A, additional mitigation has been identified that would reduce the risk of a release of drilling mud into the Nigliq Channel during the HDD operation, and for the sealing of the drill hole if HDD was not successful.

4D.3.3 Birds

See discussions of impacts by bird group presented in Section 4A.3.3 Birds for additional descriptions of impact mechanisms and for description of impact calculation assumptions and methods.

4D.3.3.1 Alternative D – CPAI Development Plan Impacts on Birds

Under Alternative D, all production pads would be the same locations as proposed under Alternative A but most of the roads would be eliminated and each site would be developed with aircraft and ice road access. Table 4D.3.3-1 and Table 4D.3.3-2 present the estimated number of nests displaced as a result of habitat loss, alteration, and disturbance for CPAI Development Plan Alternatives D-1 and D-2 by bird species and species group.

WATERFOWL AND LOONS

Alternative D is most similar to Alternative B, with the exception of removal of connecting roads between CD-1 to CD-4 and CD-6 to CD-7 and addition of airstrips or helipads at all production pads. At the CD-5 site, the airstrip would be near wetlands that support nesting red-throated and Pacific loons, tundra swans, white-fronted and Canada geese, brant, and several duck species including king eider (Burgess et al. 2003b). The airstrip at CD-6 would be in a dry upland area where small numbers of white-fronted geese, northern pintails, and long-tailed ducks were reported nesting (Burgess et al. 2003b). The airstrip at the CD-7 site could affect nesting

Pacific and yellow-billed loons and small numbers of northern pintails, long-tailed ducks, and king eiders nesting in wetlands north of the proposed airstrip (Burgess et al. 2003b).

CONSTRUCTION PERIOD

Habitat Loss and Alteration

The footprint of the production pads at each site would be larger under Alternative D, and gravel placement for airstrips would further increase the amount of tundra lost as waterfowl and loon habitat in the immediate area of each pad site. However, the total area of tundra covered by gravel within the Plan Area would be reduced. Reduction in gravel placement by elimination of the connecting roads would decrease direct and indirect habitat impacts for an estimated 25.5 fewer waterfowl nests and 3.2 fewer loon nests in Sub-Alternative D-1 compared to Alternative A (Table 4D.3.3-1and Table 4A.3.3-2). The additional reduction in gravel fill from airstrips in Sub-Alternative D-1 to helipads in Sub-Alternative D-2 would affect an estimated 16.7 fewer waterfowl nests and 2.3 fewer loon nests (Table 4D.3.3-1 and Table 4D.3.3-2). Habitat impacts would also be decreased in Sub-Alternative D-1 and Alternative B and Sub-Alternative C-1 affecting an estimated 6.6 and 46.2 fewer waterfowl nests and 0.5 and 5.7 fewer loon nests (Table 4D.3.3-1 and Table 4B.3.3-1, 4C-1.3.3-1). Annual ice roads and the ice bridge across the Nigliq Channel during drilling could alter availability of nesting habitat by late meltout and alteration of water flows. Ice road requirements would be increased in Alternative D compared to Alternative A because of the roadless nature of this alternative, affecting an additional estimated 1.7 waterfowl nests. Ice road impacts for Sub-Alternative D-1 are similar to Alternative B but would increased from Sub-Alternative C-1 affecting a few additional waterfowl nests (Table 4D.3.3-1, 4B.3.3-1, and 4C-1.3.3-1). Ice road estimates for Sub-Alternative D-1 are presented for Sub-Alternative D-2 calculations, but under Sub-Alternative D-2 ice road construction would continue for an unknown amount of time, so average annual totals were not available. The types of impacts associated with gravel placement for waterfowl and loons in Alternative D would be the same as those described under Alternative A.

Patterned Wet Meadow waterfowl and loon nesting habitat in the Colville River Delta in Sub-Alternative D-1 would have additional gravel related impacts compared to Alternatives A and B (Table 4D.3.3-3, 4A.3.3-3, and 4B.3.3-2). Deep Open Water with Islands or Polygonized Margins and Moist Sedge-Shrub Meadow nesting habitats would have reduced gravel cover compared to Alternative A to Sub-Alternative C-1. More Aquatic Sedge Marsh habitat would be covered by gravel in Sub-Alternative D-1 than in Alternative A, although impacts to this habitat type are reduced in Sub-Alternative D-1 compared to Alternative B and Sub-Alternative C-1. In all instances, except for Young Basin Wetland Complex, habitat impacts in Sub-Alternative D-1 would affect less than 1 percent of habitats used by waterfowl and loons and available in the Colville River Delta or in the National Petroleum Reserve-Alaska portion of the Plan Area (Table 4D.3.3-3). Habitat impacts for Sub-Alternative D-2 would affect similar habitat types although fewer quantities than Sub-Alternative D-1 (Table 4D.3.3-3)

Disturbance and Displacement

Disturbances from vehicle traffic would be reduced in Alternative D compared to Alternatives A through C by elimination of roads connecting production pads. Some vehicular traffic would occur on production pads and on access roads from production pads to airstrips. The roadless nature of Alternative D could lead to increased requirements for tundra travel during both summer and winter. Ground access during the summer would potentially disturb waterfowl and loons.

Disturbance from air traffic would be increased in Alternative D compared to Alternatives A through C by the addition of airstrips at all pad locations. This increase in disturbance would lead to the potential displacement of an additional estimated 16 to 70 waterfowl nests in Sub-Alternative D-1 compared to Alternatives A through Sub-Alternative C-1 with an additional 5 to 8 loon nests. Potential displacement would be reduced in Sub-Alternative D-2 from Sub-Alternative D-1 by the reduction in the helipad area and the resulting disturbance buffer surrounding the helipad affecting 42 fewer waterfowl and 5 fewer loon nests (Table 4D.3.3-1 and Table 4D.3.3-2). Associated hazing of waterfowl and loons from the airstrip areas would cause additional disturbance.

TABLE 4D.3.3-1 SUB-ALTERNATIVE D-1 – CPAI DEVELOPMENT PLAN - ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	
WATERFOWL											
Greater white-fronted goose	2.5	5.0	1.0	23.6	32.1	3.5	4.4	4.5	22.4	34.8	66.9
Snow goose	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Canada goose	0.0	0.1	0.0	0.1	0.2	0.9	1.1	1.1	6.0	9.1	9.3
Brant	0.2	0.4	0.1	2.0	2.7	0.4	0.6	0.5	3.0	4.5	7.2
Tundra swan	0.1	0.3	0.1	0.9	1.4	0.0	0.1	0.0	0.3	0.4	1.8
Mallard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern shoveler	0.0	0.1	0.0	0.2	0.3	0.0	0.1	0.0	0.3	0.4	0.7
Northern pintail	0.3	0.6	0.1	2.4	3.4	0.2	0.3	0.1	1.8	2.4	5.8
Green-winged teal	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.4	0.4
Greater scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lesser scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
King eider	0.0	0.0	0.0	0.1	0.1	0.3	0.4	0.5	1.8	3.0	3.1
Long-tailed duck	0.2	0.5	0.1	2.3	3.1	0.3	0.4	0.3	2.2	3.2	6.3
Waterfowl Total[b]	**3.4**	**7.1**	**1.6**	**31.8**	**43.9**	**5.8**	**7.4**	**6.9**	**38.2**	**58.3**	**102.2**
LOONS											
Red-throated loon	0.1	0.3	0.1	1.2	1.7	0.1	0.1	0.1	0.5	0.8	2.5
Pacific loon	0.2	0.5	0.1	1.9	2.7	0.6	0.7	0.7	3.5	5.5	8.2
Yellow-billed loon	0.1	0.1	0.0	0.6	0.8	0.1	0.1	0.1	0.5	0.8	1.6
Loon Total[b]	**0.4**	**0.9**	**0.2**	**3.7**	**5.2**	**0.8**	**0.9**	**0.9**	**4.5**	**7.1**	**12.3**
PTARMIGAN											
Willow ptarmigan	0.4	0.8	0.2	3.1	4.5	0.4	0.5	0.3	2.7	3.9	8.4
Rock ptarmigan	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.2
Ptarmigan Total[b]	**0.4**	**0.8**	**0.2**	**3.3**	**4.7**	**0.4**	**0.5**	**0.3**	**2.7**	**3.9**	**8.6**
SEABIRDS											
Parasitic jaeger	0.0	0.1	0.0	0.2	0.3	0.1	0.1	0.2	0.5	0.9	1.2
Long-tailed jaeger	0.0	0.1	0.0	0.3	0.4	0.1	0.1	0.1	0.3	0.6	1.0
Glaucous gull	0.1	0.2	0.0	0.7	1.0	0.4	0.4	0.5	2.0	1.5	2.5
Sabine's gull	0.0	0.1	0.0	0.6	0.7	0.2	0.2	0.2	1.0	1.6	2.3
Arctic tern	0.2	0.4	0.1	1.8	2.5	0.3	0.4	0.5	1.7	2.9	5.4
Seabird Total[b]	**0.4**	**0.9**	**0.2**	**3.6**	**5.1**	**1.1**	**1.2**	**1.5**	**5.5**	**9.3**	**14.4**
SHOREBIRDS											
Black-bellied plover	0.6	1.5	0.5	0.0	2.6	0.8	0.8	1.5	0.0	3.1	5.7
American golden-plover	0.8	1.9	0.6	0.0	3.3	0.6	0.7	1.0	0.0	2.3	5.6
Bar-tailed godwit	0.1	0.4	0.1	0.0	0.6	0.3	0.3	0.4	0.0	1.0	1.6
Semipalmated sandpiper	7.1	17.8	5.9	0.0	30.8	4.5	4.9	8.8	0.0	18.2	49.0
Baird's sandpiper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.1
Pectoral sandpiper	13.5	33.6	11.1	0.0	58.2	8.2	10.5	8.2	0.0	26.9	85.1
Dunlin	0.5	1.2	0.4	0.0	2.1	0.7	0.8	1.2	0.0	2.7	4.8
Stilt sandpiper	0.6	1.5	0.5	0.0	2.6	0.8	1.0	1.4	0.0	3.2	5.8
Buff-breasted sandpiper	0.0	0.0	0.0	0.0	0.0	0.2	0.1	0.6	0.0	0.9	0.9
Long-billed dowitcher	1.1	2.6	0.9	0.0	4.6	2.7	3.3	3.9	0.0	9.9	14.5

TABLE 4D.3.3-1 SUB-ALTERNATIVE D-1 – CPAI DEVELOPMENT PLAN - ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE (CONT'D)

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	
SHOREBIRDS (CONT'D)											
Red-necked phalarope	3.3	8.3	2.8	0.0	14.4	5.0	6.5	4.2	0.0	15.7	30.1
Red phalarope	2.3	5.7	1.9	0.0	9.9	1.7	2.1	2.2	0.0	6.0	15.9
Shorebird Total[b]	**29.8**	**74.6**	**24.6**	**0.0**	**129.0**	**25.5**	**31.0**	**33.5**	**0.0**	**90.0**	**219.0**
PASSERINES											
Yellow wagtail	0.1	0.4	0.1	0.0	0.6	0.1	0.0	0.2	0.0	0.3	0.9
Savannah sparrow	0.8	1.9	0.6	0.0	3.3	1.2	1.5	1.5	0.0	4.2	7.5
Lapland longspur	13.6	34.0	11.2	0.0	58.8	14.4	17.5	19.3	0.0	51.2	110.0
Common redpoll	0.1	0.4	0.1	0.0	0.6	0.5	0.6	1.1	0.0	2.2	2.8
Passerine Total[b]	**14.6**	**36.6**	**12.1**	**0.0**	**63.3**	**16.2**	**19.6**	**22.1**	**0.0**	**57.9**	**121.2**

Notes:
[a] See Section 4A.3.3 Birds for assumptions and calculation methods
[b] Totals rounded to include birds with <0.1 nests/km^2

TABLE 4D.3.3-2 CPAI SUB-ALTERNATIVE D-2 – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	
WATERFOWL											
Greater white-fronted goose	0.9	1.4	0.4	10.0	12.7	1.3	1.0	1.9	8.4	12.6	25.3
Snow goose	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Canada goose	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.5	2.2	3.3	3.4
Brant	0.1	0.1	0.0	0.9	1.1	0.2	0.1	0.2	1.1	1.6	2.7
Tundra swan	0.0	0.1	0.1	0.4	0.6	0.0	0.0	0.0	0.1	0.1	0.7
Mallard	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northern shoveler	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2
Northern pintail	0.1	0.1	0.1	0.9	1.2	0.1	0.1	0.0	0.7	0.9	2.1
Green-winged teal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1
Greater scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lesser scaup	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
King eider	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.7	1.1	1.2
Long-tailed duck	0.1	0.1	0.1	1.0	1.3	0.1	0.1	0.1	0.8	1.1	2.4
Waterfowl Total[b]	**1.3**	**1.9**	**0.7**	**13.4**	**17.3**	**2.1**	**1.7**	**3.0**	**14.3**	**21.1**	**38.4**
LOONS											
Red-throated loon	0.0	0.1	0.0	0.5	0.6	0.0	0.0	0.0	0.2	0.2	0.8
Pacific loon	0.1	0.1	0.1	0.8	1.1	0.2	0.2	0.3	1.3	2.0	3.1
Yellow-billed loon	0.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.2	0.2	0.4
Loon Total[b]	**0.1**	**0.2**	**0.1**	**1.6**	**2.0**	**0.2**	**0.2**	**0.4**	**1.7**	**2.5**	**4.5**

TABLE 4D.3.3-2 CPAI SUB-ALTERNATIVE D-2 – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE (CONT'D)

SPECIES	COLVILLE RIVER DELTA					THE NPR-A AREA					GRAND TOTAL[a]
	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL	
PTARMIGAN											
Willow ptarmigan	0.1	0.2	0.1	1.2	1.6	0.1	0.1	0.1	1.0	1.3	2.9
Rock ptarmigan	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1
Ptarmigan Total[b]	**0.1**	**0.2**	**0.1**	**1.3**	**1.7**	**0.1**	**0.1**	**0.1**	**1.0**	**1.3**	**3.0**
SEABIRDS											
Parasitic jaeger	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	0.2	0.3	0.4
Long-tailed jaeger	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.2
Glaucous gull	0.0	0.0	0.0	0.3	0.3	0.1	0.1	0.2	0.7	1.1	1.4
Sabine's gull	0.0	0.0	0.0	0.2	0.2	0.1	0.0	0.1	0.4	0.6	0.8
Arctic tern	0.1	0.1	0.1	0.7	1.0	0.1	0.1	0.2	0.6	1.0	2.0
Seabird Total[b]	**0.1**	**0.2**	**0.1**	**1.5**	**1.9**	**0.4**	**0.2**	**0.6**	**2.1**	**3.3**	**5.2**
SHOREBIRDS											
Black-bellied plover	0.2	0.4	0.2	0.0	0.8	0.3	0.1	0.7	0.0	1.1	1.9
American golden-plover	0.3	0.4	0.3	0.0	1.0	0.2	0.2	0.4	0.0	0.8	1.8
Bar-tailed godwit	0.0	0.1	0.1	0.0	0.2	0.1	0.1	0.2	0.0	0.4	0.6
Semipalmated sandpiper	2.3	4.1	2.5	0.0	8.9	1.7	0.9	3.8	0.0	6.4	15.3
Baird's sandpiper	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pectoral sandpiper	4.4	7.7	4.8	0.0	16.9	2.8	2.4	3.6	0.0	8.8	25.7
Dunlin	0.2	0.3	0.2	0.0	0.7	0.3	0.2	0.5	0.0	1.0	1.7
Stilt sandpiper	0.2	0.4	0.2	0.0	0.8	0.3	0.2	0.6	0.0	1.1	1.9
Buff-breasted sandpiper	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.3	0.0	0.4	0.4
Long-billed dowitcher	0.3	0.6	0.4	0.0	1.3	1.0	0.7	1.7	0.0	3.4	4.7
Red-necked phalarope	1.1	1.9	1.2	0.0	4.2	1.6	1.5	1.8	0.0	4.9	9.1
Red phalarope	0.8	1.3	0.8	0.0	2.9	0.6	0.4	1.0	0.0	2.0	4.9
Shorebird Total[b]	**9.9**	**17.0**	**10.6**	**0.0**	**37.5**	**9.0**	**6.6**	**14.5**	**0.0**	**30.1**	**67.6**
PASSERINES											
Yellow wagtail	0.0	0.1	0.1	0.0	0.2	0.0	0.0	0.1	0.0	0.1	0.3
Savannah sparrow	0.3	0.4	0.3	0.0	1.0	0.4	0.3	0.6	0.0	1.3	2.3
Lapland longspur	4.5	7.8	4.8	0.0	17.1	5.1	3.7	8.3	0.0	17.1	34.2
Common redpoll	0.0	0.1	0.1	0.0	0.2	0.2	0.1	0.5	0.0	0.8	1.0
Passerine Total[b]	**4.8**	**8.4**	**5.2**	**0.0**	**18.4**	**5.8**	**4.2**	**9.5**	**0.0**	**19.5**	**37.9**

Notes:
[a] See Section 4A.3.3 Birds for assumptions and calculation methods
[b] Totals rounded to include birds with <0.1 nests/km^2

TABLE 4D.3.3-3 CPAI SUB-ALTERNATIVE D-1 – SUMMARY OF AFFECTED HABITAT TYPES USED BY WATERFOWL, LOONS AND SEABIRDS

HABITAT TYPES	COLVILLE DELTA						THE NPR-A				
	ACRES IN COLVILLE RIVER DELTA[b]	LOSS OR ALTERATION[c] (ACRES AND % OF AVAILABLE HABITAT)		SPECIES[a] (16)			ACRES IN THE NPR-A[d]	LOSS OR ALTERATION[c] (ACRES AND % OF AVAILABLE HABITAT)		SPECIES[a] (20)	
				NESTING (16)	BROOD-REARING (13)	STAGING (3)				NESTING (20)	BROOD-REARING (15)
Open Nearshore Water	1,162					1	0				
Brackish Water	1,807			2		2	2				
Tapped Lake with Low-water Connection	5,397	<0.1	<0.1%			1	412				
Tapped Lake with High-water Connection	5,146	0.6	<0.1%	5			7				
Salt Marsh*	4,473	0.8	<0.1%	2	1	1	36				
Tidal Flat*	18,187					1	0				
Salt-killed Tundra	6,362			5	1	1	0				
Deep Open Water without Island*s	5,650	1.2	<0.1%	4	5		12,386			1	3
Deep Open Water with Islands or Polygonized Margins*	2,160	0.1	<0.1%	12	8	1	9,988			3	6
Shallow Open Water without Islands	547	0.1	<0.1%				1,744			5	3
Shallow Open Water with Island or Polygonized Margins	155			4	4		2,877			11	7
River or Stream	20,306	3.9	<0.1%			1	1,456				
Aquatic Sedge Marsh	32						3,037	1.4	<0.1%	10	2
Aquatic Sedge with Deep Polygons	3,275	15.3	0.5%	12	3		66				
Aquatic Grass Marsh*	369			2			501			2	
Young Basin Wetland Comple*x	0						624	23.5	3.7%	9	3
Old Basin Wetland Comple*x	2						15,673	7.6	<0.1%	12	4
Riverine Complex*	0						698			3	1
Dune Complex	0						1,889				
Nonpatterned Wet Meadow	11,162	49.3	0.4%	7	2		5,697	22.4	0.4%	4	
Patterned Wet Meadow	27,969	214.8	0.8%	8	4		19,861	26.4	0.1%	7	1
Moist Sedge-Shrub Meadow	2,927	5.7	0.2%	2			42,071	50.8	0.1%	8	1
Moist Tussock Tundra	525						49,647	233.1	0.5%	3	1
Riverine Low and Tall Shrub*	1,270						1,803				1
Upland Low and Tall Shrub	419						735				
Upland and Riverine Dwarf Shrub*	0						2,240	0.8	<0.1%		
Riverine or Upland Shrub*	6,305	18.3	0.3%	2			0				
Barrens (riverine, eolian, or lacustrine)	20,993	3.6	<0.1%	2			1,552				
Artificial (water, fill, peat road)	38						150				
Total Area	**146,638**	**313.6**	**0.2%**				**175,152**	**366.0**	**0.2%**		

Notes:
[a] Numbers of species using habitats by life history stage (Johnson et al. 2004). Species included are: greater white-fronted goose, snow goose, Canada goose, brant, tundra swan, northern pintail, green-winged teal, greater scaup, spectacled eider, king eider, long-tailed duck, red-breasted merganser, red-throated loon, Pacific loon, yellow-billed loon, parasitic jaeger, long-tailed jaeger, glaucous gull, Sabine's gull, arctic tern,
[b] Habitat type mapped for the Colville River Delta (Jorgenson et al. 1997) within the Plan Area boundaries
[c] Total includes gravel for pads and airstrips and area indirectly affected by dust, snowdrifts, and alteration in thermal or moisture regimes (Table 4D.3.1-2)
[d] Habitat type mapped for the National Petroleum Reserve-Alaska area (Jorgenson et al. 2003c) within the Plan Area boundaries
* key wetlands

Obstructions to Movement

Under Alternative D, any potential obstructions to waterfowl and loon movements related to the presence of gravel roads would be reduced when compared to Alternatives A through C because of the elimination of roads under the alternative.

