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SECTION 2
ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

This section describes oil and gas development that is currently proposed by the applicant, CPAI, and is reasonably foreseeable to begin over the next 20 years within the ASDP, hereafter referred to as the Plan Area. Section 2.2 of this document presents a discussion of how alternatives were developed. Section 2.3 presents a description of features common to alternatives. Section 2.4 presents detailed descriptions of the alternatives and of FFD scenarios developed consistently with the themes of several alternatives. Section 2.5 presents a side-by-side presentation of the features of all alternatives in tabular format for ease of comparison. Section 2.6 describes alternatives considered but eliminated from detailed analysis. Section 2.7 presents a comparison of the impacts of alternatives. Section 2.8 discusses future inspection and monitoring. Finally, Section 2.9 provides a description of the need for further analysis under NEPA.

The proposed action consists of the ASDP for five satellite[1] production pads north, south, and west of the existing APF-1 at Colville Development Production Pad (CD-1).

The applicant's proposed action is described as Alternative A. Alternatives B, C, and D, which also fulfill the purpose and need of the proposed action, were presented and evaluated in the Draft EIS (DEIS), as was Alternative E, the No Action Alternative. Alternative E serves as a benchmark, enabling the public and decision makers to compare the magnitude of environmental effects of the action alternatives. The Final EIS (FEIS) presents Alternative F, the Preferred Alternative. It also presents an additional sub-alternative (C-2) to consider the impacts of utilizing a possible alternative access road proposed by the State of Alaska from the existing oilfields east of Nuiqsut. These alternatives cover the full range of reasonable development alternatives.

2.2 OVERVIEW OF ALTERNATIVES

2.2.1 Overview of EIS Alternatives and Permitting Process

The alternatives developed in this EIS respond to a request by CPAI to develop oil and gas leases it holds in whole or in partnership with Anadarko Petroleum Corporation. CPAI provided an initial description of its proposed action in September 2002 and refined it in the course of the development of the DEIS. CPAI submitted permit applications to the federal, state, and NSB permitting agencies on January 16, 2004, and a revision to those applications on January 30, 2004. CPAI provided additional clarification of its application to the USACE, which the USACE reflected in its Public Notice of Application for Permit (POA-2004-253-2) (See Appendix L) issued April 9, 2004. Alternative A as described in the FEIS reflects the applicant's proposed action as of March 2004.

The alternatives presented in the DEIS provide for development of all five oil accumulations proposed for development by CPAI. The decision BLM will make regarding the applicant's proposed action is limited to BLM-managed lands; i.e., CD-6 and CD-7 and roads and pipelines eastward from those pads to where BLM-managed land abuts Kuukpik Corporation land. The cooperating agencies will make permitting decisions within their respective authorities (see Section 1.1.3) on federal, state, and private lands.

NEPA regulations issued by the CEQ require the identification of an agency-preferred alternative in the FEIS, unless another law prohibits the agency from expressing a preference. The BLM, as the lead agency, and the

[1] In oil and gas terminology, a "satellite" is a separate hydrocarbon accumulation that shares processing facilities and infrastructure with a nearby established oil and gas development.

cooperating agencies for this NEPA process have reviewed the information in the DEIS, comments received on the DEIS, and other pertinent information. On the basis of this review, the BLM, with the involvement of the cooperating agencies, has developed the agency-preferred alternative described below. The BLM intends to issue permits for actions on lands it manages consistent with the analysis contained in this EIS. After consultation with the cooperating agencies, the BLM determined that the provisions of the Preferred Alternative (Alternative F) are most consistent with the cooperating agencies' regulations. The USACE, however, is prohibited by law from identifying a preferred alternative prior to issuance of its ROD on the applicant's pending permit application. Accordingly, although the BLM has involved the USACE in its decision-making process to identify the Preferred Alternative, the regulation dictates that the USACE must reserve its decision pending issuance of the FEIS and its own independent review.

To be approved, CPAI's applications must be consistent with the requirements of the agencies' regulations. The agencies are reviewing the applications and additional information provided by the applicant as part of their permit review. The agencies will develop their decision documents, including RODs and permits, based on (1) findings of this review, and (2) additional information contained in the FEIS.

2.2.2 CPAI Development Plan Alternatives

Alternatives to the CPAI proposed action presented in the DEIS were developed based on public comments from public scoping comments, tribal consultation, and the purpose and need of the proposed action. (The alternatives are summarized in Table 2.2.2-1.) Most comments focused on specific options for different design components of the applicant's proposed action (for example, gravel roads instead of aircraft, pipelines of different heights, etc.). When grouping these components into action alternatives, the BLM conducted a series of working meetings with the cooperating agencies to develop a range of "themes" under which to place the various potential components. Each theme represented a certain goal, such as maximizing local economic benefit, minimizing environmental and cultural impacts, focusing on subsistence and community needs, and maximizing the safety and reliability of the development. The components selected for inclusion in each theme supported the theme's respective goal.

TABLE 2.2.2-1 ALTERNATIVES

Alternatives	Themes
A	**Applicant's Proposed Action:** This is the CPAI project as proposed.
B	**Conformance with Stipulations:** All activities must be conducted and facilities sited in accordance with the ROD for the Northeast National Petroleum Reserve-Alaska IAP/EIS development stipulations.
C	**Alternative Access Routes:** This alternative has two Sub-Alternatives, both of which include alternate road routes and bridge locations to those proposed in the ASDP. A road connection to Nuiqsut and higher pipelines are included. Under Sub-Alternative C-2, some access roads and bridge locations have been changed from the locations in Sub-Alternative C-1 to reflect access to National Petroleum Reserve-Alaska via the proposed State Colville River Road.
D	**Roadless Development:** This alternative has two Sub-Alternatives. Under Sub-Alternative D-1, the production pads would be developed with gravel airstrips. Under Sub-Alternative D-2, the production pads would be developed with gravel helipads. Gravel roads would be limited to those roads necessary for access from the airstrips or helipads to the drill sites.
E	**No Action:** CPAI would not be authorized to develop the five oil accumulations for which they have applied. No new oil and gas production or processing facilities would be developed in the near future in the Plan Area. Production, operation, and eventual abandonment would occur at the existing facilities (CD-1 and CD-2).
F	**Agency Preferred Alternative:** This is the agency preferred alternative. It requires that bridges over the Nigliq Channel and the Ublutuoch River be from bank to bank* and that their approaches provide for natural flow. It relocates the road to CD-4, accommodates natural water flow and fish passage, and removes substantial infrastructure from the 3-mile Fish Creek Buffer Zone. This alternative also requires that all powerlines be on cable trays, that the pipelines be 7 feet above the tundra, and that lighting on higher structures address bird strike issues.

Notes: * "bank to bank" is explained in detail in Section 2.4.6.5

Many components were common to multiple themes and many of the themes could be combined without conflict among the respective goals. The BLM grouped design components and themes that were not in conflict into discrete alternatives. The grouping of components and themes into discrete alternatives was accomplished by applying these themes and associated design components to the applicant's proposed action. This activity produced the set of alternatives introduced in Section 2.1 and described in more detail in the following text.

This "component approach" addressed a range of alternatives for individual elements of the applicant's proposed action, such as production pad access by gravel road or gravel airstrip, powerlines on power poles or cable trays mounted on vertical support members (VSMs), and specific roadway routing and river crossing locations. These components were combined into complete concepts based on unifying themes. For example, Alternative C includes a roadway connection to Nuiqsut and other features that would enhance Nuiqsut economic development and subsistence-hunting access to the development area, and roadless development Alternative D includes other components intended to minimize surface disturbance.

Following the public comment period on the DEIS, BLM and the cooperating agencies created the Preferred Alternative and a new sub-alternative of Alternative C. The Preferred Alternative and Sub-Alternative C-2 respond to comments received during the comment period and are further variations of components and themes considered within the range of alternatives presented in the DEIS. They are described at 2.2.2.3 and 2.2.2.6, respectively.

A discussion of alternative components that the BLM considered but eliminated from detailed analysis is provided in Section 2.6. These components either were suggested by members of the public, tribes, or agency representatives during the scoping process or are options that have been considered in other North Slope developments.

2.2.2.1 Alternative A – Theme: Applicant's Proposed Action

This description is consistent with the applicant's proposed action as of March 2004. Five production pads, CD-3 through CD-7, would be built, and produced fluids would be transported by pipeline for processing at APF-1. The five proposed pad locations correlate with former CPAI exploratory well locations, as indicated in Table 2.2.2-2. Gravel roads would connect CD-4 through CD-7 to the existing Alpine Field road. CD-3 would be constructed with a gravel airstrip but without a gravel access road. Gravel used for construction of roads, pads, and airstrips would be obtained from the existing ASRC Mine Site and the Clover Potential Gravel Source (Clover) (referred to as Clover A Mine Site in Appendix O). A bridge across the Nigliq Channel near CD-2 would accommodate road traffic and the pipelines. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 5 feet above the tundra. Powerlines in general would be supported by cable trays placed on the pipeline VSMs. Cable trays would not hang below the pipelines. Industry, local residents, and government would use the gravel roads. CD-6 and its access road and pipelines and the powerline from CD-6 to CD-7 would be within a 3-mile setback from Fish Creek, in which the BLM's Northeast National Petroleum Reserve – Alaska IAP/EIS ROD (BLM and MMS 1998b) (Stipulation 39[d]) (see Appendix D) prohibits permanent oil facilities. This alternative would provide an exception to this provision to allow location of CD-6 and its associated road and pipeline and the powerline within the setback. Additional exceptions would be required to locate oil infrastructure within 500 feet of some water bodies (Stipulation 41) and to locate roads between separate oilfields (Stipulation 48). In addition, although BLM does not interpret the first sentence of Stipulation 48 to apply to the applicant's proposed action (i.e., the agency does not consider the road between CD-1 and CD-2 or the additional road to CD-4 to constitute a connection to a "road system" outside the Northeast National Petroleum Reserve-Alaska planning area), out of an abundance of caution, if it is determined that this sentence applies in this case, the BLM would modify Stipulation 48 to allow the road from public land connecting to the existing road at APF-1. Finally, the USACE would have to determine that the applicant's proposed alternative for a road to CD-4 met the intent of Special Condition 10 of its 1998 permit that authorized the placement of fill associated with the construction of the Alpine Development Project. Special Condition 10 required roadless development in the Delta, unless an environmentally preferable alternative is available or roadless was infeasible, and that any alternative dependent on roads must be approved by the USACE as preferable to a roadless alternative. (See Appendix L for Special Condition 10.)

TABLE 2.2.2-2 PRODUCTION PAD NAMES FOR CPAI'S PROPOSED ACTION

Production Pad Name in this EIS	Former CPAI Exploration Well Designation
CD-3	Fiord or CD-North
CD-4	Nanuq or CD-South
CD-5	Alpine West
CD-6	Lookout
CD-7	Spark

Notes:
Existing CD-1 and CD-2 produce from the reservoir or hydrocarbon accumulation commonly referred to as "Alpine Field".
Proposed production pads CD-3, CD-4, CD-6, and CD-7 are near the locations of former exploration wells that tap reservoirs other than the Alpine Field. CD-5 will tap the Alpine Field.

2.2.2.2 Alternative B – Theme: Conformance with Stipulations

All activities would be conducted and facilities sited in accordance with Northeast National Petroleum Reserve-Alaska IAP/EIS development stipulations, as requested by many local residents and others. The location of CD-6 and its associated access road would be moved south, outside the 3-mile setback for Fish Creek. A gravel road would connect CD-4 with CD-1 and CD-6 with CD-7, but CD-3 and CD-5 would be roadless. Only CD-4 would be connected by road to existing Alpine Development Project. Airstrips would be required at CD-3, CD-5, and CD-6. Permanent oil infrastructure would be located at least 500 feet from water bodies to the maximum extent possible. Traffic on gravel roads would be open to industry and government and closed to local residents. The bridge crossing the Nigliq Channel near CD-2 would be for pipelines only. Powerlines would be buried in roads or at the toe of the slope of road, everywhere there is a road. Where there are no roads, powerlines would be buried in tundra adjacent to the pipelines. Powerlines would be hung off pipeline bridges at stream crossings and trenched across minor drainages**.** All other construction and operation strategies described for Alternative A would generally apply. The USACE would have to determine that the alternative for the road to CD-4 met the intent of Special Condition 10 of its 1998 permit that authorized the placement of fill associated with the construction of the Alpine Development Project.

2.2.2.3 Alternative C – Theme: Alternative Access Routes

Alternative C includes alternate road routes and bridge locations that differ from those proposed by the applicant. All pads would be accessed by gravel roads and would be sited in the same location as in Alternative A. Roads to CD-3 and CD-4 would connect to the Alpine Development Project. Roads to CD-5, CD-6, and CD-7 would connect to either the Alpine Development Project (Sub-Alternative C-1) via a road and pipeline bridge near CD-4 or to existing oilfields east of the Colville River using the state's proposed Colville River Road (Sub-Alternative C-2). To address interest by some local residents, both sub-alternatives would provide road access from Nuiqsut to the oilfields. To take better advantage of the state road under Sub-Alternative C-2, a bypass of Nuiqsut would be constructed from the state road to the satellite road of the applicant's proposed action (and the spur from the latter road to the north end of the village would be deleted) and an approximately two-acre pad would be added along the bypass primarily for vehicle storage. Powerlines would be hung from power poles. No new airstrips would be constructed. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 7 feet above the tundra, as measured at VSM locations. (Local residents and others had requested pipelines be elevated more than the 5 feet proposed by CPAI.) Use of roads on BLM lands would be unrestricted; all other roads would be open to industry, local residents, and government only. Both sub-alternatives would require the same exceptions to BLM stipulations as Alternative A; however, Sub-Alternative C-2 would also require that BLM modify Stipulation 48 to allow connection of roads on BLM-managed lands with the state's proposed road. The USACE would have to determine that the roads to CD-3 and CD-4 meet the intent of Special Condition 10 of its 1998 permit that authorized the placement of fill associated with the construction of the Alpine Development Project.

2.2.2.4 Alternative D – Theme: Roadless Development

In Alternative D all gravel roads are eliminated and the production pads would be accessible only by air, ice road, and low-pressure vehicle. Air access would be via fixed-wing aircraft or helicopter. Because of different implications of the mode of air access, Alternative D is separated into Sub-Alternative D-1, fixed-wing aircraft access, and Sub-Alternative D-2, helicopter access. All pad locations would be the same as those for Alternative A, and this alternative would provide for the exceptions to Stipulations 39[d] and 41 of the Northeast National Petroleum Reserve-Alaska IAP/EIS. The pipeline crossing across the Nigliq Channel near CD-2 would employ horizontal directional drilling (HDD) in lieu of a pipeline bridge. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 7 feet above the tundra as measured at VSMs. Powerlines between pads would be in cable trays mounted on the pipeline VSMs. All other construction and operation strategies described for Alternative A would generally apply.

2.2.2.5 Alternative E – No Action

Under this alternative, CPAI would not be authorized to develop the five oil accumulations for which it currently seeks authorization. No oil in the Plan Area, except that extracted from CD-1 and CD-2, would be produced in the near future, and no new roads, airstrips, pipelines, or other oil facilities would be constructed beyond what is authorized in connection with CPAI's current development at CD-1 and CD-2.

2.2.2.6 Alternative F – Preferred Alternative

The Preferred Alternative modifies key components of the applicant's proposed action to minimize, mitigate, or avoid certain potential environmental impacts identified by the BLM or the cooperating agencies or by the public through the NEPA process while achieving the purpose and need described in Section 1 of this EIS. The modified elements of Alternative F – the Preferred Alternative have either been adopted directly from alternatives analyzed in detail in the DEIS or reflect measures identified through the DEIS comment process or additional agency review of the applicant's proposal.

Alternative F modifies the applicant's proposed action (Alternative A) by the following:

- Requiring that the road and pipeline bridge across the Nigliq Channel extend from bank to bank
- Requiring that the road and pipeline bridge across the Ublutuoch River extend from bank to bank
- Requiring that approaches to both the Nigliq Channel and Ublutuoch River bridges provide for natural water flow
- Requiring that the road to CD-4 be either relocated around Lake 9323 or engineered to provide for natural water flow and fish passage
- Removing substantial infrastructure from the Fish Creek 3-mile setback, while allowing CD-6 to be located as requested by CPAI
- Increasing the elevation of pipelines to 7 feet minimum at the VSMs
- Requiring that powerlines between CD-6 and CD-7 be placed on cable trays
- Requiring lighting of higher structures to address bird strike issues

This alternative is described in greater detail in Section 2.4.6.

2.2.3 Full-Field Development Scenario

The concept of combining alternative development components into discrete development scenarios based on common themes also was applied to the identification of scenarios addressing reasonably foreseeable future oil and gas development throughout the Plan Area. In this manner, through this EIS process, the BLM, the cooperating agencies, other agencies, and the public will be better able to assess the total potential impact of development in the Plan Area and consider adoption of appropriate protective measures.

Potential production pad and processing facility locations were situated to allow consideration of effects to a wide range of environmental settings. Sites were located based in part on government and industry knowledge of oil resources, but purposely altered and masked to prevent revealing confidential or proprietary information. Sites were also located to ensure that a representation was provided of different habitats and use areas. This approach for locating sites was used to help elicit impact analysis of the widest range of potential impacts. The consequence was the identification of a number of hypothetical sites well beyond any present industry plan for development.

Once the potential sites were identified, the development themes and associated development components defined for the ASDP alternatives were used to construct comparable FFD scenarios. The resulting FFD scenarios explore a full range of potential environmental issues and encompass an aggressive level of potential development to help identify important environmental issues and associated mitigation measures that might be overlooked if a more limited review of the proposed action were implemented.

The FFD presented here is for analytical purposes only; no Preferred Alternative or ROD will be developed for FFD. The number and location of analysis sites were developed to protect proprietary geologic data, provide for consideration of potential impacts to a broad range of resources, and portray one of an infinite number of potential future development pictures. The BLM does not imply that development will or will not occur at any of these specific locations or on this scale. This analysis is not intended to result in agency approval of a specific FFD site analysis pad.

Although not proposed for development at this time, it is likely that currently undiscovered additional resources will be proposed for development in the Plan Area in the reasonably near future. This EIS examines various development approaches for FFD that are similar to those examined in each alternative for the proposed ASDP. Because they are similar to the FFD scenarios evaluated in other alternatives, no FFD scenarios are developed for Sub-Alternative C-2 or Alternative F. By examining these different FFD approaches, analyzing their impacts, and considering mitigation for them in the EIS process, the BLM and the cooperating agencies can provide the public and decision-makers with a more complete understanding of potential environmental issues associated with future potential long-term oil and gas development in the Plan Area. Any future proposal for development of the Plan Area will be subject to additional NEPA analysis. Such future analysis of impacts and potential mitigating measures will occur before issuance of any permits or approvals for future proposed oil and/or gas development in the Plan Area.

The FFD could entail development of additional production pads whose drilling product would flow back to the APF for processing or production pads that require additional hypothetical processing facilities (HPFs) at new locations in the Plan Area. It becomes technically challenging to transport three-phase produced fluids (oil, gas, and water) more than approximately 25 or 30 miles for processing. Therefore, FFD scenarios include new HPFs. The BLM has identified hypothetical locations for 22 production pads and two pads that would have both processing facilities and production wells. The actual location and number of production pads and HPFs that would be required to accomplish FFD are not known. The conceptual FFD portrayed and evaluated in this EIS is believed to overstate the anticipated FFD. CPAI projects that its leases, which cover the great majority of existing leases in the Plan Area, would not support more than a total of 12 production pads, including existing CD-1 and CD-2 and the five proposed pads. This analytical approach, however, is appropriate to address potential environmental issues at multiple locations where development could occur, given that the exact number, location, and future economic viability of future developments are not known. Figures presenting FFD scenarios show a circle around locations of each HP (hypothetical production Pad). The EIS considers the potential environmental issues associated with development within the entire Plan Area and specifically references the general area (the circle) rather than the specific facility site within the circles identified in the FFD scenario**.** Figure 2.2.3-1 is a map presenting the locations of the existing Alpine Development Project (CD-1 and CD-2), the locations of proposed production pads, and the approximate locations of the HPs and HPFs used in the FFD scenarios. The FFD HPFs would be similar to those described for the ASDP, and the HPFs would be similar to the APF. Other infrastructure in each scenario—roads, pipelines, powerlines, etc.—is anticipated to be similar to that described for the ASDP. Each FFD HP location is assumed to be able to extract 25 to 150 million barrels (MMbbl) of oil (50 MMbbl average); each pad with a processing facility is assumed to process 150 to 300 MMbbl of oil (250 MMbbl average). A sales oil pipeline from the HPFs would connect to APF-1 for transport of the sales oil to market via TAPS.

Although all production and processing facility pads, as well as roads and airstrips, are assumed to be constructed of gravel in a manner consistent with all other onshore North Slope oil and gas fields, the proposed gravel resources may not be adequate for FFD on the scale hypothesized. Consequently, for the FFD analysis, this EIS will examine the impacts of developing yet-unidentified additional gravel sources.

The following briefly describes the hypothetical scenarios for FFD examined in this EIS.

2.2.3.1 Alternative A – Full-Field Development Scenario

For the FFD scenario, two additional HPFs and 22 additional production pads could be constructed in the Plan Area. Gravel roads would connect all pads, except four in the lower Colville River Delta (downstream from the existing APF-1) and one pad near the Kogru River. Production pads not accessed by roads would be accessed by air; they would have gravel airstrips. Construction and operation strategies described for the applicant's proposed action would apply for the FFD scenario. As noted above, exceptions to the stipulations in the Northeast National Petroleum Reserve-Alaska IAP/EIS ROD would be necessary to allow placement of facilities in certain areas.

2.2.3.2 Alternative B – Full-Field Development Scenario

There are several major differences between Alternatives A and B relative to the FFD scenario. Pads would not be allowed in setbacks along Fish Creek, Judy Creek, the Colville River, and near the Kogru River in the Alternative B – FFD scenario. This restriction could result in either elimination of pads that could not be developed for technical or economic reasons from outside the setbacks or the relocation of pads to outside the setbacks and possible reduced production. Gravel road alignments would be altered so that they were outside of the setback areas. Networks of pads would be connected to the new HPFs, but no continuous road connection would be available for access to all pads. Airstrips would be constructed at all pads in the lower Colville River Delta, at the two HPFs, and at production pads not connected by roads to an HPF.

2.2.3.3 Alternative C – Full-Field Development Scenario

For the FFD scenario, airstrips would be built at the two HPFs. Gravel roads would connect all pads, including those in the lower Colville River Delta. Powerlines would be hung from power poles. Aboveground pipelines would be at elevations of at least 7 feet above the tundra, as measured at VSM locations. All other construction and operation strategies described for the Alternative A – FFD scenario would generally apply.

2.2.3.4 Alternative D – Full-Field Development Scenario

As with the development of the five proposed pads, Alternative D – FFD scenario would not include gravel roads between production pads and process facilities. Ice roads and/or low-pressure vehicles would be used more than in the other three action alternatives. All construction and operation strategies described for the proposed ASDP under Alternative D would apply. There are two options to this alternative, and they are reflected in the following scenarios:

SUB-ALTERNATIVE D-1 – AIRSTRIPS

Sub-Alternative D-1 would use fixed-wing aircraft to provide access to the proposed production pads and under FFD to HPs and HPFs. A gravel airstrip would be constructed at each production pad and process facility, including an apron/taxiway and an access road that would connect to the production or process facility pad. All airstrips are assumed to be 5,000 feet long to allow aircraft capable of flying in a relief rig. Drilling in the lower Colville Delta would be limited to the winter season.

SUB-ALTERNATIVE D-2 – HELIPADS

Sub-Alternative D-2 would use helicopters to provide access to the proposed production pads and under FFD to HPs and HPFs. A gravel helipad would be constructed at each production pad and process facility, immediately adjacent to the production or process facility pad. Drilling at all production pads would be restricted to winter only, when drilling crews, supplies, and if necessary, relief rigs could access the drilling site by ice road. Ice airstrips could be used to allow fixed-wing aircraft access to support construction or drilling operations. If an ice airstrip were in place, it could be used for relief rig access. Adopting the winter-only drilling program would result in a significantly extended development schedule for the applicant's proposed action. This approach would require approximately six to seven winter seasons of drilling to complete a single production pad, rather than 1 to 2 years of year-round drilling. The winter-only drilling extends the FFD drilling schedule from approximately 25 years (including CD-3 to CD-7) to approximately 100 years. The associated intensity of manpower and resource use (water, gravel, etc.) would be reduced on a seasonal basis but would extend over many more years.

2.3 FEATURES COMMON TO ALTERNATIVES

This section provides descriptions of features that are common to several of the action alternatives. Specific descriptions of components that vary from the general descriptions presented in this section are presented in Section 2.4, Description of Alternatives.

2.3.1 Roads

2.3.1.1 Road Design

Roads are proposed to have a 32-foot-wide driving surface to accommodate two-lane traffic and wide-load moves such as drill rigs and modules (Figures 2.3.1.1-1, 2.3.1.1-2, and 2.3.1.1-3). They would be constructed with a minimum slideslope of 2-feet horizontal (H) to 1-foot vertical (V) (2H:1V). In areas subject to inundation, the potential for erosion exists, and necessary protection measures would be designed for the road slideslopes. Protective measures could include articulated concrete mat or gravel bags and are discussed further in Section 2.4.3.

The minimum depth of gravel roads would be 5 feet (Figures 2.3.1.1-2 and 2.3.1.1-3). This depth maintains the permafrost condition by insulating the tundra and offsetting the loss of insulating effect caused by compression of the vegetated tundra below the gravel and heat transmitted by the ground. On the North Slope, fill sections are used almost exclusively because cuts disturb the tundra mat, promoting thermokarsting (the melting of permafrost near the surface) and instability of the gravel structure. Tundra coverage and gravel volume estimates for typical roads were generated by using a 5.5-foot average depth to account for topographic variations and a slideslope of approximately 2H:1V.

Ideally, gravel used for road construction would be a clean, well-graded material free of ice and snow concentrations, overburden, clay or silt seams, and organic matter. The desired silt/clay fraction in the gravel is 15 percent (PN&D 2002b); however, actual pit run gravel would be used and it may vary from this specification. Less desirable gravel may require more grading maintenance and repair work or the use of advanced road construction techniques, such as chemical stabilizers and additives, sand bases with gravel caps, various synthetic geoproducts, insulation-founded roadbeds, interlocking steel mats, and constructing singlelane roads with pullouts for passing. These methods have not been proved as an alternative to the standard gravel road.

Road surfaces would be designed to be above a floodwater surface elevation for a 50-year return period plus 3 feet of freeboard (PAI 2002a). In addition to flooding and storm surges, other hydrologic factors will be accounted for during design, including scour protection, ice jams, drainage structure (bridge and culvert) requirements, and water body separation distances.

2.3.1.2 Road Construction

Roads would be constructed during winter. As shown in Table 2.3.1-1, road construction is the first step of the various construction activities required to build the infrastructure necessary for oil and gas production.

TABLE 2.3.1-1 TYPICAL CONSTRUCTION SCHEDULE FOR DRILL SITE DEVELOPMENT

Task	Year 1		Year 2	
	Winter	Summer	Winter	Summer
Lay gravel for road	X			
Lay gravel for drill sites	X			
Drilling operations			X	X
Install vertical support members for pipelines	X			
Install pipelines	X		X	
Install powerlines	X			
Install module piles	X			
Install bridge foundations	X			
Construct bridges			X	
Work gravel on pad/roads		X		
Install surface facilities			X	
Set modules			X	
Production startup				X

Note: This is one possible schedule. The drilling schedule and pipeline/road/bridge construction schedules are site dependent and program dependent.

The first step in gravel road construction for surveyors is to stake out the designed road alignment. Next, ice roads are built to provide transportation of equipment and trucks for gravel hauling. For lengthy roads, such as those that would be built in the proposed action, an ice road is usually constructed adjacent to the toe of the designed road. The ice road would be the minimum size necessary to allow a large truck to conveniently dump its load, turn around, and return to the gravel source.

The volume of gravel required to construct the typical North Slope road cross-section (Figures 2.3.1.1-1, 2.3.1.1-2, and 2.3.1.1-3) is approximately 41,100 cubic yards (cy) per mile of roadway, for a road with 5.0-foot average thickness, 32-foot-wide driving surface and 2H:1V slideslopes. If gravel were hauled by using trucks with a 40-cy capacity (typical for a B-70 haul unit), it would take approximately 1,030 truck round trips per mile of road built.

Roads would be built by using a bulldozer, B-70-type haul trucks, a grader, and vibratory compactors. Gravel placed during winter contains ice and therefore continues to settle through the following summer when it must be finish-graded and compacted to produce a stable driving surface. Regrading is not expected to require additional gravel. Material typically would be compacted from 90 to 95 percent of the maximum density. Maximum density is the measure of the maximum theoretical density achievable for a particular type of soil at the optimum moisture content.

2.3.1.3 Road Use During Operations

After completion of drilling operations, normal field operations would require approximately two round trips per day (once per shift), per roaded production pad, by truck from APF-1. In addition, there would be infrequent heavy truck traffic associated with maintenance and resupply. Normal road maintenance activities such as road watering would be implemented to control dust and protect the integrity of the roadbed.

To minimize potholes, roads would be graded periodically. Grading frequency would vary with weather and road conditions and with the number and weight of vehicles. Grading typically would occur twice a month during June through September. Care would be required while grading to prevent disturbance to the tundra adjacent to the road-fill slopes.

Winter maintenance would include snow removal for vehicle access and to prevent unnecessary runoff, road erosion, and tundra silting during the spring melt.

2.3.1.4 Road Abandonment and Rehabilitation

By the terms of federal and state leases and permits, it is the responsibility of the lessee/applicant to remove facilities and rehabilitate the land upon field abandonment or expiration of a lease or oil- and gas-related permit to the satisfaction of the land management authority. Abandonment plans would be developed at the time of abandonment or expiration of the lease or permit in consultation with appropriate local, state, and federal agencies and would be subject to federal (BLM, USACE, and/or USEPA) and state approval. The AO will take into consideration alternative uses for the infrastructure and the impacts of removing infrastructure and alternative means to rehabilitate the land. Federal agencies would undertake appropriate NEPA analysis of any such abandonment and rehabilitation decision at the time of abandonment or expiration of a lease or permit. All costs associated with abandonment, removal, and restoration are the responsibility of the lessee.

There is currently no estimate available of the economic life of CPAI's proposed facilities, but it is likely to be consistent with the expected life of the Alpine Field, which may be several decades. Abandonment would occur when the cost of producing and transporting oil exceeds the market value of the oil.

The AO may require any of a range of abandonment and rehabilitation steps for roads. Among the most prominent possibilities, gravel roads may be:

- Removed, the gravel either placed back into gravel pits (restoration plans may need to be altered) or used for other development, and the area revegetated
- Left in place and maintained for continued use
- Revegetated either naturally or actively by the permittee and bridges and culverts removed and roads breached to facilitate more natural water flow

2.3.2 Pipelines

2.3.2.1 Pipeline Design

Pipelines connecting production pads to processing facilities would consist of elevated 16- to 24-inch-diameter, three-phase (oil, water, gas) production lines; 6- to 10-inch-diameter miscible injectant (MI) lines (MI is natural gas); 8- to 14-inch-diameter seawater injection lines; and 6-inch-diameter lift-gas lines (CPAI 2004a). Production pads that are not connected to processing pads by roads would also be served by 2-inch-diameter product supply lines that would carry diesel and mineral oil and occasional batches of chemicals (methanol, corrosion inhibitor, scale inhibitor, and emulsion breaker). The need for and potential quantity of the chemicals required would depend on operating experience after start-up. All pipelines would have a non-reflective finish. The pipelines would be insulated, except for the 2-inch line. A cross-section of a typical pipeline support system is shown in Figure 2.3.2.1-1.

For FFD, a U.S Department of Transportation (USDOT)-regulated 14-inch-diameter sales oil pipeline and a 12-inch-diameter seawater supply pipeline would be constructed on the same VSM supports as the in-field pipelines described above. A cross-section of a typical pipeline support system carrying these pipelines in addition to in-field pipelines is shown in Figure 2.3.2.1-2 These pipelines would extend from the APF to the FFD HPFs. They would have a non-reflective finish and would be insulated. The sales oil and seawater supply pipelines would include a pig launcher/receiver pair for each line segment. The pig launcher/receiver pair allows inspection and maintenance devices called pigs to be inserted into and removed from the inside of the pipeline. Launchers and receivers would be located inside modules on the gravel pads at the HPFs.

New pipelines would be constructed so that the bottom of the pipe elevation is a minimum of 5 feet above the tundra in two alternatives. Three other alternatives consider a minimum of 7 feet above the tundra, measured at the VSMs. Actual clearances could be greater than the minimum because of topography and the allowable rate of elevation changes for the pipelines. Minimum clearances above the tundra would include insulation, jacketing, and appurtenances to the pipelines, except for vibration dampeners. Vibration dampeners that could encroach into the minimum clearance space would be added to certain segments of the pipelines to minimize wind-induced stress. Dampeners typically could extend approximately 1.5 feet below the pipeline and would be spaced at the midpoint of each span of pipeline between VSMs (Borden 2003). In addition to the minimum height above the tundra, pipelines in the Colville River Delta would be designed with a minimum elevation of the 200-year return period plus 3 feet of freeboard (CPAI 2002a). The span between VSMs would be approximately 55 feet. Pipeline design would comply with the American Society of Mechanical Engineers (ASME) Codes B31.4 and B31.8 and CPAI internal standards. These standards are not strictly applicable to in-field pipelines, but Code B31.4 would be used as the design basis for water and oil pipelines and Code B31.8 would be used for gas pipelines.