Mortality

Under Alternative D, the potential for loon and waterfowl mortality from collisions with vehicular traffic or bridges would be reduced when compared to Alternatives A through C because of the elimination of roads and bridges. Mortality from collisions with aircraft would be increased by the addition of airstrips at all pad locations under Alternative D.

Any increase in predator populations attracted to the development areas would result in decreased reproductive success for waterfowl and loons. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as long-tailed ducks (Mallek et al. 2003) and red-throated loons (Larned et al. 2003b); and to colonial nesting species which concentrate in specific locations providing an abundant and predictable protein source. Ravens could be discouraged from nesting on oilfield structures. If problem birds persist, control may be necessary to reduce depredation on tundra nesting birds.

OPERATION PERIOD

Habitat Loss and Alteration

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. Habitat alterations from dust fallout would be reduced in Alternative D compared to Alternatives A through C because of the roadless nature of this alternative. Habitat alterations from use of low-ground-pressure vehicles during summer or winter would be increased in Alternative D compared to Alternatives A through C because of the lack of road access to most facilities.

Disturbance and Displacement

Disturbance from vehicle traffic would be nearly eliminated in Alternative D compared to Alternatives A through C with the elimination of connecting roads. Disturbance from air traffic would be increased in Alternative D compared to Alternatives A through C by the addition of airstrips at all pad locations. Potential disturbance for Sub-Alternative D-2 could be reduced from Sub-Alternative D-1 by the reduction in the area exposed to disturbance because of the reduced size of the helipad. More traffic would be expected, however, with Sub-Alternative D-2 because of the reduced payload for most helicopters compared to fixed-wing aircraft.

Obstructions to Movement

Potential obstructions to movements of waterfowl and loon broods across roads would continue during project operation. This potential obstruction would be very low for Alternative D because of the roadless nature of this alternative.

Mortality

Potential mortality resulting from collisions with vehicles would be very low in Alternative D compared to Alternatives A through C because of the lack of road connections between facilities. Mortality from collisions

with aircraft would be increased in Alternative D compared to Alternatives A through C because of the addition of airstrips or helipads at all pad locations. Potential mortality from collisions with power lines would be eliminated in Alternative D by the placement of all power lines on VSMs.

Any increase in predator populations would result in decreased reproductive success for waterfowl and loons. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as long-tailed ducks (Mallek et al. 2003) and red-throated loons (Larned et al. 2003b); and to colonial nesting species which concentrate in specific locations providing an abundant and predictable protein source. Potential mortality resulting from depredation by raptors, ravens, or seabirds could also be increased in Alternative D compared to Alternatives A or B by the increased vantage from the 7-foot versus the 5-foot elevation of the pipeline.

PTARMIGAN

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Under Alternative D, the footprint of the production pads at each site would be larger than that proposed for Alternative A, and gravel placement for airstrips would further increase the amount of tundra potentially lost as ptarmigan habitat in the immediate area of each site. However, the elimination of most of the roads under Alternative D and general reduction in gravel fill would reduce the amount of habitat affected in Alternative D compared to Alternatives A though C.

Habitat loss resulting from gravel fill would affect an estimated 0 to 3 fewer ptarmigan nests compared to Alternatives A through C. Less area of Patterned Wet Meadow and Moist Sedge-Shrub Meadow habitats used by ptarmigan for nesting and brood-rearing would be covered by gravel fill in Alternative D compared to Alternatives A through C (Table 4D.3.3-3).

Disturbance and Displacement

Under Alternative D, potential disturbance to ptarmigan by vehicular traffic would be reduced compared to Alternatives A through C, while the potential for disturbance from aircraft would be increased by 3 to 6 ptarmigan nests for Sub-Alternative D-1 (Table 4D3.3-1, 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Disturbance due to air traffic would be reduced for Sub-Alternative D-2 affecting an estimated 4 fewer ptarmigan nests (Table 4D.3.3-1 and Table 4D.3.3-2).

Obstruction to Movement

The elimination of the road systems connecting pad sites would likely decrease any potential obstruction to ptarmigan brood movements in the Plan Area compared to Alternatives A through C. Infrastructure and activities under all alternatives would likely have little impact on obstruction of ptarmigan movements.

Mortality

The potential for ptarmigan mortality related to collisions with vehicular traffic in the Plan Area under Alternative D would be reduced compared to Alternatives A through C because of the elimination of most roads. Collisions of ptarmigan with vehicles or machinery could occur on production pads or access roads to airstrips. Ptarmigan mortality could also occur from collisions with buildings, facilities, and pipelines. Ptarmigan may collide with aircraft, and mortality would be increased by the additional airstrips in Alternative D.

Any increase in predator populations would result in increased adult mortality and decreased reproductive success for ptarmigan. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. Mortality caused by avian predators may be reduced in Alternative D compared to Alternatives A and C by reduction in available perching habitat for avian predators with placement of power lines on VSMs. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining, which aggregate in predictable locations year to year, and with low total population sizes.

OPERATION PERIOD

During the operation period under Alternative D, the potential types of impacts to ptarmigan from habitat loss and alteration, disturbance, obstructions to movements, and mortality would be the same as those described above for project construction.

RAPTORS AND OWLS

Raptors are generally uncommon visitors and occasional nesters in the Plan Area. Habitat loss and disturbance resulting from the proposed development in Alternative D are unlikely to affect raptors because of the low numbers of raptors reported in the Plan Area. Gravel roads, buildings, pipelines, and bridges would not obstruct raptor movements. Perches provided by communication towers, buildings, and pipelines at 7 feet may increase the ability of raptors to prey on other waterfowl, shorebirds, passerines, and ptarmigan. The small numbers of raptors and owls that occur in the Plan Area are unlikely to suffer any mortality from collisions with vehicular traffic, buildings, bridges, or pipelines.

SHOREBIRDS

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Under Alternative D, habitat loss associated with gravel roads and mining would be greatly reduced compared to Alternatives A through C because of the elimination of roads connecting pads. Total habitat loss and alteration would be reduced in Alternative D compared to Alternatives A though C because of the smaller area of gravel fill, affecting an estimated 21 to 302 fewer shorebird nests for Sub-Alternative D-1 (Table 4D.3.3-1, 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Habitats used by shorebirds that would be less affected by gravel impacts in Alternative D compared to Alternatives A through Sub-Alternative C-1 are Moist Sedge-Shrub Meadow, Moist Tussock Tundra, and Barrens (Table 4D.3.3-3). Fewer shorebird nests would be affected by Sub-Alternative D-2 than Sub-Alternative D-1 because of the reduced gravel fill for helipads compared to airstrips. In all cases, less than 1 percent of habitats used by shorebirds available in the Colville River Delta and in the National Petroleum Reserve-Alaska portion of the Plan Area would be affected directly and indirectly by gravel fill (Table 4D.3.3-3). Habitat alteration from ice road construction would be increased in Sub-Alternative D-1 compared to Alternative A and B, but would be decreased from Alternative C. Average annual ice road impacts for all alternatives would effect an estimated 46 to 62 shorebird nests (Table 4D.3.3-1, 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). The extent and duration of ice road construction for Sub-Alternative D-2 is uncertain, estimated ice road construction for Sub-Alternative D-1 was used to estimate ice roads for Sub-Alternative D-2 (Table 4D.3.3-1 and Table 4D.3.3-2).

Disturbance and Displacement

Impacts to shorebirds from human activities during summer construction activities at production pads would be limited to the area around production pads. Noise-related impacts associated with aircraft would increase because of the presence of airstrips at all pads; however, no displacement was shown, as indicated by decreased nesting density for shorebird nesting in the vicinity of the ADF-1 airstrip (Johnson et al. 2003a). Disturbance to

staging shorebirds in the lower Colville River Delta would be similar to Alternative A, affecting an estimated 313 shorebirds.

Obstructions to Movements

Potential obstructions to movements of shorebird broods would be nearly eliminated in Alternative D by elimination of roads connecting pads.

Mortality

Potential mortality resulting from collisions with vehicles would be nearly eliminated in Alternative D by the elimination of roads connecting pads. The potential for mortality from collisions with aircraft would be increased in Alternative D with the addition of airstrips at each pad location. Potential mortality from collisions with power lines would be eliminated with the placement of power lines on VSMs instead of poles in Alternative D. Any increase in predator populations attracted to development areas would result in decreased reproductive success for shorebirds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as buff-breasted sandpipers and dunlin. Potential mortality from depredation of adults, nests, and chicks by raptors, owls, or ravens could be increased by providing an increased vantage for predators with the 7-foot pipeline elevation compared to the 5-foot pipeline elevation.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Impacts to shorebirds from habitat loss and alteration would continue during project operations and would be reduced in Alternative D compared to Alternatives A through C because of the decreased gravel fill. Ice roads and tundra travel would be increased in Alternative D compared to Alternatives A through C because of the roadless nature of the alternative.

Disturbance and Displacement

Disturbance from vehicle traffic would be decreased in Alternative D compared to Alternatives A through C because of the elimination of road access to the pads. Disturbance and displacement from airplane noise could be increased in Alternative D by the addition of airstrips at each pad. Shorebirds were not shown to be displaced by the APF-1 airstrip during nesting (Johnson et al. 2003a); however disturbance during staging in the lower Colville River Delta would affect an estimated 313 shorebirds.

Obstructions to Movements

Obstruction to movements of shorebird broods would continue during project operation and would be decreased in Alternative D compared to Alternatives A through C by the elimination of road connections between pads.

Mortality

Mortality resulting from collisions with vehicles would be nearly eliminated in Alternative D because of the elimination of road access to pads. Shorebirds are not likely to collide with aircraft. Mortality resulting from collisions with power lines would be eliminated by the placement of power lines on VSMs. Any increase in predator populations attracted to development areas would result in decreased reproductive success for shorebirds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as buff-breasted sandpipers and dunlin.

SEABIRDS (GULLS, JAEGERS, AND TERNS)

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Under Alternative D, most roads would be eliminated and the amount of tundra covered by gravel and lost as seabird habitat would be reduced compared to Alternatives A through C. Airstrips at each of the proposed sites would increase potential habitat loss in the immediate area of each site other than CD-3, which would remain the same as under Alternative A. Reduction in gravel placement by elimination of the connecting roads would affect an estimated 1 to 9 fewer seabird nests in Sub-Alternative D-1 compared to Alternatives A through Sub-Alternative C-1. Gravel fill would affect fewer acres of Deep Open Water with Islands or Polygonized Margins, and similar amounts of Aquatic Sedge with Deep Polygon habitats, used by nesting and brood-rearing seabirds in Sub-Alternative D-1 compared to Alternatives A through Sub-Alternative C-1 (Table 4D.3.3-3, 4C-1.3.3-2, 4B.3.3-2, and 4A.3.3-3). Elevation of the pipeline from 5 feet to 7 feet could provide perching habitat that would enhance foraging efficiency for seabirds.

Disturbance and Displacement

Disturbance from vehicle traffic would be nearly eliminated in Alternative D compared to Alternatives A through Sub-Alternative C-1 because of the elimination of roads connecting pads. Disturbance from air traffic would be increased in Sub-Alternative D-1 affecting an estimated 4 to 9 additional seabird nests compared to Alternatives A through Sub-Alternative C-1 (Table 4D.3.3-1, 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Replacing the airstrips in Sub-Alternative D-1 with helipads in Sub-Alternative D-2 would affect an estimated 6 fewer seabird nests (Table 4A.3.3-1and Table 4D.3.3-2).

Obstructions to Movement

Obstructions to movements of seabird broods would be decreased in Alternative D compared to Alternatives A through C by the elimination of road connections between pads.

Mortality

Mortality resulting from collisions with vehicles would be nearly eliminated in Alternative D compared to Alternatives A through C by the elimination of roads connecting pads. Mortality from collisions with aircraft would be increased in Alternative D compared to Alternatives A through C with the addition of airstrips at each pad. Mortality from collisions with power lines would be eliminated by placement of all power lines on VSMs. Any increase in predator populations attracted to the development could result in decreased reproductive success for seabirds. The magnitude and extent of this decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as jaegers and arctic tern (Mallek et al. 2003). Mortality from increased depredation on eggs or young could be further exacerbated by increasing the pipeline height from 5 feet to 7 feet, giving raptors, ravens, and seabirds a better vantage point.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration resulting from gravel placement would continue during project operations and would be decreased in Alternative D compared to Alternatives A through C because of the general decrease in gravel fill associated with this alternative.

Disturbance and Displacement

Under Alternative D, disturbance to seabirds from vehicular traffic would be nearly eliminated by the lack of a road system. Disturbance from air traffic would continue during operations for Alternative D.

Obstructions to Movement

Under Alternative D, any potential obstructions to movements of seabird broods related to the presence of gravel roads would be nearly eliminated compared to Alternatives A through C because of the elimination of roads connecting pads.

Mortality

Under Alternative D, the potential for seabird mortality from collisions with vehicular traffic or bridges would be nearly eliminated compared to Alternatives A through C, while mortality resulting from collisions with aircraft would be increased by the addition of airstrips at all pads. Mortality from collisions with power lines would be eliminated with placement of power lines on VSMs in Alternative D. Any increase in predator populations attracted to the development could result in decreased reproductive success for seabirds. The magnitude and extent of this decreased productivity have not been quantified, but would be most detrimental to species with populations which may be declining such as jaegers and arctic tern (Mallek et al. 2003). Mortality from increased depredation on eggs or young could be further exacerbated by increasing the pipeline height from 5 feet to 7 feet, giving raptors, ravens, and seabirds a better vantage point.

PASSERINES

CONSTRUCTION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration due to gravel fill and mining would be reduced in Sub-Alternative D-1 compared to Alternatives A through C by a reduction in gravel fill affecting an estimated 16 to 183 fewer passerine nests (Table 4D.3.3-1, 4C-1.3.3-1, and 4B.3.3-1, 4A.3.3-2). Further reduction in habitat loss with replacement of airstrips with helipads would affect an additional 64 fewer passerine nests (Table 4D.3.3-1 and 4D.3.3-2). Fewer areas of Riverine or Upland Shrub and Moist Sedge-Shrub Meadow habitats used by nesting passerines would be covered by gravel in Alternative D compared to Alternatives A through C. Average annual ice road construction would affect an additional 29 to 35 passerine nests for Alternatives A through D (Table 4D.3.3-1, 4C-1.3.3-1, 4B.3.3-1, and 4A.3.3-2). Communication towers, pipelines, and buildings could provide perches for common ravens and possibly structures for nesting. VSMs and buildings would provide nesting structures for snow buntings.

Disturbance and Displacement

Disturbance from vehicle traffic would be nearly eliminated in Alternative D with the elimination of roads connecting pads. Noise-related impacts associated with aircraft would be increased with the addition of airstrips at all pads; however, no effect on nesting density was found for passerines at the APF-1 airstrip (Johnson et al. 2003a).

Obstructions to Movements

As with Alternatives A through C, proposed development structures are not anticipated to obstruct passerine movements.

Mortality

Mortality resulting from collisions with vehicles would be nearly eliminated in Alternative D compared to Alternatives A through C by the elimination of roads connecting pads. Mortality from collisions with power lines would be eliminated in Alternative D with the placement of power lines on VSMs. Construction of oil production pads may result in an increase in predator species such as foxes, bears, glaucous gulls, and common ravens. Any increase in predator populations could result in increased adult mortality and decreased reproductive success for passerines. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations. Mortality from depredation of adults, nests, and young could be increased by providing a better vantage for predators with a 7-foot elevated pipeline compared to a 5-foot elevated pipeline.

OPERATION PERIOD

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration would continue during project operation and would be reduced in Alternative D compared to Alternatives A through C because of the reduced gravel fill.

Disturbance and Displacement

Disturbance from vehicle traffic would be nearly eliminated in Alternative D compared to Alternatives A through C because of the elimination of roads connecting pads. Disturbance from aircraft would be increased but would be expected to have little or no effect on passerines.

Obstructions to Movements

Operational activities are not anticipated to obstruct movements of passerines.

Mortality

Mortality resulting from collisions with vehicles would be nearly eliminated in Alternative D. Mortality from collisions with power lines would also be nearly eliminated with placement of power lines on VSMs. Construction of oil production pads may result in an increase in predator species such as foxes, bears, glaucous gulls, and common ravens. Any increase in predator populations could result in increased adult mortality and decreased reproductive success for passerines. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations. Mortality from depredation of adults, nests, and chicks by raptors, owls, and common ravens perching on pipelines could be increased with the increased vantage point provided by a 7-foot versus a 5-foot pipeline elevation.