Where roads are proposed between production and HPF pads, pipelines would parallel the roads. Pipelines generally would be placed 350 to 1,000 feet from the access road (at least 500 feet, if feasible, on BLM-managed lands), except at the bridge over the Nigliq Channel, where pipelines would be located on the downstream side of the road bridge structure. In the Colville River Delta, roads generally will be located upstream from the pipeline to help protect the pipeline from ice; elsewhere the road generally would be downstream from the pipeline to serve as a containment barrier in the event of a pipeline spill.

2.3.2.2 Pipeline Construction

Pipeline construction would take place from an ice road that would serve as a work pad for pipeline installation. Typically, the base width of the ice road would be approximately 40 feet, but the width would be increased if the vehicles or construction methods used require more width. Ice pad staging areas also would be constructed approximately every half-mile along the pipeline route. Staging areas would be 150 feet wide by 300 feet long and would be used to stage materials temporarily, provide turnaround areas for large trucks, and provide storage and work areas for refueling trucks, maintenance crews, and other support functions.

Borings for the VSMs would be drilled directly from the ice road by a heavy-duty, truck-mounted VSM drill rig. Alternatively, VSMs could be driven into the tundra by a pile driver. Cuttings from borings may be hauled to gravel source locations and deposited there as part of the reclamation plan, or may be used as fill for another project. The 20- to 25-foot-deep borings usually would be bored 3 to 4 inches wider than the VSM pipe. VSM pipe diameters would vary from 12 to 40 inches. Pier piles supporting pipeline bridges such as those proposed between CD-1 and CD-3 would range from 30 to 36 inches in diameter. Pipeline bridge abutment piles would range from 24 to 30 inches in diameter. After the VSM would be set in the boring, the annulus space would be filled with a sand-water slurry mixture and vibrated to evacuate air voids. The pile then would be allowed to freeze back naturally from the cold surrounding permafrost, which would take approximately 1 day. As soon as the pile would freeze in place, construction could continue and loads could be applied.

Horizontal-pipe-support cross beams, or horizontal support members (HSMs) (Figures 2.3.2.1-1, 2.3.2.1-2, 2.3.2.1-3, 2.3.2.1-4, 2.3.2.1-5), and insulated pipe sections would be shop-fabricated. Shop fabrication minimizes the waste material produced in the field and eases field assembly. Materials would be trucked to and staged along the pipeline route by conventional tractor-trailer trucks. There would be approximately 75 truckloads per mile of pipeline to transport VSM and pipeline construction materials.

The HSMs would be bolted or welded to the VSMs. The pipelines would be welded together while temporarily supported alongside the VSMs. Boom tractors would then lift long sections of assembled pipe into the pipe saddles mounted onto the HSMs. Pipeline construction typically would follow VSM installation by a lag of a few days, resulting in a single-season project. However, longer pipelines may require multiple seasons, resulting in VSM installation during one winter season, followed by pipeline installation during the next winter season (Table 2.3.1-1).

Throughout construction, welds would be tested for defects, and the completed pipeline would be pressure tested. Hydrostatic testing would be performed to ensure integrity of the pipe material, fittings, and welds. In general the pipeline would be filled with water and pressurized to a specified test pressure. The pressure would be maintained for a time period specified by code. At the end of the test, the water would be discharged from the pipeline. If fresh water is used, it would first be tested for contaminants and then discharged onto the tundra through a filter medium to remove any solids. The tundra would be protected so that erosion would not occur during the discharge. After testing, the water would be discharged in accordance with the General National Pollutant Discharge Elimination System (NPDES) Permit for Oil and Gas Extraction on the North Slope of the Brooks Range, Permit Number AKG-33-0000, which covers discharges from hydrostatic testing of pipelines. If seawater is used, it could be injected into the reservoir to maintain reservoir pressure or disposed of in a disposal well.

On rare occasions, pipeline hydrostatic tests could be conducted in the winter. In this case, freeze-protected water would be used. The options would be salt brine, glycol/water, or methanol/water solution. At the end of the test, the test fluid could be re-used for another purpose, injected for pressure maintenance, or disposed of in an injection well.

2.3.2.3 Pipeline Operation

Pipelines would be ready for start-up upon completion of hydrostatic testing. Production start-up would proceed in accordance with the schedule in Table 2.3.1-1. Pipeline segments connecting production pads with APF-1 would be placed into operation individually as the production pads are completed.

PRODUCTION PIPELINE

The production line would be three-phase, which means that the line carries a mix of oil, water, and gas. Three-phase flow in pipelines could cause “slugging,” wherein pressure pulses or vibrations occur when flow and pressure differences between gas and oil/water occur. This phenomenon is frequently a function of the pipeline elevation changes and/or erratic operating conditions of production wells. In the case of pipelines crossing rolling terrain, slugging occurs when liquid gathers at the lowest parts of the pipeline until it is forced onward through the rest of the pipe by the pressure of the gas caught behind the pooled liquid.

A central operations center at APF-1 would operate the production pipeline on a continuous basis. The operations center also would monitor conditions such as flow, pressure, and valve status (open or closed) to detect leaks or other upset conditions.

SEAWATER INJECTION PIPELINE

The seawater injection pipeline would carry treated seawater from APF-1 to the production pads. No seawater treatment plant (STP) is contemplated for the Plan Area. Instead, treated seawater would be piped from an existing treatment facility at Oliktok Point, through an existing seawater supply pipeline from the Kuparuk Oilfield to APF-1. Under FFD, the seawater supply pipeline would be extended from APF-1 to the HPFs. The seawater would be distributed from each processing facility to production pads through seawater injection pipelines, and then injected into the reservoirs to maintain pressure. Operation of the seawater injection pipeline also would be controlled from APF-1 operations center. Deoxygenation at the existing Oliktok Point STP would minimize the corrosivity of the water. In addition, the water would be treated periodically with a biocide or other chemicals in an effort to limit the potential of microbiologically influenced corrosion. The seawater injection pipelines to CD-5, CD-6, and CD-7 could also be used for produced water injection. For those production pads, CPAI could alternate the pipeline service between seawater and produced water.

MISCIBLE INJECTION PIPELINE

The MI pipeline would transport MI from APF-1 or, in the case of FFD, from an HPF to the production pads. The MI enhances oil recovery by acting as a solvent to flush oil out of the reservoir formation and by maintaining reservoir pressure. MI is produced gas that is blended to provide a specific composition (ethane, propane, etc.). The specific composition is dependent upon the reservoir the MI would be injected into. The normal operating pressure of the MI pipelines would be about 4,200 pounds per square inch.

LIFT GAS PIPELINE

The lift gas line would carry natural gas from the existing APF, or in the case of FFD, from an HPF to the production pads. Lift gas is produced gas that has been dehydrated. The lift gas would be injected into the annular space of production wells. From there, it would pass through valves into the produced fluids in the production tubing. Lift gas is injected to reduce the density of the produced fluids and thus help “lift” them out of the well and to the surface facilities. The operating pressure of the lift gas pipelines would be about 4,200 pounds per square inch.

PRODUCT SUPPLY PIPELINE

The 2-inch product supply line would be a non-insulated carbon steel line. The product supply line primarily would be used to transfer diesel and also could be used to transfer batch quantities of mineral oil, corrosion inhibitor, scale inhibitor, methanol, and emulsion breaker to production pads that are not served by gravel roads. The products would not be heated and the line would operate at ambient temperature. Because the ambient temperature is below freezing during most of the year, external corrosion is anticipated to be limited. Because this pipeline would be used to transfer finished products, it would be regulated under USDOT pipeline rules.

PIPELINE MAINTENANCE AND REPAIR

Maintenance and repair activities would be required during the operational life of the pipelines. These activities could include but are not limited to support adjustment, insulation repairs, corrosion repairs, and valve repairs. Most of these activities would occur with the pipeline in operation. In some cases, a pipeline shutdown would be required to make repairs and perform maintenance. Extended flow interruptions during winter would likely necessitate that produced fluids and seawater pipelines be evacuated and the contents displaced with appropriate gases or fluids. During extended pipeline shutdowns, wells would be freeze-protected and shut in.

Most planned maintenance and repair activities would occur during winter to allow ground access to pipelines on ice roads or frozen tundra. However, urgent repairs may require access when the tundra is not frozen. In these cases a helicopter, low-ground-pressure vehicle, or rig mats would be used. A typical maintenance and repair crew could range from 5 to 25 people.

2.3.2.4 Pipeline Abandonment and Rehabilitation

As noted in Section 2.3.1.4, removal of facilities and rehabilitation of the land is the responsibility of the permittee, and approval of the plan for removal and rehabilitation is within the discretion of the AO. Abandonment of the proposed pipelines could include demolition and removal of the facilities and restoration of disturbed ground. It is anticipated that pipeline removal would be consistent with that described for TAPS in the TAPS ROW Renewal EIS (TAPS Owners 2001a). On the basis of the pipeline removal for TAPS, it is assumed that abandonment could include:

- All aboveground pipelines, valves, and supporting structures would be removed to a depth that would prevent frost-heave action lifting the remnant to the surface.

- Any belowground pipeline segments would be cleared, cleaned of oil and other residues, capped, and left in place in locations where they would not interfere with other abandonment activities or planned land uses.

- APF and HPFs would be used as work camps and staging areas to support pipeline abandonment activities.

- Residual, surplus, and scrap materials would be reused or recycled to the extent possible, and waste materials would be disposed of in accordance with applicable regulations.

2.3.3 Production Pads

2.3.3.1 Production Pad Design

The following sections describe production pads proposed for the ASDP. The five production pads are known as CD-3, CD-4, CD-5, CD-6, and CD-7. Production pad design would be similar for FFD.

There would be three typical sizes of production pads. The road-connected production pads would be approximately 9.1 acres; non-road connected or roadless pads in the Delta areas would be approximately 12.6 acres; and other roadless pads would be approximately 17.6 acres. These pad sizes exclude associated airstrips, helipads, boat launch facilities, and access roads. Non-Delta roadless pads must be larger because equipment would be brought in over ice roads in winter and staged on the pad so that the pad could be self-sustaining during the summer months when roads access would not be available for transportation of heavy equipment (PAI 2002a). Because roadless pads in the Delta would support winter-only drilling, there is no need for an additional materials staging area. Production pads with no road access back to CD-1 during drilling would require additional pad space for a mud plant. This design is similar to that used for other recent production pad developments such as Tarn and Meltwater, east of the National Petroleum Reserve-Alaska (CPAI 2003a). Production pads would be designed with an orientation that minimizes wind-drifted snow accumulations, and would use natural slope or culverts to alleviate ponding. The CD-3 and CD-4 production pad layouts are presented in Figures 2.3.3.1-1 and 2.3.3.1-2.

The minimum production pad thickness would be 5 feet to maintain a stable thermal regime (see Section 2.3.1.1, Road Design, for discussion on thermal stability). The volume of gravel fill for a production pad would vary depending on site-specific topography and design criteria, but would be approximately 80,000 to 100,000 cy. Slideslopes would be at least 2H:1V. Potential for erosion would be evaluated on a pad-specific basis, and if necessary slideslope protective measures would be designed. Gravel quantity estimates in this section are based on a 5.5 to 6.0-foot pad thickness with slideslopes that are approximately 2H:1V. See Figure 2.3.3.1-3 for a typical satellite production pad layout, as would be applicable for CD-5, CD-6, and CD-7.

The existing production pads in the Colville River Delta have been designed to accommodate a floodwater surface elevation for a 200-year (Q_{200}) return period plus 1 foot of freeboard (PAI 2002a). Design thickness for the pads outside the Colville River Delta is driven by the permafrost protection criteria. Conceptual design for the proposed pads and HPs would be designed to the same criterion (Q_{200} plus 1 foot). Other hydrologic factors that would be considered in the detailed design to protect the structural integrity of the pads include scour protection, ice jams, storm surges, and separation distances from water bodies. (CPAI proposes a minimum separation of 200 feet.) On the basis of the elevation at the location of proposed CD-3 and hydrologic data, CPAI has estimated gravel quantities by using an average pad thickness of 5.5 feet, except for CD-4 which is 7.5 feet (CPAI 2004). Gravel quantities and acres of cover for the HPs north of CD-1 and CD-2 (CD-3, HP-5, HP-7, HP-12, HP-13, HP-14, and HP-22) were estimated by using these same average pad thicknesses.

Typical facilities on a production pad would include the following infrastructure:

- Approximately 20 to 30 wellhead houses

- Manifold piping
- Pig launcher/receiver building
- Production heater
- A communications building that doubles as an emergency shelter for operators stranded by inclement weather
- A permanent radio transmission tower up to 200 feet high at CD-7; 60-foot-high permanent towers at CD-3, CD-4, and CD-5; and a temporary radio tower up to 140 feet tall at CD-6. Permanent towers would be triangular self-supporting towers with 9-foot-wide bases or other design proven in previous North Slope use. The temporary tower would be pile supported. All towers would have warning lights. Similarly for FFD, there would be 60-foot towers at all production pads, except for 140-foot towers at HP-11, HP-12, HP-13, and HP-15 and 200-foot towers at HP-10, HP-14, HP-19, and HP-22.
- Spill response equipment container
- Emergency generator for roadless pads
- Temporary tanks, in secondary containment, to support drilling operations at road-connected pads:
  - Two 16,800-gallon (400-barrel [bbl]) brine tanks
  - One 8,400-gallon (200-bbl) cuttings and mud tank
  - A drill rig diesel fuel tank built in as part of the drill rig structure
- Additional temporary storage tanks in secondary containment for a roadless production pad, to support drilling operations:
  - Two 25,200 gallon (600-bbl) brine tanks
  - One 25,200-gallon (600-bbl) freshwater tank
- Production operations storage tanks, in secondary containment:
  - One 16,800-gallon (400-bbl) or smaller corrosion inhibitor tank
  - One 6,300-gallon (150-bbl) methanol tank
  - One 4,200-gallon (100-bbl) or smaller scale inhibitor tank
  - One 6,300-gallon (150 bbl) or smaller emulsion breaker tank
- Production operations stand-by tank (normally empty), in secondary containment, to support well and pad operational activities and maintenance, on an as-needed basis:
  - Two 500-bbl work tanks to facilitate well work
  - Well testing equipment
- Mud plant tanks and silos, to support year round drilling at a pad or cluster of pads that do not have gravel or ice roads access from CD-1:
  - Six 25,000-gallon (600-bbl) tanks (two for brine, three for mud, one for water)

- Silo for bulk barite (mud weighting material)
- Silo for gel (bentonite used to adjust mud rheology)
- Silo for bulk dry cement
- Mixing tank and equipment to mud and/or brine
- Production operations storage tanks, in secondary containment:

  One 16,800-gallon (400-bbl) corrosion inhibitor tank

  One 6,300-gallon (150-bbl) methanol tank

  One 4,200-gallon (100-bbl) diesel fuel tank

  One 4,200-gallon (100-bbl) scale inhibitor tank

  One 6,300-gallon (150 bbl) or smaller emulsion breaker tank

- Production operations stand-by tanks (normally empty), in secondary containment, to support well and pad operational activities and maintenance on an as-needed basis:
  - Two 400-bbl waste oil and water recycle tanks for storm water and oil transfer
  - Two 500-bbl work tanks to facilitate well work

No major hydrocarbon processing facilities would be located at the production pads; all produced fluids would be transported by pipelines to processing facilities.

2.3.3.2 Production Pad Construction

Construction of production pads would begin by surveying and staking out the pad limits. For the road-connected pads, the gravel road first would be built directly to a point intersecting with the pad site. Pad construction would entail placing gravel off the end of the gravel road in a 24-inch initial lift (layer) until the entire footprint of the pad is covered. This initial lift would provide an area in which trucks to turn around and would enable the placing and compacting of successive lifts to proceed efficiently until the pad would be completed.

In the roadless scenario, an ice road would be built to transport equipment and haul the necessary gravel to build the pad structure. Pad construction would commence with placement of gravel off the end of the ice road in a 24-inch lift until the entire footprint of the pad would be covered (PN&D 2002b). Construction would proceed in winter months only, with construction access via the ice road.

Uneven thaw settlement caused by winter placement of gravel would necessitate remobilizing or leaving a grader and vibratory compactor on the pad until summer to regrade and compact the pad as the embankment thaws during the following summer. Poor quality gravel with high water content and organic matter would extend the amount of time required to compact the gravel adequately.

The number of haul trucks required would depend on the distance from the gravel source; that is, if the source were farther away, more haul trucks would be required to keep equipment working continuously. The distance to the gravel source would be especially important because the winter construction window is typically 5 months or less as a result of time constraints for tundra access during winter.

Under both the gravel road access and ice road access scenarios, construction crews would access production pads only by road. Construction crews would fly into APF-1 from the Kuparuk Oilfield. Construction crews for CPAI's five proposed production pads would be housed at APF-1 or at Nuiqsut. In FFD, construction crews might also be housed at a new HPF. Estimated North Slope manpower required for the applicant's proposed action during the construction phase is provided in Table 2.3.3-1. This estimate includes labor for all construction activities, not just pad construction. It has been assumed for the purposes of analysis for the five production pads, that there would be no difference in construction manpower requirements for the different ASDP alternatives.

TABLE 2.3.3-1 CONSTRUCTION AND DRILLING MANPOWER REQUIREMENTS

Time Period	Construction Craft and Staff Personnel	Drilling Personnel
Activity		5-Pad[1]
Summer 2004	50	0
Winter 2004/2005	550	75
Summer 2005	250	0
Winter 2005/2006	550	75
Summer 2006	300	60
Winter 2006/2007	400	75
Summer 2007	100	60
Winter 2007/2008	350	135
Summer 2008	250	60
Winter 2008/2009	250	135
Summer 2009	10	0
Winter 2009/2010	100	195
Summer 2010	200	120
Winter 2010/2011	200	195

Source: CPAI 2003n
Notes:
[1] Drilling manpower requirements reflect a maximum of 60 personnel residing at the temporary drilling camp at each of the four road-connected pads in the ASDP. Winter drilling at CD-3 requires an additional 15 people for a total of 75 personnel at that roadless location.

2.3.3.3 Drilling Activities at Production Pads

During construction and drilling, portable generators would provide temporary power as necessary. A drill rig and consumables would be driven to the production pads either across ice roads in the winter (CD-1) or on gravel roads. The drill rig would use reduced sulfur diesel-generated power, with reduced sulfur diesel fuel transported from APF-1 to the production pads by tank truck on gravel or ice roads, or to roadless production pads through the 2-inch-diameter products pipeline (CPAI 2003a). Development drilling would begin after production pads were constructed and would continue until all wells at a production pad were completed or until the drill rig needs to move to accommodate a seasonal drilling program, as with the proposed winter-only drilling at CD-3 and summer-drilling at CD-4. In the latter case, the drill rig would have to be remobilized to the production pad the following season to continue drilling.

The drill rig would be totally enclosed with wind walls and arctic winterization. The enclosure would retain heat to protect the mud pumps and associated engines, mud mixing and cleaning equipment, and diesel-driven generators. These winterization measures also provide noise abatement. Loading bins would be oriented to minimize noise impacts on adjacent areas.

A temporary modular camp for up to 75 workers (Table 2.3.3-1) would be established on each production pad during drilling to support 24-hour drilling operations (CPAI 2003a; CPAI 2003e). Camps would be utilized year-round until drilling is complete for CD-5, CD-6, and CD-7. Camps would be present during winter drilling at CD-3 and during summer drilling at CD-4. Wastewater discharges associated with the temporary camps would be limited to domestic wastewater (both graywater and sanitary waste).

In addition to camp water requirements, approximately 38,000 gallons per day (gpd) of water would be required to support drill rig and mud plant operations at each production pad location (CPAI 2003e). Water would be obtained from lakes for which permits have been obtained.

Drilling wastes (mud and cuttings) could be managed by a combination of methods: annular disposal into permitted development wells onsite; transport and injection into an approved Class II Disposal (Class IID) well at APF-1 or other North Slope operating unit; and reapplication of washed/tested gravels onto production pad and/or road surfaces. Associated regulatory guidance is described in Section 2.3.11.6. Drilling waste (mud, ground cuttings, excess cement, mix water, etc) is almost exclusively disposed of in annular disposal at the existing CD-1. Conservation Order 443 issued March 15, 1999 contains the pool rules for the Alpine Field. Findings 14-21 and conclusions 5 and 6 apply to annular disposal at the Alpine Development Project. CPAI projects that the lithologies and absence of underground sources of drinking water (USDWs) would be similar for the five new proposed CD sites; annular disposal would also be used for drilling waste disposal. As of the end of 2002, a total of 908,686 of drilling waste has been disposed of in 33 annuli on CD-1 and CD-2. The waste was from 68 wells. This volume gives an average of slightly under 13,400 bbl per well. 20 AAC 25.080 allows for a total of 35,000 bbl of waste to be disposed of in a permitted annulus. For comparison, at the end of 2002, the Alaska Oil and Gas Conservation Commission (AOGCC) records show that a total of 184,032 bbl of waste has been injected into CD1-19A (Class IID well) and 1,155,330 bbl of waste had been injected into WD-02 (Class I Disposal [Class ID] well).

A Class ID well is an injection well for disposal of non-hazardous waste or RCRA-exempt waste. Class ID wells are permitted and regulated by the USEPA through the UIC Program. Class ID wells may also accept wastes that are eligible for injection in Class IID wells.

A Class IID well is a well for injection of materials that are brought to the surface in connection with conventional oil and gas exploration and production. The USEPA has delegated authority for Class IID wells to AOGCC, under the UIC Program.

In the event of well control problems, CPAI will have provisions in place for drilling a relief well or for well capping as required in Alaska Department of Environmental Conservation (ADEC) regulation 18 AAC 75.445(d)(2). Specialized personnel and the equipment needed for well control are available on the North Slope through mutual agreement and would be able to be mobilized within 24 to 48 hours of notification (CPAI 2003f).

Gravels generated during drilling are washed at the Alpine Field. Washed gravel is tested for heavy metals, diesel, and other hydrocarbons. After testing, the washed gravel is used on pads and roads to compensate for gravel loss from compaction. Each well typically generates about 50 cy of gravel for re-use (ref memo from T Maunder, PE, AOGCC).

Estimated North Slope manpower required for the applicant’s proposed action during the drilling phase is provided in Table 2.3.3-1. This estimate includes labor for all drilling. It has been assumed for the purposes of analysis for the applicant’s proposed production pads that there would be no difference in drilling manpower requirements among the alternatives, except for roadless pads, which would have an additional 15 personnel. The drilling requirements for FFD only can be estimated in broad ranges until specific plans and schedules are developed.

2.3.3.4 Operational Activities at Production Pads

Permanent camp facilities would not be required at any production pads because operations personnel would be based at APF or HPFs. Approximately 100 gpd-per-person of wastewater would be generated during production operations, resulting in an additional 1,000 to 1,500 gpd of wastewater to be disposed of, based on approximately 11 incremental staffing positions estimated for the five proposed pads. Similarly, 1,000 to 1,500 gpd of additional potable water would be necessary. The additional wastewater and fresh water would be generated at and disposed of through APF-1, or for FFD through APF-1 and the new HPFs.

Operations personnel would visit production pads as dictated by the activity level, spill prevention requirements, and access. Manpower requirements for operations at each of CPAI's five proposed production pads are presented in Table 2.3.3-2. For pad access by gravel roads, personnel would make up to two round trips per day (one per 12-hour shift) to each production pad. Operation and maintenance of roadless production pads would be performed remotely from processing facilities, with operators visiting the production pad by aircraft, ice road, or other approved surface transport approximately three times per week (CPAI 2003a). It has been assumed for the purposes of analysis for the five production pads that there would be no difference in operations manpower requirements for the ASDP alternatives, except for roadless pads for which two people would travel together for safety reasons. Manpower requirements for FFD would be comparable on a per-production pad basis, with total manpower levels dependent on the schedule for development.

In addition to the facilities listed in Section 2.3.3.1, the following equipment would be located at a roadless production pad during operations:

- Pickup truck
- Hot oil truck
- Front-end loader
- Tioga heaters (two or three)
- Upright work tanks(s)
- Supersucker or vacuum truck
- Slickline unit
- Portable air compressor
- Bleed tank

Warm and cold storage sheltersRoadless sites would have remote freeze protection of surface piping and well bores, remote monitoring of well annuli, and more extensive use of visual, infrared, gas detection, or camera surveillance than roaded sites.

TABLE 2.3.3-2 OPERATIONS MANPOWER REQUIREMENTS

Estimated Startup Date	Jun. 2006	Oct. 2006	Nov. 2008	Jan. 2010	Nov. 2010
Field Personnel	**CD-3**	**CD-4**	**CD-6**	**CD-5**	**CD-7**
CPAI Operator	0.50	0.25	1.00	0.25	0.25
CPAI Maintenance	0.50	0.10	1.00	0.10	0.10
Contract Operator	0.50	0.25	0.00	0.25	0.25
Contract Maintenance	0.50	0.10	0.00	0.10	0.10
Heavy Equipment Operator	0.40	0.25	2.50	0.10	0.10
Heavy Equipment/Vehicle Repair	0.20	0.10	1.00	0.00	0.10
Incremental Number of 12-hour positions per production pad	2.60	1.10	5.50	0.80	0.90
Cumulative Number of 12-hour positions per production pad	2.60	3.70	9.20	10.00	10.90

Source: CPAI 2003k

Notes: Each 12-hour position represents two people and is equivalent to 4,380 man-hours per year.

This manpower estimate assumes that a road connects CD-1 to all production pads except CD-3.

The manpower forecast is an estimate of the number of 12-hour positions (that is, two people per position) that would work onsite at the five proposed production pad locations. An estimate of additional personnel necessary at CD-1 to support the five new production pads includes the equivalent of three positions: one additional facility startup supervisor/lead, one additional plant board operator position, one half of an additional contract spill technician position, and one half of an additional contract operations and maintenance position.

The applicant would prepare an SPCC Plan. The SPCC Plan would identify locations and capacities of bulk storage tanks, spill prevention measures, training, inspection and record-keeping requirements, spill response equipment locations, and spill response procedures.

Operation and maintenance responsibilities would include monitoring of the wells, pumping, metering units, monitoring of the pipelines, potential initial spill response, snow removal, and routine operation and maintenance. For remote roadless production pads, all maintenance activities that need ice road support and that are not essential to maintain a safe and environmentally sound operation would be deferred until an ice road is available. Warehousing and repair shops would be located at CD-1 (CPAI 2003a). Cleared snow would be placed in designated areas to minimize ponding during the summer melting period.

Primary electrical power to production pads would be provided by the main power generation facility at APF-1, a generator at CD-6, and power generation at new HPFs. Facility upgrades would be required at CD-1 to provide power to the production pads of the ASDP alternatives. Communications systems between the production pads and processing facilities would include fiber-optic cable and hand-held radio systems. The fiber-optic cable would be supported in cable trays on the new pipeline VSMs or buried in gravel roads (CPAI 2003a; CPAI 2003c). Production pad radio towers to support radio communications are listed in Section 2.3.3.1.

2.3.3.5 Production Pad Abandonment and Rehabilitation

As noted in Section 2.3.1.4, removal of facilities and rehabilitation of the land is the responsibility of the permittee and approval of the plan for removal and rehabilitation is within the discretion of the AO. All costs are the responsibility of the lessee. It is assumed that aboveground facilities would be removed and wells plugged and capped. Equipment could be retrofitted for other North Slope use, or removed from the North Slope for subsequent re-use or scrap. Just as with roads, the ultimate fate of the gravel pad would not be known until closer to the end of the production pad life. Permitting agencies may require that gravel be removed, in part or total, and the tundra be revegetated or, if other uses are determined by the permitting agencies to be preferable, the agencies may allow the permittee to leave the gravel pads in place, revegetated or not revegetated. Removed gravel either would be disposed of or reused for another development.

2.3.4 Oil Spill Prevention, Detection and Response Monitoring, and Surveillance of Pipeline Condition

The uninsulated products line and associated saddle-style pipe supports would be inspected periodically for external corrosion. Internal monitoring for corrosion of pipelines is accomplished by periodic use of an in-line inspection tool called a "smart pig." The smart pig is an instrumented device that is transported through the pipe with a slug of liquid and records the pipeline wall thickness and changes in pipeline alignment with on-board instruments. Deviations in successive readings would indicate corrosion, broken welds, or pipeline movement, which would trigger closer inspection and possibly repair of the affected section of pipe. Smart pig technology is applicable to pipeline 8 inches in diameter or larger. The seawater, sales oil lines, and MI lines of sufficient diameter would be instrument-pigged on a 5-year interval to verify the effectiveness of the corrosion control programs. Inspection intervals by pipeline type are shown below in Table 2.3.4-1.

Cleaning pigs are non-instrumented devices that are periodically sent through a pipeline to clean and remove wax, scale, and debris. This type of pig would be used for maintenance of the three-phase produced fluid, products, and water injection pipelines. The gas and MI pipelines would not be cleaned by maintenance pigs. To enhance visual monitoring for leak detection, the product line would have dye added to diesel and other products when practical and as determined by operations personnel (CPAI 2003f). In addition, the product line would be monitored for any pressure loss during each transfer procedure.

TABLE 2.3.4-1 PIPELINE MONITORING AND SURVEILLANCE

Pipeline	Type of Surveillance or Monitoring	Frequency	Regulatory Requirement
Three-Phase infield (produced fluids)	Surveillance (No Road = Aerial, Road = Ground Based)	Routine (at least monthly during operations)	NA
	Maintenance pigging	As needed	NA
	Mainline Valve Inspections	Twice per year	NA
	Relief Valves	Annually	NA
Seawater	Surveillance (No Road = Aerial, Road = Ground Based)	Weekly	ROW Lease*
	Surveillance (Ground Based)	Annually	ROW Lease*
	Mainline Valve Inspections	Twice per year	ROW Lease*
	Relief Valves	Annually	ROW Lease*
	Corrosion coupons	Twice per year	ROW Lease*
(If pipeline buried)	Rectifiers	Six times per year	ROW Lease*
(If pipeline buried)	Cathodic protection survey	Annually	ROW Lease*
	Corrosion pigging	Once every 5 years	ROW Lease*
	Maintenance pigging	Monthly	ROW Lease*
	CPM leak detection: application	Once every 5 years	ROW Lease*
	CPM leak detection: temperature transmitters	Annually	ROW Lease*
	Telecommunication Systems	Annually	ROW Lease*
Miscible Injectant	Surveillance (No Road = Aerial, Road = Ground Based)	Routine (at least monthly during operations)	NA
	Pressure loss monitoring	Routinely	NA
	Mainline Valve Inspections	Twice per year	NA
	Relief Valves	Annually	NA
(If over 8-inch in diameter)	Instrumented pigging	Once every 5 years	NA
Products	Surveillance (Aerial)	Weekly	ROW Lease*
	Surveillance (Ground Based)	Annually	ROW Lease*
	Mainline Valve Inspections	Twice per year	ROW Lease*
	Relief Valves	Annually	ROW Lease*
	Corrosion coupons	Twice per year	ROW Lease*
(If pipeline buried)	Rectifiers	Six times per year	ROW Lease*
(If pipeline buried)	Cathodic protection survey	Annually	ROW Lease*
	Maintenance pigging	Quarterly	ROW Lease*

TABLE 2.3.4-1 PIPELINE MONITORING AND SURVEILLANCE (CONT'D)

Pipeline	Type of Surveillance or Monitoring	Frequency	Regulatory Requirement
	CPM leak detection: application	Once every 5 years	ROW Lease*
	CPM leak detection: temperature transmitters	Annually	ROW Lease*
	Telecommunication Systems	Annually	ROW Lease*
	Pressure loss monitoring	Each transfer	NA
Sales oil	Surveillance (Aerial)	Weekly 49 CFR 412: 26 times per year	18 AAC 75.055(a)(3) 49 CFR 195.412
	Surveillance (Ground Based)	Annually	ROW Lease*
	Mainline Valve Inspections	Twice per year	49 CFR 195.420
	Relief Valves	Annually	49 CFR 195.428
	Corrosion coupons	Twice per year	49 CFR 195.579(b)
(If pipeline buried)	Rectifiers	Six times per year	49 CFR 195.573(c)
(If pipeline buried)	Cathodic protection survey	Annually	49 CFR 195.573(a)
	Corrosion pigging	49 CFR 195.579(a) Once every 5 years (operator defined) 49 CFR 195.452(j)(3): Once every 5 years	49 CFR 579(a) 49 CFR 195.452(j)(3) (Integrity Management Program Covered Sections Only)
	Maintenance pigging	Monthly (operator defined)	49 CFR 579(a)
	CPM leak detection: application	Once every 5 years	49 CFR 195.444
	CPM leak detection: temperature transmitters	Annually (operator defined)	49 CFR 195.444
	Telecommunication Systems	Annually (operator defined)	49 CFR 195.408

Notes:
ROW Lease could be a Unit Plan of Operation Approval or Spill Plan and Prevention Approval in some cases.

For the seawater line and sales oil line in the FFD scenario, internal corrosion would be monitored by use of corrosion coupons that determine corrosion rates based on weight loss. Two corrosion coupon stations would be located in each segment of the USDOT-regulated sales line: one upstream of the pig launcher and one downstream of the pig receiver. Air and ground inspections of the sales oil pipelines in the FFD scenario would be conducted at least monthly. The goal of these aerial surveys would be visual detection of oil leaks that may develop as a result of a leak below the monitoring threshold of the leak detection system. Twin Otter flights also would be equipped with a Forward-Looking Infrared Radar (FLIR) system for use periodically in conjunction with the weekly aerial surveillance. The FLIR system is capable of detecting small temperature differences that result if a leak occurs (CPAI 2003f).

2.3.4.1 Spill Prevention

The information presented here summarizes the equipment and operational procedures and requirements included in the applicant's proposed action. The spill prevention, detection, and response plans for facilities included in FFD would be similar in nature. The Alpine Oil Discharge Prevention and Contingency Plan (ODPCP) would be revised to address spill prevention measures, potential spills, and capability to meet spill response planning standards at the satellite locations.

CPAI would provide training to its employees on the importance of avoiding oil or hazardous material spills and on spill response. CPAI would also provide new-employee orientation, annual environmental training seminars, and appropriate certification classes. Safety meetings would be held on a regular basis, and would include training for spill prevention and response. An Incident Management Team also would participate in scheduled training programs and would conduct spill response drills. These training programs are regularly conducted at the Alpine Development Project, and the ASDP personnel would receive training through that established program (CPAI 2003a).

Actuated block valves would be installed on each end of some pipeline segments to control flow (CPAI 2003g). CPAI proposes to install a block valve on the produced fluids pipeline at CD-3 and one at CD-1, to allow isolation of the pipeline across lower Colville River Delta channels. These valves would be shut manually or by remote control. Workers could reach manually controlled valves by use of a helicopter, all-terrain vehicle, low-ground-pressure vehicle, snowmobile, boat, etc. (CPAI 2003a). The BLM approval of an exception to Stipulation 24(i) in the Northeast National Petroleum Reserve-Alaska IAP/EIS would be required for emergency tundra travel to allow tundra access during a spill response in the summer. CPAI has committed to designing pipeline valve placement in accordance with ASME B31.4 (2002) Section 434.15 (CPAI 2003g). ASME B31.4 Clause 434.15.2 calls for a mainline block valve on the upstream side of a major river crossing and either a block or check valve on the downstream side of a major river crossing. CPAI proposes to install valves in the produced fluids pipeline on both sides of the Nigliq Channel and on both sides of the Ublutuoch River. Spill containment equipment would be installed below each isolation valve.

2.3.4.2 Spill Response Resources

Oil spill responders would be able to reach production pads by several means. Primary spill responders would come from CD-1 and from Alaska Clean Seas (ACS), with additional resources available from the Kuparuk Oilfield, the Nuiqsut Village Response Team, and mutual aid providers (CPAI 2003a). Some response equipment also would be staged at the production pads and at key control points on or adjacent to river or stream pipeline crossings. ACS has pre-staged equipment in containers by the Nigliq Channel crossing. Where applicable, the existing response vessels staged at CD-1 would be utilized, including shallow-draft response workboats and airboats. To expedite response to a spill event in the Delta, CPAI proposes two additional river access points. A gangway to a floating dock at CD-3 would access the East Ulamnigiaq Channel. The Nigliq Channel would be accessed by a boat ramp to be located at CD-4. The CD-3 gangway and dock would be used for launching small aluminum skiffs and airboats for rapid deployment of personnel and spill response equipment such as booms, skimmers, and pumps. The ramp at CD-4 would be designed to launch a 12,000-pound freighter, twin-engine airboat, a boat that is larger than existing boats in the spill response fleet of the Alpine Development Project. Response workboats and airboats typically would be able to access larger river channels within a few hours, depending on the location and channel characteristics. Low-ground-pressure vehicles for tundra travel such as Rolligons or Tuckers generally would have access to the production pads from CD-1, except during high water when conditions are not safe for their use. The state allows the use of low-ground-pressure vehicles on its lands on a case-by-case basis from July 15 to the following break-up, and additional vehicles are allowed to respond to catastrophic oil spills. The BLM does not allow vehicle access to its lands until specific frost and snow conditions have been met, but could grant exceptions to address a spill.

Specialized personnel and equipment (capping stack, cutting tools, etc.) would be available for response to a well blowout at a satellite production pad location within 24 to 48 hours.

Cross-tundra travel using Rolligons, Tuckers, or other approved tundra travel vehicles would be slow because these low-ground-pressure vehicles are designed to travel at a speed of only 6 to 12 miles per hour (mph) (ABR, Inc. 2003; RTSC 2000). Motorized vehicles from CD-1 would have access to the production pads when ice roads are serviceable (historically from January to early May) and year-round for those production pads with gravel road access. Helicopters and small cargo aircraft would have year-round access to production pads with airstrips when visibility permits.

2.3.4.3 Spill Detection Methods

The primary methods for leak detection would be pipeline pressure/flow monitoring and visual inspection. Three-phase produced fluids pipelines would contain low-pressure switches that automatically shut in the pipelines upon detection of a significant leak or line rupture (CPAI 2003h). Monitoring for small leaks would be accomplished primarily by visual inspection during routine visits to production pads. Additionally, all pipelines would be visually inspected on a regular schedule by (1) aircraft overflight observations; (2) use of the FLIR monitoring system operated from aircraft (such as a Twin Otter); or (3) ground observations from vehicles traveling on an access road (CPAI 2003a).

2.3.5 Gravel Sources

Gravel for building roads and pads would be mined from one of several potential source locations. Two locations already identified are the existing ASRC Mine Site and Clover (see Figure 2.2.3-1). The ASRC Mine Site is approximately 6 miles southeast of the proposed CD-4 facilities. Clover is on the distal western edge of the Colville River Delta, approximately 10.8 miles southwest of CD-1 and 7.4 miles southwest of the proposed CD-4 (CPAI 2002). The ASRC Mine Site already is permitted, Clover would require a separate permit and reclamation plan (see Appendix O).

The existing ASRC Mine Site would be utilized as a source of gravel fill material for proposed roads, pads, and airstrips in the eastern portion of the Plan Area. For Alternative A, approximately 27 acres within the existing ASRC Mine Site would yield approximately 836,000 cy of gravel for use in the ASDP. Use of the ASRC Mine Site for the ASPD would be within the existing capacity as permitted by the USACE and State of Alaska. Accordingly, analysis of the impacts of the proposed use of the ASRC Mine Site as a gravel source for the ASDP are not described in detail in this EIS document.

Nuiqsut contractors received Permit No. 4-960869 for the ASRC Mine Site from the USACE on June 23, 1997, authorizing a 10-year phased development of a consolidated sand and gravel site involving excavation of up to 5 million cy of sand and gravel. Phase 1 includes approximately 1.5 million cy from a 32-acre area. Additional authorized phases to meet future sand and gravel needs in the area include approximately 3.5 million cy from 80 acres. The total permitted footprint for the ASRC Mine Site is 150 acres. A site-specific mine reclamation plan is included in the permits. Successful execution of the reclamation plan is required by permit conditions. The USACE completed a Permit Evaluation and Decision Document that included an EA, and reached a Finding of No Significant Impact. A final Coastal Zone Management Consistency Determination was issued March 5, 1997, by the Office of the Governor of Alaska.

Estimates indicate that the ASRC Mine Site has sufficient gravel for road and pad construction associated with CD-3 and CD-4, and Clover would provide gravel for road and pad construction associated with CD-5, CD-6, and CD-7. Additional gravel sources probably would be needed for FFD. Any new gravel source would require a separate permit and reclamation plan. The impacts to physical resources from developing future gravel sources could be similar to those associated with developing Clover if in similar habitat. The impacts to biological resources would depend on what biological resources make use of the specific area in which gravel is identified. Analysis of those impacts and appropriate mitigation would be examined before approval of use of such future sites.

The development process for Clover or any future gravel source would include planning, designing, temporary staging areas, removal of overburden, blasting and excavation of gravel, and rehabilitation of the site (see

Appendix O). Rehabilitation would consist of regrading and landform construction, water recharging, and revegetation. If the mine site is within a floodplain, the rehabilitation plan also could address creation of fish habitat areas.

The use of gravel source sites would require developing and transporting the gravel by ice roads and pads. A detailed geotechnical analysis of the fill material would delineate areas of different material size and moisture content and quality. Fill would be segregated at the time of mining, and the higher-grade material would be reserved for the CD-1 to CD-4 road lake crossing (Lake L9323) or as topping material.

Excavation would occur during winter months to support winter road and pad construction. Blasting would be required to mine gravel, regardless of season, because all but the surface layers are permafrost. An ice bridge would be required if gravel would be transported over the Colville River Delta from the ASRC Mine Site (Figure 2.2.3-1). Equipment required to mine the large quantities of gravel needed for the applicant's proposed action would typically include the large bulldozers, excavators and/or loaders, hauling trucks, drill rig/compressor, and road grader.

Overburden materials would have to be stockpiled. The ASRC Mine Site overburden is approximately 22 feet deep at run (TMA 2000). Stockpile areas may consist of ice pads constructed adjacent to the gravel pit, with the pad size depending on the depth of overburden soils and the volume of underlying gravel to be extracted. For example, overburden soils removed from the ASRC Mine Site during previous operations required 1 acre of stockpile area (on an ice pad) for every 25,000 cy of overburden (TMA 2000).

Blasting holes typically are made with a pneumatic drill/compressor arrangement that may operate continuously during drilling. After blasting with dynamite, trucks would transport the gravel on ice roads to the road or pad construction locations where it would be placed.

Closure of a gravel mine site would occur after the supply of gravel is exhausted, or operation is no longer economical. Upon closure of mining cells, the overburden material would be placed back into the gravel pit, and landforms as required by permit stipulations would be constructed. To illustrate, landforms required during development of Phase 1 of the ASRC Mine Site included shallow littoral zones, very shallow littoral zones, waterfowl nesting islands within the nesting lake, and artificial revegetation (TMA 2000). New surface water bodies created by the mine pit impoundments would be left to recharge naturally through a stream or man-made channel during annual spring break-up floods. This process could be aided by placement of upwind soil berms to accumulate windblown snow in the water impoundments.

2.3.6 Airstrips

To allow year-round access during drilling and operation phases, gravel airstrips would be constructed at roadless production pads, isolated groups of interconnected pads, and in the FFD scenario, the new HPFs. Airstrips would be constructed in the same manner as gravel roads, typically offset slightly from the main pad but connected with a short access road. Gravel airstrips would be at least 5 feet thick and would have slideslopes of at least 2H:1V (CPAI permit application). Potential for erosion would be evaluated for each airstrip, and if necessary, slideslope protection measures would be designed. For impact analysis, tundra coverage and gravel quantities are estimated by using a 5-foot average thickness. All airstrip quantities and acres covered are calculated by using a 2H:1V slideslope. Airstrips as proposed by CPAI and as anticipated for FFD would be oriented so that the runways would be aligned with the prevailing northeast winter winds to minimize snow drifting. No hangars or aircraft refueling facilities would be available at the individual production pads. Dimensions of airstrips at production pads would be sized appropriately for the particular aircraft that would be used. Dimensions would range from a short airstrip of 3,400 feet by 100 feet used by CASA or Otter aircraft to a long airstrip approximately 5,000 feet by 100 feet used by DC-6 and C-130 Hercules (CPAI 2003i). General knowledge of aviation industry practices indicates that the proposed airstrip dimensions would be adequate to serve fully loaded aircraft safely (Stout 2003). Shorter airstrips could be constructed at some roadless production pads, but drilling would be limited to the winter season because airlifting well control equipment during the non-ice road season may not be possible with shorter airstrips

(CPAI 2003a). For the purposes of analysis in this EIS, the working surface of all airstrips is assumed to be 5,000 feet long by 100 feet wide. In addition there would be a safety area approximately 25 feet wide along each side of any runway, 60-foot-wide taxiways and 18-foot-wide runway access roads. All these gravel features would be a minimum of 5 feet thick (CPAI permit application).

For the applicant's proposed action, airstrip construction would occur during the winter. Construction access would be by ice road. Once construction is complete, the estimated flight frequency to production pad airstrips would be two fixed-wing aircraft (usually CASA or Twin Otter) flights every 2 to 3 days. In the case of helicopter-supported production pads, the same frequency would apply for the helicopters.

For CPAI projects, during a 1-year construction season, there would be approximately 700 landings by small aircraft (e.g., CASA or Twin Otter) for personnel, 250 landings for cargo aircraft (e.g., DC-6), and 20 landings by C-130 Hercules aircraft. Air traffic estimates for construction of APF-1 were higher. This EIS includes analysis of air traffic impacts associated with new HPFs based on history at APF-1 (see Figure 2.3.6-1). Heaviest traffic would occur during construction. After the completion of construction and the start of drilling and production, the number of flights would decline. Once drilling has ceased, air traffic at a new HPF might decline; however, it might remain unchanged if the HPF is used to support drilling hypothetical nearby production pads.

The anticipated flight path for the airstrip at CD-3 would be over land areas in the Coleville River Deltas. Flight elevations of less than 1,000 ft would be confined to areas within 3.6 miles northeast and southwest of the airstrip. Flight paths to other airstrips in the FFD scenario would depend on prevailing winds but would generally align with the orientation of the airstrips.

As noted in Section 2.3.1.4, removal of facilities and rehabilitation of the land is the responsibility of the permittee, and approval of the plan for removal and rehabilitation is within the discretion of the AO. Abandonment of airstrips could occur in conjunction with abandonment of pads. The gravel airstrips would be managed in a similar manner, depending on the decisions made by land managers and permitting agencies at the time of abandonment. Gravel airstrips would be (1) removed and the tundra revegetated, (2) revegetated but otherwise left in place, or (3) left in place and maintained for public use.

Unscheduled helicopter traffic, overwhelmingly in summer, would likely occur. It is not part of the applicant's proposed action, though. Rather, this traffic would largely be associated with scientific studies and monitoring of development. The frequency of this traffic and the areas in which it would take place are unpredictable.

2.3.7 Off-Road Travel

2.3.7.1 Ice Roads

Construction of roads could take place throughout the winter season, with road building later in the season being more efficient because of generally colder temperatures, which reduces the time required between water applications. Construction of ice roads would begin in early winter, as soon as tundra travel restrictions are lifted. Current criteria allow ice road construction to begin after the seasonal frost in the tundra and underlying mineral soils has reached a depth of 12 inches of hard frozen ground and the average snow cover is 6 inches of snow (ADNR 2003; BLM and MMS 1998b).

Construction of ice roads begins by compacting snow with wheeled front-end loaders and water trucks. If pre-packing is authorized, it is done with low-ground-pressure vehicles, commonly Rolligons, or various tracked rigs. An initial thin lift of ice aggregate is placed, if available, and water is applied to the snow and/or ice aggregate by water trucks. In conducting this work, machine operators would avoid clipping tussocks or the edges of low-centered polygons and would avoid shrub areas where possible. Upon complete freezing, successive lifts would be sprayed on the surface to a minimum depth of 6 inches, or until polygon ridges or tussocks are completely covered. Ice roads over land typically use approximately 1 million gallons of water per mile of constructed road (PAI 2002a). Typical ice road construction rates on the North Slope average approximately 1 mile per day per crew (Nelson 2003). The typical ice road would be 40 feet wide. Proposed ASDP ice roads for 2005 through 2011 are presented in Figures 2.3.7.1-1 through 2.3.7.1-7.

Ice road maintenance is necessary to keep the road from deteriorating and creating unsafe conditions. Typical equipment necessary for maintaining 20 miles of ice road includes at least one motor grader, a loader-mounted snow blower, and a water tanker truck. Increased numbers of each type of equipment would depend on road orientation, weather, and usage volumes. Graders with snow wings and snow blowers would be used to remove snow and keep berms leveled to prevent drifting.

2.3.7.2 Low-Pressure Vehicle Tundra Traffic

Development and operation of oil facilities in the Plan Area may require access across the tundra off pads or gravel or ice roads. Such access could be necessary to respond to spills or other emergencies, conduct pipeline maintenance and repair, facilitate ice road construction, or transport equipment and supplies to a roadless development site. Vehicles would conduct these activities from the nearest production or processing facility pads or gravel or ice roads.

Low-pressure vehicles, such as Rolligons and Tuckers, are used for such activities. These vehicles commonly exert less than 4 pounds per square inch of pressure to the ground. CPAI can obtain approval to use such vehicles on Kuukpik Corporation lands, on a case-by-case basis. CPAI can obtain permits from the state on a case-by-case basis to use such vehicles on state land between July 15 and break-up the following year. In emergency situations, such as a catastrophic oil spill, the state provides that these vehicles can be used in cleanup operations if the cleanup will be expedited and the use of the vehicle will prevent further environmental damage from the spill.

CPAI also can obtain approval from the BLM to use such vehicles on federal lands. Such use would have to comply with Northeast National Petroleum Reserve-Alaska stipulations. The BLM typically allows low-pressure vehicle use after the frost underlying mineral soil has reached a depth of 12 inches and an average snow cover of 6 inches.

Where roads are available, low-pressure vehicles would only traverse short distances. Pipeline repair and spill response likely would entail travel on the road to a place near the repair or spill, before traversing the tundra to reach the pipeline or spill location. If there are no roads, pipeline repair or spill response would require cross-tundra travel by the nearest low-pressure vehicle. Transporting equipment or supplies to a roadless site could entail many miles of tundra travel. This travel most likely would occur during the winter, when state, federal, and/or the NSB governments would put fewer restrictions on travel.

2.3.8 Boat Ramps and River Access

Two river access points are proposed to provide safe and reliable river access for spill response personnel. Two types of river access are proposed. Access to the East Ulamnigiaq Channel via a floating dock and gangway is proposed for CD-3 (see Figure 2.3.8.1-1). Access to the Nigliq Channel via a boat ramp is proposed for CD-4 (see Figure 2.3.8.1-2). Additional boat ramp facilities may be required for spill response under FFD. Design of these facilities would be similar to that of the proposed facilities.

2.3.8.1 Boat Ramp

One boat ramp is proposed for CD-4 (see Figure 2.3.8.1-2). The ramp would be designed to launch a 12,000-pound freighter, twin-engine airboat, a boat that is larger than existing boats in the spill response fleet of the Alpine Development Project. The potential CD-4 location would include a 2,400-foot-long by 22-foot-wide, minimum 4-foot-thick, gravel-access road and a 130-foot-long concrete launch ramp. Upstream and wrap-around surfaces of the gravel access road would receive slope protection.

2.3.8.2 Floating Dock

An 8-foot-wide gangway connecting the shore to a 12-foot by 16-foot floating dock is proposed for CD-3. This gangway and dock would be used for launching small aluminum skiffs for rapid deployment of personnel and spill response equipment such as booms, skimmers, and pumps. The gangway and floating dock would be installed each spring and removed at freeze-up by a front-end loader. Pilings would be installed to support the gangway and to anchor the floating dock. The pilings would be permanent, year-round installations.

2.3.9 Bridges and Culverts

The decision about whether to use culvert(s) or bridge(s) in the proposed action is based on the best technical and economical way to provide drainage at each particular crossing. Considerations include drainage discharge, limiting erosion, crossing footprint, fish passage criteria, constructability issues, ice passage issues, impacts on road design, maintenance, and load limits.

2.3.9.1 Bridge and Culvert Design

BRIDGES

Bridges may be necessary for either vehicle or pipeline crossings of certain water bodies. All planned vehicle-capable bridges would be heavy-duty; i.e., capable of supporting a fully-assembled drill rig.

Pipeline-only bridges carry much-reduced loads, which allows the structure generally to span longer distances, reducing the need for instream piers. CPAI proposes to use a box girder design for any pipeline-only bridge. Figures 2.3.9.1-1 through 2.3.9.1-3 present pipeline bridge crossings for the Sakoonang, Tamayayak, and Ulamnigiaq channels. Figure 2.3.9.1-4 shows a typical pipeline bridge abutment foundation cross-section.

This type of bridge can span 200 to 350 feet (Michael Baker, Jr. 2002c). Box girders are very rigid and can support pipelines from above, beneath, or along the sides.

Vehicle-bridge crossing lengths may be further refined as the existing hydraulic assessment data are augmented by ongoing CPAI studies and data collection. Short crossings typically could be made to clear-span approximately 55 feet without requiring instream supports. CPAI's vehicle bridge design for short crossings is shown in Figures 2.3.9.1-5, 2.3.9.1-6, and 2.3.9.1-7. Long crossings could span approximately 130 feet between piers. CPAI's bridge design for long crossings is shown in Figure 2.3.9.1-8. Bridge structural design would account for the higher-magnitude and lower-frequency floods, and ground protection armor would protect against the higher-frequency, lower-magnitude floods.

The road bridges typically would be designed so that structural support consisting of box girders or I-shaped plate girders would be located under the driving surface to accommodate the wide loads common to oil development. They would have 30-foot- (two-lane) wide driving surfaces and removable guardrails, again to accommodate the occasional wide loads. Decking material would be constructed out of pre-cast concrete decking.

The Nigliq Channel bridges would be built with a foundation consisting of a steel pile system with ice-breaking structures designed into the upstream side on each instream pier. An ice-breaking structure would be installed on the upstream side of each instream pier group. Each ice-breaking structure would require three additional pilings (Figure 2.3.9.1-8).

Box girder bridges are most desirable for co-locating pipelines on the vehicle bridges. Pipelines co-located on vehicle bridges would be situated alongside the girders, which would be below the driving surface and would not have an effect on the capability of the bridge to handle wide vehicle loads (Figure 2.3.9.1-8). The pipelines would be installed on the downstream side of the bridge structure in areas where there is potential for ice impacts to pipelines during break-up. An exception could be if a bridge is high enough to avoid any potential ice impacts; the pipelines then could be placed on the upstream side of a bridge structure.

Bridge crossing lengths and other variables necessary for detailed bridge design may be further refined as the existing hydrologic and hydraulic assessment data are augmented by ongoing CPAI studies and data collection.

For general navigability purposes, water level clearance to the lowest point of the superstructure crossing the Nigliq Channel would be 20 feet during normal summer water levels, except for the support piers, which would extend down through the water and below the river bed. Other drainages could have lower clearances, as determined by hydraulic and navigability factors.

Hydrologic constraints are an important consideration when designing bridges. Factors that are considered in the detailed design to protect the integrity of the bridge structure include design water surface elevations and velocities, scour protection, ice impacts and jams, storm surges, and waterway opening requirements. Bridge siting criteria generally include narrow channel, straight reach of stream, hydrological stability, good access from each side, ice jam potential, and direction of flow.

Bridge abutments would be armored. Armoring would consist of pile-supported pier groups, similar to the instream structure, or open-cell sheet pile. To reduce the footprint and prevent scouring of gravel roads leading up to a bridge, sheet-pile wing walls would be driven around bridge abutments.

CULVERTS

Generally, the use of large diameter culverts has not been very successful on the North Slope because of long-term thermal stability issues, difficulty of construction, and load-carrying capacity issues. Therefore, current road construction practice is to utilize available line pipe, usually up to 60 inches in diameter, as culverts in place of corrugated metal pipe types of culverts (see Figures 2.3.9.1-9 and 2.3.9.1-10). The line pipe culvert has more structural strength and has had a much better record of survivability and service. Corrugated metal pipe is preferable for fish passage.

At a discharge of 500 cubic feet per second (cfs), the number and spacing of culverts required to pass the flow and/or ice may not easily fit within the specific channel/floodplain for which it is designed. Therefore, a bridge would be considered when channelized flow occurs with a 50-year recurrence interval flood discharge of 500 cfs or more.

As a standard practice, cross-drainage culverts would be placed under roads approximately every 500 feet. These cross-drainage culverts would be used in addition to culverts or bridges specifically placed in known drainage locations. Cross-drainage culverts would be up to 5 feet in diameter (see Figures 2.3.9.1-10 and 2.3.9.1-11).

2.3.9.2 Bridge and Culvert Construction

BRIDGES

Bridge construction is anticipated to take place during the winter (CPAI 2003a). Ice pads would be constructed at each end of the bridge to stage girders, bridge decking, pilings, and equipment. Large cranes set up on each bank would bore holes for pile installation or would drive the piles. If instream piers were necessary, an ice pad would likely be built adjacent to the bridge site for the crane to work from.

If cuttings were produced from pile installation, those cuttings would be used for backfill around the piles and would be hauled by truck to a road or pad construction site for immediate use or to gravel pits and placed in the waste material area of the pit.

Ice pads for staging areas would vary with the size of the bridge and the equipment needs. However, if all construction materials had to be stored onsite at one time before construction began, such as for the approximately 1,200-foot-long Nigliq Channel bridge, the estimated pad size would be approximately 800 feet by 800 feet and would surround the abutment structure at each end of the bridge.

An entire bridge assembly, particularly the larger bridges, would be too heavy for a typical mobile crane to lift into place. Therefore, components would be fabricated offsite, with assembly taking place in the field. Tractor-trailer trucks would usually transport materials to the site. Assembly and installation would require cranes, loaders outfitted with forks, and various welding and light construction equipment. Depending on the type of bridge, every 100-foot section of bridge would require up to 16 truckload cycles to transport materials to the bridge site (maximum of 40-foot lengths), and each abutment would require 15 truckloads to haul sheet piling.

CULVERTS

Culverts typically would be installed perpendicular to the roadbed to minimize the length of culvert required, unless the drainage channel requires the culvert to be skewed relative to the road alignment. For culverts to allow cross flow and prevent ponding, installation typically would occur after the gravel structure of the roadbed has been constructed. The first step would involve excavating a trench across the roadbed, including a minimum of 2 feet of the thaw-unstable Native soils below the gravel road structure (McDonald G.N. 1994). The average width of the culvert trench is 5 feet (email, S Rothwell, 3-18-04). The Native soils would be replaced by gravel to provide stable bedding for the culvert. Gravel used to backfill around the culvert would consist of the same material utilized in road construction. Culverts placed in streams and flow ways would be constructed in a manner to maintain flow and fish passage.

2.3.9.3 Bridge and Culvert Operations and Abandonment and Rehabilitation

Typical maintenance activities could include removing sediment buildup on structural members, maintaining the corrosion protection system, monitoring the deck surface, replacing or resurfacing the deck system, and monitoring foundations.

As with roads, abandonment of bridges and culverts would occur after the economic life of the oilfields had passed. As noted in Section 2.3.1.4, removal of facilities and rehabilitation of the land is the responsibility of the permittee, and approval of the plan for removal and rehabilitation is within the discretion of the AO. Because the bridges and culverts are an integral portion of the proposed road network, the fate of the bridges would likely be determined by the fate of the road network. Abandonment of gravel roads is discussed in Section 2.3.1.4. If bridges would be removed, bridge superstructures would be taken apart and transported out of the area for recycling or disposal of the materials. Bridge piles likely would be cut off below the lowest anticipated scouring elevation from either natural scouring or a flood-induced event. The area of bridge abutments would be revegetated in a manner similar to that of the roadbed after gravel removal. If roads are left in place but not with the intention that they would be maintained for continued use, culverts may be removed and the gravel pads breached to facilitate water flow.

2.3.10 Traffic

Seasonal air and ground traffic estimates to support the construction, drilling, and operations for the ASDP are presented in Table 2.3.10-1 below. These traffic estimates are pertinent to Alternatives A, B, C-1, C-2, and F. Total traffic for Sub-Alternative C-2 would be split between CD-1 and Nuiqsut after the state-proposed Colville River Road is operational; however, this is not anticipated to occur until late in the construction phase (2010). Traffic for Alternative D is presented separately with the details of Sub-Alternatives D-1 and D-2. These traffic estimates assume all construction travel to production pads is via ice roads or gravel roads. Traffic for FFD would continue at levels proportional to those estimated for the five-pad ASDP. The extent of FFD traffic would be determined by how many of the HPs and HPFs would be proposed. In all cases, speed limits for traffic would be the same as currently enforced at existing North Slope pads and roads: 5 mph on process pads, 15 mph on production pads, and up to 45 mph on roads. Non-operations traffic would likely occur in the area of the applicant's proposed action from a variety of users besides industry, including federal and state agencies, universities, and local residents.

TABLE 2.3.10-1 ASDP – TRAFFIC ESTIMATES

	Construction Phase		Drilling Phase		Operations Phase	
	Round-Trip Vehicle Trips per Month [a]	One-Way Aircraft Flights Per Month [a]	Round-Trip Vehicle Trips per Month	One-Way Aircraft Flights Per Month	Round-Trip Vehicle Trips per Month	One-Way Aircraft Flights Per Month
Winter 2004/2005	6,000 (18,600 max.)	70 (235 max.)	390-450	70-90	0	0
Summer 2005	740 (2300 max.)	180 (500 max.)	0	0	0	0
Winter 2005/2006	5,800 (19,800 max.)	60 (245 max.)	390-450	70-90	0	0
Summer 2006	1,700 (3,100 max.)	340 (615 max.)	390-450	70-90	60-120	8-32
Winter 2006/2007	3,900 (12,000 max.)	70 (165 max.)	390-450	70-90	68-120	8-16
Summer 2007	3,000 (3,000 max.)	45	390-450	70-90	60-120	8-32
Winter 2007/2008	4,000 (11,700 max.)	50 (145 max.)	390-450	70-90	68-120	8-16
Summer 2008	8,000 (8,100 max.)	100 (105 max.)	780-900	70-90	60-120	8-56
Winter 2008/2009	2,800 (7,500 max.)	50 (205 max.)	390-450	70-90	76-180	8-24
Summer 2009	0	0	390-450	70-90	60-180	8-56
Winter 2009/2010	1,000 (3,600 max.)	50	780-900	70-90	76-180	8-24
Summer 2010	6,600 (6,700 max.)	85 (100 max.)	780-900	70-90	60-180	8-80
Winter 2010/2011	600 (3,300 max.)	45	780-900	70-90	84-180	8-32

Source: CPAI 2003l

Notes:

Includes one-way aircraft flights between Kuparuk and Alpine or between Nuiqsut and Alpine.

All production-pad access for construction is either via ice road or gravel road, no construction-related flights to production pads.

Indicated schedule is applicable to Alternatives A, B, C, and F.

Excludes non-operational helicopter flights estimated at 2500 per summer season.

For the purposes of this table, seasons have been defined to correspond to periods when wildlife and bird populations are prevalent in the plan area, i.e., Summer = May through SeptemberNovember and Winter = December October through April. These seasonal designations do not correspond with periods of ice road travel, for which winter would be defined as December through April.

[a] Averages are shown, followed by maximum monthly estimates in parenthesis.

In addition to the traffic indicated in Table 2.3.10-1, non-operations helicopter flights would occur. Activities supported by non-operational helicopter flights may include environmental studies, environmental monitoring, surveys, travel for important people, and agency tours. CPAI reported 1,250 non-operational helicopter flights departing from and 1,250 non-operational helicopter flights returning to the Alpine Development Project for a summer season. Each of those flights could include multiple landings and takeoffs away from the Alpine Development Project, but those intermediate landings and take-offs are not logged. It should be noted that some studies performed during the last 3 years, and presumably included in those numbers, are studies supporting the ASDP. Thus, a best-case scenario could be that ASDP non-operational helicopter flights are ongoing and are included in the CPAI count of non-operational helicopter flights for the existing Alpine Development Project.

For impact analysis, a conservative approach assumes that ASDP non-operational helicopter flights will be equal to the CPAI count of non-operational helicopter flights for the existing Alpine Development Project; that is, 1,250 outgoing and 1,250 returning flights per summer season, with those flights potentially including intermittent landings and take-offs to various locations. The ASDP flights would also be departing from and returning to CD-1, resulting in a total summer season of 5,000 non-operational helicopter flights at CD-1.

2.3.11 Utilities

2.3.11.1 Electric Power Generation

Delivery of electrical power to CD-3 through CD-5 during operations would be provided from APF-1. An additional 2.7 to 3.1 megawatts (MW) of power generation capacity would be provided from CD-6 and would also serve CD-7. Facility upgrades would be required at APF-1 to provide power to the production pads. These upgrades may include additional gas-fired turbo-generation. During construction and drilling, portable generators would provide temporary power, as necessary. There would also be 500-kilowatts (kW), diesel-fired emergency generators provided at CD-3 and CD- 6 in the ASDP, and at all roadless pads in FFD alternatives. Electric power generator sets would be totally enclosed or would be acoustically packaged to abate noise emissions.

2.3.11.2 Electric Power Distribution

CPAI proposes to route power cables in cable trays mounted on VSMs, and to use an overhead powerline between CD-6 and CD-7. Overhead powerlines would be strung on 60-foot poles spaced 250 feet apart. Borings for power pole installation would be 2 feet in diameter and 14 to 17 feet deep (email, S Rothwell, 3-18-04). Other alternatives look at placing all power wires on poles or burying them. Cable trays would be added to VSMs at the same time as the pipelines. Direct burial of the powerline would occur during the winter, installing the powerline into a trench in the gravel roadbed. In areas where trenching into the tundra would be required, the trench would be cut through an ice road, the power cable placed, and the cuttings pushed back into the trench. The typical trench for power cable burial is 10 to 12 inches wide and 4 to 6 feet deep (email, S Rothwell, 3-18-04). A 500 – kilowatt (kW) emergency generator would be located at all pads that are not road accessible.

2.3.11.3 Communications

Communications systems between the production pads and APF-1 and FFD HPFs would include fiber-optic cable and various wireless systems (PAI 2002d). The fiber-optic cable would be strapped to a pipeline or laid in a cable tray as shown in Figure 2.3.2.1-1. Transmission towers up to 200-feet-high would support radio communications for the processing facility.

2.3.11.4 Fresh Water

Fresh water would be required for ice road construction; potable water use to support construction, drilling, and operating camps; and drilling and drilling mud use. Fresh water or seawater could be used for hydrostatic testing. Estimated water demand for fresh water for ice road and ice pad construction is presented in the discussion of each alternative. Potable water requirements are based on a demand of 100 gpd per person, and the construction, drilling, and operations manpower estimates presented above. Drilling water requirements are estimated to be 38,000 gpd. Fresh water would be taken from approved surface water sources.