ABANDONMENT AND REHABILITATION

Increased reliance of ice roads under Alternative D would, as in construction, reduce the habitat for nests the summer following ice road use. However, these impacts would be minor. Analogous to impacts incurred from traffic during construction, disturbance by aircraft would be increased, while that by gravel road travel will be essentially eliminated. There would be less continued loss or alteration (depending upon on the type of rehabilitation required) of bird habitat upon abandonment, because there would be fewer acres (approximately 20 fewer under Sub-Alternative D-1, approximately 170 fewer under Sub-Alternative D-2) of gravel fill constructed.

4D.3.3.2 Alternative D – Full-Field Development Scenario Impacts on Birds

Under Alternative D-FFD, roads to production pads would be eliminated and an airstrip (Sub-Alternative D-1) or a helipad (Sub-Alternative D-2) would be constructed at each production pad site. The mechanisms associated with habitat loss and alteration, disturbance and displacement, obstruction to movements, and

mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups would be the same as those described under Alternative A (Section 4A.3.3). Table 4D.3.3-4 and Table 4D.3.3-5 summarize impacts for Alternative D-FFD based on assumptions and calculation methods presented in Section 4A.3.3 for estimated numbers of bird nests affected in the Colville River Delta and the National Petroleum Reserve-Alaska. Total gravel placement would be reduced in Alternative D compared to Alternatives A through C, resulting in reduced habitat loss and alteration.

TABLE 4D.3.3-4 FFD SUB-ALTERNATIVE D-1 - ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION AND DISTURBANCE

BIRD GROUP	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL[a]
COLVILLE RIVER DELTA					
Waterfowl	6	11	8	49	74
Loons	1	2	1	7	11
Ptarmigan	1	1	1	7	10
Raptors and Owls	0	0	0	0	0
Seabirds	1	1	1	7	10
Shorebirds	91	166	131	0	388
Passerines	45	82	64	0	191
Total Birds	**145**	**263**	**206**	**70**	**684**
FISH-JUDY CREEKS					
Waterfowl	31	32	23	180	266
Loons	3	4	3	22	32
Ptarmigan	1	2	1	8	12
Raptors and Owls	0	0	0	0	0
Seabirds	6	7	5	38	56
Shorebirds	148	153	111	0	412
Passerines	97	101	66	0	264
Total Birds	**286**	**299**	**209**	**248**	**1,042**
KALIKPIK-KOGRU RIVERS					
Waterfowl	31	14	32	75	130
Loons	3	2	4	9	16
Ptarmigan	1	1	1	3	6
Raptors and Owls	0	0	0	0	0
Seabirds	2	3	6	16	27
Shorebirds	43	65	153	0	261
Passerines	29	43	100	0	172
Total Birds	**85**	**128**	**296**	**103**	**612**

Notes:
[a] See Section 4A.3.3 for assumptions and calculation methods

TABLE 4D.3.3-5 FFD SUB-ALTERNATIVE D-2 - ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION, AND DISTURBANCE

BIRD GROUP	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL[a]
COLVILLE RIVER DELTA					
Waterfowl	4	3	3	23	33
Loons	1	0	0	4	5
Ptarmigan	1	0	0	3	4
Raptors and Owls	0	0	0	0	0
Seabirds	1	0	39	3	4
Shorebirds	61	42	19	0	142
Passerines	30	21	61	0	70
Total Birds	**98**	**66**		**33**	**258**
FISH-JUDY CREEKS					
Waterfowl	13	8	7	68	96
Loons	2	1	1	8	12
Ptarmigan	1	0	0	3	4
Raptors and Owls	0	0	0	0	0
Seabirds	3	2	1	14	20
Shorebirds	61	41	35	0	137
Passerines	40	27	23	0	90
Total Birds	**120**	**79**	**67**	**93**	**359**
KALIKPIK-KOGRU RIVERS					
Waterfowl	5	4	7	28	44
Loons	1	0	1	3	5
Ptarmigan	0	0	1	1	2
Raptors and Owls	0	0	0	0	0
Seabirds	1	1	1	6	9
Shorebirds	25	18	35	0	78
Passerines	17	12	22	0	51
Total Birds	**49**	**35**	**67**	**38**	**189**

Notes:
[a] See Section 4A.3.3 for assumptions and calculation methods

COLVILLE RIVER DELTA FACILITY GROUP

A summary of the estimated numbers of bird nests affected by habitat loss, alteration, and disturbance due to the hypothetical FFD in the Colville River Delta are presented in Table 4D.3.3-4 for Sub-Alternative D-1 and Table 4D.3.3-5 for Sub-Alternative D-2.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Under Alternative D-FFD, the amount of habitat loss associated with the project compared to Alternatives A through C would be reduced by elimination of the access roads to CD-4 and HP-5 and the road to the Nigliq Channel. However, habitat loss would be increased by construction of airstrips at HP-4, HP-5, and HP-8. Reduction in gravel related habitat impacts would affect an estimated 50 to 289 fewer bird nests for Sub-Alternative D-1 compared to Alternatives A through C (Table 4D.3.3-4, 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4). Further reduction in gravel related impacts result from replacement of airstrips in Sub-Alternative D-1 and with helipads in Sub-Alternative D-2 affecting an estimated 244 fewer bird nests (Table 4D.3.3-5 and Table 4D.3.3-4). Ice road impacts, however, would more than double for Sub-Alternative D-1 effecting an additional

137 to 145 bird nests compared to Alternatives A through C, and for Sub-Alternative D-2 the impacts would continue indefinitely.

DISTURBANCE AND DISPLACEMENT

Under Alternative D-FFD in the Colville River Delta Facility Group, the potential for disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A through C because of the elimination of access roads and the road to Nuiqsut. The potential for disturbance related to aircraft would be increased by the construction of airstrips at all pad locations, which would affect an additional 70 (Sub-Alternative D-1) or 33 (Sub-Alternative D-2) nests (Table 4D.3.3-4 and Table 4D.3.3-5). Disturbance at the HP-14 site would affect the largest brant nesting colony in the Colville River Delta (Figure 3.3.3-4). Disturbance impacts may be especially detrimental to brood-rearing and molting birds due to the energetic requirements associated with molting. The lower Colville River Delta is an important feeding area for post-breeding shorebirds. Foraging flocks of shorebirds would be disturbed and displaced from tidal habitats used in the lower Delta. An estimated 1,250 shorebirds would be potentially displaced by air traffic disturbance from 789 acres of Barrens, Tidal Flat, and Salt Marsh habitats within 500 meters of airstrips at HP-7, HP-12, HP-13, and HP-14.

OBSTRUCTION TO MOVEMENT

Under Alternative D-FFD in the Colville River Delta Facility Group, any potential obstruction to movement related to roads would be nearly eliminated compared to Alternatives A through C.

MORTALITY

Mortality resulting from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A through C FFD by the elimination of access roads to pads and placement of power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at each pad location.

Any increase in predator populations attracted to development areas could result in increased adult mortality and decreased reproductive success for birds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations, with low total population sizes, and which aggregate in predictable locations year to year. Within the Plan Area, species which may be declining include long-tailed ducks (Mallek et al. 2003), red-throated loons (Larned et al. 2003b), buff-breasted sandpipers (Lanctot and Laredo 1994), dunlin, jaegers and arctic tern (Mallek et al. 2003); with low total population sizes include red-throated loons, yellow-billed loons, buff-breasted sandpipers, and dunlin; and colonial nesting species include brant and snow geese.

FISH-JUDY CREEKS FACILITY GROUP

Summaries of the estimated numbers of bird nests affected by the hypothetical FFD in the Fish-Judy Creeks Facility Group are presented in Table 4D.3.3-4 for Sub-Alternative D-1 and Table 4D.3.3-5 for Sub-Alternative D-2.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Under Alternative D-FFD, the amount of habitat loss associated with the project compared to Alternatives A through C would be reduced by elimination of the access roads to CD-4 and HP-5 and the road to the Nigliq Channel, but would be increased by construction of airstrips at HP-4, HP-5, and HP-8. Habitat impacts related to gravel fill would affect an estimated 542 to 1,006 fewer bird nests for Sub-Alternative D-1 compared to Alternatives A through C (Table 4D.3.3-4, 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4). Replacement of airstrips with helipads in Sub-Alternative D-2 affects an additional 386 fewer bird nests compared to Sub-Alternative D-1 in the Fish-Judy Creeks Facility Group (Table 4D.3.3-4 and Table 4D.3.3-5). The requirement for ice roads would

increase the area impacted by ice roads by 4 times affecting an additional 163 to 175 bird nests in the Fish-Judy Creeks Facility Group area (Table 4D.3.3-4, 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4).

DISTURBANCE AND DISPLACEMENT

Under Alternative D-FFD in the Fish-Judy Creeks Facility Group, the potential for disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A through C because of the elimination of access roads. The potential for disturbance related to aircraft would be increased by the construction of airstrips at all pad locations which would affect an estimated 248 (Sub-Alternative D-1) or 93 (Sub-Alternative D-2) nests (Table 4D.3.3-4 and Table 4D.3.3-5). Air traffic disturbance within the 3-mile Fish Creek buffer and at coastal sites HP-3 and HP-15 may be especially detrimental to brood-rearing and molting waterfowl due to the energetic requirements associated with molting.

OBSTRUCTION TO MOVEMENT

Under Alternative D-FFD in the Fish-Judy Creeks Facility Group, any potential obstruction to movement related to roads would be nearly eliminated compared to Alternatives A through C.

MORTALITY

Mortality resulting from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A through C FFD by the elimination of access roads to pads and placement of power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at each pad location.

Any increase in predator populations attracted to development areas could result in increased adult mortality and decreased reproductive success for birds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations, with low total population sizes, and which aggregate in predictable locations year to year. Within the Plan Area, species which may be declining include long-tailed ducks (Mallek et al. 2003), red-throated loons (Larned et al. 2003b), buff-breasted sandpipers (Lanctot and Laredo 1994), dunlin, jaegers and arctic tern (Mallek et al. 2003); with low total population sizes include red-throated loons, yellow-billed loons, buff-breasted sandpipers, and dunlin; and colonial nesting species include brant and snow geese.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

Summaries of the estimated numbers of bird nests affected by the hypothetical FFD in the Kalikpik-Kogru Rivers Facility Group are presented in Table 4D.3.3-4 for Sub-Alternative D-1 and Table 4D.3.3-5 for Sub-Alternative D-2.

HABITAT LOSS, ALTERATION, OR ENHANCEMENT

Under Alternative D-FFD, the amount of habitat loss and alteration associated with gravel placement and mining compared to Alternatives A through C would be reduced by elimination of all access roads in the Kalikpik-Kogru Rivers Facility Group, affecting an estimated 332 to 536 fewer bird nests than Alternatives A through C (Table 4D.3.3-4, 4C-1.3.3-3, 4B.3.3-3, and 4A.3.3-4). Replacing airstrips in Sub-Alternative D-1 and with helipads in Sub-Alternative D-2 would affect an estimated 332 to 536 fewer bird nests (Table 4D.3.3-4 and Table 4D.3.3-5). Ice roads would increase because of the lack of gravel access roads to pads, affecting an additional 215 to 227 bird nests in the Kalikpik-Kogru Rivers Facility Group area (Table 4D.3.3-4).

DISTURBANCE AND DISPLACEMENT

Under Alternative D-FFD in the Kalikpik-Kogru Rivers Facility Group, the potential for disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A to C because of the elimination of

access roads. The potential for disturbance related to aircraft would be increased by the construction of airstrips at all pad locations, which would affect an estimated 103 (Sub-Alternative D-1) or 38 (Sub-Alternative D-2) bird nests (Table 4D.3.3-4 and Table 4D.3.3-5). Air traffic disturbance near the large lakes surrounding HPF-2 and at the coastal HP-22 site may be especially detrimental to brood-rearing and molting waterfowl due to the energetic requirements associated with molting.

OBSTRUCTION TO MOVEMENT

Under Alternative D-FFD in the Kalikpik-Kogru Rivers Facility Group, any potential obstruction to movement related to roads would be nearly eliminated compared to Alternatives A through C.

MORTALITY

Mortality resulting from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A through C FFD by the elimination of access roads to pads and placement of power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at each pad location.

Any increase in predator populations attracted to development areas could result in increased adult mortality and decreased reproductive success for birds. The magnitude and extent of this potential decreased productivity have not been quantified, but would be most detrimental to species with declining populations, with low total population sizes, and which aggregate in predictable locations year to year. Within the Plan Area, species which may be declining include long-tailed ducks (Mallek et al. 2003), red-throated loons (Larned et al. 2003b), buff-breasted sandpipers (Lanctot and Laredo 1994), dunlin, jaegers and arctic tern (Mallek et al. 2003); with low total population sizes include red-throated loons, yellow-billed loons, buff-breasted sandpipers, and dunlin; and colonial nesting species include brant and snow geese.

4D.3.3.3 Alternative D – Summary of Impacts (CPAI and FFD) on Birds

Impacts to birds associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Additional impacts due to lost productivity are not quantified by this analysis, including impacts due to increased nest depredation caused by increased predator populations. We estimated the number of nests effected by habitat loss, alteration or disturbance for each alternative based on site specific nesting densities for bird species and species groups to compare alternative development scenarios. Effects would be localized and no measureable effects to North Slope populations would be expected. CPAI Alternative D would reduce nesting by 2 percent or less for Plan Area waterfowl, loon and seabird populations and less than 1 percent for Plan Area shorebird and passerine populations. FFD Alternative D would reduce nesting by 4 to 8 percent for Plan Area waterfowl, loon and seabird populations and 1 percent for Plan Area shorebird and passerine populations. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice road construction, snow dumping, and snow drifting occurs when nests are not active. Most impacts would be initiated during the construction period, including gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The results of effects of these activities on estimated bird production due to loss, alteration, or disturbance of nesting habitat for Alternative D CPAI Development Plan and the FFD, are presented in Table 4D.3.3-6.

4D.3.3.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Birds

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.3).

4D.3.3.5 Alternative D – Effectiveness of Protective Measures for Birds

The effectiveness of the protective measures would be similar to Alternative A, however, mitigation measures that reduce speeds of ground transportation are not necessary due to the roadless nature of this alternative.

TABLE 4D.3.3-6 CPAI AND FFD ALTERNATIVE D – ESTIMATED NUMBER OF BIRD NESTS POTENTIALLY DISPLACED BY HABITAT LOSS, HABITAT ALTERATION, AND DISTURBANCE

BIRD GROUP	HABITAT LOSS	HABITAT ALTERATION	ICE ROAD HABITAT LOSS	AIR TRAFFIC DISTURBANCE	TOTAL[a]
CPAI DEVELOPMENT PLAN SUB-ALTERNATIVE D-1 TOTALS					
Waterfowl	9	14	9	70	102
Loons	1	2	1	8	12
Ptarmigan	1	1	1	6	9
Seabirds	2	2	1	9	14
Shorebirds	55	106	58	0	219
Passerines	31	56	34	0	121
Total Nests	**99**	**181**	**104**	**93**	**477**
CPAI DEVELOPMENT PLAN SUB-ALTERNATIVE D-2 TOTALS					
Waterfowl	3	3	4	28	38
Loons	0	1	1	3	5
Ptarmigan	0	1	0	2	3
Seabirds	1	0	1	3	5
Shorebirds	19	24	25	0	68
Passerines	11	12	15	0	38
Total Nests	**34**	**41**	**46**	**36**	**157**
FFD SUB-ALTERNATIVE D-1 TOTALS					
Waterfowl	46	57	63	304	470
Loons	5	8	8	38	59
Ptarmigan	3	4	3	18	28
Seabirds	9	11	12	61	93
Shorebirds	282	384	395	0	1,061
Passerines	171	226	230	0	627
Total Nests	**516**	**690**	**711**	**421**	**2,338**
FFD SUB-ALTERNATIVE D-2 TOTALS					
Waterfowl	22	15	17	119	173
Loons	4	1	2	15	22
Ptarmigan	2	0	1	7	10
Seabirds	5	3	2	23	33
Shorebirds	147	101	109	0	357
Passerines	87	60	64	0	211
Total Nests	**267**	**180**	**195**	**164**	**806**

Notes:
[a] See Section 4A.3.3 Birds for assumptions and calculation methods

4D.3.4 Mammals

4D.3.4.1 Terrestrial Mammals

SUB-ALTERNATIVES D-1 AND D-2 – CPAI DEVELOPMENT PLAN IMPACTS ON TERRESTRIAL MAMMALS

The primary characteristic of Alternative D (Figure 2.4.4-1) with regard to potential impacts on terrestrial mammals is the lack of roads (except access roads from airstrips to CD-4 and CD-5 in Sub-Alternative D-1). Pipelines in Alternative D would be elevated to at least 7 feet, and Alternative D would include new airstrips

(Sub-Alternative D-1) or helipads (Sub-Alternative D-2) at CD-3 through CD-7. There would be more gravel fill at the production pads/airstrips (221 acres) compared to Alternative A. There would be 20 fewer total acres of gravel fill under Sub-Alternative D-1 (221 acres) than under Alternative A (241 acres). Sub-Alternative D-2 would have helipads instead of airstrips and would have a total of only 71 acres of gravel fill.

CONSTRUCTION PERIOD

Direct Habitat Loss, Alteration, or Enhancement

Under Alternative D no permanent roads would connect drilling pads or processing facilities, and airstrips would be constructed adjacent to five of the production sites. There would be 20 fewer acres of gravel fill and mining in Sub-Alternative D-1 (and 170 fewer acres in Sub-Alternative D-2), than in Alternative A. Loss of habitat during construction of pipelines from ice roads would be similar to Alternative A. See the Operation Period section under Alternative D for quantification of habitat types lost or altered under gravel fill.

Disturbance and Displacement

Because there is almost no road construction under Alternative D, disturbance and displacement effects on terrestrial mammals during the construction phase would be reduced compared to Alternatives A, B, and C. There would be pipeline construction but greatly reduced hauling and placing of gravel. This will reduce the noise and vehicle traffic significantly compared to the other alternatives. Construction at the production sites and airstrips would include gravel fill, so potential disturbance at these sites would parallel that described in Alternative A.

Obstruction to Movements

During the construction phase, there would be some traffic on ice roads during construction of pads, pipelines, and airstrips. The duration and extent of traffic would be considerably less than in the other alternatives with road construction. This would result in less obstruction of movements of caribou that winter in the Plan Area than under the other alternatives.

Mortality

Vehicle collisions with terrestrial mammals would be fewer under Alternative D than the other alternatives because of the reduced extent of road construction. Mortality to small mammals is expected to be reduced by the elimination of gravel placement for roads.

OPERATION PERIOD

Direct Habitat Loss, Alteration, or Enhancement

Direct habitat loss under Alternative D would be substantially less than the other alternatives because of the lack of gravel roads. However, 221 acres of gravel fill would be placed for Sub-Alternative D-1 (and 71 acres for Sub-Alternative D-2), some of which might provide insect-relief habitat. Gravel fill at airstrips would probably not provide insect relief because, for aircraft safety, animals would not be allowed to stay on the airstrips. During winter throughout the life of the project, ice roads would be constructed for ground access to production pads throughout the Plan Area every few years, causing temporary loss of foraging habitat in winter.