2.3.11.5 Wastewater

Discharges to surface water would occur in compliance with the NPDES Permit for Oil and Gas Extraction on the North Slope of the Brooks Range, Permit Number AKG-33-0000, or an Individual NPDES Permit. The NPDES permit covers gravel pit dewatering, storm water, hydrostatic test water, and domestic wastewater from temporary camps. Wastewater sources, quantities, and disposition are comparable for each alternative.

The USEPA is a cooperating agency for the ASDP EIS because of its NEPA compliance responsibilities for issuing an NPDES permit under Section 402 of the CWA. Discharges associated with oil and gas facilities are subject to effluent limitations and are considered new sources; therefore, a NEPA evaluation is required before issuance of an NPDES permit (40 CFR §122).

The USEPA General NPDES Permit may be used to authorize new source discharges specified in the General Permit. However, the USEPA may determine that an Individual NPDES Permit may be required if the discharge fails to meet the applicability requirement or if certain conditions exist as indicated in Section 1.F of the General Permit. This determination may require additional NEPA compliance that is tiered from this EIS.

The USEPA expects that the General Permit or any Individual Permit developed would have similar limitations. Domestic wastewater discharges associated with the General NPDES permit would be limited and monitored according to the effluent limitations presented in Table 2.3.11-1. However, applicants for either a General Permit or an Individual Permit may apply to the ADEC for a mixing zone for fecal, chlorine, and dissolved oxygen. For a General Permit, the mixing zone would be subject to public notice prior to permit coverage being authorized. For an Individual Permit, the mixing zone would be included in the ADEC's water quality certification of the permit. It is expected that the requirements would be the same under either permitting alternative.

TABLE 2.3.11-1 DOMESTIC WASTEWATER EFFLUENT LIMITATIONS

Parameter (units)		Daily Minimum	7-day Average	30-day Average	Daily Maximum
Flow, gpd		—	—	—	25,000
Biochemical Oxygen Demand (BOD5), mg/L		—	45	30	60
Total Suspended Solids (TSS), mg/L		—	45	30	60
Loading limits for BOD and TSS will be calculated based on design flow.					
Fecal Coliform, # colonies/100 mL	Freshwater	—	—	20	40
	Marine	—	—	14	43
Dissolved Oxygen, mg/L	Freshwater	7.0	—	—	—
	Marine	6.0	—	—	—
Total Residual Chlorine (TRC), ug/L	Salmonid stream	—	—	—	2
	Non-salmonid stream	—	—	—	10
pH, standard units		6.5	—	—	8.5

Notes:
The discharge shall not, alone or in combination with other substances, cause a film, sheen or discoloration on the surface of the receiving water or adjoining shorelines.
No discharge of floating solids, foam or garbage.
Kitchen oils from food preparation shall not be discharged.
A Best Management Practices (BMP) Plan is required by the permittee.

Wastewater discharges associated with temporary drilling camps would be limited to domestic wastewater (both graywater and sanitary waste). Discharges would be sporadic, varying in quantity with the time of day. Average daily temporary camp water and wastewater flow would be approximately 100 gpd per person, or 10,000 gpd. The maximum flow discharge would normally occur any time from later afternoon until midnight each day. This maximum flow rate would be limited to 25,000 gpd of combined sanitary and graywater. Receiving waters would be frozen tundra during winter months and thawed tundra (wetlands) or streams during the nonfrozen season. The major streams closest to each production pad are identified in Table 2.3.11-2.

TABLE 2.3.11-2 PROXIMITY OF PRODUCTION PADS AND PROCESSING FACILITIES TO MAJOR RIVERS AND STREAMS

Facility	Nearest Major Stream	Approximate Distance (miles)
CD-3	Tamayayak Channel	<0.1
CD-4	Nigliq Channel	<0.5
CD-5	Nigliq Channel	2.0
CD-6	Fish Creek	2.0
CD-7	Judy Creek	3.0
HP-1	Fish Creek	<0.5
HP-2	Judy Creek	2.0
HP-3	Fish Creek	<0.5
HP-4	Colville River	1.5
HP-5	Sakoonang Channel	1.0
HP-6	Ublutuoch River	2.0
HP-7	Tamayayak Channel	<1.0
HP-8	Nigliq Channel	<1.0
HP-9	Colville River	3.0
HP-10	Ublutuoch River	2.0
HP-11	Colville River	1.5
HP-12	Kupigruak Channel	<0.5
HP-13	Elaktoveach Channel	<1.0
HP-14	Colville River	<0.5
HP-15	Tingmeachsiovik	<0.5
HP-16	Judy Creek	1.0
HP-17	Judy Creek	1.5
HP-18	Fish Creek	3.0
HP-19	Judy Creek	2.0
HP-20	Kalikpik River	<0.5
HP-21	Kogru River	4.0
HP-22	Kogru River	<0.5
HPF-1	Judy Creek	<1.0
HPF-2	Kalikpik River	2.0

Wastewater would be treated and discharged in compliance with the NPDES Permit. Sludge either would be incinerated on site or hauled to other operating fields and incinerated. The ash would be transported to the NSB landfill.

Hydrostatic testing would be performed throughout construction. If fresh water is used, it would be tested for contaminants after hydrostatic testing is completed, and then would be discharged onto the tundra through a filter medium to remove any solids. The tundra would be protected so that erosion would not occur during the discharge. The water would be discharged in accordance with the permit requirements. If seawater is used, it could be injected into the reservoir to maintain reservoir pressure or disposed of in a disposal well.

On rare occasions, pipeline hydrostatic tests could be conducted in the winter. In this case, freeze-protected water would be used. The options would be salt brine, glycol/water, or methanol/water solution. At the end of the test, the test fluid could be re-used for another purpose, injected for pressure maintenance, or disposed of in an injection well.

Approximately 100 gpd per person of domestic wastewater would be generated during production operations. This volume would result in an additional 1,000 to 1,500 gpd of wastewater to be disposed of, based on approximately 11 incremental staffing positions estimated for the five proposed pads. The additional wastewater and fresh water would be generated at and disposed of through APF-1, or for FFD, through APF-1 and the HPFs. At the existing APF, domestic wastewater is treated and then disposed of by injection. Solids are filtered prior to the injection. The residual solids are incinerated. The treated camp effluent could be injected into the Class ID well or mixed with seawater and injected into the oil reservoir formation by a Class IID well for enhanced oil recovery (PAI and BP Exploration [Alaska] [BPXA] 2002). Existing Class ID well WD-2 can receive non-hazardous and RCRA-exempt fluids.[2]

No new Class IID wells at any ASDP production pad is proposed. The Class IID well CD1-19A at the existing Alpine Development Project is permitted for disposal of produced fluids, drill cuttings, and other materials that originate below ground; drilling muds and other products that are circulated or used in a well system; or products that come into contact with downhole materials in the course of the production process (PAI and BPXA 2002).

The FFD would include both a Class ID and a Class IID well at each HPF (HPF-1 and HPF-2), and could include additional Class ID and/or Class IID wells at HPs. Because the number and location of additional Class ID and/or Class IID wells is unknown, the potential impacts from locating a Class I or Class II injection well at each HP are considered in this document.

2.3.11.6 Solid Waste

Drilling and operations could generate oily gravel and soil, and would generate food wastes, sewage sludge, and other non-hazardous burnable and non-burnable wastes. Oily gravel and soil would be tested, and depending on test results could be re-used or disposed of. Non-hazardous burnable wastes would be transported to CD-1 and incinerated at the existing Alpine Development Project incinerator in accordance with procedures in *Alaska Waste Disposal and Reuse Guide* (PAI and BPXA 2002). Residual solid waste that cannot be incinerated would be transported to the existing landfill at Deadhorse. The NSB operates that landfill.

2.3.12 Processing Facilities

The five production pads proposed by CPAI, and several of the production pads included in the FFD scenarios, would be connected to the existing APF-1. In addition, two new HPFs similar to APF-1 are considered in the FFD alternatives, HPF-1 and HPF-2. It is anticipated that, similar to APF-1, the pads supporting the HPFs would host production wells. The HPFs for the FFD scenario would be designed, built, and operated in a manner analogous to that used for the existing APF-1.

2.3.12.1 Existing Alpine Processing Facility

The existing Alpine Development Project includes the CD-1 and CD-2 pads, the 5,000-foot-long airstrip (CPAI 2002b), and the interconnecting road from the airstrip to CD-2. Total area permitted by the USACE to be covered by gravel is 112.3 acres. This area includes approximately 36.3 acres for the CD-1 pad and 10.1 acres for the CD-2 pad. APF-1 is at CD-1 and includes a crude oil processing plant, housing for employees, maintenance facilities, a production pad, and a drill equipment storage area. Figure 2.3.12.1-1 presents a plot plan of the existing APF-1.

2.3.12.2 Alpine Capacity Expansion

CPAI plans to upgrade APF-1. These upgrades would require modification to existing processing facilities and construction and eventual mobilization of new facilities to CD-1. Some of the upgrades would support the proposed ASDP; some upgrades would be independent of the ASDP.

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[2] Class I (non-hazardous wells) can accept non-hazardous wastes, sanitary and domestic wastewater, and RCRA-exempt wastes (40 CFR 144.6). Note that there are a total of seven Class I non-hazardous waste wells on the North Slope. Class I (hazardous) wells can accept hazardous wastes. Note that no Class I hazardous well exists on the North Slope. Class II wells are designated for oil and gas production wastes that are brought to the surface from downhole sources. However, fluids that are not from down hole sources can be commingled with wastewater or storm water and injected in a Class II well for enhanced oil and gas recovery.

The upgrades that are independent of the ASDP include Alpine Capacity Expansion (ACX) Projects 1 and 2. The first phase, ACX Project 1 (ACX1), planned for construction to begin in 2004, would increase APF-1 produced-water handling capacity. ACX Project 2 (ACX2), expected to be constructed during 2004 and 2005, would increase the oil train and water injection capacity for the existing Alpine Field. ACX1 and ACX2 are unrelated to the proposed satellite developments and are therefore not considered as part of the ASDP analyzed in this EIS (CPAI 2003j); however, the activities involved with ACX1 and ACX2 are considered in the analysis of reasonably foreseeable cumulative impacts.

ACX Project 3 (ACX3) includes an expansion of gas-handling capacity that is necessary to handle production at CD-7. The gas expansion component of ACX3 is planned for offsite construction of modules in 2008 and sea lift to the North Slope in 2009. It would increase gas-handling capacity from 180 million standard cubic feet per day (mmscfd) to 270 mmscfd or up to 360 mmscfd. Timing of these expansions is presented below in Table 2.3.12-1 along with the proposed drill site production schedule. Because the gas expansion portion of ACX3 is related to the ASDP, ACX-3 is analyzed in this EIS.

Separate from ACX3, the ASDP also proposes to add a new 31,500-gallon (750-bbl) corrosion inhibitor storage tank, in secondary containment, at APF-1. The added corrosion inhibitor capacity would support corrosion inhibitor distribution to the production pads. This tank addition is included in all alternatives.

TABLE 2.3-12-1 POTENTIAL SCHEDULE FOR PROCESSING FACILITY EXPANSION

Year	Drill Sites in Production	Expansion Activity	Projected Total Processing Capacity at CD-1
2004	CD-1 and 2	ACX1	Oil: 105,000 bbls/day Gas: 180 mmscfd Water: 98,000 bbls/day
2004/2005	CD-1 and 2	ACX2	Oil: 145,000 bbls/day Water: 133,000 bbls/day
2010	CD-1, 2, 3, 4, and 6	ACX3	Gas: 270 or 360 mmscfd

Source: CPAI 2003j

2.3.12.3 Full-Field Development Scenario Processing Facilities

New HPFs would have to be built if additional production pads are developed farther west because three-phase flow from the wells is limited to a maximum distance of approximately 25 to 30 miles without processing and pump station support (Michael Baker, Jr. 2002e). The new HPFs would likely have structures, equipment, personnel, and air traffic similar to those at APF-1 and would have a footprint roughly equal in size. For purposes of analysis, the BLM has assumed that HPF-1 and HPF-2, in all alternatives other than the No Action Alternative, would be comparable in size and other design aspects to APF-1. The size of the FFD HPF pads could be reduced relative to APF-1, dependent on whether they are road-connected to the existing Alpine Development Project and dependent on the processing needs of the produced fluids handled. In the road-connected scenarios, FFD Alternatives A and C, there could be opportunities to share infrastructure such as maintenance facilities with APF-1. The roadless development scenario such as FFD Alternative D and the non-interconnected road development, FFD Alternative B, would necessitate replication of all the Alpine Development Project infrastructure and equipment at the isolated sites within the National Petroleum Reserve-Alaska (PAI, 2002c).

The following infrastructure is currently installed at APF-1, and is assumed to reflect what would be installed at the HPFs:

Employee camp

- Wastewater treatment system
- Lake water supply
- Diesel fuel supply
  - –Arctic heating fuel – 15,000 gallon
  - –Arctic heating fuel – 15,000 gallon
  - –Arctic heating fuel – 15,000 gallon
  - –Arctic heating fuel – 15,000 gallon (ADEC 2003b)
- Drilling mud plant
- Processing facilities
  - –Generators
  - –Compressors
  - –Gas strippers
  - –Heat exchangers
  - –Slug catchers
  - –Separators
  - –Flare system
  - –Control room
- Tankage in secondary containment
  - –Methanol – 31,500 gallon (750 bbl)
  - –Methanol – 21,200 gallon (500 bbl)
  - –Crude flowback tank 1 – 15,200 gallon (360 bbl)
  - –Crude flowback tank 2 – 15,200 gallon (360 bbl)
  - –Crude frac tank 1 – 29,400 gallon (700 bbl)
  - –Crude frac tank 2 – 29,400 gallon (700 bbl)
  - –Corrosion inhibitor – 10,700 gallon (25 bbl)
  - –Corrosion inhibitor – 31,500 gallon (750 bbl)
  - –Demulsifier – 10,700 gallon (25 bbl)(ADEC, 2003b)
- 5,000-foot airstrip
- Heavy-equipment shop
- Various equipment (rolling stock)
- Drilling shop
- Machine shop
- Warehouse for offices and inventory
- Cold storage tent
- New construction warehouse
- Class ID well
- Class IID well
- Emergency response center
- Medical clinic
- Spill response equipment (PAI 2002c)

Processing facility buildings, and other occupied structures would be designed to building codes appropriate for each facility. The designs would take into account many factors, such as temperature, wind, precipitation, seismic, and the many environmental factors discussed in this EIS. Production facilities, as with other facilities on BLM lands, are prohibited within 500 feet of a water body or within distances specified for certain areas identified in Stipulation 39 of the Northeast National Petroleum Reserve-Alaska IAP/EIS ROD (BLM and MMS 1998b). Pads will be sited and oriented to minimize the length perpendicular to sheet flow. The pad construction would proceed similar to that described in Section 2.3.3.2 for production pads.

2.3.13 Specific Procedures for the Applicant's Proposed Action

In addition to the features common to all alternatives described above, additional specific procedures would be followed in all alternatives. These specific procedures are presented in Table 2.3.13-1.

TABLE 2.3.13-1 PROJECT SPECIFIC PROCEDURES

General Topic	Procedure
Construction-ground disturbance	A cultural resource survey would be conducted prior to any ground disturbing activity. If cultural resources are found on National Petroleum Reserve-Alaska lands BLM would be notified and work would be suspended in the immediate area until written authorization to proceed is obtained.
Cultural resources	Oil field workers would be trained not to disturb cultural resources or paleontological sites.
Cultural resources	A ¼-mile buffer would be observed around known cultural resources.
Cultural resources	An archeologist would periodically visit cultural resources found within ¼-mile of the proposed project to monitor their condition and the effectiveness of the buffer zone.
Cultural resources	If recommended by State Historic Preservation Office (SHPO), a cultural resources management plan would be developed for sites less than ¼-mile from the proposed project.
Routing of pipelines, gravel roads, footprints of facility gravel pads	SHPO surveys have been completed for pipeline, road and pad locations.
Routing of ice roads	Archeological/cultural reconnaissance would be done for ice road routes.
Noise abatement	Mufflers and other measures would be used to abate noise from exhaust systems of engines and turbines.
Air emission abatement	Air pollution control equipment on construction equipment and vehicles would be maintained according to manufacturer's specifications.
Fish and wildlife resources	Oil field workers would be forbidden from interfering with wildlife by feeding, approaching, or harassing.
Fish and wildlife resources	No-fishing and no-hunting policies would be adopted for oil field workers to restrict non-resident taking of resources.

2.4 DESCRIPTION OF ALTERNATIVES

A description of alternatives follows in Sections 2.4.1 through 2.4.6. Section 2.4.1 provides detailed information about Alternative A. Subsection 2.4.1.1 describes CPAI's proposed action, and Subsection 2.4.1.2 describes the FFD scenario. Sections 2.4.2 through 2.4.6 provide discussion of how Alternatives B, C, D, and E differ from Alternative A, for both the applicant's proposed action and the FFD scenario. Except where specifically indicated in the description of the alternative, components of alternatives are the same as those for Alternative A.

2.4.1 Alternative A – Applicant's Proposed Action

2.4.1.1 Alternative A – CPAI Development Plan

This description is consistent with the applicant's proposed action as submitted in March 2004. Five production pads, CD-3 through CD-7, would be built, and produced fluids would be transported by pipeline to be processed at APF-1 (see Figure 2.4.1.1-1). Gravel roads would connect CD-4 through CD-7 to CD-1. CD-3 would be accessed by ice road or by air. Gravel used for construction of roads, pads, and airstrips would be obtained from the existing ASRC Mine Site and Clover. A bridge across the Nigliq Channel near CD-2 would accommodate road traffic and the pipelines. CD-3 would be the only new pad with an airstrip. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 5 feet above tundra. Powerlines would be supported by cable trays placed on the pipeline VSM, except for a powerline suspended from poles between CD-6 and CD-7. Industry, local residents, and government would be allowed access to the gravel roads.

CD-6 and it access road and pipelines and the powerline from CD-6 to CD-7 would be within a 3-mile setback from Fish Creek in which the BLM's Northeast National Petroleum Reserve-Alaska IAP/EIS ROD (BLM and MMS 1998b) (Stipulation 39[d]) prohibits permanent oil facilities. This alternative would provide for an exception to this provision to allow location of CD-6 and its associated road, powerline, and pipeline within the setback. Additional exceptions would be required to locate oil infrastructure within 500 feet of some water bodies (Stipulation 41) and to locate roads between separate oilfields (Stipulation 48). In addition, although the BLM does not interpret the first sentence of Stipulation 48 to apply to the applicant's proposed action (i.e., the agency does not consider the road between CD-1 and CD-2 or the additional road to CD-4 to constitute a connection to a "road system" outside the Northeast National Petroleum Reserve-Alaska planning area), if it is determined that this sentence applies in this case, the BLM will modify Stipulation 48 to allow the applicant's proposed road from public land connecting to the existing road at APF-1. Finally, the USACE would have to determine that the applicant's proposed alternative for a road to CD-4 meets the intent of Special Condition 10 of its 1998 permit that authorized the placement of fill associated with the construction of the Alpine Development Project. Special Condition 10 requires roadless development in the Colville Delta unless an environmentally preferable alternative is available or roadless development is infeasible, and that any alternative dependent on roads must be approved by the USACE as preferable to a roadless alternative.

ALTERNATIVE A – ROADS

There is no proposed road to CD-3. As proposed, access to CD-4 would consist of a gravel road connecting the drill site to the road between CD-1 and CD-2. The road alignment would follow a naturally occurring ridge spanning 80 percent of the route (Figure 2.4.1.1-2). The top of the ridge lies above typical spring break-up water levels. The remaining 20 percent of the route is on discontinuous sections of the ridge that maintain, though not as prominently, separation of the drainage paths for the Nigliq and Sakoonang channels. Road segments along the discontinuous ridge would be provided with slideslope protection, geotextile, revetment, and other measures (as needed) to protect the facilities from erosion that might result from high-water events, including wind/wave run-up, storm surge, and ice run-up and impact associated with break-up flooding. The southernmost portion of the road bisects a lake at a relatively narrow point between two basins. Typical slope protection of the road at the lake near CD-4 is shown in Figure 2.4.1.1-3. The lake crossing is approximately 350 to 425 feet wide and 8 feet deep (Figure 2.4.1.1-4). Cross-flow culvert placement for the lake crossing is shown in Figure 2.4.1.1-5.

Proposed access to CD-5, CD-6, and CD-7 consists of a gravel road connecting to the existing CD-2 pad. The road alignment would avoid water bodies, routing 200 feet or more from them where possible. The road would cross the Nigliq Channel, the Ublutuoch River, and several smaller unnamed drainages. Industry, government agencies, and local residents would use the roads (see Bridge and Culverts discussion under Alternative A – Production Pads in this section).

ALTERNATIVE A – PIPELINES

The new pipeline corridor from CD-3 would extend approximately 6.5 miles south to APF. The route follows naturally occurring higher ground, crossing narrow portions of three distributary channels (Ulamnigiaq, Tamayayak, and Sakoonang) of the Colville River Delta (PAI 2002a).

The new pipeline corridor from CD-4 would extend approximately 2,500 feet east and then north parallel to the existing Alpine Sales Oil Pipeline on new VSMs to APF, for a total length of 3.6 miles (Figure 2.4.1.1-1). The existing Alpine Sales Oil Pipeline throughout this area is 5 feet or more above the tundra. New pipeline VSMs for the section parallel to existing pipelines would be aligned to match existing VSMs to avoid a picket-fence effect that might impede caribou movement.

The pipelines connecting CD-3 to CD-1 would consist of a 16-inch-diameter, three-phase (oil, water, and gas) production line; a 6-inch-diameter gas MI line; an 8-inch-diameter water line; a 6-inch-diameter lift gas line; and a 2-inch-diameter products line. Between CD-4 and CD-1, there would be a 14-inch production line and all other lines would be the same as CD-3, except there would be no products line (5/6/04 email from Sally Rothwell to Jim Ducker; CPAI 2004).

Pipelines connecting to CD-5 and CD-6, and CD-7 would consist of a 16- to 24-inch-diameter, three-phase (oil, water, and gas) production line; a 6- to 10-inch-diameter gas MI line; an 8- to 14-inch-diameter seawater injection line; and a 6-inch-diameter lift gas line, possibly.

Pipelines to the production pads would have to cross several drainages, including the 1,200-foot-wide Nigliq Channel. The pipelines would generally follow an alignment separate from the access road, except over the Nigliq Channel, where the pipeline and road would be co-located on the same bridge structure.

ALTERNATIVE A – PRODUCTION PADS

AIR-SUPPORTED PADS

CD-3

The CD-3 production pad would be between West Ulamnigiaq and East Ulamnigiaq channels. A CD-3 site map is provided as Figure 2.4.1.1-6. The CD-3 production pad would be located adjacent to the southwest end of a small lake (M9313) on the highest terrain in the area. The CD-3 production pad would be situated at least 200 feet from surrounding water bodies (PAI 2002a).

The CD-3 production pad would consist of a production pad connected to an airstrip and apron/taxiway by an access road. The area covered by these facilities is presented in Table 2.4.1-1. No year-round ground access to the site is planned. Operators based at CD-1 would access the CD-3 drill site via small aircraft or helicopter, by using the gravel airstrip (CPAI 2003a). Operators could also use a boat for seasonal emergency access to CD-3, and an ice road for routine winter-season access.

The size of the CD-3 production pad would include space for staging of materials during the winter ice road season. Details on the size of production pads are presented in Table 2.4.1-1.

TABLE 2.4.1-1 ALTERNATIVE A – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips And Apron/Taxiways/Boat Launches		Totals	
Site	Gravel Qty (1,000 cy)	Coverage (Acres)	Gravel Qty (1,000 cy)	Coverage (Acres)	Gravel Qty (1,000 cy)	Coverage (Acres)
CD-3	110	12.6	144	18.0	254	30.6
CD-4	112	9.3	16	1.4	128	10.7
CD-5	78	9.1	0	0.0	78	9.1
CD-6	78	9.1	0	0.0	78	9.1
CD-7	78	9.1	0	0.0	78	9.1
Total	**456**	**49.2**	**160**	**19.4**	**616**	**68.6**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

A winter-development drilling program is proposed by the applicant. This winter drilling program involves a minimum of 100 days per season and would allow access by air and ice road for emergency relief well purposes. The drilling rig would be transported, before break-up, to other sites for use during the summer. Development of CD-3 would require five to seven winter drilling seasons from January until May to complete the development program (CPAI 2003a).

In addition to the typical facilities for all production pads, CD-3 would include an emergency power generator.

ROAD-SUPPORTED PADS

CD-4, CD-5, CD-6, and CD-7 pads would be located south and west of the existing facilities. CD-4 would be located west of the existing Alpine Sales Oil Pipeline corridor and east of the Nigliq Channel. CD-5 would be located approximately 6 miles south-southwest of CD-1 and west of the Nigliq Channel. CD-6 would be located approximately 15 miles southwest of CD-1. CD-7 would be located approximately 20 miles southwest of CD-1. Site maps of CD-4 through CD-7 are presented in Figures 2.4.1.1-7 through 2.4.1.1-10. Production pads would be situated at least 200 feet from surrounding water bodies (PAI 2002a).

Crews based at APF-1 would service and maintain the production pads. The CD-4 development-drilling program would consist of up to 32 wells drilled during the summer by the same rig that would drill wells at CD-3 in the winter (CPAI 2003a; PAI 2002a).

ICE ROADS

Annual ice roads would be built from CD-1 to CD-3 and CD-1 to the Kuparuk Oilfield road system during the construction and development-drilling phase of the applicant’s proposed action, to provide seasonal access and resupply. Well workovers and other drilling activities would be conducted every few years during the life of the facility, and an ice road would be needed to support these operations.

During the construction phase for CD-4, CD-5, CD-6, and CD-7, a winter ice road system from APF-1 and the Kuparuk Oilfield would be necessary to support gravel placement and facilities construction.

Fresh water will be required for construction of an ice road system to support placement of the gravel fill and pipelines during the winter. Approximately 1 million gallons of water typically are used to construct 1 mile of ice road. Ice aggregate and water for ice roads would be obtained from lakes and river channels for which permits have been obtained consistent with state and federal requirements. Table 2.4.1-2 shows the estimated water usage by year for ice roads.

Development of satellites in the CRU will utilize existing Alpine water use permits (CPAI 2002b). Additional permitted water sources may be used in accordance with permit stipulations. In 2003, the ADNR issued permanent water rights status for seven lake near CD-1 (CPAI 2003a). CPAI may apply for water rights for longer-term water sources at other locations. Figure 2.4.1.1-11 shows authorized lakes within the Plan Area. Lakes in the CRU and National Petroleum Reserve-Alaska are identified in Figures 2.4.1.1-12 and 2.4.1.1-13, respectively. Water use for exploration and development activities and for ice road, pad, and airstrip construction over state land is authorized under ACMP General Concurrence GC-8 and General Concurrence GC-34.

Estimated water usage by year for ice roads, pads, and airstrips follows in Table 2.4.1-2.

TABLE 2.4.1-2 ALTERNATIVE A – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Annual Total Ice Road (miles) and Water Usage (million gallons)
2005	47	0	47
2006	34	10	44
2007	67	14	81
2008	31	10	41
2009	44	10	54
2010	16	10	26
2011	0	10	10
TOTAL	**239**	**64**	**303**

Source: CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

BRIDGES AND CULVERTS

A road and pipeline bridge approximately 1,200 feet long would cross the Nigliq Channel (Figure 2.4.1.1-14). An approximately 140-foot-long road bridge would be built across the Ublutuoch River (Figure 2.4.1.1-15). Culverts or minor bridges would be required at smaller water crossings. Culverts would be installed when the road is constructed. Additional culverts may be installed after break-up if ponding occurs near the road.

A culvert battery is proposed for placement in Lake L9323 for road access to CD-4. The water is 8 feet deep at the culvert location and shallower along the road alignment. (Figure 2.4.1.1-4). The road slideslopes are projected to be 2H:1V in the area of the lake crossing and 2H:1V in the other areas.

ALTERNATIVE A – QUANTITY ESTIMATES

Primary access to the five proposed production pads is by a combination of air support and gravel roads. Table 2.4.1-3 provides the estimated gravel quantities required for production pad construction under Alternative A and also provides estimates of road mileage and yards of gravel required for construction of road segments connecting the proposed production pads and existing Alpine Development Project. Table 2.4.1-4 shows the pipeline lengths and diameters associated with the ASDP under Alternative A. Estimated vehicle traffic and aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—are provided in Table 2.3.10-1.

TABLE 2.4.1-3 ALTERNATIVE A – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
CD-1 to CD-4	3.5	210.0	25.3
CD-1 to CD-6	14.7	761.0	96.4
CD-5 access spur	0.1	5.0	0.6
CD-6 access spur	0.4	19.0	2.3
CD-6 to CD-7	7.3	376.0	47.6
TOTAL	**26.0**	**1371.0**	**172.2**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.
Coverage and quantity based on CPAI permit application data (CPAI 2004a) and calculations using GIS measurements.

TABLE 2.4.1-4 ALTERNATIVE A – LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	B	624
CD-1 to CD-4	4.5	A	432
CD-1 to CD-2	2.4	A	230
CD-2 to CD-6	15.0	A	1,440
CD-6 access spur	0.2	A	19
CD-6 to CD-7	7.0	A	672
TOTAL	**35.6**		**3,418**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in “A” above and 2-inch products.

CONSTRUCTION AND OPERATIONS SCHEDULE

CPAI proposes to construct the facilities on the schedule indicated in Table 2.4-5. As detailed design progresses, the schedule may change. However, the identified work would occur in the indicated season, if not in the indicated year, or in the indicated sequence of pad development. Under the proposed construction schedule, construction of an ice road, the gravel road, the production pad, and the pipelines typically would be completed in the first and second winters after approval of the applicant’s proposed action for each individual production pad. After gravel placement, development drilling and workover operations would begin in the second winter and would continue intermittently throughout the life of the field. Final road compaction and grading, installation of some facilities and pipelines, and start-up of oil production would be completed in the second year.

2.4.1.2 Alternative A – Full-Field Development Scenario

Two HPFs (each including production facilities) and 22 HPs would be constructed in the Plan Area, in addition to the five production pads proposed by CPAI. Gravel roads would connect all but six production pads. Five productions pads in the lower Colville River Delta (CD-3, HP-7, HP-12, , HP-14, and HP-15) and one near the Kogru River (CD-29) would be designed with airstrips for access, instead of roads. Construction and operation strategies described for the applicant’s proposed action would apply for the FFD scenario. Exceptions to the stipulations in the Northeast National Petroleum Reserve-Alaska IAP/EIS ROD would be necessary to allow placement of facilities in certain areas. Figure 2.4.1.2-1 presents Alternative A – FFD pad, road, and pipeline locations.

ALTERNATIVE A – FFD DESCRIPTION

For purposes of analysis, this EIS provides an FFD scenario for each alternative. The scenario describes the potential development that would be associated with HPs and HPFs. The design of the FFD scenario for Alternative A would assume construction of the five pads proposed by CPAI as described for Alternative A and would mimic the design for infrastructure associated with those five pads. Under Alternative A, roads would link 17 HPs to 2 HPFs and to APF-1.

Suitable gravel sources within the National Petroleum Reserve-Alaska remain an uncertainty. The only identified source thus far is Clover (Figure 2.4.1.2-1). Further exploration could identify other sources within the FFD area, providing flexibility and cost savings to road and pad development scenarios.

No schedule is provided for construction of this hypothetical infrastructure. However, construction of infrastructure on this scale would likely occur over a matter of decades.

TABLE 2.4.1-5 ASDP CONSTRUCTION SCHEDULE BY PRODUCTION PAD

Task	2005		2006		2007		2008		2009		2010		2011	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
CD-3														
Lay gravel for production pad	X													
Drilling	X		X		X		X		X		X		X	
Install VSMs for pipelines	X													
Install pipelines			X											
Install powerlines			X											
Install module piles	X													
Install pipeline bridge foundations	X													
Construct pipeline bridges			X											
Work gravel on pad		X		X										
Install surface facilities			X											
Set modules			X											
Production startup				X										
CD-4														
Lay gravel for road	X													
Lay gravel for production pad	X													
Drilling				X		X								
Install VSMs for pipelines	X													
Install pipelines	X													
Install powerlines	X													
Install module piles	X													
Construct Bridges	X													
Work gravel on pad/roads		X												
Install surface facilities			X											
Set modules			X											
Production startup				X										

TABLE 2.4.1-5 ASDP CONSTRUCTION SCHEDULE BY PRODUCTION PAD (CONT'D)

Task	2005		2006		2007		2008		2009		2010		2011	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
CD-6														
Lay gravel for road					X									
Lay gravel for production pad					X									
Drilling							X	X	X					
Install VSMs for pipelines					X									
Install pipelines							X							
Install powerlines					X									
Install module piles					X									
Install bridge foundations					X									
Construct bridges					X									
Work gravel on pad/roads						X								
Install surface facilities							X							
Set modules							X							
Production startup								X						
CD-7														
Lay gravel for road									X					
Lay gravel for production pad									X					
Drilling											X	X	X	
Install VSMs for pipelines									X					
Install pipelines											X			
Install powerlines											X			
Install module piles									X					
Install bridge foundations									X					
Construct bridges									X					
Work gravel on pad/roads										X				
Install surface facilities											X			
Set modules											X			

TABLE 2.4.1-5 ASDP CONSTRUCTION SCHEDULE BY PRODUCTION PAD (CONT'D)

Task	2005		2006		2007		2008		2009		2010		2011	
	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer	Winter	Summer
CD-7 cont'd														
Production startup												X		
CD-5														
Lay gravel for road									X					
Lay gravel for production pad									X					
Drilling											X	X	X	
Install VSMs for pipelines									X					
Install pipelines									X					
Install powerlines									X					
Install module piles									X					
Work gravel on pad/roads										X				
Install surface facilities											X			
Set modules											X			
Production startup												X		

ALTERNATIVE A – FFD QUANTITY ESTIMATES

In Alternative A, the 5 proposed production pads (CD-3, CD-4, CD-5, CD-6, and CD-7) and 13 HPs (HP-1, HP-3, HP-4, HP-5, HP-6, HP-7, HP-8, HP-9, HP-11, HP-12, HP-13, HP-14, and HP-15) -would tie-in by pipeline to APF-1. HP-2, HP-10, HP-16, HP-17, and HP-19 would tie in by pipeline to HPF-1. HP-18, HP-20, HP-21, and HP-22 would tie in by pipeline to HPF-2. Under Alternative A, airstrips and winter ice roads, rather than gravel roads, would provide access to CD-3, HP-7, HP-12, HP-13, HP-14, and HP-22. A gravel road network would interconnect all other pads and processing facilities.