The two most important foraging habitat types for caribou in summer are Moist Sedge-Shrub Meadow and Moist Tussock Tundra (Lawhead et al. 2003, Russell et al. 1993, Jorgenson et al. 2003c). The Barrens habitat type primarily provides insect relief to caribou in summer (Jorgenson et al. 2003c). The most important habitat types for muskoxen include the Riverine, Upland Shrub, and Moist Sedge-Shrub Meadow habitat types (PAI 2002a; BLM and MMS 2003a, and references therein). These habitat types, as well as Barrens, are the most important habitat types for grizzly bears (Shideler and Hechtel 2000; Jorgenson et al. 2003c; PAI 2002a, and

references therein). The Riverine and Upland Shrub habitat types are also the most important habitat types for moose. These habitat types potentially lost from gravel fill (roads, pads and airstrips) under Alternative D are quantified below.

A total of 2,927 acres of Moist Sedge-Shrub Meadow is available in the Colville River Delta (Table 4A.3.3-3). The total area of Moist Sedge-Shrub Meadow in the habitat-typed area of the National Petroleum Reserve-Alaska is 42,071 acres (Table 4A.3.3-3). A total of 14.0 acres (0.6 acre in the Colville River Delta; 13.4 acres in the National Petroleum Reserve-Alaska) of Moist Sedge-Shrub Meadow would be lost as a result of gravel placement (roads, pads, and airstrips) under Sub-Alternative D-1 (there would be no loss of Moist Sedge-Shrub Meadow in the Colville River Delta and 1.7 acres lost in the National Petroleum Reserve-Alaska for Sub-Alternative D-2) (Tables 4D.3.1-2 and 4D.3.1-4). The potential loss of Moist Sedge-Shrub Meadow habitat type from gravel fill under either Sub-Alternative D-1 or D-2 is less than 0.1 percent of that available on the Colville River Delta. The potential loss under gravel fill in the habitat-typed area in the National Petroleum Reserve-Alaska is less than 0.1 percent of the Moist Sedge-Shrub Meadow habitat type available in that area. In addition to gravel fill, 42.4 acres (5.1 acre in the Colville River Delta; 37.3 acres in the National Petroleum Reserve-Alaska) of Moist Sedge-Shrub Meadow would be altered by dust fallout under Sub-Alternative D-1 (no loss of Moist sedge-Shrub Meadow in the Colville River Delta and 5.1 acres lost in the National Petroleum Reserve-Alaska) (Tables 4D.3.1-2 and 4D.3.1-4).

The combined area of riverine and upland shrub habitats in the Colville River Delta is 7,994 acres (Table 4A.3.3-3). The combined area of riverine and upland shrub habitats in the National Petroleum Reserve-Alaska is 49,647 acres (Table 4A.3.3-3). A total of 2.8 acres (2.7 acres in the Colville River Delta and 0.1 acres in the National Petroleum Reserve-Alaska) of riverine and upland shrub habitats would be lost as a result of gravel placement (roads, pads, and airstrips) under Sub-Alternative D-1 (1.4 acres in the Colville River Delta under Sub-Alternative D-2) (Table 4D.3.1-2 and 4D.3.1-4). No riverine and upland shrub habitats would be lost or altered in the National Petroleum Reserve-Alaska under Sub-Alternative D-2 (Table 4D.3.1-4). The potential loss of riverine and upland shrub habitats is less than 0.1 percent of that available on the Colville River Delta and in the National Petroleum Reserve-Alaska in the case of Sub-Alternative D-1. In addition to gravel fill, 15.6 acres of riverine and upland shrub habitats in the Colville River Delta and 0.7 acres in the National Petroleum Reserve-Alaska would be altered by dust fallout under Sub-Alternative D-1 (7.7 acres in the Colville River Delta and no altered acreage in the National Petroleum Reserve-Alaska under Sub-Alternative D-2) (Tables 4D.3.1-2 and 4D.3.1-4).

A total of 525 acres of Moist Tussock Tundra habitat type is available in the Colville River Delta (Table 4A.3.3-3). The total area of Moist Tussock Tundra in the habitat-typed area of the National Petroleum Reserve-Alaska is 49,647 acres (Table 4A.3.3-3). No Moist Tussock Tundra would be lost or altered in the Colville River Delta under Sub-Alternative D-1 or D-2 (Tables 4D.3.1-2 and 4D.3.1-4). A total of 93.0 acres of Moist Tussock Tundra would be lost as a result of gravel placement (roads, pads, and airstrips) in the National Petroleum Reserve-Alaska (Tables 4D.3.1-2 and 4D.3.1-4) under Sub-Alternative D-1 (25.4 acres for Sub-Alternative D-2). No acreage would be lost in the Colville River Delta under either alternative. The potential habitat loss in the National Petroleum Reserve-Alaska cannot be calculated because a habitat map is not available for the entire area. However, the potential loss under gravel fill in the area in the National Petroleum Reserve-Alaska for which there is habitat-typing is less than 0.1 percent of that available in that area. In addition to gravel fill, 140.1 acres of Moist Tussock Tundra habitat type would be altered by dust fallout in the National Petroleum Reserve-Alaska under Sub-Alternative D-1 (24.5 acres under Sub-Alternative D-2) (Table 4D.3.1-2).

The total area of Barrens habitat type in the Colville River Delta is 19,440 acres (PAI 2002a). The total area of Barrens in the habitat-typed area of the National Petroleum Reserve-Alaska is 1,698 acres (Jorgenson et al. 2003c). A total of 0.3 acres (0.2 acres under Sub-Alternative D-2) of Barrens habitat type would be lost as a result of gravel placement (roads, pads, and airstrips) in the Colville River Delta, and no Barrens would be lost or altered in the National Petroleum Reserve-Alaska under either Sub-Alternative D-1 or D-2 (Table 4D.3.1-2). The potential loss of Barrens habitat is less than 0.1 percent of that available in the Colville River Delta. In

addition to gravel fill in the Colville River Delta, 3.4 acre of Barrens habitat type would be altered by dust fallout under Sub-Alternative D-1 (3.3 acres under Sub-Alternative D-2) (Table 4D.3.1-2).

Disturbance and Displacement

Without roads, and therefore with no vehicle traffic, disturbance and displacement of terrestrial mammals would be primarily at production pads and adjacent airstrips/helipads under Alternative D. Air traffic would be a source of disturbance to caribou, moose, bears, and muskoxen (Miller and Gunn 1984, TAPS Owners 2001a). Five new airstrips in Sub-Alternative D-1 (and helipads in Sub-Alternative D-2) would result in more aircraft disturbance year-round than in the other alternatives. Traffic on ice roads between the production sites could disturb caribou or denning bears in the winter. This could also apply to muskoxen and moose, but these species are not common in the Plan Area in the winter. Summer use of low-ground-pressure vehicles throughout the Plan Area would cause some disturbance of terrestrial mammals. This traffic would be considerably less frequent than the vehicle traffic on gravel roads in the other alternatives. There could be less disturbance and displacement of terrestrial mammals under Alternative D because there would be no road access by local residents.

Obstruction to Movements

Sub-Alternatives D-1 and D-2 would include construction of access roads to airstrips at CD-4 and CD-5. There would be 33 miles of pipeline elevated to 7 feet, none of which would have an accompanying road (Figure 2.4.4-1). Because elevated pipelines without roads do not usually obstruct caribou movements, this would allow free passage of caribou and probably muskoxen and moose. There could still be some deflection or delay in crossing under pipelines, but it would be less than in the alternatives with road/pipeline combinations. The other alternatives have considerable amounts of road/pipeline combination (Alternative A, 26 miles; Alternative B, 10 miles; and Alternative C, 42 miles) that could result in some obstruction of caribou movements.

Mortality

The potential for animal-vehicle collisions would be greatly reduced under Alternative D and would be limited to winter ice roads and the short roads from airstrips to production pads. Collisions on ice roads would be primarily with caribou, because grizzly bears are in dens and moose and muskoxen are uncommon in the Plan Area in winter. Mortality from increased hunter access on roads would be eliminated. Some disturbance of denning grizzly bears could occur near production pads and airstrips. Bear-human conflicts or exposure to harsh winter conditions following den abandonment could result in mortality of adults or cubs.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON TERRESTRIAL MAMMALS

The primary characteristic of Alternative D with regard to effects on terrestrial mammals is the lack of roads connecting facilities, and the airstrips at each facility. The pipeline routes are the same as those of Alternative A, but pipelines would be elevated to 7 feet. Access to the production sites would be restricted to industry only because of the lack of roads.

The total amount of gravel fill under Sub-Alternative D-1 would be 1,101 acres versus 1,262 acres for Alternative A. Sub-Alternative D-2 would have 545 total acres of gravel fill. Because neither detailed site locations nor habitat mapping are available, we cannot quantify specific terrestrial mammal habitat lost under Alternative D-FFD. However, Alternative D-2 has the smallest acreage covered with gravel of the four FFD scenarios and the smallest direct loss of vegetated habitat. A large proportion of the Sub-Alternative D-1 gravel would be airstrips and would probably not be used extensively by caribou for insect relief because they would be chased off for aircraft safety.

COLVILLE RIVER DELTA FACILITY GROUP

Direct Habitat Loss, Alteration, or Enhancement

The differences between Alternative D and the other alternatives would be primarily the reduced amount of gravel fill under the roadless Alternative D. As with Alternative A, there would be seven new production sites with associated airstrips in this group. Alternative D would not differ appreciably from Alternatives A and B, which have limited new roads in this group of sites. Alternative D would have much less new road than would Alternative C.

Disturbance and Displacement

The lack of roads with traffic and lack of access by local residents would minimize disturbance under Alternative D compared to Alternative C, which would have new roads to all sites in this facility group. There would be disturbance associated with increased aircraft and low-ground-pressure vehicle traffic and activity on pads, but the level across the sites in the Colville River Delta would be low compared with other areas and alternatives with more extensive roads. This would include less disturbance of denning grizzly bears, caribou during the summer insect season, and muskoxen and moose in the riparian areas.

Obstruction to Movements

The roadless nature of Alternative D, combined with pipelines elevated 7 feet, would minimize obstructions to movement of terrestrial mammals in the Colville River Delta Facility Group. There could be some deflection along the pipelines or around facilities and airstrips, but it would be predictably less than in the alternatives with roads between the facilities.

Mortality

The lack of roads under Alternative D would result in a minimum level of vehicle-animal collisions. Other mortality from hunting and human-animal interactions would also be minimized because of limited access to the Plan Area.

FISH-JUDY CREEKS FACILITY GROUP

Direct Habitat Loss, Alteration, or Enhancement

Alternative D has no new roads in this group of sites, while Alternatives A and C have extensive roads and Alternative B has an intermediate amount of roads. This would result in the minimum amount of habitat lost in Alternative D compared with the other alternatives.

Disturbance and Displacement

The lack of roads with traffic and lack of access by the public and local residents would minimize disturbance under Alternative D. There would be disturbance associated with increased air traffic and activity on pads, but the level across the Plan Area would be substantially reduced without roads. This would include less disturbance of calving caribou that may extend eastward into the Fish-Judy Creeks Facility Group and caribou on summer and winter ranges in this area. Grizzly bears in dens would experience less disturbance with the lack of road traffic, as would moose and muskoxen in the riparian areas. There would still be some level of disturbance associated with the production sites and airstrips in the Fish-Judy Creeks Facility Group.

Obstruction to Movements

The roadless nature of Alternative D, combined with pipelines elevated 7 feet, would minimize obstructions to movement of terrestrial mammals. There could be some deflection along the pipelines or around facilities and

airstrips, but it would be predictably less than in Alternatives A through C, which would have roads between the facilities.

Mortality

The lack of roads under Alternative D would result in a minimum level of vehicle-animal collisions. Other mortality from hunting and human-animal interactions would also be minimized because of limited access to the Plan Area.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

Direct Habitat Loss, Alteration, or Enhancement

Alternative D has no new roads in this group of sites, while Alternatives A and C have extensive roads and Alternative B has an intermediate amount of roads. This would result in the minimum amount of habitat lost in Alternative D compared to the other alternatives.

Disturbance and Displacement

The lack of roads with traffic and lack of access by the public and local residents would minimize disturbance under Alternative D. There would be disturbance associated with increased air traffic and activity on facility pads, but the level across the area would be substantially reduced without roads. This would include fewer disturbances of calving caribou in the northwest part of the Plan Area and of caribou on summer and winter ranges in this area. Grizzly bears in dens would experience fewer disturbances from the lack of road traffic, as would moose and muskoxen in the riparian areas. There would still be some level of disturbance associated with the production sites and airstrips in the Kalikpik-Kogru Rivers Facility Group.

Obstructions to Movement

The roadless nature of Alternative D, combined with pipelines elevated 7 feet, would minimize obstructions to movement of terrestrial mammals. There could be some deflection along the pipelines or around facilities and airstrips, but it would be predictably less than in the alternatives with roads between the facilities.

Mortality

The lack of roads under Alternative D would result in a minimum level of vehicle-animal collisions. Other mortality from hunting and human-animal interactions would also be minimized because of limited access to the area.

ABANDONMENT AND REHABILITATION

Abandonment and rehabilitation activities and the amount of habitat ultimately left altered upon abandonment would be substantially less under this alternative than any of the other alternatives. Somewhat greater disturbance would occur at or near CD-4 through CD-7 under this alternative because of the need to remove more facilities and remove and/or rehabilitate larger acreages of gravel fill (larger production pads, airstrips, and roads between pads and airstrips).

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON TERRESTRIAL MAMMALS

CPAI Development Plan Sub-Alternative D-1 would cover 221 acres of undeveloped land with gravel fill. This is a small percentage of the land in the Plan Area, and is 20 acres less than Alternative A (170 acres less for Sub-Alternative D-2). The amount of habitat types preferred by caribou, muskoxen, and moose that would be affected by this fill is a small proportion of that available in the Plan Area. Alternative D would result in the

smallest loss of habitats of the six alternatives. This is a small direct loss of terrestrial mammal habitat, compared to that available in the Plan Area.

Disturbance, obstruction of movements, and mortality impacts of Alternative D would be similar to those described for Alternative A. However, these impacts would be of considerably less magnitude in Alternative D than in Alternative A because of the lack of road/pipeline combinations and associated vehicle traffic, and the elevation of pipelines to 7 feet. Alternative D would have airstrips or helipads at each development site, so disturbance and obstruction of movements would occur there. Access in Alternative D would be restricted to industry, so the disturbance and hunting mortality from access by local residents would not occur. The potential positive and negative aspects of hunting mortality described for Alternative A would not occur.

Impacts from Alternative D-FFD would be the same as those described for the CPAI Development Plan over a larger area. An exception is the potential for increased disturbance of calving caribou of the TCH in the northwestern part of the Plan Area.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR TERRESTRIAL MAMMALS

Potential mitigation measures for Alternative D would be generally the same as those described for Alternative A. The lack of roads alongside the pipelines between any of the production sites and elevation of pipelines to 7 feet might make buried pipeline sections unnecessary.

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR TERRESTRIAL MAMMALS

The effectiveness of the protective measures would be similar to Alternative A, however, mitigation measures that call for the separation of the pipeline and road are not necessary due to the roadless nature of this alternative.

4D.3.4.2 Marine Mammals

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON MARINE MAMMALS

Characteristics of Alternative D that could affect marine mammals include the burying of the pipeline across the Nigliq Channel, the lack of roads, and increased air traffic.

RINGED SEAL AND BEARDED SEAL

The impacts to ringed seals expected under Alternative D would differ from those expected under Alternative A. There could be more disturbances from increased air traffic. Aircraft traffic is a potential source of disturbance to ringed seals hauled out on the ice in spring. However, aircraft are expected to maintain an elevation greater than 1,000 feet, except on takeoff and landing, under the MMPA. At that elevation, the potential for disturbance to ringed seals is greatly reduced and impacts to ringed seals would not be expected to increase compared to Alternative A.

There would not be the potential for enhanced hunter access to ringed seal habitat, as there is in the other alternatives, because of the lack of roads in Alternative D.

SPOTTED SEALS

Routing the pipeline underneath the Nigliq Channel using HDD instead of the pipeline/vehicle bridge in the other alternatives would eliminate disturbance to spotted seals in the channel. However, elimination of roads requires increased aircraft traffic to access all pads. Aircraft landing and takeoff plans call for aircraft to remain at 1,000 feet altitude until 3.6 miles from the airstrip on landing, and to climb to 1,000 feet within 1 mile of

takeoff. Thus, aircraft would cross the Nigliq Channel at a minimum of 1,000 feet altitude. At such elevation, the potential to disturb spotted seals is substantially reduced. Thus, no additional impacts to spotted seals are expected to result from the increased aircraft traffic under Alternative D.

There would not be enhanced access to spotted seal habitat for hunters under Alternative D, so this impact described in the other alternatives would not occur.

POLAR BEARS

The impacts to polar bears expected under Alternative D might differ from those expected under Alternative A. The elimination of roads would require additional aircraft flights to access all production pads and the construction of ice roads every few years during operations. The additional aircraft flights would increase the disturbance to non-denning polar bears during the winter. The construction of ice roads every few years could increase disturbance to female polar bears denning within approximately 1 mile of the roads. Current regulations require a buffer of 1 mile around known and suspected polar bear dens and those regulations appear to be sufficient to prevent disturbance to denning bears. The number of bears affected would depend on the number of bears denning in the Plan Area. During recent years, few polar bears have denned within the Plan Area, and there is no reason to believe that the number of bears that den there would increase. Thus, impacts to polar bears as a result of increased ice road construction are expected to be minimal.

The lack of roads in Alternative D would reduce potential bear-human conflict and would not enhance hunter access in the Plan Area.

BELUGA WHALES

Routing the pipeline underneath Nigliq Channel via HDD and elimination of the pipeline/vehicle bridge would eliminate disturbance to beluga whales in the channel that might have been caused by construction and use of the bridge. However, elimination of roads requires increased aircraft traffic to access all pads. Several flights per week would be necessary to transport personnel and equipment across the Nigliq Channel to CD-5, CD-6, and CD-7. Aircraft landing and takeoff plans call for aircraft to remain at 1,000 feet altitude within 3.6 miles from the airstrip on landing and to climb to 1,000 feet within 1 mile of takeoff. Thus, aircraft would cross Nigliq Channel at a minimum of 1,000 feet altitude. At such elevation, the potential to disturb beluga whales is substantially reduced. Thus, no additional impacts to beluga whales are expected to result from the increased aircraft traffic under Alternative D. Hunter access to the Plan Area would not be enhanced in Alternative D because of the lack of roads. This would result in no new impacts on belugas from hunting.

ABANDONMENT AND REHABILITATION

Increased aircraft flights over the lower Colville Delta could increase disturbance of marine mammals. If minimum altitudes of 1,000 feet are maintained these impacts would be substantially reduced.

ALTERNATIVE D – FFD SCENARIO IMPACTS ON MARINE MAMMALS

Full-Field development under Alternative D has no new roads to production sites. When compared to Alternative A, impacts from Alternative D-FFD would be less during summer because of the elimination of vehicular traffic. Aircraft access to all production pads would be required, which could increase the disturbance of ringed seals hauled out on the ice, as well as disturbance of spotted seals and beluga whales in the Colville River Delta and the delta of Fish and Judy creeks. Additional aircraft traffic could increase the disturbance of non-denning polar bears.

The ice road construction required every few years would still have the potential to affect ringed seals if the ice road is constructed over water greater than 3 meters deep. If ice roads connecting pads other than CD-3 (construction of ice roads to CD-3 would be required under all alternatives other than Alternative C) were constructed along a coastal route, the potential to disturb ringed seals would be greater than if the ice roads were

constructed over land. The impacts to ringed seals would be the same as under Alternative A, but the probability of occurrence would be greater, depending on how often ice roads were built.

ALTERNATIVE D - SUMMARY OF IMPACTS (CPAI AND FFD) ON MARINE MAMMALS

Alternative D would have minimal impacts on marine mammals because of the lack of roads and no local or public access. Noise from construction and increased air traffic may cause disturbance of marine mammals as described for Alternative A.

Impacts from Alternative D – FFD would be the same as those described for CPAI over a larger area.

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR MARINE MAMMALS

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.4.2).

ALTERNATIVE D – EFFECTIVENESS OF PROTECTIVE MEASURES FOR TERRESTRIAL MAMMALS

The effectiveness of the protective measures would be similar to Alternative A.

4D.3.5 Threatened and Endangered Species

4D.3.5.1 Bowhead Whale

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON BOWHEAD WHALE

Bowhead whales are generally not found in the Plan Area. Activities that would occur in the Plan Area under this alternative would not affect the bowhead whale population, habitat, migration, foraging, breeding, survival and mortality, or critical habitat.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON BOWHEAD WHALE

Marine sealifts through the Beaufort Sea could be required to transport drilling or processing facilities under FFD. In this case, there is potential for impacts on bowhead whales. Impacts to bowheads could result from noise, pollution, displacement from the migration corridor, and vessel strikes. However, the use of docks was determined not to be a practical means of developing the facilities proposed by CPAI or during future development (Section 2.6.4), so this impact could be unlikely. If shipments in support of the ASDP are made to the existing West Dock, they can be timed for periods when bowheads are not present in the area. Aircraft noise could also disturb bowheads.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON BOWHEAD WHALE

No potential impacts from CPAI Development Plan Alternative D are expected. Under Alternative D – FFD, there is potential for disturbance due to increased air traffic compared to Alternative A.

ALTERNATIVE D – RECOMMENDED MITIGATION MEASURES (CPAI AND FFD) FOR BOWHEAD WHALE

Oil spill prevention and cleanup capabilities are appropriate mitigation measures to reduce potential impacts to bowheads. In the event of sealifts to transport material to the FFD sites, measures to minimize disturbance of, or

strikes to migrating whales by vessels would be appropriate. Flight altitude restrictions in the nearshore environment would minimize disturbance from air traffic.

4D.3.5.2 Spectacled Eider

See discussions of impacts on spectacled eiders in Section 4A.3.5.2 for additional descriptions of impact mechanisms and for description of impact calculation assumptions and methods.

ALTERNATIVE D – CPAI DEVELOPMENT PLAN IMPACTS ON SPECTACLED EIDER

Table 4A.3.5-1 presents the estimated number of spectacled eider nests displaced as a result of habitat loss, alteration and disturbance for the CPAI Development Plan Alternative D. In CPAI Alternative D, facilities would be in the same locations as Alternative A and power lines on poles would be replaced by power lines on cable trays on VSMs.

Under Alternative D the potential for the project to affect spectacled eider habitat loss and alteration at CD-3 would be the same as under Alternative A. For CD-4, CD-5, CD-6, and CD-7 there would be a decrease in potential spectacled eider habitat loss because of the elimination of the road system and reduced gravel fill. No spectacled eider nests were reported in the vicinity of the proposed pads, access roads, or airstrips in the CD-6 and CD-7 areas, but spectacled eider nests were reported in the vicinity of the CD-3, CD-4, and CD-5 sites (Burgess et al. 2003a, 2003b).

CONSTRUCTION PERIOD

Habitat Loss and Alteration

Gravel placement and mining for the construction of airstrips or helipads would reduce nesting habitat loss in Alternative D compared to Alternatives A through F. Habitat loss and alteration would affect an estimated 0.6 spectacled eider nests for Sub-Alternative D-1 and 0.1 spectacled eider nests for Sub-Alternative D-2. The types of impacts associated with gravel placement for spectacled eiders in Alternative D would be the same as those described under Alternative A.

In the Colville River Delta, Aquatic Sedge with Deep Polygons habitat used by pre-nesting, nesting, and brood-rearing spectacled eiders would have consistent impacts across Alternatives D, A, B, and F (Table 4A.3.5-2). Patterned Wet Meadow habitats in the Colville River Delta used by nesting and brood-rearing spectacled eiders would be covered by more gravel fill in Alternative D than in Alternatives A, B, and F, but fill would cover less of this habitat in Alternative C (Table 4A.3.5-2). In the National Petroleum Reserve-Alaska portion of the Plan Area, gravel related habitat impacts would be reduced in Alternative D for Old Basin Wetland Complex and Shallow Open Water with Islands habitats preferred by pre-nesting eiders and used by nesting spectacled eiders compared to Alternatives A through F (Table 4A.3.5-3). Gravel related impacts for Patterned Wet Meadow habitat used by nesting spectacled eiders in the National Petroleum Reserve-Alaska portion of the Plan Area would be reduced in Alternative D compared to Alternatives A, C, and F. In all instances, habitat impacts would affect less than 1 percent of habitats available in the Colville River Delta and in the National Petroleum Reserve-Alaska portion of the Plan Area that are used by spectacled eiders (Table 4A.3.5-2 and Table 4A.3.5-3).

Disturbance and Displacement

Fewer spectacled eiders would be displaced by vehicle traffic in Alternative D compared to Alternatives A, B, C, and F as a result of the elimination of any road connections between facilities. Addition of the airstrips or helipads at CD-5, CD-6, and CD-7 would cause additional disturbance compared to Alternatives A, B, C, and F, affecting an estimated 1.4 spectacled eider nests for Sub-Alternative D-1 and 0.6 spectacled eider nests for Sub-Alternative D-2 (Table 4A.3.5-1). This additional disturbance would generally occur in areas with low spectacled eider densities at CD-4, CD-5, CD-6, and CD-7.

Obstructions to Movement

Potential obstruction of movement would be nearly eliminated in Alternative D compared to Alternatives A through F by the removal of connecting roads between all facilities. The general reduction in gravel fill and reduction in vehicle traffic would result in a reduction in potential obstruction of movements for brood-rearing spectacled eiders.

Mortality

The elimination of connecting roads between pads would nearly eliminate potential mortality from collisions with vehicles in Alternative D compared to Alternatives A through F. Mortality from collisions with aircraft would be increased in Alternative D compared to Alternatives A through F with the additions of airstrips or helipads at all pads.

Spectacled eider nesting success in the Plan Area was generally low (33 percent) (Johnson et al. 2004). Any increase in predator populations attracted to the development areas would result in decreased reproductive success for spectacled eiders. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified, but would be most detrimental to spectacled eiders because they are known to nest in specific locations year after year and have a low total population size. The potential for increased nest and duckling depredation from raptors and ravens would be reduced in Alternative D compared to Alternatives A and C by the placement of all power lines on VSMs. Increasing the pipeline elevation to 7 feet rather than 5 feet in Alternatives A and C could lead to increased predator efficiency from the higher vantage point.

OPERATIONAL PERIOD

Habitat Loss and Alteration

Some habitat loss or alteration from snowdrifts, gravel spray, dust fallout, thermokarst, and ponding would continue during project operation. These impacts would be reduced in Alternative D compared to Alternatives A, B, C, and F because of the reduced amount of gravel fill (Table 4A.3.5-2 and Table 4A.3.5-3). Habitat alterations from dust fallout would be reduced in Alternative D compared to Alternatives A, B, C, and F by the near elimination of vehicle traffic because of the elimination of connecting roads. Habitat alterations caused by low-ground-pressure vehicles during summer or winter and annual ice roads during drilling would be increased in Alternative D compared to Alternatives A, B, C, and F because of the lack of road access to all facilities.

Disturbance and Displacement

Under Alternative D, disturbance to spectacled eiders from vehicular traffic would be nearly eliminated by elimination of the road system. Some disturbance related to vehicular traffic and machinery could occur along access roads from the well pads to the airstrips at each site. The potential for disturbance would be greatest at the CD-3 site, where spectacled eiders are known to nest and at CD-4 with the extended access road to the airstrip. The potential for disturbance related to air traffic at the CD-3 site under Alternative D would be the same as under Alternative A. At all other sites, the potential for aircraft-related disturbance would be increased compared to Alternatives A, B, C, and F because of the addition of airstrips at each of these sites. The potential for impacts to affect spectacled eiders would be greatest at the CD-4 and CD-5 sites where eiders have been reported nesting (Burgess et al. 2003a, 2003b; Johnson et al. 2004). Disturbance from air traffic would affect an estimated 1.4 spectacled eider nests in Sub-Alternative D-1 and 0.6 spectacled eider nests in Sub-Alternative D-2.

Obstructions to Movement

Under Alternative D, any potential obstruction to spectacled eider brood movements in the CD-3 area would be the same as that discussed above for Alternative A. At the proposed National Petroleum Reserve-Alaska sites

and CD-4, potential obstructions from road placement to spectacled eider brood movements would be reduced because of the reduction in roads in this alternative.

Mortality

Under Alternative D, the potential for spectacled eider mortality related to collisions with vehicular traffic would be virtually eliminated because of the elimination of roads under this alternative. There would be a potential for collisions of eiders with vehicles along access roads between production pads and roads, but collisions would be unlikely. The potential for spectacled eider mortality from collisions with aircraft would be increased under Alternative D compared to Alternatives A, B, C, and F. Mortality from collisions with power lines would be eliminated by placement of all power lines on VSMs. Mortality from collisions with buildings, towers, and elevated pipelines, particularly during periods of poor visibility, would be similar among alternatives.

ALTERNATIVE D – FULL-FIELD DEVELOPMENT SCENARIO IMPACTS ON SPECTACLED EIDER

The mechanisms associated with habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups would be the same as those described under Alternative A. Table 4A.3.5-4 summarizes potential impacts for Alternative D-FFD based on nesting spectacled eider densities in the Colville River Delta and the National Petroleum Reserve-Alaska.

The mechanisms associated with habitat loss and alteration, disturbance and displacement, obstruction to movements, and mortality for birds in the Colville River Delta, Fish-Judy Creeks, and Kalikpik-Kogru Rivers facility groups would be the same as those described under Alternative A (Section 4A.3.5.2). Potential impacts are summarized for Alternative D-FFD based assumptions and calculation methods presented in Section 4A.3.5.2 for estimated numbers of spectacled eider nests affected in the Colville River Delta and the National Petroleum Reserve-Alaska. Under Alternative D of the FFD roads to production pads would be eliminated and an airstrip would be constructed at each pad site. The proposed facilities for FFD would be the same as those discussed for the FFD under Alternative A. The effects of FFD on spectacled eiders would depend on the location and extent of development in specific locations within each area. Habitat-related impacts by vegetation class for FFD Alternative D are summarized in Tables 4D.3.5-1 and 4D.3.5-2 by facility group.

COLVILLE RIVER DELTA FACILITY GROUP

Table 4A.3.5-4 presents a summary of the estimated numbers of spectacled eider nests affected by the hypothetical FFD, including the Colville River Delta.

Habitat Loss, Alteration, or Enhancement

Habitat loss and alteration resulting from gravel placement and mining would be reduced in Alternative D-FFD compared to Alternatives A, B, and C – FFD Scenario. Habitat related impacts would affect an estimated 3.0 spectacled eider nests in Sub-Alternative D-1, and 1.2 spectacled eider nests in Sub-Alternative D-2 (Table 4A.3.5-4). Total habitat alteration from ice road construction and tundra travel would be increased from Alternatives A, B, and C FFD because of the lack of road access to all facilities. Ice road construction for Sub-Alternative D-2 would continue for 100 years. The 7-foot pipeline elevation could decrease the amount of snow drifting and the resulting habitat alteration. Vegetation classes used by spectacled eiders that would receive decreased gravel fill related impacts in Sub-Alternative D-1 compared to Alternatives A, B, and C are Fresh Grass Marsh and Wet Sedge Meadow Tundra (Table 4D.3.5-1, 4C.3.5-1, 4B.3.5-1, and 4A.3.5-5). Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts in Sub-Alternative D-1 compared to Alternatives A, B, and C are Deep Polygon Complex, Salt-killed Wet Meadow and Halophytic Sedge Wet Meadow (Table 4D.3.5-1, 4C.3.5-1, 4B.3.5-1, and 4A.3.5-5).

Disturbance and Displacement

Under Alternative D-FFD in the Colville River Delta area, disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A, B, and C FFD by the elimination roads connecting all pads. The potential for disturbance related to aircraft would be increased compared to Alternatives A, B, and C FFD because of the construction of airstrips at all production pads. The addition of airstrips and helipads at all pads would affect an estimated 6.0 spectacled eider nests in Sub-Alternative D-1 and 2.8 spectacled eider nests in Sub-Alternative D-2 (Table 4A.3.5-4). The greatest effects of disturbance to spectacled eiders likely would be in the CD-3 and HP-5, areas where spectacled eiders are more abundant (Figure 3.3.5.2-1).

Obstruction to Movement

The removal of access roads would reduce any potential obstruction of brood-rearing spectacled eiders in Alternative D-FFD compared to Alternatives A, B, and C FFD.

Mortality

Mortality from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A, B, and C FFD by the elimination of access roads to pads and placement of all power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at all pad locations. Any increase in predator populations would result in decreased reproductive success for spectacled eiders. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified.

FISH-JUDY CREEKS FACILITY GROUP

A summary of the estimated number of spectacled eider nests affected by the hypothetical FFD including the Fish-Judy creeks is presented in Table 4A.3.5-4.

Habitat Loss, Alteration, or Enhancement

Under Alternative D-FFD in the Fish-Judy Creeks Facility Group, the overall amount of habitat loss would be reduced compared to Alternatives A, B, and C because of the decrease in the road system. Habitat related impacts would affect an estimated 1 spectacled eider nests in Sub-Alternative D-1 and 0.3 spectacled eider nests in Sub-Alternative D-2 (Table 4A.3.5-4). Habitat loss from the construction of airstrips would be most likely to affect spectacled eiders near the HP-1 and HP-15 sites where eider densities appear to be higher (Figure 3.3.5.2-1). Total habitat alteration from ice road construction and tundra travel would be increased from Alternatives A, B, and C FFD because of the lack of road access to all facilities. The 7-foot pipeline elevation could decrease the amount of snow drifting and the resulting habitat alteration. Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts in Sub-Alternative D-1 compared to Alternatives A, B, and C are Fresh Grass Marsh, Old Basin Wetland Complex and Wet Sedge Meadow Tundra (Table 4D.3.5-1, 4C.3.5-1, 4B.3.5-1, and 4A.3.5-5). Vegetation classes used by spectacled eiders that would receive increased gravel fill related impacts in Sub-Alternative D-1compared to Alternatives A, B, and C are Fresh Sedge Marsh and Deep Polygon Complex (Table 4D.3.5-1, 4C.3.5-1, 4B.3.5-1, and 4A.3.5-5).

Disturbance and Displacement

Under Alternative D-FFD in the Fish-Judy Creeks Facility Group, disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A, B, and C FFD by the elimination of connecting roads between pads. The potential for disturbance related to aircraft would be increased compared to Alternatives A through C FFD because of the construction of airstrips at all production pads. Disturbance related to air traffic would affect an estimated 2.0 spectacled eider nests in Sub-Alternative D-1 and 0.7 spectacled eider nests in Sub-Alternative D-2 (Table 4A.3.5-4).

Obstruction to Movement

The removal of connecting roads between facilities would reduce any potential obstruction of brood-rearing spectacled eiders in Alternative D-FFD compared to Alternatives A, B, and C FFD.

Mortality

Mortality from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A, B, and C FFD by the elimination of connecting roads between facilities and placement of all power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at all pad locations. Any increase in predator populations would result in decreased reproductive success for spectacled eiders. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

A summary of the estimated number of spectacled eider nests affected by the hypothetical FFD including the Kalikpik-Kogru Rivers Facility Group is presented in Table 4A.3.5-4.

Habitat Loss, Alteration, or Enhancement

Under Alternative D-FFD, the potential for habitat loss and alteration to affect spectacled eiders in the Kalikpik-Kogru Rivers Facility Group would be reduced compared to Alternatives A, B, and C because of the reduction in gravel fill related impacts. Habitat loss from the construction of airstrips may be most likely to affect spectacled eiders near the HP-20 and HPF-2 sites in the Kalikpik-Kogru Rivers Facility Group where eider densities appear to be higher (Figure 3.3.5.2-1). Increased ice road construction resulting from the elimination of road access and summer tundra travel would increase habitat alteration during construction and drilling for Sub-Alternative D-1,compared to Alternatives A, B, and C – FFD Scenario. Impacts related to habitat loss and alteration would affect an estimated 0.6 spectacled eider nests in Sub-Alternative D-1 and 0.2 spectacled eider nests in Sub-Alternative D-2. Habitat impacts for vegetation classes used by spectacled eiders would be decreased for Fresh Sedge Marsh and Wet Sedge Meadow Tundra and increased for Fresh Sedge Marsh and Deep Polygon Complex compared to Alternatives A, B, and C FFD (Table 4D.3.5-1, 4C.3.5-1, 4B.3.5-1, and 4A.3.5-5). The 7-foot pipeline elevation could decrease the amount of snow drifting and the resulting habitat alteration.

Disturbance and Displacement

Under Alternative D for FFD in the Kalikpik-Kogru Rivers Facility Group area, disturbance from vehicular traffic would be nearly eliminated compared to Alternatives A, B, and C FFD by the elimination of roads connecting facilities. The potential for disturbance related to aircraft would be increased compared to Alternatives A, B, and C FFD because of the construction of airstrips at all production pads. The addition of airstrips and helipads at all pads would affect an estimated 0.8 spectacled eider nests in Sub-Alternative D-1 and 0.3 spectacled eider nests in Sub-Alternative D-2 (Table 4A.3.5-4). The greatest potential for disturbance to spectacled eiders in the Kalikpik-Kogru Rivers Facility Group could occur at the HP-20 and HPF-2 sites where spectacled eider densities appear to by higher (Figure 3.3.5.2-1).