Estimates of the areas that would be covered by gravel and the volume of gravel required to construct the hypothetical facilities are presented in Tables 2.4.1-6 and 2.4.1-7. Lengths and diameters of pipelines are shown in Table 2.4.1-8. Estimated miles of annual ice roads are shown in Table 2.4.1-9**,** assuming a hypothetical sequence of development for analysis purposes.

TABLE 2.4.1-6 ALTERNATIVE A – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	PRODUCTION PAD		AIRSTRIP AND APRON/TAXIWAY		TOTALS	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
HP-1	78	9.1	—	—	78	9.1
HP-2	78	9.1	—	—	78	9.1
HP-3	78	9.1	—	—	78	9.1
HP-4	78	9.1	—	—	78	9.1
HP-5	78	9.1	—	—	78	9.1
HP-6	78	9.1	—	—	78	9.1
HP-7	110	12.6	162	21.5	272	34.1
HP-8	78	9.1	—	—	78	9.1
HP-9	78	9.1	—	—	78	9.1
HP-10	78	9.1	—	—	78	9.1
HP-11	78	9.1	—	—	78	9.1
HP-12	110	12.6	162	21.5	272	34.1
HP-13	110	12.6	162	21.5	272	34.1
HP-14	110	12.6	162	21.5	272	34.1
HP-15	78	9.1	—	—	78	9.1
HP-16	78	9.1	—	—	78	9.1
HP-17	78	9.1	—	—	78	9.1
HP-18	78	9.1	—	—	78	9.1
HP-19	78	9.1	—	—	78	9.1
HP-20	78	9.1	—	—	78	9.1
HP-21	78	9.1	—	—	78	9.1
HP-22	149	17.6	162	21.5	311	39.1
HPF-1	317	36.3	228	29.4	545	65.7
HPF-2	317	36.3	228	29.4	545	65.7
TOTAL	**2549**	**295.3**	**1266**	**166.3**	**3815**	**461.6**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 2H:1V slideslopes.
Total may not be exact because of rounding.

TABLE 2.4.1-7 ALTERNATIVE A – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
HP-1 to CD-6/5 road	2.5	103	16.1
CD-7 HP-2	2.8	115	18.3
HP-3 to CD-6/5 road	4.3	177	28.1
CD-4 to HP-4	2.5	103	16.2
CD-2 to HP-5	3.0	123	29.0
HP-6 to CD-5/6 road	5.0	206	32.7
HP-8 to HP-6/HP-9 road	3.9	160	25.1
HP-6 to HP-9	7.2	296	46.7
HP-10 to CD-7/HP-2 road	7.3	300	47.0
HP-9 to HP-11	8.7	358	56.4
CD-6 to HP-15	10.4	427	67.3
HPF-1 to HP-16	5.5	226	35.7
HP-16 to HP-17	6.6	271	42.8
HP-18 to HPF-1	7.8	321	50.7
HP-17 to HP-19	9.1	374	59.3
HP-20 to HPF-2/HP-18 road	8.9	366	57.6
HP-21 to HPF-2	9.8	403	63.4
HPF-1 to CD-6/7 road	5.8	238	37.7
HPF-2 to HP-18	10.7	440	69.7
TOTAL	**121.8**	**5,006**	**799.8**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope
Coverage calculation assumes 52-foot wide toe of slope-to-toe of slope road width, 2H:1V slideslope

TABLE 2.4.1-8 ALTERNATIVE A – FFD ESTIMATED LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
HP-1 to CD-6/5 line	2.5	A	242
HP-2 to CD-7	2.7	B	260
HP-3 to CD-6/5 line	4.5	A	433
HP-4 to CD-4	2.2	A	215
HP-5 to CD-2	3.1	A	295
HP-6 to CD5/6 road	4.7	B	451
HP-7 to CD-3/1 pipeline	1.5	B, D	143
HP-8 to HP-6/HP-9 road	4.0	A	387
HP-9 to HP-6	7.1	B	680
HP-10 to CD-7/HP-2 line	7.1	A	685
HP-11 to HP-9	8.7	A	840
HP-12 to HP-7	6.0	B, D	575
HP-13 to HP-12	4.3	A, D	412
HP-14 to HP-12	5.2	A, D	503
HP-15 to CD-6	10.6	A	1,016
HP-16 to HPF-1	5.4	B	517
HP-17 to HP-16	6.8	B	650
Spine, HP-18 to HPF-1	7.8	C	753
HP-19 to HP-17	9.0	A	860
HP-20 to HPF-2/HP-18 road	8.9	A	854
HP-21 to HPF-2	10.0	B. D	965
HP-22 to HP-21	11.1	A, D	1,069
Spine, HPF-2 to HP-18	10.7	B, C	1,029
Spine, HPF-1 to CD-6/7 road	6.2	B, C	577
TOTAL	**150.1**		**14,411**

Notes:
A = Pipelines include 18-inch produced fluids, 8-inch gas, 10-inch water, and 6-inch lift gas.
B = Pipelines include 24-inch produced fluids, 10-inch gas, 14-inch water, and 6-inch lift gas.
C = 14-inch sales oil and 12-inch seawater supply pipeline.
D = 2-inch products line to non-roaded production pads.

TABLE 2.4.1-9 ALTERNATIVE A – FFD ICE ROAD ESTIMATES

Construction Timeframe	Year	Facilities Constructed	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Total Annual Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	HP-4 & HP-5	21	NA	21
	2012	HP-7	16	5	21
	2013	HP-12	21	7	28
	2014	HP-13	27	5	32
	2015	HP-14	28	6	34
2016 to 2018	2016	HP-1	9	NA	9
	2017	HP-3	14	NA	14
	2018	HP-15	28	NA	28
2019 to 2022	2019	HPF-1 & HP-2	29	NA	29
	2020	HP-10	20	NA	20
	2021	HP-16	13	NA	13
	2022	HP-17 & HP-19	35	NA	35
2023 to 2026	2023	HPF-2 & HP-18	52	NA	52
	2024	HP-20	40	NA	40
	2025	HP-21	32	NA	32
	2026	HP-22	30	13	43
2027 to 2030	2027	HP-6	15	NA	15
	2028	HP-8	19	NA	19
	2029	HP-9	13	NA	13
	2030	HP-11	33	NA	33
		TOTAL	**495**	**36**	**531**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Estimates assume gravel supply from the ASRC Mine Site, Clover Potential Gravel Source, and hypothetical future gravel source(s).
Assumes ice roads annually to all sites not connected via gravel roads.

2.4.2 Alternative B – Conformance with Stipulations

2.4.2.1 Alternative B – CPAI Development Plan

Except for those aspects specifically discussed below, the components of Alternative B are the same as those for Alternative A. Most differences between the two alternatives are based on the theme that Alternative B would alter the applicant's proposed action to conform completely to Northeast National Petroleum Reserve-Alaska IAP/EIS development stipulations (see Appendix D). Accordingly, Alternative B would alter the applicant's proposed action on BLM-managed lands by:

- Moving proposed permanent oil infrastructure to a distance at least 3 miles from Fish Creek (Stipulation 39[d]). This activity requires that CD-6 and associated roads and pipelines be moved from within the setback.

- Moving proposed permanent oil infrastructure, except essential pipeline and road crossings, to a distance of at least 500 feet from water bodies (Stipulation 41). Roads and pipelines would be moved to conform to this provision to the maximum extent possible

- Eliminating roads to a road network outside BLM-managed lands in the National Petroleum Reserve-Alaska (Stipulation 48). Road connection between CD-6 and CD-7, and other facilities are eliminated.

In addition, access to roads would be restricted to industry and government agency personnel only.

Roads would be built to connect CD-4 to APF-1 and CD-7 to CD-6. A pipeline-only bridge would span the Nigliq Channel. Airstrips would be built at both CD-5 and CD-6, in addition to the one at CD-3. Access to CD-5, CD-6, and CD-7 during the construction and drilling phases would require ice roads and an ice bridge across the Nigliq Channel. The size of the gravel production pads at CD-5 and CD-6 would be increased to approximately 11.6 acres from the approximately 9.1 acres proposed in Alternative A to allow for staging of equipment and supplies airlifted or hauled in over ice roads (Table 2.4.1-9). A 2-inch products pipeline would be added to serve CD-5, CD-6, and CD-7, as well as CD-3**,** because gravel roads would not connect back to APF-1. Larger bulk storage tanks for corrosion inhibitor and other materials would be installed at CD-3, CD-5, CD-6, and CD-7. These bulk liquids would be delivered by tanker truck over ice roads and stored for use throughout the year, or could be batched through the 2-inch products pipeline. Mud plants would be located at DC-5 and CD-6. The mud plant at CD-6 would also support drilling at CD-7. Figure 2.4.2.1-1 presents the Alternative B site map.

ALTERNATIVE B – QUANTITY ESTIMATES

Table 2.4.2-1 provides the estimated gravel quantities required for the production pad and airstrip under Alternative B, and Table 2.4.2-2 contains annual projected water usage for the ice road. Estimated areas that would be covered by gravel and length of the road segments are presented in Table 2.4.2-3. Lengths and diameters of pipelines are shown in Table 2.4.2-4.

ALTERNATIVE B – CONSTRUCTION AND OPERATIONS SCHEDULE

The construction and operations schedule for Alternative B would be essentially the same as that for Alternative A (Table 2.4.1-5). Alternative B would differ from Alternative A by laying gravel for adjoining airstrips, airstrip aprons, and roads to the airstrips at the same time that gravel is laid for CD-5 and CD-6, and no gravel would be laid for a road between CD-2 and CD-6.

2.4.2.2 Alternative B – Full-Field Development Scenario

ALTERNATE B – FFD DESCRIPTION

Alternative B for FFD would alter the FFD scope to conform completely to Northeast National Petroleum Reserve-Alaska IAP/EIS development stipulations. Figure 2.4.2.2-1 presents the Alternative B – FFD pad, road, and pipeline locations. In accordance with Stipulation 41, permanent oil infrastructure would be placed 500 feet or more from water bodies. Stipulation 31 sets aside the Teshekpuk Lake Surface Protection Area. Conformance would preclude development in the northwesternmost part of the Plan Area near the Kogru River. This change would eliminate hypothetical CD-29.

TABLE 2.4.2-1 ALTERNATIVE B – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips and Apron/Taxiways/Boat Launches		Totals	
Site	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**
CD-3	110	12.6	144	18.0	254	30.6
CD-4	112	9.3	16	1.4	128	10.7
CD-5	149	17.6	196	24.3	345	41.9
CD-6	149	17.6	201	24.9	350	42.5
CD-7	78	9.1	0	0.0	78	9.1
TOTAL	**598**	**66.2**	**557**	**68.6**	**1155**	**134.8**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.2-2 ALTERNATIVE B – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Total Annual (miles) and Water Usage (million gallons)
2005	44	5	49
2006	39	5	44
2007	39	5	44
2008	51	5	56
2009	68	5	73
2010	0	5	5
2011	0	0	0
TOTAL	**241**	**30**	**271**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Construction estimate includes a 28-mile annual ice road from Kuparuk to CD-1.
Estimates assume gravel supply from the ASRC Mine Site and Clover Potential Gravel Source.
Assumes ice roads annually, during construction and drilling, to all sites not connected via gravel roads.

TABLE 2.4.2-3 ALTERNATIVE B – ESTIMATED GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
CD-1 to CD-4	3.5	210	25.3
CD-6 to CD-7	6.6	273	43.4
TOTAL	**10.1**	**483**	**68.7**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.

TABLE 2.4.2-4 ALTERNATIVE B – ESTIMATED LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	B	624
CD-1 to CD-4	4.5	A	432
CD-2 to CD-5	6.2	B	595
CD-5 to CD-6	10.1	B	970
CD-6 to CD-7	6.8	A	653
CD-1 to CD-2	2.4	B	230
TOTAL	**36.5**		**3504**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in "A" above and 2-inch products.

Stipulation 39 requires setback of permanent oil and gas facilities from Fish Creek (3 miles below Section 21, T11N, R1E, U.M. and 1/2 mile upstream from there), Judy Creek (1/2 mile), and the Colville River (1 mile). Conformance with Stipulation 39 would require moving the CD-6 drill site and associated road away from Fish Creek. Future development also would have to stay out of these setbacks. For relatively narrow setbacks, this restriction normally would not deny oil companies access to oil. However, oil accumulations centered within a large setback area such as that for Fish Creek may not be able to be reached economically with currently available technology, and associated developments would not be built. For example, HPF-1 is located within the 3-mile setback around Fish Creek. Under Alternative B, this HPF probably would not be developed because the resource that would justify its construction would be economically unreachable from outside the setback. Without a processing facility in this area of the Plan Area, smaller oil accumulations would become uneconomic. In the hypothetical scenario of this EIS, HP-10 and HP-19 probably would be uneconomic to develop. The economic analysis of this alternative in Chapter 4 will analyze the impact of the elimination of HPF-1.

To ensure thorough analysis of FFD, however, Chapter 4 also will assume that an HPF can be located just outside the 3-mile Fish Creek setback. Figure 2.4.2.2-1 reflects this scenario. In this figure, HPF-1 has been relocated and has absorbed HP-2. HP-1 would shift north to a location outside BLM-managed lands. Essential roads and pipelines could cross the Fish Creek and Judy Creek setbacks under existing Northeast National Petroleum Reserve-Alaska stipulations. For this scenario, the EIS hypothesizes that pipelines could cross the setbacks, but roads would be deleted or relocated. The removal of these roads is consistent with the intent of Stipulations 39 and 48.

Finally, consistent with Stipulation 48, roads would not be allowed to connect BLM-managed lands to roads on state or private lands.

Although FFD would not be altered from that described for Alternative A east of the Nigliq Channel, FFD for Alternative B would differ substantially west of the channel. Each production pad under this scenario would have its drilling product processed at the same processing facility as in Alternative A, although the pipeline routes between the pads and processing facility would change. Access to production pads on Kuukpik Corporation land would be by a road from Nuiqsut, taking advantage of the airstrip at that village, as well as the airstrip that would have been built at CD-5 as part of this alternative's scenario for development of CPAI's proposed five pads. Other airstrips in the NPR-A would be required at HPF-2, HP-11, HP-15, and HP-17, in addition to the one built at CD-6 as part of this alternative's scenario for development of the applicant's proposed action. Ice roads would be necessary to obtain access to isolated pads and road segments every winter during construction and drilling, and periodically thereafter for well workover rig access and other maintenance and operations work.

ALTERNATIVE B – FFD QUANTITY ESTIMATES

The differences between FFD Alternative A and FFD Alternative B have been described above and can be seen by comparing Figures 2.4.1.2-1 and 2.4.2.2-1. Tables 2.4.2-5 and 2.4.2-6 present the areas covered by the FFD Alternative B facilities and the estimated volume of gravel required to develop those hypothetical facilities. Table 2.4.2-7 presents the lengths and diameters of pipelines. Table 2.4.2-8 presents the water usage projected annually for ice roads, assuming a hypothetical sequence of development for analysis purposes.

TABLE 2.4.2-5 ALTERNATIVE B – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production Pad		Airstrip and Apron/Taxiway		Total	
Site	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**
HP-1	78	9.1			78	9.1
HP-2	0	0.0			0	0.0
HP-3	78	9.1			78	9.1
HP-4	78	9.1			78	9.1
HP-5	78	9.1			78	9.1
HP-6	78	9.1			78	9.1
HP-7	110	12.6	162	21.5	272	34.1
HP-8	78	9.1			78	9.1
HP-9	78	9.1			78	9.1
HP-10	78	9.1			78	9.1
HP-11	149	17.6	162	21.5	311	39.1
HP-12	110	12.6	162	21.5	272	34.1
HP-13	110	12.6	162	21.5	272	34.1
HP-14	110	12.6	162	21.5	272	34.1
HP-15	149	17.6	162	21.5	311	39.1
HP-16	78	9.1			78	9.1
HP-17	149	17.6	162	21.5	311	39.1
HP-18	78	9.1			78	9.1
HP-19	78	9.1			78	9.1
HP-20	78	9.1			78	9.1
HP-21	78	9.1			78	9.1
HP-22	0	0.0			0	0.0
HPF-1	317	36.3			317	36.3
HPF-2	371	36.3	228	29.4	599	65.7
TOTAL	**2589**	**294.1**	**1362**	**179.9**	**3951**	**474.0**

Notes:Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 2H:1V slideslopes.
Total may not be exact because of rounding.

TABLE 2.4.2-6 ALTERNATIVE B – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
HP-1 to HP-3	4.3	177	27.7
HP-3 to CD-5 road	3.8	156	24.6
HP-4 to CD-4	2.5	103	16.1
HP-5 to CD-2	3.1	127	30.0
HP-6 to CD-5	5.6	230	35.8
HP-8 to HP-6/HP-9 road	3.8	156	24.5
HP-9 to HP-6	5.5	226	35.5
HP-10 to HPF-1/CD-7 road	7.2	296	46.4
HP-16 to HP-17	6.7	275	43.0
HP-18 to HPF-2	10.7	440	69.1
HP-19 to HP-10	13.5	555	86.7
HP-20 to HPF-2/HP-18 road	8.9	366	57.1
HP-21 to APF-3	9.8	403	63.0
HPF-1 to CD-7	4.5	185	28.9
TOTAL	**89.9**	**3,695**	**588.4**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.

TABLE 2.4.2-7 ALTERNATIVE B – FFD ESTIMATED LENGTHS AND DIAMETER OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
HP-1 to HP-3/22	2.7	A, D	256
HP-2 to CD-7	0	None, no HP-2	0
HP-3 to CD-5	3.8	B, D	363
HP-4 to CD-4	2.2	A	215
HP-5 to CD-2	3.2	A	303
HP-6 to CD-5	5.6	B, D	534
HP-7 to CD-3/1	1.5	B, D	143
HP-8 to HP-6/HP-9	3.9	A, D	375
HP-9 to HP-6	7.2	B, D	688
HP-10 to HPF-1/CD-7	7.3	B	697
HP-11 to HP-9	8.7	A, D	840
HP-12 to HP-7	6.0	B, D	575
HP-13 to HP-12	4.3	A, D	412
HP-14 to HP-12	5.2	A, D	503
HP-15 to HP-3	9.5	A, D	908
HP-16 to HPF-1	5.5	B, C, D	523
HP-17 to HP-16	6.8	A, D	653
HP-18 to HP-16	7.3	C	702
HP-19 to HP-10	13.2	A	1,266
HP-20 to HPF-2/HP-18	8.9	A	854

TABLE 2.4.2-7 ALTERNATIVE B – FFD ESTIMATED LENGTHS AND DIAMETER OF PIPELINES (CONT'D)

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
HP-21 to HPF-2	9.8	A	938
HP-22 to HP-21	0	None, no HP-22	0
HPF-2 to HP-18	10.7	B, C	1,029
HPF-1 to CD-7	2.8	B, C	267
TOTAL	**135.9**		**13,044**

Notes:
A = Pipelines include 18-inch produced fluids, 8-inch gas, 10-inch water, and 6-inch lift gas.
B = Pipelines include 24-inch produced fluids, 10-inch gas, 14-inch water and 6-inch lift gas.
C = 14-inch sales oil and 12-inch seawater supply pipeline.
D = 2-inch products.

TABLE 2.4.2-8 ALTERNATIVE B – FFD ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Construction Timeframe	Year	Facilities Constructed	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Annual Total Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	HP-4 & HP-5	21	NA	21
	2012	HP-7	18	8	26
	2013	HP-12	21	7	28
	2014	HP-13	27	5	32
	2015	HP-14	28	6	34
2016 to 2018	2016	HP-1	33	NA	33
	2017	HP-3	6	NA	6
	2018	HP-15	15	NA	15
2019 to 2022	2019	HPF-1	17	11	28
	2020	HP-10	31	NA	31
	2021	HP-19	42	NA	42
	2022	HP-16 & 24	35	9	44
2023 to 2026	2023	HPF-2	32	NA	32
	2024	HP-18	53	10	63
	2025	HP-20	42	NA	42
	2026	HP-21	43	NA	43
2027 to 2030	2027	HP-6	22	NA	22
	2028	HP-8	24	NA	24
	2029	HP-9	18	NA	18
	2030	HP-11	37	NA	37
		TOTAL	**565**	**56**	**621**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Estimates assume gravel supply from the ASRC Mine Site, Clover Potential Gravel Source and hypothetical future gravel source(s).
Assumes ice roads annually to all sites not connected via gravel roads.

2.4.3 Alternative C – Alternative Access Routes

Alternative C differs from Alternative A principally by including a different, more southern bridge location over the Nigliq Channel, a road connection to Nuiqsut, a southerly road and pipeline route to CD-6 and CD-7, and road connections to all production pads, including those in the lower Colville River Delta. This alternative also contrasts with Alternative A by requiring a minimum pipeline height of 7 feet and placing powerlines on separate poles rather than on VSMs. The road route to Nuiqsut would allow easier use of existing Nuiqsut facilities such as the airstrip and lodging during construction and operations. The route also offers potential efficiencies if the state constructs the proposed Colville River Road it is now considering to Nuiqsut from the western end of the Spine Road system at Iceberg. For purposes of analysis Alternative C is separated into two sub-alternatives, Sub-Alternative C-1 and Sub-Alternative C-2. Sub-Alternative C-1 provides for stand-alone gravel road development as part of the applicant's proposed action, without anticipating the presence of the Colville River Road. Sub-Alternative C-2 has road alignments comparable to Sub-Alternative C-1, except it relies on the existence of a state-built gravel Colville River Road connecting Nuiqsut and the Spine Road, including a state-built bridge across the Nigliq Channel. The state road has not been built yet, but the State is actively working on a proposal with that objective. Under Sub-Alternative C-2, the applicant would not construct a vehicle bridge over the Nigliq Channel. Production pad locations for Sub-Alternatives C-1 and C-2 would be the same as those proposed in Alternative A. Exceptions to the same Northeast National Petroleum Reserve-Alaska IAP/EIS stipulations as in Alternative A would be required. Use of roads on BLM lands would be unrestricted. Industry, government agencies, and local residents would have access to other roads.

Roads constructed across the lower Colville River Delta (to CD-3) would include extensive bridging and culverts to maintain surface flow paths and prevent damming. Roadside embankments would likely require stabilization and armoring to protect against the forces of floodwaters and ice impacts. Hydraulic modeling would be performed as part of the road design to ensure that the presence of the road would not increase the peak water surface elevations used for design at the existing CD-1 and CD-2 facilities. Roads in the lower Colville River Delta would be designed with an elevation equal to a 200-year flood with 1 foot of freeboard, in contrast to the 50-year flood with 3-feet of freeboard for the other alternatives. Roads to the lower Colville River Delta pads would use more embankment material than the typical North Slope road. Roads to production pads in the lower Colville River Delta would be designed to prevent washout. Thus, the proposed roads may require slope armoring or protection to resist hydraulic scouring forces from floodwaters. Generally, floodplain flows do not carry much velocity; however, the proposed roads would border or cross many channels that may have more aggressive flow regimes. Roadway embankment armoring could be accomplished with various methods. Conventionally, rock armoring in the form of riprap would be used. Articulated concrete mat is a matrix of concrete blocks held together by a web of concealed steel cables. Concrete mats also can be effective at limiting bank erosion. Another option would be to place sand or gravel into large geotextile bags, which are essentially large sandbags. The roads and armoring system would require annual repair and maintenance.

Several bridges would be built in the lower Colville River Delta to reach CD-3 and additional pads as part of FFD. A road to CD-3 from APF-1 would cross three channels. Roads to the four FFD HPs in the lower Colville River Delta would include more than 2 miles of bridges crossing eight channels.

Wind-drifted snow is a common concern on the North Slope, and snow blockage of culverts is a primary concern. Because break-up usually occurs before snowdrifts have melted, the culverts cannot handle flooding. Two options are available for ensuring culverts are clear and capable of handling flooding: (1) annual clearing or (2) the placement of a plywood end cap in the fall and removal of the end cap before break-up. In some cases, a battery of culverts may not be as efficient as a large multi-plate culvert, or a bridge, when life-cycle maintenance costs are considered (McDonald 1994). Ongoing monitoring would likely be required to determine if the roads in the lower Colville River Delta were affecting the Colville River Delta flow regimes and causing changes to river erosion and deposition patterns.

2.4.3.1 Alternative C, Sub-Alternative C-1 – CPAI Development Plan

SUB-ALTERNATIVE C-1 – CPAI DEVELOPMENT PLAN

SUB-ALTERNATIVE C-1 DESCRIPTION

Figure 2.4.3.1-1 depicts Sub-Alternative C-1 for CPAI's proposed pad developments. Although the pads are in the same locations as in Alternative A, access to them differs. A road, rather than an airstrip, provides access to CD-3. The bridge across the Nigliq Channel is located at an alternative crossing location originally identified by CPAI. Instead of being directly west of CD-2, the bridge is near CD-4. This bridge leads to a northern spur road to CD-5 and a southern route that has connections to Nuiqsut, CD-6, and CD-7.

Road and pipeline lengths would be greater for this alternative than for other alternatives, but infrastructure construction south and west of APF-1 would not differ markedly from that for Alternative A. The road to CD-3, however, would have to address additional engineering challenges. A road to CD-3 would have to be reachable year-round. Estimated elevations based on topographic maps at the proposed CD-3 pad indicate that the embankments would range from 5 to 16 feet. Also, the road may have to accommodate storm surges that could cause the Delta to back up from elevated sea levels offshore.

Several bridges would be required to construct a year-round gravel road between CD-1 and CD-3. Bridge lengths are shown in Table 2.4.3-1.

TABLE 2.4.3-1 SUB-ALTERNATIVE C-1 – BRIDGE LENGTHS

Road Segment	Waterbodies Crossed	Estimated Lengths (Feet)
CD-1 to CD-3	Sakoonang Tamayayak Ulamnigiaq	450 750 500

Bridges are expected to be aligned perpendicular to the channels and do not include any additional length that may be required to accommodate waterway opening requirements. Waterway opening requirements are calculated from the design flood flows at each location and thus determine the overall span length (McDonald 1994). Overall bridge lengths may be longer than estimated if detailed engineering shows additional length is necessary for flood flows.

SUB-ALTERNATIVE C-1 – QUANTITY ESTIMATES

Table 2.4.3-2 and Table 2.4.3-3 provide the estimated gravel quantities required for production pad, airstrip, and road segments construction under Sub-Alternative C-1. Table 2.4.3-4 contains additional information for ice road construction. Table 2.4.3-5 shows the estimated pipeline lengths and diameters associated with production pads under Sub-Alternative C-1. Estimated vehicle traffic and aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—are the same as Alternative A and are provided in Table 2.3.10-1.

SUB-ALTERNATIVE C-1 – CONSTRUCTION AND OPERATIONS SCHEDULE

The construction and operations schedule for Sub-Alternative C-1 would be essentially the same as that for Alternative A (Table 2.4.1-5). The primary difference would be that for Sub-Alternative C-1, gravel would be laid for a road to CD-3 at the same time as gravel is laid for that pad. CD-3 remains restricted to winter-only drilling, and CD-4 drilling would remain in the summer, on a rotation with CD-3.

TABLE 2.4.3-2 SUB-ALTERNATIVE C-1 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips and Apron/Taxiways/Boat Launches		Totals	
Site	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**
CD-3	78	9.1	2	0.1	80	9.2
CD-4	112	9.3	16	1.4	128	10.7
CD-5	78	9.1	0	0.0	78	9.1
CD-6	78	9.1	0	0.0	78	9.1
CD-7	78	9.1	0	0.0	78	9.1
TOTAL	**424**	**45.7**	**18**	**1.5**	**442**	**47.2**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.3-3 SUB-ALTERNATIVE C-1 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
Alpine to CD-3	6.4	264	41.9
Alpine to CD-4	3.5	210	25.3
CD-5 to CD-6 Primary Road	9.5	392	62.3
CD-6 to CD-7, Primary Road	6.0	246	39.2
CD-5 Pad Access Road	5.0	207	33.0
CD-6 Pad Access Road	4.4	181	28.8
CD-4 to National Petroleum Reserve-Alaska	4.1	169	26.8
CD-4/CD-5 Junction to Nuiqsut Primary Road	2.1	85	13.5
Nuiqsut Spur	1.1	44	7.0
TOTAL	**42.1**	**1798**	**277.8**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.

TABLE 2.4.3-4 SUB-ALTERNATIVE C-1 – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Total Annual Ice Road (miles) and Water Usage (million gallons)
2005	67	0	67
2006	56	0	56
2007	57	0	57
2008	83	0	83
2009	63	0	63
2010	0	0	0
2011	0	0	0
TOTAL	**326**	**0**	**326**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Construction estimate includes a 28-mile annual ice road from Kuparuk to CD-1.
Estimates assume gravel supply from the ASRC Mine Site and Clover Potential Gravel Source.
Assumes ice roads annually, during construction and drilling, to all sites not connected via gravel roads.

TABLE 2.4.3-5 SUB-ALTERNATIVE C-1 – APPROXIMATE LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	A	624
CD-1 to CD-4	4.5	A	432
CD-5 to CD-5 tie-in	4.9	A	470
CD-5 tie-in to CD-1/4	4.4	A	422
Y to CD-5 tie-in	11.7	A	1123
CD-6 to Y	4.4	A	422
CD-7 to Y	5.9	A	566
TOTAL	**42.3**		**4059**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in “A” above and 2-inch products.

2.4.3.2 Alternative C, Sub-Alternative C-2 – CPAI Development Plan

SUB-ALTERNATIVE C-2 – CPAI DEVELOPMENT PLAN

SUB-ALTERNATIVE C-2 DESCRIPTION

Sub-Alternative C-2 is similar to Sub-Alternative C-1 with respect to following the theme of gravel road access to production pads. The difference is that the proposed Colville River Road into Nuiqsut would be incorporated into ASDP access designs. The Colville River Road is proposed by the State of Alaska and is not a proposed component of Sub-Alternative C-2. For Sub-Alternative C-2 to be practicable, the Colville River Road would need to be constructed and operational by late 2009, as currently proposed by the State of Alaska. Section 4G.4.5 includes additional information regarding the proposed Colville River Road. In order to adopt Alternative C-2, the BLM would have to modify the Northeast National Petroleum Reserve-Alaska IAP/EIS (Stipulation 48) to allow roads connecting to a road system outside the National Petroleum Reserve-Alaska. The

Sub-Alternative C-1 Nigliq Channel crossing between the CD-4 road and the CD-5 road would be eliminated, in lieu of a crossing farther south at the location of the Colville River Road bridge proposed by the state. There would be no direct gravel road connection between the existing Alpine Development Project and the Colville River Road. ASDP facilities would instead be developed with two separate clusters. The eastern cluster of pads would include CD-3 and CD-4, interconnected by gravel roads to the existing Alpine Development Project at CD-1 and CD-2. The western cluster of pads would include CD-5, CD-6, and CD-7, interconnected to Nuiqsut and by the Colville River Road and Spine Road to the Kuparuk Oilfield. Equipment, supplies, and personnel destined for CD-5, CD-6, and CD-7 could be flown or trucked directly into Nuiqsut, and then transported via the Alpine road system to the desired Alpine production pad. Ice roads could be constructed for vehicle access between the eastern and western clusters of pads, and from CD-4 to Nuiqsut during the winter months.

Pipelines under Sub-Alternative C-2 would be routed similarly to those under Sub-Alternative C-1. The pipeline lengths and diameters associated with Sub-Alternative C-2 would be the same as for Sub-Alternative C-1. Differences in pipelines would be that the Colville River crossing near CD-4 under Sub-Alternative C-2 would be via a pipeline-only bridge. Also, because there would be no road connection between the existing Alpine Development Project and the pads west of the Colville River, a 2-inch products pipeline would be required to supply reduced sulfur diesel fuel to the drill rig until the state's road has been completed. After the Colville River Road has been completed, diesel may be resupplied to the drill rigs by truck.

Sub-Alternative C-2 would include a modified connection to Nuiqsut, and is presented in Figure 2.4.3.2-1. The road would bypass Nuiqsut to the west. The bypass road would be sited on Kuukpik and BLM lands, and would go south and then west around Nuiqsut to tie into the proposed state Colville River Road south of Nuiqsut.