Obstruction to Movement

The removal of connecting roads between facilities would reduce any potential obstruction of brood-rearing spectacled eiders in Alternative D-FFD compared to Alternatives A, B, and C FFD.

Mortality

Mortality from collisions with vehicles and power lines would be nearly eliminated in Alternative D-FFD compared to Alternatives A, B, and C FFD as a result of the elimination of connecting roads between facilities and placement of all power lines on VSMs. Mortality from collisions with aircraft would be increased by the addition of airstrips at all pad locations. Any increase in predator populations would result in decreased reproductive success for spectacled eiders. This is particularly true for increased glaucous gull, common raven, bear and arctic fox populations. The magnitude and extent of decreased productivity have not been quantified.

ALTERNATIVE D – SUMMARY OF IMPACTS (CPAI AND FFD) ON SPECTACLED EIDER

Impacts to spectacled eiders associated with construction and operation of the proposed development include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Spectacled eiders occur in greater numbers near proposed developments in the Colville River Delta than in the National Petroleum Reserve-Alaska portion of the Plan Area. Additional impacts due to lost productivity were considered but are not quantified by this analysis, including impacts due to increased nest depredation caused by increased predator populations. The Project Team estimated the number of nests effected by habitat loss, alteration and disturbance for each alternative based on site specific nesting densities for spectacled eiders to compare alternative development scenarios. Effects would be localized, and no measureable effects to North Slope populations would be expected. CPAI Sub-Alternative D-1 would reduce nesting by 4 percent for Plan Area spectacled eiders and Sub-Alternative D-2 would reduce nesting by 2 percent. FFD Sub-Alternative D-1 would reduce nesting by 28 percent for Plan Area spectacled eiders and FFD Sub-Alternative D-2 would reduce nesting by 14 percent. FFD Sub-Alternative D-1 and D-2 would reduce nesting by less than 1 percent for the North Slope population. Habitat loss does not involve the direct loss of active nests because winter gravel placement, ice road construction, snow dumping, and snow drifting occurs when nests are not active. Most impacts would be initiated during the construction period, including gravel placement, grading of the gravel surface, placement of all facilities, and initial drilling. The results of effects of these activities on estimated spectacled eider production due to loss, alteration, or disturbance of nesting habitat for Alternative B, CPAI Development Plan is presented in Table 4A.3.5-1 and for the FFD is presented in Table 4A.3.5-4. Impacts from CPAI Alternatives A through F on habitats used by spectacled eiders are summarized in Table 4A.3.5-2 and Table 4A.3.5-3. Summaries of vegetation classes affected directly and indirectly by gravel fill for FFD Sub-Alternative D-1 are presented in Table 4D.3.5-1 and for FFD Sub-Alternative D-2 are presented in Table 4D.3.5-2.

TABLE 4D.3.5-1 SUB-ALTERNATIVE D-1 – SUMMARY OF AFFECTED VEGETATION CLASSES FOR FFD USED BY SPECTACLED EIDERS

VEGETATION CLASSES	COLVILLE RIVER DELTA FACILITIES GROUP[a]		FISH-JUDY CREEKS FACILITY GROUP[a]		KALIKPIK-KOGRU RIVERS FACILITY GROUP[a]		GRAND TOTAL	PLAN AREA TOTALS[b]		SPECTACLED EIDER HABITATS
	LOSS (ACRES)	ALTERATION (ACRES)	LOSS (ACRES)	ALTERATION (ACRES)	LOSS (ACRES)	ALTERATION (ACRES)		ACRES	PERCENT AFFECTED	
Riverine Complex	0.0	0.0	0.4	0.6	0.0	0.0	1.0	698.3	<1%	
Fresh Grass Marsh	0.7	1.3	3.6	5.4	0.7	1.1	12.8	2583.7	<1%	√
Fresh Sedge Marsh	<0.1	0.1	43.7	65.2	21.7	32.7	163.5	40953.6	<1%	√
Deep Polygon Complex	7.0	12.7	63.2	94.2	21.9	32.9	231.9	55208.0	<1%	√
Young Basin Wetland Complex	0.0	0.0	26.3	39.2	10.6	15.9	92.0	22910.8	<1%	
Old Basin Wetland Complex	0.0	0.0	16.5	24.6	0.0	0.0	41.1	15674.5	<1%	√
Wet Sedge Meadow Tundra	120.1	220.0	129.0	192.1	95.8	144.2	901.2	185820.8	<1%	√
Salt-Killed Wet Meadow	20.7	37.8	0.0	0.0	0.0	0.0	58.5	6368.7	1%	√
Halophytic Sedge Wet Meadow	15.3	28.0	0.0	0.0	0.0	0.0	43.3	4453.2	1%	√
Halophytic Grass Wet Meadow	0.4	0.7	0.0	0.0	0.0	0.0	1.1	398.3	<1%	√
Moist Sedge-Shrub Tundra	9.9	18.1	56.5	84.1	0.0	0.0	168.6	44405.7	<1%	
Tussock Tundra	1.8	3.2	195.4	291.1	79.9	120.3	691.7	208178.9	<1%	
Dryas Dwarf Shrub Tundra	0.4	0.7	3.1	4.6	0.0	0.0	8.8	1358.6	1%	
Cassiope Dwarf Shrub Tundra	0.0	0.0	5.2	7.7	4.2	6.3	23.4	7734.0	<1%	
Halophytic Willow Dwarf Shrub Tundra	0.1	0.2	0.0	0.0	0.0	0.0	0.3	143.1	<1%	√
Open and Closed Low Willow Shrub	24.4	44.7	6.8	10.1	<0.1	<0.1	86.2	13557.3	1%	
Open and Closed Tall Willow Shrub	0.0	0.0	2.3	3.4	0.0	0.0	5.7	687.2	1%	
Dune Complex	0.0	0.0	11.8	17.6	2.7	4.1	36.2	5913.9	1%	
Partially Vegetated	15.0	27.4	5.4	8.0	2.3	3.4	61.5	10149.3	1%	
Barrens	56.8	104.0	13.5	20.1	6.0	9.1	209.5	44009.2	<1%	
Totals	**272.4**	**499.0**	**582.7**	**868.0**	**245.8**	**370.0**	**2837.9**	**671207.1**	**<1%**	

Notes:
[a] Totals from Table 4D.3.1-5
[b] Totals from Table 3.3.1-1 (no data, shadows and water categories not included)

TABLE 4D.3.5-2 SUB-ALTERNATIVE D-2 – SUMMARY OF AFFECTED VEGETATION CLASSES FOR FFD USED BY SPECTACLED EIDERS

VEGETATION CLASSES	COLVILLE RIVER DELTA FACILITIES GROUP[a]		FISH-JUDY CREEKS FACILITY GROUP[a]		KALIKPIK-KOGRU FACILITY GROUP[a]		GRAND TOTAL	PLAN AREA TOTALS[b]		SPECTACLED EIDER HABITATS
	LOSS (ACRES)	ALTERATION (ACRES)	LOSS (ACRES)	ALTERATION (ACRES)	LOSS (ACRES)	ALTERATION (ACRES)		ACRES	PERCENT AFFECTED	
Riverine Complex	0.0	0.0	0.1	0.2	0.0	0.0	0.3	698.3	<1%	
Fresh Grass Marsh	0.5	0.3	1.4	1.4	0.4	0.3	4.3	2583.7	<1%	√
Fresh Sedge Marsh	<0.1	<0.1	16.4	17.3	12.6	9.1	55.6	40953.6	<1%	√
Deep Polygon Complex	4.7	3.2	23.7	25.0	12.7	9.2	78.5	55208.0	<1%	√
Young Basin Wetland Complex	0.0	0.0	9.9	10.4	6.1	4.4	30.8	22910.8	<1%	
Old Basin Wetland Complex	0.0	0.0	6.2	6.5	0.0	0.0	12.7	15674.5	<1%	√
Wet Sedge Meadow Tundra	80.8	55.5	48.4	50.9	55.6	40.1	331.0	185820.8	<1%	√
Salt-Killed Wet Meadow	13.9	9.6	0.0	0.0	0.0	0.0	23.5	6368.7	<1%	√
Halophytic Sedge Wet Meadow	10.3	7.1	0.0	0.0	0.0	0.0	17.4	4453.2	<1%	√
Halophytic Grass Wet Meadow	0.3	0.2	0.0	0.0	0.0	0.0	0.5	398.3	<1%	√
Moist Sedge-Shrub Tundra	6.7	4.6	21.2	22.3	0.0	0.0	54.8	44405.7	<1%	
Tussock Tundra	1.2	0.8	73.3	77.1	46.4	33.5	232.3	208178.9	<1%	
Dryas Dwarf Shrub Tundra	0.2	0.2	1.2	1.2	0.0	0.0	2.8	1358.6	<1%	
Cassiope Dwarf Shrub Tundra	0.0	0.0	1.9	20.	2.4	1.7	8.0	7734.0	<1%	
Halophytic Willow Dwarf Shrub Tundra	0.1	<0.1	0.0	0.0	0.0	0.0	0.2	143.1	<1%	√
Open and Closed Low Willow Shrub	16.4	11.3	2.6	2.7	<0.1	<0.1	33.2	13557.3	<1%	
Open and Closed Tall Willow Shrub	0.0	0.0	0.8	0.9	0.0	0.0	1.7	687.2	<1%	
Dune Complex	0.0	0.0	4.4	4.7	1.6	1.1	11.8	5913.9	<1%	
Partially Vegetated	10.1	6.9	2.0	2.1	1.3	0.9	23.3	10149.3	<1%	
Barrens	38.2	26.3	5.1	5.3	3.5	2.5	80.9	44009.2	<1%	
Totals	**183.3**	**126.0**	**218.6**	**230.0**	**142.8**	**103.0**	**1003.7**	**671207.1**	<1%	

Notes:
[a] Totals from Table 4D.3.1-6
[b] Totals from Table 3.3.1-1 (no data, shadows and water categories not included)

ALTERNATIVE D – POTENTIAL MITIGATION MEASURES (CPAI AND FFD) FOR SPECTACLED EIDER

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.3.5.2).

4D.3.5.3 Steller's Eider

This section describes the potential impacts of the ASDP on threatened Steller's eiders. Impacts to other bird groups associated with the proposed development are described in Section 4A.3.3 and can be referred to for more detailed description of the mechanisms of specific impacts. In general, impacts to Steller's eider potentially are the same as those described for spectacled eider under all of the alternatives. However, the likelihood of impacts occurring to Steller's eider is very small, even under FFD scenarios, because Steller's eiders occur very rarely in the Plan Area. Still, there would be a loss of potential Steller's eider habitat from the ASDP. Given the current distribution of Steller's eider in the Plan Area, it is unlikely that any of the project alternatives would have impacts on this species.

4D.3.5.4 Abandonment and Rehabilitation

The impacts of abandonment and rehabilitation on threatened and endangered species would be similar to those for Alternative A because there would be little or no change in activities in the area of highest use by these species.

4D.3.5.5 Alternative D – Effectiveness of Protective Measures for Threatened and Endangered Species

The effectiveness of the protective measures would be similar to Alternative A.

4D.4 SOCIAL SYSTEMS

4D.4.1 Socio-Cultural Characteristics

4D.4.1.1 Alternative D – CPAI Development Plan Impacts on Socio-Cultural Characteristics

Socio-cultural impacts under the Alternative D – CPAI Development Plan would generally be similar to those under the Alternative A – CPAI Development Plan with the following differences.

Under Alternative D roads have been eliminated and replaced with airstrips or helipads at pad and processing facility locations. These changes in infrastructure would likely change the nature but not necessarily the extent of impacts to subsistence harvest activities in the Plan Area. However, to the extent that these changes do result in increased impacts to subsistence harvest, indirect impacts to community health and welfare could also result.

ABANDONMENT AND REHABILITATION

Impacts will be similar to those under Alternative A, however, it is less likely that Nuiqsut residents would have become accustomed to using the oilfield roads to access subsistence resources.

4D.4.1.2 Alternative D – Full-Field Development Scenario Impacts on Socio-Cultural Characteristics

Socio-cultural impacts under Alternative D – Full-Field Development Scenario are expected to be the same as those under Alternative A – Full-Field Development Scenario with the following differences.

Under Alternative D, roads have been eliminated and replaced with airstrips or helipads at pad and processing facility locations. These changes in infrastructure would likely change the nature but could not necessarily change the extent of impacts to subsistence harvest activities in the Plan Area. However, to the extent that these changes do result in increased impacts to subsistence harvest, indirect impacts to community health and welfare could also result.

4D.4.1.3 Alternative D – Summary of Impacts (CPAI and FFD) on Socio-Cultural Characteristics

Impacts to socio-cultural characteristics under Alternative D – CPAI Development Plan and FFD are generally expected to be the same as those under the Alternative A – CPAI Development Plan and FFD. Exceptions under Alternative D are changes in impacts related to subsistence harvest that could result from the general elimination of roads in the Plan Area.

4D.4.1.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Socio-Cultural Characteristics

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.1).

4D.4.1.5 Alternative D – Effectiveness of Protective Measures for Socio-Cultural Characteristics

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.2 Regional Economy

4D.4.2.1 Alternative D – CPAI Development Plan Impacts on Regional Economy

There is no information to lead to the assumption that overall oil production for Alternative D – CPAI Development Plan would vary materially from the estimates given in Section 4A.4.2, for Alternative A. Because the economic impacts are directly related to oil production, the economic impacts of Alternative D would be similar to those determined for Alternative A.

The substantial reduction in the use of roads and substitution of airstrips would reduce the amount and associated costs of road construction. This reduction would be offset by increased costs for airstrip construction. Capital costs for Sub-Alternative D-1 would be approximately $123 million (11.6 percent) more than Alternative A. Capital Costs for Sub-Alternative D-2 would be approximately $496 million (46.7 percent) more than Alternative A. The large cost increase for Sub-Alternative D-2 is related to the cost of drilling. To the extent that local residents are employed as equipment operators during construction, some reduction in employment opportunities could occur. However, the potential reduction in construction costs and associated employment is expected to be small.

ABANDONMENT AND REHABILITATION

Employment created by removing facilities and rehabilitation the land may be comparable to that during construction if gravel fill is removed. Once oil ceases to flow from the satellites and termination activities are complete, economic stimulus from the satellites—with the exception of relatively insignificant employment from monitoring and long-term rehabilitation—would cease.

4D.4.2.2 Alternative D – Full-Field Development Scenario Impacts on Regional Economy

There is no information to lead to the assumption that overall oil production for Alternative D – FFD would vary materially from the estimates given in Section 4A.4.2, for Alternative A. Because the economic impacts

are directly related to oil production, the economic impacts of FFD under Alternative D would be similar to those determined for FFD under Alternative A.

4D.4.2.3 Alternative D – Summary of Impacts (CPAI and FFD) on Regional Economy

Overall economic impacts of Alternative D would be the same as those determined for Alternative A.

4D.4.2.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Regional Economy

Potential mitigation is the same as that proposed for Alternative A (CPAI and FFD). See Section 4A.4.2.

4D.4.2.5 Alternative D – Effectiveness of Protective Measures for Regional Economy

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.3 Subsistence

4D.4.3.1 Alternative D – CPAI Development Plan Impacts on Subsistence

CONSTRUCTION PERIOD

Pipeline lengths would be shorter because of more direct routing of pipelines. Production pad CD-6 and its associated airstrip or helipad and pipeline would be within the stipulated 3-mile sensitive area along Fish Creek, as in Alternative A, with effects similar to those for Alternative A. Each pad would have an airstrip or helipad, which would potentially increase air traffic during the construction phase, possibly deflecting caribou, wolves, and wolverines (Section 4D.3.4). Ice roads used during construction would also likely deflect caribou, wolves, and wolverines during high-traffic periods, as noted in Section 4D.3.4. However, these high-traffic periods could be short during the construction period. Alternative D proposes the annual construction of an ice bridge across the Nigliq Channel. Ice roads and bridges could also impound water and segment fish and waterfowl habitats in the event of delayed meltdown, changing the distribution and availability of some waterfowl and fish species for subsistence uses (Sections 4D.3.2 and 4D.3.3).

Construction period activities would deflect subsistence uses away from construction areas. Caribou, wolf, and wolverine would be deflected away from areas of land, air traffic, and construction noise (Section 4D.3.4). The HDD pipeline crossing of the Nigliq Channel would likely have less direct impact on fish during construction than the bridge proposed in Alternative A (Section 4D.3.2). Subsistence resource users would avoid activity areas during the construction phase for safety reasons, but could use the ice road system to gain access to subsistence use areas.

The following increases in the effects on subsistence uses in the area would occur: the annual ice bridge over the Nigliq Channel would alter availability of waterfowl nesting habitat through late melt-out and change water flows; increased cross-tundra travel would disturb or deflect subsistence resources; and an increase in air traffic would deflect subsistence resources. Effects from construction are expected to last 5 years and be primarily local in extent.

Construction would affect availability of key subsistence resources because of wildlife disturbance and would occur in seasonal and general use areas for key subsistence resources that are used for more than one season each year, have been used for multiple generations, and are used for multiple resources each year. Effects from construction would occur in key geographic areas relative to other areas of subsistence availability and would affect individual subsistence users, groups of users, and the overall pattern of community subsistence uses. Access to key subsistence-use areas could be affected because of hunter perception of regulatory barriers, as well as safety concerns. Construction and operation of these facilities would contribute to the perception by

Nuiqsut residents that they are surrounded by development. Competition for subsistence resources between communities could increase temporarily as hunters move from traditional subsistence-use areas to avoid industrial activity.

OPERATION PERIOD

Direct effects to subsistence resource availability during operation of the facility would be similar to those described for Alternative A, with the differences described below. The lack of roads connecting the pads would decrease ground traffic-induced deflection of caribou, wolf, and wolverine except during winter, and would reduce waterfowl and caribou disturbance during spring and summer. However, the likely increase in cross-tundra travel would deflect subsistence resources in the summer. Furthermore, in the area of the pads, disturbance to waterfowl, caribou, wolf, and wolverine would increase because of the increase in air traffic, consisting of either fixed or rotary wing aircraft (Section 4D.3.3 and Section 4D.3.4).

As discussed in Section 4A.4.3, airstrip operation would disturb and temporarily displace subsistence species (caribou and spotted seals) from the vicinity of airstrip and landing areas. According to scoping testimony, low-altitude flights (helicopter and scientific survey flights) divert subsistence species from air transport corridors and survey transects (Section 4A.4.3). Nuiqsut mayor Rosemary Ahtuangaruak described the displacements of subsistence species by aircraft and its effect on hunters:

> "When I went camping last year, I waited 3 days for the herd, to have a helicopter to divert them away from us. When they were diverted, we went without. We have had to deal with harassment. We had over flights three times while trying to cut the harvest. It is disturbing. The next year we had a helicopter do the same thing, but it was worse. They were carrying a sling going from Alpine to Meltwater, another oilfield. It went right over us three times. The herd was right there and it put us at risk. I had my two young sons with me and it made me very angry. What am I to do when the activities that have been handed down for thousands of years to our people are being changed by the global need for energy?" (Mayor Rosemary Ahtuangaruak 2003 ASDP Scoping, Nuiqsut)

In the winter, periodic construction of ice roads to the pads would have localized effects on caribou, wolf, and wolverine during the construction, operation, and high-traffic periods (Section 4D.3.4). Under Alternative D, an increase of the pipeline height from 5 feet to a minimum of 7 feet would result in less deflection of caribou and increased access for subsistence users.