A 2-acre vehicle storage area would be constructed on a new gravel pad adjacent to the Nuiqsut bypass road. The vehicle storage area would be located near the junction of the ASDP Nuiqsut bypass road and the west end of the Colville River Road. The vehicle storage area would be developed with a vehicle storage and repair warehouse to shelter and service vehicles routinely used on the ASDP road network west of the Colville River. The vehicles could include pickup trucks, road graders, water trucks, and front-end loaders. The pad would also have cold storage and warm storage. Electrical power supplied from the Nuiqsut grid would be connected to vehicle storage area facilities. The power wires would be suspended from overhead power poles, 60 feet high and spaced 250 feet apart. The vehicle storage area would have a water storage tank and a waste accumulation tank. Water would be supplied from Nuiqsut or the Kuparuk Oilfield. Wastewater would be hauled by tank truck to existing approved treatment and disposal facilities at Nuiqsut or the Kuparuk Oilfield.

A spur road from the Colville River Road to the Nuiqsut village and airstrip is an existing component of the state's proposed Colville River Road project. This spur road would effectively connect the ASDP road system from CD-5 to CD-7 to Nuiqsut. Existing infrastructure at Nuiqsut includes limited lodging and stores. Lodging includes the Kuukpik Hotel and Kuukpik Arctic Catering. Supply stores include Kuukpik Hardware and Kuukpik AC Store. The Nuiqsut Airport has an unattended 4,340-foot gravel runway. For comparison, the Alpine Development Project runway is a 5,000-foot gravel runway. The Nuiqsut runway is lighted and used year-round. Northern Air Cargo (NAC) flies a DC-6 chartered by the oil companies into the airstrip fairly regularly. NAC operates regularly scheduled flights to Deadhorse. When flying into Nuiqsut NAC can carry 20,000 pounds of cargo from Anchorage,24,000 pounds from Fairbanks, and 28,000 pounds from Deadhorse, NAC does not carry passengers. Other carriers are available for charter to transport passengers to Nuiqsut.

The NSB Nuiqsut Utility power plant has a generating capability of 2.7 MW. The Nuiqsut Landfill is a Class III (village), landfill authorized for disposal of septage, inert, municipal, ash, sludge, construction debris, fish waste, and animal waste. The landfill is operated by the NSB. The ADEC Wastewater Disposal Permit No. 0136-DB006 for the Nuiqsut Wastewater Treatment Plant allows disposal of a maximum of 28,000 gpd of secondary treated domestic wastewater onto the tundra. In 2002, the NSB CIP installed interior water piping and sewage connections to all buildings in Nuiqsut. Thus, it seems possible that other facilities could be hooked up to the village utilities. Nuiqsut drinking water is derived from a nearby lake then treated and stored in a holding tank. Residents also have individual water tanks with water delivery service, and use honeybuckets to dispose of sewage. Hauling services are provided. A majority of homes have running water to the kitchen.

Community plans call for the construction of a piped system with flush toilets, showers, and household plumbing.

SUB-ALTERNATIVE C-2 – QUANTITY ESTIMATES

Table 2.4.3-6 and Table 2.4.3-7 provide the estimated gravel quantities required for production pad, airstrip, and road segment construction under Sub-Alternative C-2. Annual water use for ice roads would be different than that for Sub-Alternative C-1 and are presented in Table 2.4.3-8. The difference in ice road requirements between Sub-Alternatives C-1 and C-2 is due to the construction of the gravel road connection to the proposed state road, and not having a gravel road connection across the Nigliq Channel, which necessitates annual operations ice roads. Although it is not related to or part of the ASDP project, if it is constructed in the next several years, the Colville River Road proposed by the state would eliminate the need for an annual ice road between the Kuparuk Oilfield and CD-1. Table 2.4.3-9 shows the estimated pipeline lengths and diameters associated with production pads under Sub-Alternative C-2.

Estimated vehicle traffic and aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—for Sub-Alternative C-2 are similar to Alternative A and Sub-Alternative C-1 because under the schedule proposed by the State the proposed state road connection to the Kuparuk Oilfield would not be completed until late in the construction phase (2010). Once available for use by industry, the road connection might result in a decrease in aircraft flights into the Plan Area but an increase in vehicle traffic from the Kuparuk Oilfield; however, the total number of trips made by workers into the Plan Area would remain the same for Alternative A, Sub-Alternative C-1, and Sub-Alternative C-2. For purposes of analyses, Sub-Alternative C-2 is assumed to have the same vehicle traffic and aircraft flights as Alternative A and Sub-Alternative C-1.

Once the proposed state road to Nuiqsut is completed, industry flights into the Plan Area likely would be split between Nuiqsut and CD-1. Similarly, total road traffic would be comparable to Alternative A and Sub-Alternative C-1, but would be split between the two separate road clusters because of the lack of road connection between CD-4 and CD-5 in Sub-Alternative C-2. Workers traveling to CD-3 or CD-4 would fly into CD-1; however, nearly all construction traffic after 2010 would be in support of CD-5, CD-6, or CD-7 and would go over the Colville River Road. Construction workers would be housed either at CD-1 or Nuiqsut, as with other alternatives. Drilling crews would fly into the Kuparuk Oilfield and travel by bus to the drill sites. Operations personnel would be housed at CD-1. They would make two routine trips daily to the pads by flying from CD-1 to Nuiqsut.

SUB-ALTERNATIVE C-2 – CONSTRUCTION AND OPERATIONS SCHEDULE

The construction and operations schedule for Sub-Alternative C-2 would be the same as that for Sub-Alternative C-1, except that modules and other surface facilities at CD-5 and CD-7 and the pipeline and the powerlines and poles to be installed to connect with CD-7 in the winter of 2010 may reach the area of construction via the state road, rather than from CD-1 via the Nigliq Channel bridge. Similarly, during drilling, one drill rig may reach CD-5 or CD-7, and supplies, equipment, and personnel for drilling may reach both pads via the state road, rather than from CD-1. During operations, personnel would make their up to two routine round trips daily to the pads by flying to Nuiqsut from CD-1, where personnel, unless residents of Nuiqsut, would be housed. Heavier vehicles, such as graders and road-watering trucks, would be driven from the storage area near Nuiqsut, rather than directly from CD-1. Some repairs that would have been staged out of CD-1 could also be accomplished by transportation by the state road from the Kuparuk Oilfield. Finally, abandonment also could be accomplished on a direct road to the Dalton Highway, rather than relying on use of the road bridge across the Nigliq Channel to CD-1 and an ice road between CD-1 and the Kuparuk Oilfield.

TABLE 2.4.3-6 SUB-ALTERNATIVE C-2 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips and Apron/Taxiways/Boat Launches		Totals	
Site	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**
CD-3	78	9.1	2	0.2	80	9.3
CD-4	112	9.3	16	1.4	128	10.7
CD-5	78	9.1	0	0.0	78	9.1
CD-6	78	9.1	0	0.0	78	9.1
CD-7	78	9.1	0	0.0	78	9.1
Nuiqsut Storage Pad	16	2.0	0	0.0	16	2.0
TOTAL	**440**	**47.7**	**18**	**1.6**	**458**	**49.3**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.3-7 SUB-ALTERNATIVE C-2 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	**Length (miles)**	**Gravel (1,000 cy)**	**Coverage (acres)**
Alpine to CD-3	6.4	264	41.9
Alpine to CD-4	3.5	210	25.3
CD-5 to CD-6, Primary Road	9.5	392	62.3
CD-6 to CD-7, Primary Road	6.0	246	39.2
CD-5 Pad Access Road	5.0	207	33.0
CD-6 Pad Access Road	4.4	181	28.8
Nuiqsut junction To State Road	4.7	193	30.4
CD-4/CD-5 junction To Nuiqsut junction	2.1	85	13.5
Total	**41.6**	**1778**	**274.4**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.3-8 SUB-ALTERNATIVE C-2 – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Total Annual Ice Road (miles) and Water Usage (million gallons)
2005	61	0	61
2006	51	0	51
2007	65	7	72
2008	81	12	93
2009	65	5	70
2010	0	5	5
2011	0	0	0
TOTAL	**323**	**29**	**352**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Construction estimate includes a 28-mile annual ice road from Kuparuk to CD-1.
Estimates assume gravel supply from the ASRC Mine Site and Clover Potential Gravel Source.
Assumes ice roads annually, during construction and drilling, to all sites not connected via gravel roads.

TABLE 2.4.3-9 SUB-ALTERNATIVE C-2 – APPROXIMATE LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	A	624
CD-1 to CD-4	4.5	B	432
CD-5 to CD-5 tie-in	4.9	A	470
CD-5 tie-in to CD-1/4	4.4	B	422
CD-6/CD-7 junction to CD-5 tie-in	11.7	B	1123
CD-6 to CD-6/CD-7 junction	4.4	B	422
CD-7 to CD-6/CD-7 junction	5.9	A	566
TOTAL	**42.3**		**4,059**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in “A” above and 2-inch products.

2.4.3.3 Sub-Alternative C-1 – Full-Field Development Scenario

SUB-ALTERNATIVE C-1 – FFD DESCRIPTION

In the FFD scenario for Sub-Alternative C-1, roads would link all pads to processing facilities, CD-1, and Nuiqsut. Roads in the Colville River Delta also would be constructed.

Road construction could occur in the lower Colville River Delta to reach future oil production pads. The extent of such roads and the challenges they would pose are illustrated by extending roads to four HPs (HP-7, HP-12, HP-13, and HP-14) requiring multiple channel crossings. To design such roads, the design floodwater surface elevations, as discussed in Section 2.4.3, would need to be ascertained. There are very few physiographic features that remain above floodwaters, which can make siting roads difficult (PN&D 2002b).

The bridge crossing lengths required to reach the HPs in the Colville River Delta are listed in Table 2.4.3-10, based on the routes shown in Figure 2.4.3.3-1 in the same manner as previously estimated for Figure 2.4.3.1-1.

TABLE 2.4.3-10 SUB-ALTERNATIVE C-1 – ESTIMATED BRIDGE LENGTHS

Road Segment	Channels Crossed	Estimated Lengths (feet)	Segment Total (feet)
CD-1 to HP-7 (1.6 miles)	Tamayayak	1,100	1,100
HP-7 to HP-12 (6.0 miles)	unnamed Elaktoveach Elaktoveach	400 1,000 3,500	4,900
HP-12 to HP-13 (4.3 miles)	unnamed unnamed	150 800	950
HP-12 to HP-14 (5.2 miles)	unnamed Kupigruak	400 4,800	5,200

To have accessible year-round roads to the hypothetical FFD pads in the Delta, the road surfaces would be designed to be above conservative estimates of flood levels. With the use of design criteria from the *Colville River Unit Satellite Environmental Evaluation Document* (PAI 2002a), the road should be high enough to handle a 200-year flood with 1 foot of freeboard. In addition, roads on the Colville River Delta would have to accommodate storm surges that could cause the Delta to back up from elevated sea levels offshore.

A study estimating culvert needs for the National Petroleum Reserve-Alaska roads (PN&D 2002b) identified drainages from maps and photographs and sized culverts to match. It also estimated an additional 10 culverts per mile of roadway (approximately one per 500 feet of roadway) to address additional drainage issues. A road bisecting major Colville River Delta channels would require more culverts and bridges of varying sizes per mile to alleviate hydraulic forces from floodplain flow from a spring break-up/ice dam event or a mid-summer, rain-induced flood. The proposed roads would be monitored to determine if they were affecting the Colville River Delta flow regimes or causing changes to river erosion and deposition patterns.

SUB-ALTERNATIVE C-1 – FFD QUANTITY ESTIMATES

The differences between Alternative A – FFD and Sub-Alternative C-1 – FFD have been described above and can be seen by comparing Figures 2.4.1.2-1 and 2.4.3.3-1. Tables 2.4.3-11 and 2.4.3-12 present the estimated areas covered by the Sub-Alternative C-1 FFD facilities and the volume of gravel required to develop those hypothetical facilities. Table 2.4.3-13 presents estimated pipeline lengths and diameters. Table 2.4.3-14 shows the annual projected water usage for the ice roads associated with FFD Sub-Alternative C-1, assuming a hypothetical sequence of development for analysis purposes.

TABLE 2.4.3-11 SUB-ALTERNATIVE C-1 – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production Pad		Airstrip Taxiway and Access Road		Totals	
Site	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**	**Gravel Qty (1,000 cy)**	**Coverage (acres)**
HP-1	78	9.1	—	—	78	9.1
HP-2	78	9.1	—	—	78	9.1
HP-3	78	9.1	—	—	78	9.1
HP-4	78	9.1	—	—	78	9.1
HP-5	78	9.1	—	—	78	9.1
HP-6	78	9.1	—	—	78	9.1
HP-7	78	9.1	—	—	78	9.1
HP-8	78	9.1	—	—	78	9.1
HP-9	78	9.1	—	—	78	9.1
HP-10	78	9.1	—	—	78	9.1
HP-11	78	9.1	—	—	78	9.1
HP-12	78	9.1	—	—	78	9.1
HP-13	78	9.1	—	—	78	9.1
HP-14	78	9.1	—	—	78	9.1
HP-15	78	9.1	—	—	78	9.1
HP-16	78	9.1	—	—	78	9.1
HP-17	78	9.1	—	—	78	9.1
HP-18	78	9.1	—	—	78	9.1
HP-19	78	9.1	—	—	78	9.1
HP-20	78	9.1	—	—	78	9.1
HP-21	78	9.1	—	—	78	9.1
HP-22	78	9.1	—	—	78	9.1
HPF-1	317	36.3	228	29.4	545	65.7
HPF-2	317	36.3	228	29.4	545	65.7
TOTAL	**2350**	**272.8**	**456**	**58.8**	**2806**	**331.6**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 2H:1V slideslopes.
Total may not be exact because of rounding.

TABLE 2.4.3-12 SUB-ALTERNATIVE C-1 – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
HP-1 to CD-6	4.7	193	27.9
HP-2 to CD-7	2.6	107	15.6
HP-3 to CD-5	3.8	156	22.4
HP-4 to CD-4	2.5	103	15.0
HP-5 to CD-2	3.2	132	27.8
HP-6 to Spine	1.5	62	9.0
HP-7 road to CD-3/1 road	1.5	62	8.1
HP-8 to HP-9/spine road	3.9	160	22.9
HP-9 to Spine	5.6	230	33.3
HP-10 to CD-7/HP-2 road	7.3	300	42.9
HP-11 to HP-9	8.7	358	51.3
HP-12 to HP-7	6.0	247	52.5
HP-13 to HP-12	4.3	177	38.0
HP-14 to HP-12	5.2	214	46.0
HP-15 to CD-6	10.4	427	61.3
HP-16 to HPF-1	5.6	230	33.0
HP-17 to HP-16	6.9	284	40.9
HP-18 to HPF-1	7.8	321	46.1
HP-19 to HP-17	9.0	370	53.2
HP-20 to HPF-2/HP-18 road	8.9	366	52.4
HP-21 to HPF-2	9.8	403	57.8
HP-22 to HP-21	11.0	452	96.5
HPF-1 to CD-7	5.8	238	34.5
Spine, HPF-2 to HP-18	10.7	440	63.4
TOTAL	**147.2**	**6,029**	**951.7**

Notes:
32-foot road width covers area 52 feet toe-of-slope to toe-of-slope.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.

TABLE 2.4.3-13 SUB-ALTERNATIVE C-1 – ESTIMATED LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
HP-1 to CD-6	4.9	A	467
HP-2 to CD-7	2.8	B	267
HP-3 to CD-5	3.8	A	365
HP-4 to CD-4	2.2	A	207
HP-5 to CD-2	3.2	A	303
HP-6 to Spine	1.5	A	144
HP-7 to CD-3/1	1.5	B	142
HP-8 to HP-9 tie-in	4.0	A	386
HP-9 to Spine	7.1	B	682
HP-10 to CD-7/HP-2	7.3	B	697
HP-11 to HP-9	8.7	A	840
HP-12 to HP-7	6.0	B	575
HP-13 to HP-12	4.2	A	402
HP-14 to HP-12	5.2	A	499
HP-15 to CD-6	10.6	A	1,016
HP-16 to HPF-1	5.4	B	523
HP-17 to HP-16	6.9	B	665
HP-18 to HPF-1	7.8	C	753
HP-19 to HP-17	9.0	A	867
HP-20 to HPF-2/HP-18	8.9	A	854
HP-21 to HPF-2	10.1	B	968
HP-22 to HP-21	11.1	A	1069
HPF-2 to HP-18	10.7	B, C	1,029
HPF-1 to CD-6/7	5.8	B, C	560
TOTAL	**148.7**		**14,278**

Notes:
A = Pipelines include 18-inch produced fluids, 8-inch gas, 10-inch water, and 6-inch lift gas.
B = Pipelines include 24-inch produced fluids, 10-inch gas, 14-inch water and 6-inch lift gas.
C = 14-inch sales oil and 12-inch seawater supply pipeline.

TABLE 2.4.3-14 SUB-ALTERNATIVE C-1 – FFD ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Construction Timeframe	Year	Facilities Constructed	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	HP-4 & HP-5	18	NA
	2012	HP-7	21	NA
	2013	HP-12	33	NA
	2014	HP-13	30	NA
	2015	HP-14	33	NA
2016 to 2018	2016	HP-1	17	NA
	2017	HP-3	12	NA
	2018	HP-15	47	NA
2019 to 2022	2019	HPF-1 & HP-2	45	NA
	2020	HP-10	33	NA
	2021	HP-16	23	NA
	2022	HP-17 & HP-19	31	NA
2023 to 2026	2023	HPF-2 & HP-18	84	NA
	2024	HP-20	21	NA
	2025	HP-21	42	NA
	2026	HP-22	49	NA
2027 to 2030	2027	HP-6	13	NA
	2028	HP-8	12	NA
	2029	HP-9	18	NA
	2030	HP-11	44	NA
TOTAL			**626**	**0**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Estimates assume gravel supply from the ASRC Mine Site, Clover Potential Gravel Source and hypothetical future gravel source(s).
Assumes ice roads annually to all sites not connected via gravel roads.

2.4.3.4 Sub-Alternative C-2 – Full-Field Development Scenario

SUB-ALTERNATIVE C-2 – FFD DESCRIPTION

Sub-Alternative C-2 – FFD, would be much the same as Sub-Alternative C-1 – FFD. All of the differences between these alternatives occur near Nuiqsut and as described above under the CPAI Development Plan. Therefore, a specific FFD scenario for Sub-Alternative C-2 has not been developed.

2.4.4 Alternative D – Roadless Development

Alternative D excludes the construction of roads for access to production pads. Access to production pads would be by fixed-wing aircraft, helicopter, ice road, or low-ground-pressure-vehicle travel on tundra. The pipeline crossing of the Nigliq Channel would be accomplished by using HDD rather than a pipeline bridge. Pipelines would be built with 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 IAP/EIS 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. A short airstrip access road at CD-4 requires a 40-foot vehicle bridge over the Sakoonang Channel. 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 elements are common to both sub-alternatives. Figure 2.4.4-1 presents the site map for Alternative D, and Figure 2.4.4-2 presents the site map for Alternative D-FFD.

Two-inch product pipelines would be routed, along with the other pipelines, to each production pad. Ice roads and an ice bridge across the Nigliq Channel would be constructed every winter during drilling and every few years during operations. In the summer, ground access could include the use of low-ground-pressure vehicles on the tundra, though an exception would have to be obtained for such use on BLM-managed lands.

All production pads in Alternative D would be in the same locations as in Alternative A; however, pipelines would be routed slightly differently (more directly) because there would not be roads. When roads are constructed, the pipelines are usually placed parallel to the roads for ease of inspection. This alternative would employ HDD for placement of pipelines under Nigliq Channel. Use of HDD for the Nigliq Channel crossing would entail the use of a transition cellar at each end of the crossing to pass the warm pipeline through the active layer of soil. The cellars need to be actively refrigerated to prevent non-differential settlement or movement. HDD crossings require vertical pipeline elevation changes. Elevation changes in pipelines carrying multiple phase fluids can cause slugging, a phenomenon in which denser fluid accumulates in low points until it blocks flow sufficiently to cause pressure buildup that then blows the accumulated dense fluid through the low point in a "slug" or surge. During design and installation of the pipeline, elevation changes and pipeline angles would be minimized to reduce slugging potential. However, the existence of a low point in the HDD segment can not be eliminated and would present a potential slugging problem.

2.4.4.1 Sub-Alternative D-1 – CPAI Development Plan

SUB-ALTERNATIVE D-1 – CPAI DEVELOPMENT PLAN

SUB-ALTERNATIVE D-1 – DESCRIPTION

The five satellites would be developed as stand-alone production pads with year-round, fixed-wing aircraft access. Airstrips would be built at each production pad. The only gravel road segments to be constructed would be from the airstrips to the well pad at each production pad. Well pads would be the larger approximately 11.6-acre size used for roadless pads

SUB-ALTERNATIVE D-1 – QUANTITY ESTIMATES

Table 2.4.4-1 provides the estimated gravel quantities and tundra coverage required for drill site, airstrip, and apron/taxiway construction under Sub-Alternative D-1. Table 2.4.4-2 shows the annual projected water usage for ice roads. Table 2.4.4-3 presents pipeline lengths and diameters associated with development of the applicant's proposed five-pads under Sub-Alternative D-1. Estimated vehicle traffic and aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—are provided in Table 2.4.4-4.

The construction and operations schedule for Sub-Alternative D-1 would be essentially the same as that for Alternative A (Table 2.4.1-6). The primary difference would be that for Alternative D-1 gravel would not be laid for roads when gravel is laid for production pads. CD-3 remains restricted to winter-only drilling, and CD-4 would retain summer-only drilling, with the rig seasonally switching between CD-3 and CD-4.

TABLE 2.4.4-1 ALTERNATIVE D-1 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips and Apron/Taxiways/Boat Launches		Total	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
CD-3	110	12.6	144	18.0	254	30.6
CD-4	223	17.9	297	41.3	520	59.2
CD-5	149	17.6	196	24.3	345	41.9
CD-6	149	17.6	202	25.2	351	42.8
CD-7	149	17.6	227	29.2	376	46.8
TOTAL	**780**	**83.3**	**1066**	**138.0**	**1846**	**221.5**

Notes: Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.4-2 ALTERNATIVE D-1 – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Total Annual Ice Road (miles) and Water Usage (million gallons)
2005	51	0	51
2006	44	10	54
2007	55	10	65
2008	66	14	80
2009	78	25	103
2010	0	33	33
2011	0	0	0
TOTAL	**294**	**92**	**386**

Notes: Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Construction estimate includes a 28-mile annual ice road from Kuparuk to CD-1.
Estimates assume gravel supply from the ASRC Mine Site and Clover Potential Gravel Source.
Assumes ice roads annually, during construction and drilling, to all sites not connected via gravel roads.

TABLE 2.4.4-3 ALTERNATIVE D-1 – APPROXIMATE LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	B	624
CD-1 to CD-4	4.5	B	432
CD-1 to CD-5 (minus HDD)	5.6	B	538
HDD Crossing	0.6	B	NA
CD-5 to CD-6	8.6	B	826
CD-6 to CD-7	6.2	B	595
CD-5 access spur	0.3	B	29
CD-6 access spur	0.8	B	77
TOTAL	**33.1**		**3121**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in "A" above and 2-inch products.

TABLE 2.4.4-4 ALTERNATIVE D-1 – ESTIMATED TRAFFIC

	Construction Phase		Drilling Phase		Operations Phase	
	Round-Trip Vehicle Trips per Month	One-Way Aircraft Flights Per Month	Round-Trip Vehicle Trips per Month	One-Way Aircraft Flights Per Month	Round-Trip Vehicle Trips per Month	One-Way Aircraft Flights Per Month
Winter 2004/2005	6,000 (18,600 max.)	70 (235 max.)	0	0	0	0
Summer 2005	0	240 (690 max.)	0	0	0	0
Winter 2005/2006	5,800 (19,800 max.)	60 (245 max.)	0	70-90	0	0
Summer 2006	0	470 (860 max.)	0	30-40	0	56
Winter 2006/2007	3,900 (12,000 max.)	70 (165 max.)	0	70-90	16	24
Summer 2007	0	290 (300 max.)	0	30-40	0	56
Winter 2007/2008	4,000 (11,700 max.)	50 (145 max.)	390-450	70-90	16	24
Summer 2008	0	770 (790 max.)	0	65-75	0	80
Winter 2008/2009	2,800 (7,500 max.)	50 (205 max.)	390-450	70-90	24	32
Summer 2009	0	0	0	30-40	0	80
Winter 2009/2010	1,000 (3,600 max.)	50	780-900	70-90	24	32
Summer 2010	0	635 (660 max.)	0	65-75	0	128
Winter 2010/2011	600 (3,300 max.)	45	780-900	70-90	24	48

Source: CPAI 2003l

Notes:

Aircraft flights to pads are by helicopter.

Fixed Wing Aircraft flights include flights from Kuparuk to Alpine.

Each construction and drilling related flight assumed to equal 12 vehicle trips.

Operations phase flights assumed to equal four vehicle trips.

Excludes non-operational helicopter flights estimated at 2500 per summer season .

For the purposes of this table, seasons have been defined to correspond to periods when wildlife and bird populations are prevalent in the Plan Area, i.e., Summer = May through September, and Winter = October through April. These seasonal designations do not correspond with periods of ice road travel, for which winter would be defined as December through April.

2.4.4.2 Sub-Alternative D-2 – CPAI Development Plan

Sub-Alternative D-2 is similar to Sub-Alternative D-1 with respect to following the theme of roadless access to production pads. The difference is that access would be by helicopter rather than by fixed-wing aircraft. Helicopters would provide the only means of access during the summer. Ice roads could be constructed for vehicle access during the winter months, as in Sub-Alternative D-1.

Helipads would be constructed of gravel fill near each production pad. Each helipad would have a top surface area of approximately 1 acre. Production pads would be the larger; 11.6-acre size used for roadless pads, plus the additional acres for the helipad. Helipad gravel thickness would be an average of 5 feet, except at CD-3, where average thickness would be 14 feet.

Bell 212, 214, or equivalent twin-engine helicopters would be based at the Alpine Development Project (CD-1), and would transport workers, supplies, and equipment from there to the production pads.

Access to production pads only by helicopter during the summer months presents an additional challenge for a year-round drilling program. Provision to bring an emergency drill rig to a production pad for relief-well construction in case of well blow-out during drilling is a standard safety requirement. Currently, helicopters that are capable of transporting an emergency drill rig are not based on the North Slope. Implementation of Sub-alternative D-2 would require the availability of a helicopter capable of transporting an emergency drill rig during summer and delivering a relief rig to a production pad in winter. The drill rig would be left stranded to be available for relief during summer drilling or restriction to a winter-only drilling schedule. During winter, an emergency drill rig could be brought to production pads via ice roads or ice airstrips. Sub-Alternative D-2 adopts the winter-only drilling scenario. This results in an extended development schedule compared to Alternative A. This extended schedule could be accelerated by mobilizing more than one drilling rig or by stationing a relief rig at the drilling site to allow year-round drilling.

Table 2.4.4-5 provides the estimated gravel quantities required for drill site and helipad under Sub-Alternative D-2. Annual water use for ice roads is presented in Table 2.4.4-6 The pipeline lengths and diameters associated with Sub-Alternative D-2 would be the same as for Sub-Alternative D-1 (Table 2.4.4-3). Estimated aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—are provided in Table 2.4.4-7.

The construction and operations schedule for Sub-Alternative D-2 is prolonged compared to that for Alternative A (Table 2.4.1-5). The primary difference would be that for Sub-Alternative D-2, gravel would not be laid for roads or airstrips when gravel is laid for production pads. All vehicle travel would be limited to ice roads in winter. Drilling at all production pads would be restricted to winter-only drilling. Assuming a one-rig program, 20 wells per production pad, and three wells per year per rig, drilling at CD-3 would take 7 years, before drilling at CD-4 began, and a total of approximately 33 years of drilling for the five-pad ASDP.

TABLE 2.4.4-5 ALTERNATIVE D-2 – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Helipad		Total	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
CD-3	110	12.6	12	1.4	122	14.0
CD-4	165	12.9	26	2.7	191	15.6
CD-5	110	12.6	10	1.3	120	13.9
CD-6	110	12.6	10	1.3	120	13.9
CD-7	110	12.6	10	1.3	120	13.9
TOTAL	605	63.3	68	8.0	673	71.3

Notes:

Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.

Total may not be exact because of rounding.

Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.4-6 ALTERNATIVE D-2 – ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Construction Timeframe	Year	Facilities Constructed	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Drilling and Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Annual Total Ice Road (miles) and Water Usage (million gallons)
2005 to 2010	2005	CD-3	55	0	55
	2006	CD-3	0	10	10
	2007	CD-3	0	10	10
	2008	CD-3	0	10	10
	2009	CD-3	0	10	10
	2010	CD-3	0	10	10
2011 to 2015	2011	CD-3, CD-4	44	10	54
	2012	CD-3, CD-4	0	15	15
	2013	CD-4	0	15	15
	2014	CD-4	0	15	15
	2015	CD-4	0	15	15
2016 to 2018	2016	CD-4	0	15	15
	2017	CD-4, CD-6	67	15	82
	2018	CD-4, CD-6	0	31	31
2019 to 2022	2019	CD-6	0	31	31
	2020	CD-6	0	31	31
	2021	CD-6	0	31	31
	2022	CD-6	0	31	31
2023 to 2026	2023	CD-6, CD-5	40	27	67
	2024	CD-6, CD-5	0	31	31
	2025	CD-5	0	31	31
	2026	CD-5	0	31	31
2027 to 2030	2027	CD-5	0	31	31
	2028	CD-5	0	31	31
	2029	CD-5, CD-7	56	31	87
	2030	CD-5, CD-7	0	39	39
		TOTAL	**262**	**557**	**819**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Construction estimate includes a 28-mile annual ice road from Kuparuk to CD-1.
Estimates assume gravel supply from the ASRC Mine Site and Clover Potential Gravel Source.
Assumes single drill rig, winter-only drilling.

TABLE 2.4.4-7 ALTERNATIVE D-2 – ESTIMATED TRAFFIC

	Construction Phase			Drilling Phase			Operations Phase		
	RT-V[1]	RT-H[2]	OW-F[3]	RT-V	RT-H	OW-F	RT-V	RT-H	OW-F
Winter 2004/2005	6,000 (14,600 max.)	36 (183 max.)	70 (235 max.)	0		0	0	0	0
Summer 2005	0	65 (305 max.)	180 (500 max.)	0		0	0	0	0
Winter 2005/2006				390-450	38	13-26	0	0	0
Summer 2006	0			0	134	0	0	85	0
Winter 2006/2007				390-450	34	13-26	32	84	0
Summer 2007	0		0	0	85	0	0	14	0
Winter 2007/2008				390-450	34	13-26	32	36	0
Summer 2008	0			0	85	0	0	14	0
Winter 2008/2009				390-450	34	13-26	48	36	0
Summer 2009	0		0	0	85	0	0	14	0
Winter 2009/2010			0	390-450	34	13-26	48	36	0
Summer 2010	0			0	80	13-26	0	84	0
Winter 2010/2011	600 (3300 max.)	36	70 (200 max.)	390-450	34	13-26	80	36	0

Source: CPAI 2003l

Notes: Under the construction phase, the first number is the average; the numbers in parentheses represent the range.

[2] Round-Trip Vehicle Trips per month.

[3] Round Trips-Helicopter flights per month.

[4] One-Way Flights-Fixed Wing Aircraft flights per month, reflects flights in from Kuparuk to Alpine.

For the purposes of this table, seasons have been defined to correspond to periods when wildlife and bird populations are prevalent in the Plan Area, i.e., Summer = May through September, and Winter = October through April. These seasonal designations do not correspond with periods of ice road travel, for which winter would be defined as December through April.

2.4.4.3 Sub-Alternative D-1 – Full-Field Development Scenario

SUB-ALTERNATIVE D-1 – FFD DESCRIPTION

The FFD for Sub-Alternative D-1 differs from that for Alternative A primarily by excluding all roads, except short ones between production pads and nearby airstrips. Thus, all production pads would require gravel fill airstrips, ice roads, or ice airstrips. The Alternative D – FFD scenario involves construction of the same number of production pads and HPFs, and in the same locations, as described for Alternative A. Each production pad would be slightly larger than the road-supported production pads in Alternative A – FFD to allow for additional space for seasonal equipment and materials staging. Pipeline alignments for Sub-Alternative D-1 are slightly shorter and more direct than in Alternative A because they do not follow road alignments. A 2-inch products pipeline would supply each production pad. The production pads would be served by seasonal ice roads to support development drilling and construction activities. Ice airstrips and ice storage pads also could be used to support drilling, construction, or operations.

SUB-ALTERNATIVE D-1 – FFD QUANTITY ESTIMATES

The differences between Alternative A – FFD and Sub-Alternative D-1 – FFD have been described above and can be seen by comparing Figures 2.4.1.2-1 and 2.4.4-2. Table 2.4.4.8-presents the areas covered by the Alternative D – FFD facilities and the volume of gravel required to develop those hypothetical facilities. Table 2.4.4-9 presents the length and diameter of the pipelines. Table 2.4.4-10 presents the miles of ice roads and associated water requirements, assuming a hypothetical sequence of development for analysis purposes.