During operations, depending on aircraft flight elevations, Alternative D would have fewer direct effects on subsistence resource availability than would Alternative A, except near the proposed production pads, where increased air traffic could deflect subsistence resources, and periodically along ice roads constructed to link the pads. The potential for increased cross-tundra traffic, especially to the extent that it occurs in the summer, would limit the potential benefits of removing the all-weather roads and road vehicle traffic. The road connecting CD-4 to the runway with its associated fill of shallow lakes and surface depressions, and the proposed construction of the Sakoonang Channel bridge, could cause disturbance to local fish habitat and reduce availability in that area (Section 4D.3.2). The location of CD-6 and its associated airstrip and pipeline within the Fish and Judy creeks sensitive area could deter subsistence users from summer caribou harvests in the area. However, access to this important subsistence-use area would not be reduced during summer. Winter subsistence access could be enhanced by the periodic presence of ice roads, potentially expanding the subsistence range of Nuiqsut subsistence resource users. However, periods of high traffic on the ice roads could reduce subsistence resource availability in the area of the roads.

ABANDONMENT AND REHABILITATION

There would be substantially less infrastructure to remove under Alternative D than under Alternative A. Consequently, there would be less disruption of subsistence resources or users during the dismantlement and removal phase.

4D.4.3.2 Alternative D – Full-Field Development Scenario Impacts on Subsistence

Impacts caused by the FFD scenario are analyzed in a more general way than those for the CPAI scenario because of the hypothetical nature of the scenario. For assessment of impacts to subsistence from the FFD scenario, the Plan Area is divided into groups: the Colville River Delta Facility Group, Fish-Judy Creeks Facility Group, and the Kalikpik-Kogru Rivers Facility Group. The Alternative D-FFD scenario is discussed in Section 2.4.4 and Figure 2.4.4-2. Further study of subsistence resource availability would be necessary for a complete analysis of the FFD scenario.

COLVILLE RIVER DELTA FACILITY GROUP

Under Alternative D, the effects of FFD in the Colville River Delta Facility Group would be the same as under Alternative A during both construction and operation, with the exception of the reduced effects to subsistence by reducing the amount of roads between pads and by raising pipeline minimum height to 7 feet, and the increased local effects near production pads because of the increase in air traffic and the impact between pads of cross-tundra travel. Air traffic increases in this area would likely disturb or deflect seals, caribou, wolf, wolverine, and waterfowl in this group.

FISH-JUDY CREEKS FACILITY GROUP

Under Alternative D, the effects of FFD in this group would be similar to those of Alternative A, with the same exceptions as noted above for the Colville River Delta Facility Group. Hypothetical HP-1 and HP-3 production pads are close to important subsistence harvest camps on the Fish and Judy creeks, and Tingmeachsiovik River. Construction and operation at these production pads would deflect subsistence resources and users because of disturbance of the subsistence resources, subsistence users' perceptions of regulatory barriers, and reluctance to shoot firearms near industrial facilities for safety reasons.

KALIKPIK-KOGRU RIVERS FACILITY GROUP

Impacts of development in the Kalikpik-Kogru Rivers Facility Group would be similar to those listed for the Alternative A FFD, with the same exceptions as noted above for the Colville River Delta Facility Group.

4D.4.3.3 Alternative D – Summary of Impacts (CPAI and FFD) on Subsistence

Effects from construction and operation for the Alternative D and FFD Scenario would be similar to those from the Alternative A – Full-Field Development Scenario, except for the differences described above. Effects from construction and operation for Alternative D (CPAI and FFD) are expected to continue for the life of the development, and are expected to be primarily local in extent for the Alternative D CPAI Development Plan and regional in extent for the Alternative D-FFD scenario. Construction and operation would affect availability of key subsistence resources because of deflection or displacement of these resources from customary harvest locations. During operation, aircraft traffic, depending on frequency and flight elevation, would be the primary influence on resource availability. Access to subsistence resources would be affected by pipelines, especially in the winter because of snowdrifts (mitigated by 7-foot pipelines that allow for less obstruction to terrestrial mammals and subsistence hunters), hunter avoidance of pads and industrial areas, the perception of regulatory barriers, the reluctance to shoot rifles in the vicinity of industrial development, and a preference for animals not habituated to industrial development. As noted in NRC (2003:156), "Even where access is possible, hunters are often reluctant to enter oilfields for personal, aesthetic, or safety reasons. There is thus a net reduction in the available area, and this reduction continues as the oilfields spread."

Indirect effects would include hunters going to other areas that would result in harvesting in traditional places less often and increased effort, costs, and risk associated with traveling farther. Alternative D would occur in seasonal and general use areas for key subsistence resources that are used for multiple seasons each year, have been used for multiple generations, and are used for multiple resources each year. Effects from construction and

operation would occur in key geographic areas relative to other areas of subsistence availability and would affect individual subsistence users, groups of users, and the overall pattern of Nuiqsut subsistence uses. The construction and operation of this alternative would contribute to Nuiqsut residents' perceptions of being surrounded by development. Competition for certain resources among Nuiqsut, Anaktuvuk Pass, Barrow, and Atqasuk would increase as Nuiqsut hunters avoid traditional subsistence-use areas closer to Nuiqsut and travel to farther outlying areas.

4D.4.3.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Subsistence

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.3.4), except that pipelines would already be a minimum of 7 feet high.

4D.4.3.5 Alternative D – Effectiveness of Protective Measures for Subsistence

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.4 Environmental Justice

4D.4.4.1 Introduction

The basis for identifying disproportionate impacts to minority and low-income populations is described in Section 4A.4.4.

4D.4.4.2 Alternative D – Disproportionate Impacts (CPAI and FFD) on Environmental Justice

Disproportionate impacts under Alternative D (CPAI and FFD) are expected to be the same as those under Alternative A for both cases (Section 4A.4.4 on Disproportionate Impacts). The absence of roads between facilities incorporated in Alternative D could reduce access and the potential for impacts to subsistence harvest in Nuiqsut traditional use areas. However, increased use of aircraft to serve these facilities could have some limited offsetting noise impacts.

4D.4.4.3 Abandonment and Rehabilitation

Impacts will be similar to Alternative A.

4D.4.4.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Environmental Justice

Potential mitigation measures to reduce or avoid disproportionate impacts would be the same as those identified and discussed for Alternative A (Section 4A.4.4).

4D.4.4.5 Alternative D – Effectiveness of Protective Measures for Environmental Justice

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.5 Cultural Resources

4D.4.5.1 Alternative D – CPAI Development Plan Impacts on Cultural Resources

Despite the elimination of roads, addition of airstrips or helipads, and the increased size of the production pad footprint, development under this alternative would have approximately the same impacts as Alternative A. No additional documented cultural resources are in the immediate vicinity of the proposed operational facilities,

roads, or pipelines. Section 106 consultation should assure that Alternative D would have no direct effect and negligible indirect effect on known cultural resources during construction and operation. The substantially reduced need for gravel, particularly under the helipad option (D-2) of this alternative, would reduce the risk of impacts to unknown cultural resources below that of any other alternative.

ABANDONMENT AND REHABILITATION

It is unlikely that cultural resources would be impacted by abandonment activities.

4D.4.5.2 Alternative D – Full-Field Development Scenario Impacts on Cultural Resources

This alternative would have approximately the same impacts as Alternative A to known cultural resources. Because substantially less gravel would be used in this alternative, the risk to cultural resources from gravel extraction would be reduced.

4D.4.5.3 Alternative D – Summary of Impacts (CPAI and FFD) on Cultural Resources

Impacts resulting from implementation of Alternative D are similar to those of Alternative A. Those cultural resource sites that could be affected along with the impacts to those resources under Alternative D are the same as Alternative A. Any project facility or pad within 1/4 mile of a cultural resource could result in direct effects including damage to or destruction of the resource during construction of the proposed pad.

The integrity of subsurface, surface, and aboveground cultural resources could be significantly affected by construction activities. Unknown or undocumented cultural resources could be situated in the proposed ROWs or footprints of Alternative D (CPAI and FFD) components. If cultural resources were discovered as a result of construction, development, or operation activities under the proposed CPAI plan, activity would be stopped until the SHPO is consulted and an evaluation of the resource can be carried out.

4D.4.5.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Cultural Resources

Potential mitigation measures would be the same as those identified for Alternative A (Section 4A.4.5).

4D.4.5.5 Alternative D – Effectiveness of Protective Measures for Cultural Resources

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.6 Land Uses and Coastal Management

4D.4.6.1 Alternative D – CPAI Development Plan Impacts on Land Uses and Coastal Management

LAND OWNERSHIP AND USES

Development of the Alternative D – CPAI Development Plan and the two variants, Sub-Alternates D-1 and D-2, would affect the same landowners as described for Alternative A. Implementation of these developments would not change ownership status on lands within the Plan Area but would happen under negotiated leases. In addition, Kuukpik Corporation is still able to select lands, and those lands would likely be within the oil reserves. As previously stated, those lands selected are under BLM jurisdiction until patented.

The proposed development of oil production satellites and related facilities under Alternative D would result in less total area developed within the Plan Area compared to Alternative A. The ASDP under Sub-Alternative D-1 calls for development of approximately 221 acres in addition to the previously developed areas within the

Plan Area, including production pads and airstrips. This would result in an increase of approximately 2 times the total number of acres currently developed for oil production activities within the Plan Area. Sub-Alternative D-2 would result in development of approximately 71 acres of production pads and helipads.

Alternative D would provide less access to remote satellites west of Nigliq Channel than any of the other alternatives. No gravel road access would be provided to new satellite facilities; access to all remote sites would be limited to air, ice road, or low ground pressure vehicles. Although this alternative has the most severe limitations on access to remote areas, activities in these areas would still increase from current levels because of satellite facility operations. Effects to subsistence and recreation from these increased activity levels are discussed further in Sections 4D.4.3 and 4D.4.7. Other permitted uses within the Plan Area, such as scientific studies, communications and navigation-related uses, and overland re-supply transport between villages, are not expected to be affected by the proposed development.

Alternative D would be in close conformance with the BLM stipulations for the National Petroleum Reserve-Alaska in terms of restricting roads from water body setback areas. There would be less total area developed than in other alternatives, which would minimize gravel extraction operations. Development under Alternative D would, however, include CD-6 within the Fish Creek buffer area, requiring an exception from the existing BLM stipulations on this area. Other facilities may also be located within 500 feet of some other water bodies, requiring an exception to the setback around water bodies. In addition, CD-7 would be located within the CRSA as discussed in previous alternatives. This alternative minimizes development within designated areas through the elimination of roads.

There could be more flight activity during operations under Alternative D because of the reduced road access. However, disturbance by aircraft could be minimized by restricting aircraft activity in the Fish Creek area during fishing season and other sensitive time periods, to the extent possible.

COASTAL MANAGEMENT

Development proposed under Alternative D includes construction and operation of five satellite production pads, as well as pipelines and airstrips on both federal and non-federal lands. Although federal lands are excluded from the coastal zone in the CZMA, development on federal lands is required to conform with state coastal management programs to the extent possible. Therefore, this section evaluates all activities proposed in Alternative D, regardless of whether they occur on federal lands or not.

ALASKA COASTAL MANAGEMENT PROGRAM

The coastal standards are evaluated for the Alternative D – CPAI Development Plan below.

Coastal Development (6 AAC 80.040)

As discussed under Alternative A, there is no feasible inland alternative to development of the existing oil resources within the Plan Area. The proposed facilities have incorporated design measures to minimize potential effects on coastal resources, and in Alternative D, access to remote sites is limited to air. No road access across the Nigliq Channel is proposed. Stipulations on development within the National Petroleum Reserve-Alaska require continued access to the coastal resources used for subsistence and traditional land uses. Therefore, development of these facilities would not be expected to displace other important coastal uses. Development of CD-6 within the Fish Creek buffer area would require an exemption from the BLM stipulations for this area and an exception may be required for other facilities located within the setback for other water bodies. Development of Alternative D in compliance with the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and alternative measures potentially required by the state, is expected to comply with the coastal development standard.

Geophysical Hazard Areas (6 AAC 80.050)

Geophysical hazards would be addressed for Alternative D – CPAI Development Plan through design and sitting of facilities to maintain the permafrost and natural drainage patterns and to protect the built structures from flood events, scour, ice jams, and storm surges. The reduction of access road infrastructure under this alternative would reduce the effect of geophysical hazards. It is expected that the design measures incorporated into this alternative would result in compliance with this coastal standard.

Recreation (6 AAC 80.060)

Under Alternative D – CPAI Development Plan, development would comply with the existing stipulations that require continued access to coastal resources for subsistence and other traditional land uses. This alternative does not include construction of roads that could result in a much greater change in access to these areas. Due to the area's low recreation use and the minimization of resource impacts through compliance with most BLM stipulations and alternative measures potentially required by the state, Alternative D would be expected to comply with the recreation standard.

Energy Facilities (6 AAC 80.070)

Under Alternative D – CPAI Development Plan, development would be consistent with the criteria in the energy standard for maximum consolidation of facilities and minimization of the potential for adverse effects on environmental resources. The reduction of road access to remote satellites would be expected to reduce environmental effects on sensitive habitats. However, this alternative locates CD-6 within the Fish Creek buffer area and would likely result in increased aircraft activity to transport personnel to the satellite facilities. Overall, Alternative D would be expected to meet the criteria included in the energy facilities standard.

Transportation and Utilities (6 AAC 80.080)

The development proposed under Alternative D – CPAI Development Plan substantially reduces roadways compared to all other alternatives. Access to all satellite developments would be limited to air, ice road or low ground pressure vehicles. No new gravel road access would be provided to link satellite facilities west of the Nigliq Channel with the existing Alpine facilities to the east or with Nuiqsut. Alternative D is expected to conform to the transportation and utilities standard.

Mining and Mineral Processing (6 AAC 80.110)

Sub-Alternative D-1 would require development of approximately 221 acres of gravel pads and airstrips. Sub-Alternative D-2 would require development of approximately 71 acres of gravel pad. The reduction of road access under this alternative would reduce the amount of gravel needed and minimize potential environmental effects associated with gravel mining. Gravel sources for this alternative would be the same as those discussed under Alternative A. Development under these alternatives is expected to comply with the mining standard.

Subsistence (6 AAC 80.120)

Alternative D – CPAI Development Plan would not provide road access to remote satellite developments or create new access to subsistence hunting and fishing sites. However, operation of the remote facilities without roads could result in a higher level of aircraft activity in these areas, which could affect subsistence resources. The potential for adverse effects on subsistence from the proposed development are discussed in more detail in Section 4D.4.3. Development under this alternative would comply with the project specific procedures in Section 2, all but two of the BLM stipulations in Appendix D, and alternative measures potentially required by the state to reduce impacts to subsistence access and resources. Thus, Alternative D is expected to comply with the subsistence standard.

Habitats (6 AAC 80.130)

Development under Alternative D – CPAI Development Plan would minimize the extent of disturbance to sensitive habitats through a reduced development footprint and limitation of access to remote sites. Development under Alternative D is expected to conform with the habitat standards and the three-pronged test.

Air, Land, and Water Quality (6 AAC 80.140)

Development under Alternative D – CPAI Development Plan would require the same permits and reviews discussed under Alternative A. Compliance with the ADEC and USEPA regulations would result in conformance with this coastal management standard for the proposed CPAI Development Plan scenario.

Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150)

Development under Alternative D – CPAI Development Plan would require the same process for protection of cultural resources as discussed under previous alternatives. The reduced access under Alternative D would be likely to reduce the potential for inadvertent impacts to previously undocumented cultural resources. Development under this alternative, given the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state, would be expected to conform to the cultural resources standard.

NORTH SLOPE BOROUGH COASTAL MANAGEMENT PROGRAM

Development under th Alternative D – CPAI Development Plan is consistent with the current NSB Standards for Development (NSB CMP 2.4.3) through compliance with the BLM stipulations and the coastal management standards addressed above. Potential effects on subsistence and cultural resources would be expected to be lower than for other alternatives because of the decreased access to the remote satellite areas under Alternative D.

Alternative D development would comply with the current NSB Required Features for Applicable Development (NSB CMP 2.4.4) through compliance with the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state to reduce impacts to natural and cultural resources. Alternative D would result in substantially less vehicle traffic throughout the ASDP Area, but would result in increased aircraft activity to transport personnel to the remote satellites.

Development of Alternative D – CPAI Development Plan would address current NSB Best Effort Policies (NSB CMP 2.4.5). These policies call for protection of sensitive coastal resources, including subsistence and cultural resources. These issues have been addressed above in the ACMP discussion. The more restricted access to the remote satellites under Alternative D is expected to reduce potential effects.

The current NSB CMP also contains standards for Minimization of Negative Impacts (NSB CMP 2.4.6). The proposed development under Alternative D includes design measures to protect permafrost and to address geophysical hazards as discussed above under the ACMP. Roadways would be removed from water-body setback areas and reduced through increased use of air transportation. Proposed development under Alternative D would be expected to be consistent with these NSB standards.

NORTH SLOPE BOROUGH LAND MANAGEMENT REGULATIONS

As discussed under Alternative A, most of the land within the NSB is zoned as "Conservation," with the exception of some village sites and the existing oilfields at Prudhoe Bay and Alpine Field. The NSB's "Resource Development" zoning classification covers areas designated for oil development activities. Development east of the National Petroleum Reserve-Alaska in the Colville River Delta under Alternative D would require a re-zoning of the development areas to the "Resource Development" classification and permitting of

activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed.

ABANDONMENT AND REHABILITATION

Land ownership would not be affected by abandonment and rehabilitation. Upon completion of abandonment and rehabilitation, land uses and management may return to something similar to the current situation. For discussion of subsistence and recreation use after abandonment and rehabilitation, see Sections 4D.4.3.1 and 4D.4.7.1, respectively.

4D.4.6.2 Alternative D – Full-Field Development Scenario Impacts on Land Uses and Coastal Management

LAND OWNERSHIP AND USES

The Alternative D – FFD would affect the same landowners as described in Alternative A – FFD. Implementation of these developments would not change ownership status on lands within the Plan Area, but would occur under negotiated leases.

Sub-Alternative D-1 – FFD Scenario would result in development occurring throughout the Plan Area, with an additional 22 production pads and associated pipelines and airstrips totaling approximately 1,101 acres. Sub-Alternative D-2 – FFD Scenario would develop approximately 545 acres. The FFD scenario would result in a substantial increase in the area developed within the Colville River Delta, the Fish-Judy Creeks, the Kalikpik-Kogru Rivers facility groups, and the CRSA. Alternative D would propose construction of airstrips at each satellite facility with access limited to aircraft. Although there would be increased activity levels in these areas because of operation of the facilities, the activity level would be lower than that for any other alternative. Effects of FFD on subsistence resources and recreation are discussed in Sections 4D.4.3.2 and 4D.4.7.2, respectively.

Alternative D – FFD would more closely conform to the BLM stipulations for the National Petroleum Reserve-Alaska in that roads and bridges would not be built in sensitive habitats. Again, flight activity could increase for this scenario as compared with the other alternatives because of the increased number of satellite facilities accessible only by air.

COASTAL MANAGEMENT

Alternative D – FFD proposes an additional 22 production pads, as well as airstrips, pipelines, and 2 new processing facilities. Again, most of these facilities are proposed on federal lands within the National Petroleum Reserve-Alaska; however, additional development would also occur on state and Kuukpik lands within the coastal zone. This section evaluates all of the proposed development against the state and local district coastal zone standards, regardless of whether the development occurs on federal lands or not.

ALASKA COASTAL MANAGEMENT PROGRAM

The coastal standards are evaluated for Alternative D – FFD below.

Coastal Development (6 AAC 80.040)

Alternative D – FFD differs from Alternative A in the elimination of all access roads associated with the remote production satellites. The lack of feasible inland alternatives and incorporation of measures to reduce impacts are similar to the other alternatives discussed. Alternative D is expected to conform to the coastal development standard.

Geophysical Hazard Areas (6 AAC 80.050)

Geophysical hazards would be addressed for the FFD scenario through design and sitting of facilities to maintain the permafrost and natural drainage patterns and to protect the built structures from flood events, scour, ice jams, and storm surges. The reduction of access road infrastructure under this alternative would reduce the effect of geophysical hazards. Given the design measures incorporated into the alternatives, Alternative D is expected to conform with this coastal standard.

Recreation (6 AAC 80.060)

Development of facilities under FFD would be required to comply with the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state to reduce impacts to natural resources. Again, this alternative does not develop new road access; therefore, no adverse effects on recreation are anticipated. Therefore, Alternative D – FFD is expected to conform with the recreation standard.

Energy Facilities (6 AAC 80.070)

Alternative D-FFD would reduce road access to remote satellites but would result in increased aircraft activity to access remote sites. This alternative would locate satellite facilities in the Fish Creek buffer area and in a restricted area near the Kogru River. Overall, this alternative would be expected to result in a lower potential for environmental impacts by substantially reducing road construction and access throughout the Plan Area. Development under Alternative D – FFD is expected to meet the criteria required for conformance with the energy facility standard.

Transportation and Utilities (6 AAC 80.080)

The FFD scenario under Alternative D requires air access for all satellite development. This alternative maximizes conformance with the transportation standard.

Mining and Mineral Processing (6 AAC 80.110)

Alternative D-FFD would require less gravel than FFD under any other alternative. Development of the full-field scenario would still likely require resources beyond those currently identified. Any new gravel mining operation within the coastal zone would be required to receive a permit, which would maximize compliance with state coastal management standards and protection of coastal resources. Alternative D is expected to conform with mining standards through the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state. Thus, this alternative would be expected to conform with the mining and mineral processing standard.

Subsistence (6 AAC 80.120)

Development of FFD with only air access to the satellite facilities would result in increased aircraft activity associated with operation of the remote satellites. Potential effects on subsistence from FFD are discussed further in Section 4D.4.3.2. Given the incorporation of all but two of the BLM stipulations, and alternative measure potentially required by the state to minimize effects on subsistence, it is expected that FFD under Alternative D would conform with the subsistence standard.

Habitats (6 AAC 80.130)

Alternative D – FFD would minimize the extent of disturbance to sensitive habitats through a reduced development footprint and limitation of access to remote sites. It is expected that development under Alternative D would conform with the habitat standard and meet the three-pronged test.

Air, Land, and Water Quality (6 AAC 80.140)

The Alternative D-FFD scenarios would require the same permits and reviews discussed under Alternative A. Compliance with ADEC and USEPA regulations would result in conformance with this coastal management standard for the proposed FFD scenario.

Historic, Prehistoric, and Archaeological Resources (6 AAC 80.150)

Alternative D – FFD would require the same process for protection of cultural resources as discussed under Alternative A. The reduced access under this alternative would be likely to reduce the potential for inadvertent impacts to previously undocumented cultural resources. Compliance with the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state, is expected to result in conformance with the cultural resource standard.

NORTH SLOPE BOROUGH COASTAL MANAGEMENT PROGRAM

Alternative D – FFD is consistent with the current NSB Standards for Development (NSB CMP 2.4.3) through compliance with the BLM stipulations and the coastal management standards addressed earlier. Potential effects on subsistence and cultural resources would be expected to be lower than for other alternatives because of the decreased access to the remote satellite areas under Alternative D-FFD.

Alternative D-FFD would comply with the current NSB Required Features for Applicable Development (NSB CMP 2.4.4) through compliance with the project specific procedures in Section 2, the BLM stipulations (with the exceptions noted), and the alternative measures potentially required by the state. Alternative D-FFD would result in substantially less vehicle traffic throughout the Plan Area but would result in increased aircraft activity to transport personnel to the remote satellites.

Alternative D-FFD would address current NSB Best Effort Policies (NSB CMP 2.4.5). These policies call for protection of sensitive coastal resources including subsistence and cultural resources. These issues have been addressed above in the ACMP discussion. Alternative D-FFD would be expected to reduce potential effects by more restricted access to the remote satellites.

The current NSB CMP also contains standards for Minimization of Negative Impacts (NSB CMP 2.4.6). The proposed development under Alternative D for both the CPAI and the full-field alternatives includes design measures to protect permafrost and to address geophysical hazards as discussed above under the ACMP. Roadways would be removed from water body setback areas and reduced through increased use of air transportation. The proposed FFD scenario under Alternative D is expected to be consistent with these NSB standards.

NORTH SLOPE BOROUGH LAND MANAGEMENT REGULATIONS

As discussed under Alternative A FFD, most of the land within the NSB is zoned as "Conservation," with the exception of some village sites and the existing oilfields at Prudhoe Bay and Alpine Field. The NSB's "Resource Development" zoning classification covers areas designated for oil development activities. Development east of the National Petroleum Reserve-Alaska in the Colville River Delta under Alternative D-FFD would require a re-zoning of the development areas to the "Resource Development" classification and permitting of activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed..

4D.4.6.3 Alternative D – Summary of Impacts (CPAI and FFD) on Land Uses and Coastal Management

Construction and operation of the Alternative D – CPAI Development Plan would not be anticipated to result in adverse effects on existing land use and ownership. Although there would be an increase in the overall disturbed area, the increase for Alternative D would be less than that of other alternatives. Development under Alternative D would, however, include CD-6 within the Fish Creek buffer area. Approval of exceptions allowing for minimal development within Fish Creek buffer area and within other water body setbacks would be necessary for CPAI to implement the proposed plan. Full-field development of a production pad and associated pipeline in the area near the Kogru River designated for no surface activities would require an exception from the surface use restrictions for this area. It also would require approval for additional development within the Fish Creek buffer area, Sensitive Consultation areas, and the special caribou stipulation area. Development within the CRSA would be required to provide maximum protection of surface resources, consistent with development of oil resources. Compliance with the project specific procedures in Section 2, BLM stipulations (with the exceptions noted), and alternative measures potentially required by the state to reduce impacts to natural and cultural resources, is expected to result in conformance with this criterion.

The proposed development under Alternative D, constructed and operated in compliance with the existing stipulations for the area (with the noted exceptions) and the mitigation measures incorporated in this document, is expected to be consistent with state and NSB coastal management policies. Implementation of Alternative D (CPAI and FFD) would require NSB re-zoning of plan areas east of the National Petroleum Reserve-Alaska from "Conservation" to "Resource Development" and permitting of activities through the approval of a master plan. Application of the NSB's land management regulations to oil and gas activities on federal lands is subject to legal constraints and therefore must be evaluated on a case-by-case basis as particular activities are proposed.

4D.4.6.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Land Uses and Coastal Management

No mitigation measures have been identified for Alternative (CPAI and FFD).

4D.4.6.5 Alternative D – Effectiveness of Protective Measures for Land Uses and Coastal Management

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.7 Recreation Resources

4D.4.7.1 Alternative D – CPAI Development Plan Impacts on Recreation Resources

Increased air traffic under Sub-Alternative D-1, or more prolonged helicopter traffic under Sub-Alternative D-2, is the primary distinctions between this alternative and Alternative A. This traffic could affect the experience, including the solitude, quietude, naturalness, and wilderness of the infrequent recreational visitors to the area. As with Alternative A, the CPAI proposal to develop five pads could potentially affect the recreational experience over approximately 40,000 acres near the pads. However, the recreational use of the Plan Area is very low, and most recreation occurs directly along the Colville River corridor where activities associated with Nuiqsut already have decreased some of these recreation values. The recreational opportunities in the Plan Area would remain consistent with the BLM's SPM classification.

ABANDONMENT AND REHABILITATION

Compared to Alternative A, this alternative would result in more noise impacts on recreation from aircraft, but fewer visual or ground-based noise impacts from removal of infrastructure along the Nigliq Channel. Compared to the other alternatives, Alternative D would offer the least opportunity for improved access.

4D.4.7.2 Alternative D – Full-Field Development Scenario Impacts on Recreation Resources

Under FFD, the types of effects on hunting, fishing, and birding opportunities and the qualities of solitude, quietude, naturalness, and wilderness would be the same as those described for the CPAI Development Plan. However, the potential for such effects would increase under FFD as a result of the increased geographic scope of development. In addition to the potential effects on approximately 40,000 acres from the applicant's proposed plan, as with Alternative A**,** the recreational opportunities on up to 192,000 acres could be affected if as many as 24 proposed processing or production pads were developed. In addition, under Sub-Alternative D-1 increased air traffic could create short-term noise impacts. However, because recreational use is concentrated south of the likely air routes from Kuparuk and the Alpine Facility to new processing and production pads, the actual impacts to recreation could be minor.

4D.4.7.3 Alternative D – Summary of Impacts (CPAI and FFD) on Recreation Resources

Construction and operation of the facilities proposed under Alternative D (CPAI and FFD)is not expected to result in more than local or short-term adverse effects to the lightly-used recreational resources in the Plan Area.

4D.4.7.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Recreation Resources

No mitigation measures have been identified.

4D.4.7.5 Alternative D – Effectiveness of Protective Measures for Recreation Resources

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.8 Visual Resources

4D.4.8.1 Alternative D – CPAI Development Plan Impacts on Visual Resources

CONSTRUCTION PERIOD

Construction-related impacts would be approximately the same as those described under Alternative A.

OPERATION PERIOD

Operation-related impacts would be similar as those described for Alternative A. The reduction in gravel roads would reduce the number of horizontal lines, but this effect on visual contrasts with the natural landscape is negligible because the gravel roads would follow the form of the relatively flat landscape.

ABANDONMENT AND REHABILITATION

The impacts of abandonment and rehabilitation would be similar to those for Alternative A, though there would be much less short-term visual impacts created by fugitive dust because almost no traffic would be on gravel roads.

4D.4.8.2 Alternative D – Full-Field Development Scenario Impacts on Visual Resources

Since ice roads would be used more often in this alternative than in others, the ice road alignments would appear as dark green lines during summer, contrasting with characteristic grays, browns, and light green colors of the tundra. Viewers who travel across the tundra would be subjected to views of dark green lines rather than gravel roads under Alternative D. All other impacts to visual resources would be same as those described for Alternative A.

4D.4.8.3 Alternative D – Summary of Impacts (CPAI and FFD) on Visual Resources

Construction and operation impacts of Alternative D would be similar to those described in Alternative A. A decrease in the number of all-weather roads, in combination with an increase in ice roads under this alternative, would have negligible effects on visual contrasts with the natural landscape. Impacts to visual resources resulting from pads and operational facilities are the same as those described in Alternative A.

4D.4.8.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Visual Resources

Potential mitigation measures would be the same as those identified for Alternative A (Section A.4.8).

4D.4.8.5 Alternative D – Effectiveness of Protective Measures for Visual Resources

The effectiveness of the protective measures would be similar to Alternative A.

4D.4.9 Transportation

4D.4.9.1 Alternative D – CPAI Development Plan Impacts on Transportation

ROADWAYS

Alternative D – CPAI Development Plan would result in the construction of 5 new airstrips or 5 helipads and 33.1 miles of pipelines. This alternative eliminates roads between pads and relies instead on air access.

CONSTRUCTION PERIOD

Construction activities, phasing, and workforce under Alternative D would be the same as under Alternative A. No adverse effects on any public roadways from transport of construction personnel are anticipated.

OPERATION PERIOD

Of all action alternatives, Alternative D would result in the lowest level of vehicular traffic within the Plan Area. Transport of bulk operating supplies and materials to the production pads would only be possible during winter, resulting in a need to construct larger storage facilities at the production pads. High-value, low-weight supplies, or other essential supplies that cannot wait to be sent until winter, could be shipped in by air. Personnel access to the sites would be by air every 3 days. This alternative would not result in any adverse effects on public roadways.

RAILROAD TRANSPORTATION

Demand for rail transport of supplies and materials for construction and operation and the overall effects on the existing rail system under Alternative D are the same as under Alternative A.

MARINE FACILITIES

Marine transportation needs for construction would be the same under Alternative D as under Alternative A. Transport of supplies during normal operations does not typically involve marine transport.

RIVER TRANSPORTATION

CONSTRUCTION PERIOD

Effects on river transportation from construction activities associated with Alternative D would be similar to those described in other alternatives. There would be a lower level of construction activities near navigable channels because only pipeline bridges (no roads) would be constructed. There would be more reliance on ice roads for later construction periods, which could result in slowing access to channels during the open water season.

OPERATIONS PERIOD

Alternative D would result in operation of pipeline bridges over navigable channels rather than road bridges. Pipeline bridges would be designed to minimize effects on river transportation. Operation of the facilities proposed under Alternative D would be similar to Alternatives A and B and would not be expected to adversely affect river navigation.

AVIATION FACILITIES

Transport of the construction workforce to the North Slope would be the same under Alternative D as under Alternative A. Construction operations for Alternative D would result in more aircraft flights during construction than for Alternative A, particularly during summer work on production pads. It is expected that Shared Services Aviation would be supplemented with contract air support to provide the additional flights into and within the Plan Area as required during construction.

The demand for aviation support for the production pads under Alternative D would require additional flights to the production pads for normal operations, because no road access would be available. It is estimated that operations personnel would fly from the Alpine Facility to these remote sites approximately 3 times per week, averaging 176 flights per year. Shared Services Aviation is expected to be able to accommodate these additional trips with its existing crews and air fleet. These services could be supplemented with contract air support as needed. The increased demand for air support is not expected to adversely affect air transportation resources within the region.

PIPELINES

As with the other action alternatives, there would be no effects on existing pipeline facilities during the construction phase. Production flows will likely be managed to remain within the capacity of the existing sales oil pipeline, and the projected increase in throughput to TAPS is expected to remain well within the capacity of the pipeline.

Operation of the proposed facilities under Alternative D would require the same pipeline support as under Alternative A. Effects on the product supply pipeline from the Plan Area to Kuparuk and on TAPS would be the same as under Alternative A.

ABANDONMENT AND REHABILITATION

Impacts during the dismantlement and removal phase would be similar to those associated with Alternative A, except that CPAI would have to provide greater air transport capability to provide the needed additional flights to and among their facilities. If the airstrips or helicopter pads are left in place and made available to the public, there would be enhanced air access capability to the area. Unlike the other alternatives, there would not be an opportunity to enhance road access in the area upon abandonment.

4D.4.9.2 Alternative D – Full-Field Development Scenario Impacts on Transportation

ROADWAYS

Construction impacts to roadways outside the Plan Area would be similar to those identified for Alternative A, and transportation needs to new pads in the plan area would not be addressed with roads.

RAILROAD TRANSPORTATION

Effects on the existing rail system from development would be similar under Alternative D to those under Alternative A.

MARINE FACILITIES

Construction and operation of FFD would have the same effects on marine resources under Alternative D as under Alternative A.

RIVER TRANSPORTATION

Construction of Alternative D-FFD would result in more use of ice roads throughout the construction and operations periods, potentially increasing effects from delayed access to navigable channels.

AVIATION FACILITIES

Transport of construction personnel from Anchorage or Fairbanks to Deadhorse, Kuparuk, or both, would remain the same as described for Alternative A – FFD. Alternative D – FFD would require additional air support during construction and operations, especially for construction of the remote production pads. There could be increased demand for flights from Kuparuk or the Alpine Facility to the proposed construction sites throughout the Plan Area, particularly during summer months. Because development of the remote facilities under FFD is likely to be phased in slowly over time, Shared Services Aviation is believed to be able to accommodate the level of flight operations, and contract aviation support could provide supplemental support as needed. This additional demand is not expected to adversely affect air transportation resources in the region.

Operations under the FFD scenario would require personnel to fly to remote production pads approximately three times per week. The demand for aviation support for these remote facilities could substantially increase the number of flights required. It is possible that there would be a need for Shared Services Aviation to increase its capacity or to be supplemented with contract aviation support.

PIPELINES

Pipeline needs for the FFD scenario are similar under Alternative D to those under Alternative A and should be able to be met with existing infrastructure.

4D.4.9.3 Alternative D – Summary of Impacts (CPAI and FFD) on Transportation

Construction and operation of the facilities proposed under Alternative D (CPAI and FFD) in the Plan Area are not expected to result in adverse effects to transportation resources. Existing and proposed roads, airstrips, and pipelines are expected to adequately transport personnel, materials, and product throughout the Plan Area and into statewide transportation systems. Both local and statewide transportation systems are considered to have adequate capacity to accommodate the level of activity anticipated during construction and operation of the facilities.

4D.4.9.4 Alternative D – Potential Mitigation Measures (CPAI and FFD) for Transportation

Most bridge construction activities will be conducted when the impacted waterways are frozen. If not, the applicant should work with local village and other vessel operators in order to facilitate marine navigation during construction. If bridge construction activities requires limiting vessel traffic, the applicant should issue sufficient notification of such closures to reduce conflict with marine navigation activities. A condition of the applicant's Coast Guard Bridge permit will require that construction of falsework, cofferdams or other obstructions, if required, shall be in accordance with plans submitted to approved by the Commandant prior to construction of the bridges. All work shall be so conducted that the free navigation of the waterway is not unreasonably interfered with and the present navigational depths are not impaired. Timely notice of any and all events that may affect navigation shall be given to the District Commander (Seventeenth District) during construction of the bridges.

4D.4.9.5 Alternative D – Effectiveness of Protective Measures for Transportation

The effectiveness of the protective measures would be similar to Alternative A.