TABLE 2.4.4-8 ALTERNATIVE D-1 – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	PRODUCTION PAD		AIRSTRIP AND APRON/TAXIWAY		TOTAL	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
HP-1	149	17.6	228	29.4	377	47.0
HP-2	149	17.6	228	29.4	377	47.0
HP-3	149	17.6	228	29.4	377	47.0
HP-4	149	17.6	228	29.4	377	47.0
HP-5	110	12.6	228	29.4	338	42.0
HP-6	149	17.6	228	29.4	377	47.0
HP-7	110	12.6	162	21.5	272	34.1
HP-8	149	17.6	228	29.4	377	47.0
HP-9	149	17.6	228	29.4	377	47.0
HP-10	149	17.6	228	29.4	377	47.0
HP-11	149	17.6	228	29.4	377	47.0
HP-12	110	12.6	162	21.5	272	34.1
HP-13	110	12.6	162	21.5	272	34.1
HP-14	110	12.6	162	21.5	272	34.1
HP-15	149	17.6	228	29.4	377	47.0
HP-16	149	17.6	228	29.4	377	47.0
HP-17	149	17.6	228	29.4	377	47.0
HP-18	149	17.6	228	29.4	377	47.0
HP-19	149	17.6	228	29.4	377	47.0
HP-20	149	17.6	228	29.4	377	47.0
HP-21	149	17.6	228	29.4	377	47.0
HP-22	149	17.6	162	21.5	311	39.1
HPF-1	317	36.3	228	29.4	545	65.7
HPF-2	317	36.3	228	29.4	545	65.7
TOTAL	**3717**	**434.8**	**5142**	**666.1**	**8859**	**1100.9**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 2H:1V slideslopes.
Total may not be exact because of rounding.

TABLE 2.4.4-9 ALTERNATIVE D-1 – APPROXIMATE LENGTH AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
HP-1 to CD-6/5 line	2.1	A	199
HP-2 t0 CD-7	2.8	B	267
HP-3 to CD-6/5 line	3.8	A	363
HP-4 to CD-4	2.2	A	215
HP-5 to CD-2	3.2	A	303
HP-6 to CD-5/6	5.6	B	534
HP-7 to CD-3/1 pipeline	1.5	B	143
HP-8 to HP-6/HP-9	3.9	A	375
HP-9 to HP-6	7.2	B	688
HP-10 to CD-7/HP-2 line	7.3	A	697
HP-11 to HP-9	8.7	A	840
HP-12 to HP-7	6.0	B	575
HP-13 to HP-12	4.3	A	412
HP-14 to HP-12	5.2	A	503
HP-15 to CD-6	10.6	A	1,016
HP-16 to HPF-1	5.5	B	523
HP-17 to HP-16	6.8	B	653
HP-18 to HPF-1	7.8	C	753
HP-19 to HP-17	9.0	A	860
HP-20 to HPF-2/HP-18	8.9	A	854
HP-21 to HPF-2	9.8	B	938
HP-22 to HP-21	11.2	A	1,071
HPF-2 to HP-18	10.7	B, C	1,029
HPF-1 to CD-6/7	6.2	B, C	594
TOTAL	**150.1**		**14,405**

Notes:
A = Pipelines include 18-inch produced fluids, 8-inch gas, 10-inch water, 6-inch lift gas and 2-inch products.
B = Pipelines include 24-inch produced fluids, 10-inch gas, 14-inch water, 6-inch lift gas and 2-inch products.
C = 14-inch sales oil and 12-inch seawater supply pipeline.

TABLE 2.4.4-10 ALTERNATIVE D-1 – FFD ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Construction Timeframe	Year	Facilities Constructed	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Annual Total Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	HP-4 & HP-5	22	33	55
	2012	HP-7	12	37	49
	2013	HP-12	13	44	57
	2014	HP-13	14	49	63
	2015	HP-14	16	55	71
2016 to 2018	2016	HP-1	10	61	71
	2017	HP-3	15	62	77
	2018	HP-15	25	66	91
2019 to 2022	2019	HPF-1 & HP-2	26	76	102
	2020	HP-10	27	80	107
	2021	HP-16	24	88	112
	2022	HP-17 & HP-19	40	94	134
2023 to 2026	2023	HPF-2 & HP-18	56	111	167
	2024	HP-20	31	131	162
	2025	HP-21	41	142	183
	2026	HP-22	48	153	201
2027 to 2030	2027	HP-6	21	166	187
	2028	HP-8	20	172	192
	2029	HP-9	18	179	197
	2030	HP-11	31	185	216
TOTAL			**510**	**1984**	**2494**

Notes:
Estimated based on sequential pad construction, utilizing constructed gravel roads to minimize ice road needs.
Mileage estimated by straight line between locations + 25% to account for routing around land features.
Ice roads typically require 1,000,000 gallons per mile constructed.
Estimates assume gravel supply from the ASRC Mine Site, Clover Potential Gravel Source and hypothetical future gravel source(s).
Assumes ice roads annually to all sites not connected via gravel roads.

The construction and operations schedule for Sub-Alternative D-1 – FFD would be essentially the same as that for Alternative A – FFD (Table 2.4.1-5). The primary difference would be that for Sub-Alternative D-1 – FFD, gravel would not be laid for roads when gravel is laid for production pads. CD-3, other production pads in the lower Delta, and CD-2 remain restricted to winter-only drilling, and CD-4 would retain summer-only drilling, with the drill rig seasonally switching between CD-3 and CD-4.

2.4.4.4 Sub-Alternative D-2 – Full-Field Development Scenario

SUB-ALTERNATIVE D-2 – FFD DESCRIPTION

Under Sub-Alternative D-2 – FFD, production pads would be accessed by helicopter instead of fixed-wing aircraft. Fixed-wing aircraft may be used during winter when ice airstrips could be built. Other facilities and operations would be the same as those described for Sub-Alternative D-1 – FFD. Helipads would be constructed of gravel fill adjacent to each production pad. Each helipad would provide approximately 1 acre of surface area for operations. Bell 212, 214, or equivalent twin-engine helicopters would be based at production pads and would transport workers, supplies, and equipment to the production pads.

As with Sub-Alternative D-2 – CPAI Development Plan, Sub-Alternative D-2 – FFD is based on an assumed winter-only drilling at all production pads.

SUB-ALTERNATIVE D-2 – FFD QUANTITY ESTIMATES

Table 2.4.4-11 presents the areas covered by the hypothetical Sub-Alternative D-2 – FFD facilities and the volume of gravel required to develop those hypothetical facilities. Sub-Alternative D-2 – FFD would be developed with the same pipeline lengths, diameters, and number of VSMs as Sub-Alternatives D-1 – FFD.

The construction and operations schedule for Alternative D-2 – FFD is analyzed based on winter-only drilling. The resulting schedule is substantially longer than that for Alternatives A through D –FFD. This extended schedule could be accelerated by using a two- or three-rig drilling program. Winter-only drilling limits a single drill rig to approximately 3 wells per year, or 7 years for a 20-well production pad. Development of the proposed five pads would require approximately 33 years. For FFD, all construction and operational activities would remain in the same season as the five-pad development, but would spread out across more years. The extended schedule would result in lower quantities of per season construction, as well as drilling workers, traffic, and water for ice roads, but would continue for as many as 100 years**.**

TABLE 2.4.4-11 ALTERNATIVE D-2 – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production Pad		Helipad		Total	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
HP-1	120	13.9			120	13.9
HP-2	120	13.9			120	13.9
HP-3	120	13.9			120	13.9
HP-4	120	13.9			120	13.9
HP-5	120	13.9			120	13.9
HP-6	120	13.9			120	13.9
HP-7	120	13.9	162	21.5	282	35.4
HP-8	120	13.9			120	13.9
HP-9	120	13.9			120	13.9
HP-10	120	13.9			120	13.9
HP-11	120	13.9			120	13.9
HP-12	120	13.9	162	21.5	282	35.4
HP-13	120	13.9	162	21.5	282	35.4
HP-14	120	13.9	162	21.5	282	35.4
HP-15	120	13.9			120	13.9
HP-16	120	13.9			120	13.9

TABLE 2.4.4-11 ALTERNATIVE D-2 – FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS (CONT'D)

	Production Pad		Helipad		Total	
Site	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)	Gravel Qty (1,000 cy)	Coverage (acres)
HP-17	120	13.9			120	13.9
HP-18	120	13.9			120	13.9
HP-19	120	13.9			120	13.9
HP-20	120	13.9			120	13.9
HP-21	120	13.9			120	13.9
HP-22	120	13.9	162	21.5	282	35.4
HPF-1	317	36.3	228	29.4	545	65.7
HPF-2	317	36.3	228	29.4	545	65.7
TOTAL	**3274**	**378.4**	**1266**	**166.3**	**4540**	**544.7**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 2H:1V slideslopes.
Total may not be exact because of rounding.

2.4.5 Alternative E – No Action

Under this alternative, CPAI would not be authorized to develop the five oil accumulations for which it currently seeks authorization. No oil in the Plan Area, except that extracted through the existing APF, would be produced in the near future, and no new roads, airstrips, pipelines, or other oil facilities would be constructed beyond what is authorized in connection with CPAI's current development at CD-1 and CD-2. The current applicant or other leaseholders may submit applications for development. However, the applicant owns a substantial portion of the leases in the area and presumably has applied to develop those that are the most readily developable.

2.4.6 Alternative F – Preferred Alternative

Alternative F – Preferred Alternative is a variation of Alternative A and includes some components from each of the action alternatives in the DEIS. It is the same as Alternative A, except for changes described below, which reflect consideration of public and agency comments, regulatory needs, and further mitigation of environmental concerns. Construction of Alternative F would be on the same schedule and would use the same means as for Alternative A. Five production pads, CD-3 through CD-7, would be built and produced fluids would be transported by pipeline to be processed at APF-1. Gravel roads would connect CD-4 through CD-7 to APF-1. CD-3 would be accessed by ice road or by air. Gravel used for construction of roads, pads, and airstrips would be obtained from the existing ASRC Mine Site and Clover. A bridge across the Nigliq Channel near CD-2 would accommodate road traffic and the pipelines. CD-3 would be the only new pad with an airstrip. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 7 feet above the tundra, as measured at VSMs. All powerlines would be supported by cable trays placed on the pipeline VSMs. Details of variations from Alternative A are described in the subsections below.

CD-6 would be within a 3-mile setback from Fish Creek in which the BLM's Northeast National Petroleum Reserve-Alaska IAP/EIS ROD (BLM and MMS 1998b) (Stipulation 39[d]) prohibits permanent oil facilities. This alternative would provide for an exception to this stipulation to allow location of CD-6 and its associated road, pipeline spurs, and generator within the setback. As with Alternative A, additional exceptions would be required to locate oil infrastructure within 500 feet of some water bodies (Stipulation 41) and to locate roads between separate oilfields (Stipulation 48). Factors that the BLM will consider before determining to grant exceptions to these stipulations are discussed at the end of Section 2.4.6. As with Alternative A, if the first sentence of Stipulation 48 is determined to apply to the applicant's proposed action (i.e., if, contrary to BLM's interpretation, it is determined that the road between CD-1 and CD-2 or the additional road to CD-4 constitutes a connection to a "road system" outside the Northeast National Petroleum Reserve-Alaska planning area), the BLM would modify Stipulation 48 to allow the road from public land to connect to the existing road at APF. Finally, the USACE would have to determine that the applicant's proposed alternative for the road to CD-4 meets the intent of Special Condition 10 of its 1998 permit that authorized the placement of fill associated with the construction of the Alpine Development Project. Special Condition 10 required roadless development in the Delta unless an environmentally preferable alternative is available or roadless development is infeasible, and any alternative dependent on roads must be approved by the USACE as preferable to a roadless alternative.

2.4.6.1 Alternative F – Roads

All roads would be designed and constructed to provide adequate cross flow to prevent raising the water level on the upstream side of roads by more than 6 inches compared to that for the downstream side of the roads for more than 1 week after peak discharge.

Roads under Alternative F would be realigned compared to those proposed by CPAI (Figure 2.4.6-1). The road from CD-1 to CD-4 would be designed to meet the above cross-flow criteria and the state's fish passage criteria (AS 41.14.840) that requires that the fish passage way would be "kept open, unobstructed, and supplied with a sufficient quantity of water to admit freely the passage of fish through it." This requirement may be achieved by culverts crossing a narrow section of Lake 9323 as proposed in Alternative A, a bridge across the same narrow section of the lake as proposed in Alternatives B and C, or realignment of the road to the east of the lake furnished with either culverts or bridges at two water passages along its route. This alternative includes analysis of the realigned route with bridges of approximately 40 feet in length (25-foot channel opening) over the two waterways. Such a road from CD-1 to CD-4 would follow the proposed alignment in Alternative A from CD-1 to a point north of Lake 9323. This road realignment addresses concerns about the hydrology, sedimentation, and aquatic habitat of Lake 9323.

The road segment from CD-2 to CD-5 would be the same as proposed under Alternative A. The western portion of the road segment from CD-5 to CD-6 would diverge from the route in Alternative A to lessen the encroachment on the 3-mile setback from Fish Creek. The spur road to CD-6 would be extended and realigned as shown in Figure 2.4.6-1 as part of the CD-6 to CD-7 road realignment. This spur road would be located within the Fish Creek setback, a necessary condition to provide access to the CD-6 location. The road between CD-6 and CD-7 under the Preferred Alternative removes substantial infrastructure from the Fish Creek 3-mile setback. The realignment of the much of the road between CD-5 and CD-7 addresses the concern of the BLM and the public's about encroachment of permanent oil and gas facilities in the 3-mile setback from Fish Creek.

Industry, government agencies, and local residents would be allowed access to the gravel roads.

2.4.6.2 Alternative F – Pipelines

Pipelines would be as proposed by CPAI and presented under Alternative A, except for the following changes. The pipeline alignment from CD-5 to CD-6 would be adjusted slightly so that less of it remains within the Fish Creek setback. A spur off the primary pipeline alignment would enter the Fish Creek setback near CD-6, and would connect to CD-6. The primary pipeline corridor would continue, outside of the Fish Creek setback, from the CD-6 spur to CD-7. Alternative F and associated pipeline alignments are presented in Figure 2.4.6-1. The lengths of the various pipeline segments in Alternative F are presented in Table 2.4.6-1.

TABLE 2.4.6-1 ALTERNATIVE F – LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 to CD-3	6.5	B	624
CD-1 to CD-4	4.5	A	432
CD-1 to CD-2	2.4	A	230
CD-2 to CD-6 junction	15.2	A	1459
CD-6 access spur	2.1	A	202
CD-6 junction to CD-7	6.4	A	614
TOTAL	**37.1**		**3561**

Notes:
A = Pipelines include 16- to 24-inch produced fluids, 6- to 10-inch MI, 8- to 14-inch water, 6-inch lift gas.
B = Pipelines included in "A" above and 2-inch products.

All pipelines would be elevated relative to the proposed pipelines in Alternative A. Under Alternative F; pipelines would be 7 feet above the tundra, as measured at the VSMs. This use of elevated pipelines addresses concerns that lower pipelines can hinder caribou and, during times of drifting snow, human movement.

2.4.6.3 Alternative F – Production Pads

Production pads would be in the same locations, and built to the same design criteria, as the production pads proposed by CPAI and presented under Alternative A. These locations allow the most efficient production of the hydrocarbon resources in these reservoirs.

2.4.6.4 Alternative F – Ice Roads

Annual ice road requirements for the Preferred Alternative would be the same as those for the applicant's proposed action presented under Alternative A and presented in Table 2.4.6-2.

TABLE 2.4.6-2 ALTERNATIVE F-ANNUAL PROJECTED WATER USAGE FOR ICE ROADS

Year	Construction – Annual Ice Road (miles) and Water Usage (million gallons)	Operations – Annual Ice Road (miles) and Water Usage (million gallons)	Annual Total Ice Road (miles) and Water Usage (million gallons)
2005	47	0	47
2006	34	10	44
2007	70	14	84
2008	34	10	44
2009	47	10	57
2010	19	10	29
2011	0	10	10
TOTAL	**251**	**64**	**315**

Source: CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

2.4.6.5 Alternative F – Bridges and Culverts

The Preferred Alternative provides for bridges that cross the Nigliq Channel and the Ublutuoch River, that span the active flow-way, and frequently active floodplain that occupies the area between topographic rises. This area, defined as "bank to bank", is approximately 1,650 feet for the Nigliq Channel, and 350 feet for the Ublutuoch River. The resultant Nigliq Channel and Ublutuoch River bridges are longer than the bridges proposed in Alternative A., Those bridges may be relocated closer to the proposed crossings where the floodplain span is less. This EIS analyzes the longer bridges over the Nigliq Channel and the Ublutuoch River crossing at the same location as in Alternative A. The Preferred Alternative offers several options for road location and the use of bridges or culverts to meet water flow and fish passage criteria in providing for access to CD-4. (See the discussion of roads above.) This EIS analyzes a road route to the east of Lake 9323 with the use of bridges approximately 40 feet in length (25-foot channel openings) over two waterways (Figure 2.3.9.1-6).

The road and pipeline bridge across the Ublutuoch River would extend from bank to bank. The bridge, as proposed under Alternative A, is depicted in Figure 2.4.1.1-15. Figure 2.4.6-2 indicates the top of the natural bank. This would require moving the bridge to a narrower part of the channel or lengthening the bridge at its current location as measured from abutment to abutment from approximately 120 feet to approximately 350 feet. A 350-foot bridge at the same location is depicted in Figure 2.4.6-2. This bridge concept addresses concerns that the eastern abutment was within the 1-year flood level and the western abutment was in the 2-year flood level, which would regularly cause changes in stream hydrology and aquatic habitat. Culverts or minor bridges would be required at smaller water crossings. Culverts would be installed when the road is constructed. Additional culverts would be installed after break-up if ponding occurs near the road.

The road and pipeline bridge across the Nigliq Channel would extend from bank to bank. The bridge as proposed under Alternative A is depicted in Figure 2.4.1.1-14. Figure 2.4.6-3 indicates the top of the natural bank. Extending the bridge from bank to bank would require moving the bridge to a narrower part of the channel or lengthening the bridge at its current location. As measured from abutment to abutment, the bridge length at the current location would increase from approximately 1,200 feet to approximately 1,650 feet. A 1,650-foot bridge at the same location is depicted in Figure 2.4.6-3. This bridge concept addresses concerns that the eastern abutment was within the 1-year flood level and the western abutment was in the 2-year flood level, which would regularly cause changes in stream hydrology and aquatic habitat.

In addition to requiring the Nigliq Channel and Ublutuoch River bridges to extend from bank to bank, the Preferred Alternative also requires that approaches to both the Nigliq Channel and Ublutuoch River bridges provide for natural water flow. The bridge approach designs must demonstrate that cross flow will be adequate to prevent raising the water level on the upstream side of structures by more than 6 inches compared to that for downstream of the structure for more than 1week after peak discharge. The bridge approach designs must also provide assurance that the bridge approach will remain sound and not be washed out at all flow levels.

2.4.6.6 Alternative F – Utilities

The Preferred Alternative provides for all power and other cables to be routed on cable trays mounted on the pipeline VSMs. The applicant’s proposed action presented under Alternative A included power poles between CD-6 and CD-7. This change removes substantial infrastructure from the Fish Creek 3-mile setback. This measure addresses the concern of the BLM and the public about Stipulation 39 of the Northeast National Petroleum Reserve-Alaska ROD for setback from Fish Creek, which forbids permanent oil and gas facilities in the 3-mile setback.

The Preferred Alternative retains the power generating capacity at CD-6 for CD-6 and CD-7, as proposed by CPAI under Alternative A, because CD-6 would be constructed before CD-7 and would require power before CD-7 is completed. The power would be generated by a 2.7- to 3.1-MW natural gas generator (email B St. Pierre, CPAI, to J Ducker, BLM; 3-30-04).

The Preferred Alternative would require control of artificial exterior lighting on structures over 20 feet tall. Except for required safety lighting (FAA and OSHA), illumination of taller structures would be designed to direct artificial exterior lighting inward and downward, rather than upward and outward. All drilling structures, production pads, or other structures that exceed 20 feet would be illuminated in this manner.

2.4.6.7 Alternative F – Quantity Estimates

Primary access to the five proposed production pads would be by a combination of air support and gravel roads. Table 2.4.6-3 provides the estimated gravel quantities required for production pad construction under

Alternative F and also provides estimates of road mileage and yards of gravel required for construction of road segments connecting the proposed production pads and existing Alpine Development Project. Table 2.4.6-4 shows estimated gravel quantities required for road segments associated with the ASDP under Alternative F. Estimated vehicle traffic and aircraft flights during each of the three phases of the applicant's proposed action—construction, drilling, and operations—would be the same as estimated for Alternative A and are provided in Table 2.3.10-1.

TABLE 2.4.6-3 ALTERNATIVE F – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH PRODUCTION PADS

	Production and Storage Pads		Airstrips and Apron/Taxiways/Boat Launches		Totals	
Site	**Gravel Qty (1,000 cy)**	**Coverage (Acres)**	**Gravel Qty (1,000 cy)**	**Coverage (Acres)**	**Gravel Qty (1,000 cy)**	**Coverage (Acres)**
CD-3	110	12.6	144	18.0	254	30.6
CD-4	112	9.3	16	1.4	128	10.7
CD-5	78	9.1	0	0.0	78	9.1
CD-6	78	9.1	0	0.0	78	9.1
CD-7	78	9.1	0	0.0	78	9.1
Total	**456**	**49.2**	**160**	**19.4**	**616**	**68.6**

Notes:
Gravel volume assumes 5.5-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except at CD-4 which has a 7.5-foot thick production pad; 2H:1V slideslopes.
Total may not be exact because of rounding.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

TABLE 2.4.6-4 ALTERNATIVE F – APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
CD-1 to CD-4	3.8	224	26.8
CD-2 to CD-6 junction	15.2	787	99.6
CD-5 access spur	0.1	5	0.6
CD-6 access spur	2.1	88	13.9
CD-6 junction to CD-7	6.3	261	41.5
TOTAL	**27.5**	**1,365**	**182.4**

Notes:
32-foot road width covers area 52-feet wide.
Gravel volume calculation assumes 5-foot average thickness, 2H:1V slideslope.
Coverage and quantity based on CPAI Permit Application (CPAI 2004a) data and calculations using GIS measurements.

2.4.6.8 Alternative F – Construction and Operations Schedule

The construction, start-up, and operations schedule for Alternative F would be the same as that proposed by CPAI under Alternative A.

FACTORS CONSIDERED FOR EXCEPTIONS TO BLM STIPULATIONS

The Northeast National Petroleum Reserve-Alaska IAP/EIS stipulations are presented in Appendix D. CPAI has asked that exceptions be granted for their project to three stipulations. Exceptions may be granted under the stipulation exeption clause, which reads:

> Exception Clause: In the event that an exception to a lease or permit stipulation is requested and before an exception may be granted, the AO shall find that implementation of the stipulation is:
>
> 1. a. technically not feasible, or
>
>   b. economically prohibitive, or
>
>   c. an environmentally preferable alternative is available, and
>
> 2. the alternative means proposed by the leassee fully satisfies the objective(s) of the stipulation.

In additional, prior to the consideration or granting of an exception to a lease or permit stipulation, all conditions and/or consultation requirements specific to a stipulation must be met. The AO shall consult with appropriate federal, state, and NSB regulatory and resource agencies before an exception may be granted, except in the case of an emergency. The AO's power to grant stipulation exceptions is limitied to those subjects, uses, and permits over which the BLM has authority. Exceptions may be granted in emergencies involving human health and safety.

STIPULATION 39

Stipulation 39 of the Northeast National Petroleum Reserve-Alaska IAP/EIS states:

> Permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited within and adjacent to the waterbodies listed below at the distances identified to protect fish and raptor habitat, cultural and paleontological resources, and subsistence and other resource values. Setbacks include the bed of the waterbody and are measured from the bank's highest high water mark.

The stipulation designates a 3-mile setback from Fish Creek downstream from Section 31, T11N, R1E, and a ½-mile setback farther upstream. The setback from Fish Creek was designated for "fish and subsistence resources."

The Preferred Alternative removes substantial infrastructure that was included in the applicant's proposed action from within the Fish Creek setback, but retains CD-6 within the setback based on technical, economic, and environmental factors. Drilling many wells from a single pad entails use of directional drilling. Drilling from outside the setback would require drilling long distances through geologically unstable shale. This drilling approach is very problematic because shale in this area tends to collapse holes. Maintaining drill holes would be difficult and expensive. (CPAI estimates the additional directional drilling costs at $35 million to $45 million.) In addition, the BLM estimates that 10 to 30 percent of the reserves reachable from CD-6, located where proposed by CPAI, would not be recoverable from the south side of the setback, further undermining the economic viability of placing the pad outside the setback. Placing a second pad on the north side of the Fish Creek setback to attempt to reach the 10 to 30 percent of the reserve unreachable from the south side of the setback would not only dramatically increase costs (thus undermining the economics of the applicant's proposed action), but would entail increased environmental impacts through construction of a second pad, a pipeline crossing of Fish Creek either on BLM-managed lands in the 3-mile Fish Creek setback or on Kuukpik Corporation lands in the Fish Creek delta, and either a road paralleling the pipeline or air access over Fish Creek.

The Preferred Alternative relocates substantial portions of the road and pipeline between CD-5 and CD-6 and nearly all of the road and pipeline between CD-6 and CD-7 to greatly reduce the permanent oilfield infrastructure in the 3-mile setback. However, the Preferred Alternative leaves some infrastructure in the setback based on environmental factors. Moist Tussock Tundra and Moist Sedge-Shrub Meadow habitats exist between CD-2 and CD-7. These habitats are the preferred types for road construction for the Plan Area. These are relatively high and dry habitat areas compared to other habitat. They are less prone to flooding and the resultant impacts, and they are less important habitat for waterbirds. The road proposed under the Preferred Alternative utilizes these habitats. A route utilizing these habitats is available just south of the setback for the western portion of the road on BLM-managed lands. Several large closely spaced lakes both east and west of the Ublutuoch River constrict road building immediately south of the eastern portion of the 3-mile setback. Much of the land near these lakes is low and wet. Utilization of Moist Tussock Tundra and Moist Sedge-Shrub Meadow habitat for roads would require relocating the road approximately 5 miles south of the Preferred Alternative route. This relocation would require approximately 10 more miles of roads and the resultant environmental impacts associated with habitat destruction or alteration through mining and gravel road construction. The pipeline could be moved outside the setback without incurring the same ground-disturbing impacts to sensitive habitats as placement of gravel roads. However, separating the pipeline from the road by 1 to 2 miles (and in some places separating them with a lake) complicates spill response and would likely incur additional environmental impacts in the event of a spill. Therefore, leaving the eastern portion of the road on BLM-managed land in the 3-mile setback as delineated in the Preferred Alternative is environmentally preferable to moving the road outside the setback.

The setback for permanent oil and gas facilities from Fish Creek was established to minimize impacts to "fish and subsistence resources." The location of CD-6 and its associated road and pipeline approximately 2 miles from Fish Creek are not anticipated to have adverse impacts to fish. Although locating the pad farther from Fish Creek would reduce the potential for contaminants to reach the creek, the likelihood of contaminants reaching the creek is already small and spills are not likely to have a measurable effect on arctic fish populations. No important fish habitat has been identified in the immediate area of the pad. Caribou and other subsistence resources may incur some disturbance during operations from infrastructure closer to riparian areas. However, elevating the pipeline to a minimum of 7 feet as measured at the VSMs; maintaining at least a 500-foot distance between the road and pipeline if feasible; restricting road use to industry, local residents, and government employees; and other design and operation features of the Preferred Alternative ensure that impacts to subsistence resources and uses are avoided or minimized.

STIPULATION 41

Stipulation 41 of the Northeast National Petroleum Reserve-Alaska IAP/EIS states:

> For those waterbodies not listed in stipulation 39, permanent oil and gas facilities, including roads, airstrips, and pipelines, are prohibited upon or within 500 feet as measured from the highest high water mark of the active floodplain. Essential pipeline and road crossings will be permitted on a case-by-case basis.

The Northeast National Petroleum Reserve-Alaska IAP/EIS ROD contains the following definitions relevant to Stipulation 41:

> **Active Floodplain**: The lowland and relatively flat areas adjoining inland and coastal waters including flood-prone areas of offshore islands, including at a minimum that area subject to a 1 percent or greater chance of flooding in any given year (also referred to as the 100-year or base floodplain).

> **Body of Water or Waterbody**: A lake, river, stream, creek, or pond that holds water throughout the summer and supports a minimum of aquatic life.

The Preferred Alternative locates as much of the major infrastructure as possible on BLM-managed lands on relatively high and dry Moist Tussock Tundra and Moist Sedge-Shrub Meadow habitats and away from lakes and streams. However, the Plan Area, including that between CD-5 and CD-7, is characterized by many small water bodies. It may not be possible in all instances to avoid encroachment within 500 feet of every water body. Therefore, the Preferred Alternative would grant an exception to Stipulation 41 based on technical infeasibility.

The purpose of the 500-foot setback from water bodies is to protect fish, water quality, and aquatic habitat from impacts, including oil and fuel spills. On-the-ground inspections of the route of the road and pipeline determine where it is impossible to locate facilities outside of the 500-foot setback. It is anticipated that this inspection, along with existing stream and lake studies, would assist in agency determinations on facility design to minimize impacts to water bodies in any cases in which facilities cannot be placed 500 feet from water bodies. In addition, aspects of the applicant's proposed action, such as use of containment tanks and tank and pipeline inspections, and other Northeast National Petroleum Reserve-Alaska IAP/EIS stipulations (e.g., 13 through 16) provide requirements that substantially reduce the potential for impacts to water bodies. As a consequence, the objectives of this stipulation would be met.

STIPULATION 48

Stipulation 48 of the Northeast National Petroleum Reserve-Alaska IAP/EIS states:

> Permanent roads (i.e. gravel, sand) connecting to a road system or docks outside the planning area are prohibited, and no exceptions may be granted. Permanent roads necessary to connect pads within independent, remote oil fields are allowed but they must be designed and constructed to create minimal environmental impacts. Roads connecting production sites between separate oil fields may be considered if road-connected operations are environmentally preferable to independent, consolidated operations that each include airstrip, housing, production, and support facilities. This exception will only be granted following consultations with appropriate Federal, State, and NSB regulatory and resources agencies, and the appropriate level of NEPA review.

As noted near the beginning of Section 2.4.6, BLM does not interpret the first sentence of this stipulation to be applicable to the applicant's proposed action. The roads from the different production pads connect only to APF-1 and not to a road system outside the Northeast National Petroleum Reserve-Alaska planning area. The Alpine Development in the Colville River Delta is roadless and does not connect to any outside road system. The oil accumulations at CD-5 are part of the Alpine Field, but those at CD-6 and CD-7 are geologically distinct from each other and from the Alpine Field. These accumulations may be considered separate "fields." Consequently, the third sentence of Stipulation 48 applies in the case of the applicant's proposed action.

The Preferred Alternative would allow roads connecting CD-6 with CD-7 and those two pads to the Alpine Field based on environmental factors. Locating an airstrip, housing, and support facilities with production facilities at both of these pads would require a large gravel footprint for the airstrips, generate additional air traffic, and introduce air, water, waste, and other impacts associated with human presence. A road from these pads to APF-1 allows operation of these pads to be accomplished from the base at APF-1. These pads will be unmanned, thus generating much less impacts than manned facilities. A gravel road also eliminates the need for regular ice road construction to these pads and reduces waste and chemical storage needs at separate pads. In addition, locating a road parallel to the pipeline facilitates pipeline leak detection and spill response.

The objective of Stipulation 48 is to protect subsistence use and access to traditional subsistence hunting and fishing areas and minimize the impact of oil and gas activities on air, land, water, fish, and wildlife resources. Construction of roads is to be limited to those cases in which it is environmentally preferable to have roads rather than construct separate stand-alone facilities accessible only by air and ice road. Construction of the road linking CD-6 and CD-7 to APF-1 would meet the objective of the stipulation by eliminating impacts from duplicative airstrips, housing, and support facilities and from regular ice road construction, by providing better leak detection and spill response, and, because the road would be available for use by local residents, thus aiding access to traditional subsistence hunting and fishing areas.

2.5 COMPARISON OF FEATURES OF ALTERNATIVES

Table 2.5-1 summarizes the differences in features among the five action alternatives. Quantitative information, if available, is provided for each alternative.

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Pads							
Material	Armored gravel in lower Colville River Delta; gravel elsewhere.						
Location	Five Proposed Pads as CPAI proposed FFD No restrictions on locations.	Five Proposed Pads CD-6 moved outside 3-mile Fish Creek Buffer Zone. FFD Setbacks potentially eliminate or relocate production pads and HPFs .	Five Proposed Pads as CPAI proposed FFD No restrictions on locations.	Same as Sub-Alternative C-1	Five Proposed Pads as CPAI proposed FFD No restrictions on locations.	Five Proposed Pads as CPAI proposed FFD No restrictions on locations.	Five Proposed Pads as CPAI proposed
Gravel Quantity and Acreage (includes associated airstrips and aprons)	Five proposed pads 616,000 cy 68.6 acres FFD 3,815,000 cy 461.6 acres	Five proposed pads 1,155,000 cy 134.8 acres FFD 3,951,000 cy 467.40 acres	Five proposed pads 442,000 cy 47.2 acres FFD 2,806,000 cy 331.6 acres	Five proposed pads 458,000 cy 49.3 acres FFD Same as Sub-Alternative C-1	Five proposed pads 1,846,000 cy 221.5 acres FFD 8,859,000 cy 1,100.9 acres	Five proposed pads 673,000 cy 71.3 acres FFD 4,540,000 cy 544.7 acres	Five proposed pads 616,000 cy 68.6 acres
Millions of gallons of fresh water required, cumulative	Five proposed pads 410 FFD 940	Five proposed pads 420 FFD 1050	Five proposed pads 410 FFD 810		Five proposed pads 480 FFD 2,830	Five proposed pads 800 FFD Not calculated, extends 100 years.	Five proposed pads 410

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Process Facilities							
Expansions	Five Proposed Pads ACX-3 at CD-1 250 bbl CL tank at CD-1 FFD ACX-3 at CD-1 750 bbl CI tank at CD-1, HPF-1, and HPF-2						
Roads							
Road location	Five Proposed Pads as CPAI proposed FFD No restrictions on location; none to lower Colville River Delta pads.	Five Proposed Pads Moved outside 3-mile Fish Creek Buffer Zone. No road from CD-6 to CD-2. FFD Setbacks restrict areas in which roads can be placed; none allowed to cross from BLM-managed land to roads on state or private land; none to lower Colville River Delta pads.	Five Proposed Pads alternative routing FFD No restrictions on location; roads to lower Colville River Delta pads, alternative routing.	Five Proposed Pads Alternative routing; no road connection between CD-4 and CD-5; added road spur to proposed Colville River Road. FFD Same as Sub-Alternative C-1.	Five Proposed Pads None FFD None	Five Proposed Pads None FFD None	Five Proposed Pads Moved road segment near CD-4 out of Lake 9323; moved road segments from CD-5 to CD-7 outside 3-mile Fish Creek Buffer Zone.
Users of road	Industry, government agencies and local residents.	Industry and government agencies.	Unrestricted on BLM lands; industry, government agencies, and local residents elsewhere.	Unrestricted on BLM lands; industry, government agencies, and local residents elsewhere.	NA	NA	Industry, government agencies and local residents.

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Vehicle trips by industry, monthly vehicle round trips during construction	<u>Five Proposed Pads</u> Winter 2004/2005: 6,450 Summer 2005: 740 Winter 2005/2006: 6,250 Summer 2006: 2,270 Winter 2006/2007: 8,520 Summer 2007: 3,570 Winter 2007/2008: 4,570 Summer 2008: 9,020 Winter 2008/2009: 3,430 Summer 2009: 630 Winter 2009/2010: 2,080 Summer 2010: 7,680 Winter 2010/2011: 1,680 <u>FFD</u> Probably roughly within the same range as above for winter and summer; in proportion to the number of pads developed in a given year.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	<u>Five Proposed Pads</u> Winter 2004/2005: 6000 Summer 2005: 0 Winter 2005/2006: 5800 Summer 2006: 0 Winter 2006/2007: 3916 Summer 2007: 0 Winter 2007/2008: 4466 Summer 2008: 0 Winter 2008/2009: 3274 Summer 2009: 0 Winter 2009/2010: 1924 Summer 2010: 0 Winter 2010/2011: 1524 <u>FFD</u> Probably roughly within the same range as above; in proportion to the number of pads developed in a given year.	<u>Five Proposed Pads</u> Winter 2004/2005: 6000 Summer 2005: 0 Winter 2005/2006: 450 Summer 2006: 0 Winter 2006/2007: 482 Summer 2007: 0 Winter 2007/2008: 482 Summer 2008: 0 Winter 2008/2009: 498 Summer 2009: 0 Winter 2009/2010: 498 Summer 2010: 0 Winter 2010/2011: 1130 Five pad continues about 20 years. <u>FFD</u> Roughly within the same range as above every winter.	Same as Alternative A.

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Gravel quantity, lengths, and acreage for roads	Five proposed pads 1,371,000 cy[a] 26.0 miles 172.2 acres FFD 5,006,000 cy 121.8 miles 799.8 acres	Five proposed pads 483,000 cy 10.1 miles 68.7 acres FFD 3,695,000 cy 89.9 miles 588.4 acres	Five proposed pads 1,798,000 cy 42.1 miles 277.8 acres FFD 6,029,000 cy 147.2 miles 951.7 acres	Five proposed pads 1,778,000 cy 41.6 miles 274.4 acres FFD Same as Sub-Alternative C-1	Five proposed pads 0 cy 0 miles 0 acres FFD 0 cy 0 miles 0 acres	Five proposed pads 0 cy 0 miles 0 acres FFD 0 cy 0 miles 0 acres	Five proposed pads 1,365,000 cy 27.5 miles 182.4 acres
Bridge at Nigliq Channel	Road and pipeline near CD-2	Pipeline-only near CD-2	Road and pipeline near CD-4	Pipeline-only near CD-4	None	None	Road and pipeline near CD-2, longer than Alternative A bridge.
Boat ramps and docks	Five proposed pads and FFD Floating dock at CD-3, ramp at CD-4.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.
Airstrips	Five proposed pads CD-3 FFD HP-7, HP-12, HP-13, HP-14, HP-22, HPF-1, and HPF-2	Five proposed pads CD-3, CD-5, and CD-6 FFD HP-7, HP-11, HP-12, HP-13, HP-14, HP-15, HP-17, and HPF-2	Five proposed pads None FFD HPF-1 and HPF-2	Five proposed pads None FFD HPF-1 and HPF-2	Five proposed pads At all pads. FFD A all pads, HP-4 shares with CD-4	Five proposed pads None, helipads at all pads. FFD None, helipads at all pads.	Five proposed pads CD-3

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Projected average aircraft flights per month for construction, drilling, and operations phases; fixed wing (F) includes 1-way Kuparuk into Alpine and round trip to well pads, helicopter (H) is round trip to production pads	Five Proposed Pads Winter 2004/2005: 160 F Summer 2005: 180 F Winter 2005/2006: 150 F Summer 2006: 462 F Winter 2006/2007: 176 F Summer 2007: 167 F Winter 2007/2008: 156 F Summer 2008: 246 F Winter 2008/2009: 164 F Summer 2009: 146 F Winter 2009/2010: 164 F Summer 2010: 255 F Winter 2010/2011: 167 F	Same as Alternative A.	Same as Alternative A.	Same as Alternative A.	Five Proposed Pads Winter 2004/2005: 70 F Summer 2005: 240 F Winter 2005/2006: 150 F Summer 2006: 510 F Winter 2006/2007: 184 F Summer 2007: 386 F Winter 2007/2008: 164 F Summer 2008: 925 F Winter 2008/2009: 172 F Summer 2009: 120 F Winter 2009/2010: 172 F Summer 2010: 838 F Winter 2010/2011: 183 F	Five Proposed Pads Winter 2004/2005: 70 F, 36 H Summer 2005: 180 F, 65 H Winter 2005/2006: 26 F, 38 H Summer 2006: 219 H Winter 2006/2007: 26 F, 118 H Summer 2007: 99 H Winter 2007/2008: 26 F, 70 H Summer 2008: 99 H Winter 2008/2009: 26 F, 70 H Summer 2009: 99 H Winter 2009/2010: 26 F, 70 H Summer 2010: 164 H Winter 2010/2011: 96 F,106 H Five-Pad Scenario continues approximately 20 years, traffic not estimated.	Same as Alternative A.

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Other access	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice road to CD-3; low ground pressure vehicles. FFD Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice roads to non-roaded pads in lower Colville River Delta during construction and drilling and every few years thereafter; low-pressure vehicles.	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice road to CD-3, CD-5, and CD-6 during drilling, every few years thereafter; annual ice roads and ice bridge across Nigliq; low pressure vehicles. FFD Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice roads to non-roaded pads in lower Colville River Delta and to pads or isolated roads in National Petroleum Reserve-Alaska not connected by road to Nuiqsut during drilling and every few years thereafter; low-pressure vehicles.	Same as Alternative A.	Same as Alternative A.	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and powerline construction. Ice road to all pads during construction and drilling and every few years thereafter; annual ice bridge across Nigliq; low pressure vehicles. FFD Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice roads to all pads during drilling and every few years thereafter; low-pressure vehicles.	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and powerline construction. Ice road to all pads during construction and drilling and every few years thereafter; annual ice bridge across Nigliq; low pressure vehicles. FFD Ice roads to all pads during road, pad, pipeline, and powerline construction. Annual ice roads to all pads during drilling and every few years thereafter; low-pressure vehicles.	Same as Alternative A.

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Miles of ice roads and millions of gallons of freshwater required	Five Proposed Pads 2005-2010: 303 miles FFD 2011-2015: 136 miles 2016-2018: 51 miles 2019-2022: 97 miles 2023-2026: 167 miles 2027-2030: 80 miles	Five Proposed Pads 2005-2010: 271 miles FFD 2011-2015: 141 miles 2016-2018: 54 miles 2019-2022: 145 miles 2023-2026: 180 miles 2027-2030: 101 miles	Five Proposed Pads 2005-2010: 326 miles FFD 2011-2015: 135 miles 2016-2018: 76 miles 2019-2022: 132 miles 2023-2026: 196 miles 2027-2030: 87 miles	Five Proposed Pads 2005-2010: 352 miles FFD Same as Sub-Alternative C-1	Five Proposed Pads 2005-2010: 386 miles FFD 2011-2015: 295 miles 2016-2018: 239 miles 2019-2022: 455 miles 2023-2026: 713 miles 2027-2030: 792 miles	Five Proposed Pads 2005-2010: 105 miles 2011-2015: 114 miles 2016-2018: 128 miles 2019-2022: 124 miles 2023-2026: 160 miles 2027-2030: 188 miles FFD Not estimated, would extend approximately. 100 years.	Five Proposed Pads 2005-2011: 315 miles
Pipelines							
Route	Five Proposed Pads As CPAI proposed. FFD No restrictions on location.	Five Proposed Pads Pipelines near CD-6 moved outside 3-mile Fish Creek Buffer Zone. FFD Setbacks restrict areas in which pipelines can be placed.	Five Proposed Pads Parallel roads. FFD No restrictions on location	Five Proposed Pads Parallel roads. FFD No restrictions on location.	Five Proposed Pads Nearly identical to CPAI Proposal. FFD No restrictions on location.	Five Proposed Pads Nearly identical to CPAI Proposal. FFD No restrictions on location.	Five Proposed Pads Pipeline segments between CD-5 and CD-7 moved outside the 3-mile Fish Creek Buffer Zone.
Elevation	5-foot minimum	5-foot minimum	7-foot minimum at VSMs	7-foot minimum at VSMs	7-foot minimum at VSMs	7-foot minimum at VSMs	7-foot minimum at VSMs
Length of pipeline corridor Number of VSMs	Five proposed pads 35.6 miles 3,418 VSMs FFD 150.1 miles 14,411 VSMs	Five proposed pads 36.5 miles 3,504 VSMs FFD 135.9 miles 13,044 VSMs	Five proposed pads 42.3 miles 4,059 VSMs FFD 148.7 miles 14,278 VSMs	Five proposed pads 42.3 miles 4,059 VSMs FFD 148.7 miles 14,278 VSMs	Five proposed pads 33.1 miles 3,121 VSMs FFD 150.1 miles 14,405 VSMs	Five proposed pads 33.1 miles 3,121 VSMs FFD 150.1 miles 14,405 VSMs	Five proposed pads 37.1 miles 3,561 VSMs

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES (CONT'D)

	Alternative A – Applicant's Proposed Action	Alternative B – Conformance to Stipulations	Alternative C – Alternative Access Roads		Alternative D – Roadless Development		Alternative F – Preferred Alternative
			Sub-Alternative C-1	Sub-Alternative C-2	Sub-Alternative D-1	Sub-Alternative D-2	
Pipeline at Nigliq Channel	On bridge near CD-2	On pipeline-only bridge near CD-2	On bridge near CD-4	On pipeline-only bridge near CD-4	Under channel near CD-2	Under channel near CD-2	On bridge near CD-2
Powerlines	In cable trays mounted on VSMs, except 60-foot high poles at 250-foot spacing from CD-6 to CD-7	Buried in/under road or at toe of slope of road everywhere there is a road. Hung off of road bridges at stream crossings. Where no roads, buried in tundra adjacent to pipeline. Hung off pipeline bridges at stream crossings, trenched across minor drainages.	Strung along 60-foot high power poles, 250-foot spacing.	Strung along 60-foot high power poles, 250-foot spacing.	In cable trays mounted on VSMs.	In cable trays mounted on VSMs.	In cable trays mounted on VSMs.

Note:

Under all alternatives, environmental impact analysis considers whether burying specific portions of the pipeline in the tundra or road or raising the pipeline height above the prescribed 5-foot or 7-foot height would mitigate adverse impacts to each resource or use. Such analysis will be based, not on the assumption that the pipeline will be the prescribed minimum height above the tundra, but on projections of the height of the pipeline in the specific portion of the pipeline route. Depending on topography, the height can be substantially greater than the minimum.

[a] Gravel quantities for Alternative A obtained from CPAI's ASDP Permit Application. Gravel quantities for all other alternatives were calculated based on GIS measurements.

2.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

The following alternatives and suggested elements of alternatives were considered but not carried forward for further detailed analysis as an alternative. However**,** these alternatives or suggested elements may be applied as site-specific mitigation measures.

2.6.1 Buried Pipelines

The BLM considered requiring burial of all pipelines, either in gravel roadways or in the tundra. Buried pipeline may ensure easier travel by both humans and wildlife and would be more aesthetically pleasing.

Pipeline burial in roads or the tundra has rarely been used on the North Slope, except in thaw-stable soils such as the case of the TAPS along the Sagavanirktok River. Some three-phase pipelines were initially buried in the roadbed at Milne Point. Problems with these pipelines have resulted in many of these lines being abandoned, and more recent pipeline construction at Milne Point has been above ground because of the problems with belowground pipelines.

Burying pipelines has definite adverse impacts. Pipeline burial can result in thermokarsting, corrosion, erosion, and leak risk (from both external corrosion and pipeline movement). The Milne Point pipeline buried in the roadbed has had problems with corrosion and pipeline movement from expansion and contraction and from frost. Buried pipeline in permafrost areas is prone to heaving, thaw settlement, and thermokarsting, as has been the case for the TAPS fuel gas line, two Badami pipeline river crossings, and at a more recent test trench project for a possible gas sales line. Bank erosion at the site of the Colville River crossing of the sales pipeline for the Alpine Development Project has occurred, and may be attributable to the pipeline. Leaks, especially small leaks, in buried pipeline also are harder to detect than in aboveground pipelines, and consequently more product can reach the environment before a leak is stopped. This difficulty in detecting leaks can be even more problematic with three-phase pipelines for which leak detection is less sensitive than for crude-oil pipelines. Buried pipeline installation also destroys or disturbs soils and vegetation and disrupts natural drainages. Finally, burying the pipeline would increase the cost of the applicant's proposed action.

Because of the environmental risks associated with buried pipelines, burying pipelines in a road or the tundra does not achieve the purpose of the applicant's proposed action while minimizing environmental harm and is not a reasonable alternative, except where it can be shown that it provides specific environmental benefits that offset its considerable disadvantages. Without a clearly identified site-specific environmental benefit for burying a particular pipeline or a portion of a pipeline, burial of all pipelines will not be considered further as an alternative. However, pipeline burial will be considered as appropriate mitigation for particular site-specific impacts rather than as an alternative for total pipeline placement.

2.6.2 Pipeline Elevated Greater Than Seven Feet

The BLM considered elevating the pipeline to a minimum higher than the 5-foot and 7-foot minimums considered in the alternatives selected for detailed analysis. It is possible, though it has not been shown, that pipelines elevated 10 feet or more may ensure even easier travel both by humans and wildlife. However, current information is that 7-foot pipeline elevations are adequate for passage.

To date, no North Slope pipeline project has required more than a 7-foot minimum height elevation. Higher pipeline elevation would make pipelines visible from greater distances and increase work safety concerns and construction, maintenance, and repair costs.

Therefore, as is the case with burying pipeline, raising the minimum level above that considered in the alternatives presented in this EIS does not achieve the purposes of the applicant's proposed action, and is not a reasonable alternative, except where it can be shown that it provides specific environmental benefits that offset its significant disadvantages. Without a clearly identified site-specific environmental benefit for higher pipeline elevations at a particular location, this alternative was eliminated from consideration. Because higher minimum elevated pipeline is untested, entails its own risks of adverse impacts, and is more costly, this EIS has considered raising the minimum height above 7 feet only for mitigation of site-specific impacts, rather than as an alternative for total pipeline placement throughout the pipeline routes.

2.6.3 Pile-Supported Production Pads

Pile-supported production pads offer the possibility of reducing gravel needs and associated impacts from gravel pits and pads. However, pile-supported production pads currently are used only experimentally for relatively shallow exploratory wells. In the winter of 2002–2003, Anadarko Petroleum Corporation first deployed its pioneering pile-supported exploration pad on the North Slope, drilling to 1,400 feet (Maurer Technology 2003). Such a rig is far too small to reach the drilling target depths in the Plan Area. Although in the future they might be developed for production pad use, pile-supported production pads currently are not technologically capable of providing the structures necessary for this proposed action**,** and therefore are not a reasonable alternative for the applicant's proposed action.

2.6.4 Use of Docks to Develop Facilities

Docks are not a practical alternative means of developing the facilities proposed by CPAI. Use of docks within the Colville River Delta is infeasible because of the shallow depth, changing distributary channels, and maintenance dredging and associated dredge spoil disposal that would be needed. Docks located elsewhere along the Beaufort Sea coastline would be too far away from the proposed development. Therefore, the use of docks is not a reasonable alternative for the CPAI proposal**.** Winter hauling on ice roads or over the frozen tundra, lakes, and streams is much more practical for both environmental and logistical reasons. This approach is the most likely means to develop future proposed facilities in the Plan Area.

2.6.5 Conduct Long-Term Studies on North Slope Habitat, Wildlife, and Social Impacts

Some local residents would like the government to conduct long-term studies of local and regional environmental, health, and social issues. The BLM and the USGS are in the process of establishing a body to undertake such studies, partially in response to the findings and recommendations in the report of the National Research Council (NRC) of the National Academy of Science. This BLM- and USGS-led body is the appropriate vehicle for undertaking long-term studies such as those the residents have requested. Such studies, however, are not within the scope of the purpose and need of the applicant's proposed action and are not a reasonable alternative to accomplish those purposes.

2.6.6 Required Three-Mile Setback from all Rivers, Streams, and Lakes

Leaders of the village of Nuiqsut suggested a 3-mile setback from all rivers, streams, and lakes. The planning area contains so many water bodies within its entire area that a 3-mile restriction on surface occupancy throughout the area would effectively prohibit any development in the entire planning area. Thus, an alternative adopting this suggestion would be inconsistent with the purpose and need of the applicant's proposed action, and is not a reasonable alternative**.** However, setbacks of varying widths are required around all water bodies on BLM-managed public lands and are under consideration as mitigating measures on other lands in the Plan Area**.**

2.6.7 Approval of Fewer Satellite Development Pads or Pads at Substantially Different Locations

Development of fewer pads or pads at substantially different locations would not meet the purpose of the applicant's proposed action and therefore is not a reasonable alternative to the proposed action. Fewer pads would not be able to produce the oil accumulations that the applicant proposes to develop. The economics and technological limitations of North Slope oil development are such that CPAI has designed its proposal with the minimum facilities necessary to produce the discovered oil. Placing production pads at points distant from the locations proposed by CPAI would make production of the oil economically and technologically infeasible. Directional drilling has distinct limitations, and it is necessary to locate production pads so as to enable all portions of each reservoir to be accessed sufficiently to produce all the accumulated oil from a minimum of pads, or oil will be left. Therefore, more distant locations of production pads was also eliminated as an alternative to be considered in detail.

2.6.8 Develop Western Part of the Satellite Development from a Nuiqsut Operations Center

The BLM considered an alternative that would have located a new staging area and operations center at Nuiqsut. Conceptually a Nuiqsut Operations Center (NOC) would serve as a storage area and transportation hub at the village of Nuiqsut to support construction, drilling, and operation of CPAI's proposed drill sites CD-5, CD-6, and CD-7. Use of an NOC would reduce the need for a vehicle bridge over the Colville River and could provide some additional economic benefit to the village of Nuiqsut.

However, the BLM concluded that an NOC is not a practical alternative means of developing the oil accumulations CPAI proposes to develop west of the Nigliq Channel. Use of a NOC would necessitate the purchase, operation, and maintenance of numerous duplicate pieces of equipment and infrastructure that are already in place at the Alpine Development Project. Essentially the NOC would be a duplicate of the Alpine Development Project without the hydrocarbon processing facilities and the camp (although the camp size may be able to be reduced). The size and extent of CPAI's proposed satellite development west of the Nigliq Channel does not support the level of activity that would justify the capital investment required for aNOC. The projected level of development in the National Petroleum Reserve-Alaska would not support the additional expense involved with an NOC. Therefore, an alternative dependent on a NOC would not be economically viable and was eliminated from detailed analysis as an alternative.

2.6.9 Development with Access Other than Road or Air

The BLM considered requiring oil development in the Plan Area to proceed with access other than by gravel road or air. Gravel road and aircraft access both affect the environment through gravel extraction, establishment of gravel road or airstrip/helipad footprints on the tundra, and disturbance of wildlife through noise and movement. Boat access, such as CPAI has proposed to CD-3 and CD-4, offers a partial alternative means of access in summer, at least for those pads that are reasonably accessible by boat. Use of low-pressure vehicles year-round on tundra offers another means to access pads, as do ice roads.

An alternative that relies on such means of access for all but emergency purposes to develop oil and gas in the Plan Area, however, is not a reasonable alternative because it fails to provide adequate continuous access to achieve the purpose and need described in Section 1. Neither the federal nor state governments permit other than emergency tundra travel during all or portions of the summer to prevent undue damage to the environment when the ground is soft. Regular routine maintenance and inspection trips to production pads during summer by low-pressure vehicles would result in sustained and substantial damage to vegetation, soils, and water resources, including important wetland habitat. Vehicle crossings of rivers and streams would result in unacceptable damage to riparian resources and fish habitats and is prohibited in anadromous water bodies with few exceptions. Crossing channels of the Colville River or other streams, including the Ublutuoch River, with low-pressure vehicles is not feasible during some periods because of break-up, freeze-up, or high flow conditions. Although boat travel offers a means to access CD-3 and CD-4 during the summer, boat access is not available to CPAI's other proposed sites. Moreover, boat access is not possible or safe during break-up and freeze-up. Therefore, alternatives other than air or road access are not considered feasible and were not considered in detail in this EIS.

2.7 COMPARISON OF IMPACTS OF ALTERNATIVES FOR CPAI PROPOSED DEVELOPMENT

Table 2.7-1 provides a comparison of impacts of the applicant's proposed action (Alternative A) and four action alternatives (Alternatives B, C, D, and F), including the cumulative impacts. Alternative E is the No Action Alternative. Under Alternative E, development in the Plan Area would not be authorized. No oil in the Plan Area, except that extracted through the existing APF, would be produced, and no new roads, airstrips, pipelines, or other oil facilities would be constructed beyond what is authorized in connection with CPAI's current development at CD-1 and CD-2. None of the physiographic, biological, or social system impacts described for the other alternatives in Section 4 and summarized below would occur. The physiography would not be altered. Oil and gas and sand and gravel would not be exploited for the applicant's proposed action. Soils, permafrost, water, water quality, air, climate, paleontological and cultural resources, and wildlife and their habitats would not be disturbed or destroyed. There would be no impacts on subsistence, socio-cultural systems, the economy, recreation, or visual resources.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES

Physical: Terrestrial – Physiography				
Alternative A	**Alternative B**	**Alternative C**	**Alternative D**	**Alternative F**
Impacts to physiography would result in changes to landforms by construction of roads, pads, airstrips, and mine sites. If not properly designed and constructed, gravel fill can adversely affect thermal stability of the tundra and hydrology through thermokarsting and increased ponding. The total land area affected by construction of gravel facilities and mine sites would be 306 acres.	Same types of impacts as Alternative A. Lesser magnitude of land-intrusive actions than Alternative A because of fewer roads, shorter road lengths, and fewer acres involved with gravel mining. The total land area affected by construction of gravel facilities and mine sites would be 241 acres.	Same types of impacts as Alternative A. Greater magnitude of land-intrusive actions than Alternative A because of additional roads, longer road lengths, and more acres involved with gravel mining. The total land area affected by construction of gravel facilities and mine sites = 409 acres for Sub-Alternative C-1 and = 410 acres for Sub-Alternative C-2.	Same types of impacts as Alternative A. Lesser magnitude of land-intrusive actions than Alternative A because of roadless design, Total area of gravel construction and mining actions = 272 acres for Sub-Alternative D-1 and 93 acres for Sub-Alternative D-2.	Same types of impacts as Alternative A. Similar magnitude of gravel construction and mining actions as Alternative A. Total area of land affected by gravel construction and mining actions = 316 acres.
SPILLS: Spills would not affect the physiography except at a local scale on the order of acres. Spills may cause loss of vegetation, resulting in thermokarsting and possible pond formation. Spill cleanup may remove vegetation and surface soils, which also may cause thermokarsting.	**SPILLS:** Same as Alternative A, except there may be fewer spills from vehicles to gravel roads and adjacent habitats because there are fewer miles of roads.	**SPILLS:** Same as Alternative B, except there are even fewer miles of gravel roads.	**SPILLS:** Same as Alternative A, except there would be no gravel spills from road construction. There may still be gravel spills on ice roads destined for pads and airstrips.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Impacts to the physiography are associated with the development and construction of gravel pads, roads, airstrips, pipelines, and pump stations. The largest cumulative impacts on physiography are anticipated from gravel mining and it associated activities. The proportion contributed by the ASDP is relatively small compared to the effects of past, present, and reasonably foreseeable actions. While physiographic impacts, especially those resulting from gravel mining, are additive, the total incremental amount of disturbed area is small compared to the total resources within the North Slope region and is not considered to be cumulatively significant.				
Physical: Terrestrial – Geology				
All Action Alternatives				
Under all development scenarios, the irreversible and irretrievable commitment of petroleum hydrocarbon resources constitutes a major impact; however, petroleum hydrocarbon production is the purpose of the project. Impacts to bedrock under all alternatives would be negligible.				
SPILLS: Spills would not affect geology.				
CUMULATIVE IMPACTS: Cumulative geological impacts are mainly additive, and, given the objective of oil development, are unavoidable. The proposed action would likely remove a significant percent of total economically recoverable petroleum resources available within the area of known reserves, just as past, present, and reasonably foreseeable development has and will continue to remove oil from other known and perhaps as yet unknown fields.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Physical: Terrestrial – Soils and Permafrost				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Placement of fill on the tundra represents the greatest impacts on Plan Area soils and permafrost. Impacts that increase heat flux to ice-rich permafrost can initiate thermokarst. Impacts to Plan Area soil and permafrost resources would be unavoidable and semipermanent. Alternative A would place gravel or ice over 1,757 acres of soil, disturb 2.0 million cubic yards (Mcy) of soil through gravel excavation, and thermally impact 1,152 acres of tundra. The surface area of soil affected both directly and indirectly under Alternative A represents 0.2% of the total Plan Area.	Direct and indirect impact types similar to Alternative A. Lesser magnitude of road construction impacts. Surface area of soil disturbed = 1,556 acres, Volume of soil disturbed = 1.6 Mcy, Percent of Plan Area disturbed = 0.2%.	Direct and indirect impact types similar to Alternative A. Greater magnitude of gravel excavation and road construction impacts. Surface area of soil disturbed =1,993 acres (C-1) and 1,979 acres (C-2), Volume of soil disturbed = 2.2 Mcy (C-1) and 2.2 Mcy (C-2), Percent of Plan Area disturbed = 0.2% (C-1) and 0.2% (C-2).	Direct and indirect impact types similar to Alternative A. Minimal gravel road construction impacts, greater ice road construction impacts. Surface area of soil disturbed = 2,145 acres (D-1) and 602 acres (D-2), Volume of soil disturbed = 1.8 Mcy (D-1) and 0.7 Mcy (D-2), Percent of Plan Area disturbed = 0.2% (D-1) and <0.1% (D-2).	Direct and indirect impact types similar to Alternative A. Similar magnitude of road construction impacts. Surface area of soil disturbed = 1,845 acres, Volume of soil disturbed = 2.0 Mcy, Percent of Plan Area disturbed = 0.2%
SPILLS: Spills of oil and/or salt water may affect soils directly and make them unsuitable for survival of tundra vegetation, with the impact persisting longer for salt water than for oil, which weathers. The loss of vegetation as a result of spilled material and/or from cleanup actions may expose soil and underlying permafrost to thermokarsting as well as wind erosion processes. A VLVS may affect larger areas (which may also be remote from roads) than will most very small to medium and some large spills. Saltwater spills may have a smaller impact in wetland and wet tundra habitats occupied by halophytic (salt-loving) plants than in habitats farther from the coast and the Colville River estuary.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that a VLVS may take longer to contain and clean up if it occurs when there is no ice road access, thus increasing the time that the spilled material may affect the vegetation and expose soil and permafrost.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Impacts to soils and permafrost occur from activities associated with construction of gravel pads, roads, airstrips, pipelines, and pump stations and the excavation of material sites. Incremental impacts of the proposed project would be small (on the order of 2 percent) when compared to past, present, and future development. While soils and permafrost impacts are additive, the total and incremental amount of disturbed area is small compared to the total resource within the North Slope region and is not considered to be cumulatively significant.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Physical: Terrestrial – Sand and Gravel				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Sand and gravel resources used for construction of roads, pads, or airstrips would be available for reuse only upon abandonment. For Alternative A, 2.0 Mcy of gravel fill are required.	Requires 1.6 Mcy of sand and gravel for use as fill.	Requires 2.2 Mcy of sand and gravel for Sub-Alternative C-1 and 2.2 Mcy of sand and gravel for Sub-Alternative C-2 for use as fill.	Requires 1.8 Mcy of sand and gravel for Sub-Alternative D-1 and 0.7 Mcy of sand and gravel for Sub-Alternative D-2 for use as fill.	Requires 2.0 Mcy of sand and gravel for use as fill for construction of roads, pads, or airstrips.
SPILLS: Most spills are very small to medium and occur on gravel roads and pads. The spills may contaminate the gravel, depending upon its re-use upon abandonment of the facilities.	**SPILLS:** Same as Alternative A, except there are somewhat fewer miles of road and less gravel to be affected.	**SPILLS:** Same as Alternative A, except there are even fewer miles of gravel roads than in Alternatives A or B.	**SPILLS:** Same as B except there are no gravel roads to be affected. The pads may still be affected.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Use of sand and gravel resources reduces the availability of the remaining resources for future use. The contribution the ASDP to additive cumulative gravel and sand use (as measured by surface area) is approximately 5%, significantly less than the approximately 50% increase that would occur for the total of and reasonably foreseeable future development. The ASDP would result in increased cumulative impacts, although the incremental cumulative impacts that result are a small portion the cumulative impacts that result from all other reasonably foreseeable future projects**.** Once used, sand and gravel resources for construction of roads, pads, or airstrips may only be available for reuse upon abandonment.				
Physical: Terrestrial – Paleontological Resources				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Surface activities such as construction of pad, road, 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. Gravel mining would cover 65 acres.	Less chance for subsurface disturbance because of 28 fewer acres of gravel mining than Alternative A.	More chance for subsurface disturbance because of 21 (C-1 and C-2) more acres of gravel mining than Alternative A.	Less chance for subsurface disturbance because of 14 (D-1) and 43 (D-2) fewer acres of gravel mining than Alternative A.	Same as Alternative A.
SPILLS: No impact from spills expected unless there are unknown paleontological resources discovered in the course of a cleanup response to a spill.				
CUMULATIVE IMPACTS: While the nature of paleontological deposits (specifically, their unpredictable location and context on surface, near-surface, or deeply buried) make impacts difficult to assess, the continued use of current procedures for survey and inventory before exploration and development are expected to minimize the potential for impacts to occur. Effects across the North Slope of Alaska are expected to be additive and minor. Because the probability that a large oil spill would occur is extremely low (see discussion in Section 4.3), the potential for any cumulative oil spill impacts on paleontological resources is considered to be minimal.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Physical: Aquatic – Water Resources				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Shallow, thawed water-bearing zones may be enlarged or eliminated and lakes may be created during construction, operation, and abandonment of gravel extraction areas. Fresh water withdrawn from lakes for the construction of ice roads and pads during the winter seasons, for production drilling and processing operations, and for potable water at temporary construction or drilling camp facilities, would result in negligible impacts to lake water levels because natural annual recharge processes are sufficient to fully recharge lakes. Creeks could be affected when construction and operation activities associated with roads and pipelines block, divert, impede, or constrict flows, resulting in impoundment of water. Constricting flows could result in increased stream velocities and a higher potential for ice jams, ice impacts, scour and streambank erosion. Impeded flows could result in bank overflows and floodplain inundation. These potential impacts are minimized by design features that protect the structural integrity of road- and pipeline-crossing structures. Total fresh water requirement would be 713 million gallons.	Same as Alternative A, except that CD-6 and gravel roads associated with CD-2, CD-5, and CD-6 would be eliminated, minimizing (when compared to Alternative A) the potential impacts on water resources along these segments. Total fresh water requirement = 691 million gallons.	Same as Alternative A, except the road to CD-3 could have adverse effects on the peak water surface elevations. In addition, the road could be affected by storm surges related to elevated sea levels offshore. Elimination of the road-bridge over the Nigliq Channel would reduce impacts in Sub-Alternative C-2. Total fresh water requirement for Sub-Alternatives C-1 and C-2 = 736 million gallons.	Same as Alternative A, except elimination of gravel roads would reduce the overall impacts on water resources (e.g., fewer impacts to streams and rivers because of reduced road and pipeline crossings; fewer impacts on shallow subsurface waters from reduced gravel supply requirements); ice road construction would increase, creating an increased demand for water. The ability to spread out water extraction to other permitted lakes, and natural annual recharge volumes, would result in negligible impacts on lakes. Total fresh water requirement for Sub-Alternative D-1 = 866 million gallons, Sub-Alternative D-2 = 905 million gallons.	Same as Alternative A. Rerouting of the CD-4 road would minimize impacts on a nearby lake. Provisions for culvert criteria would reduce impoundment of waters compared to Alternative A. Longer bridge spans could reduce flow restriction and related erosion and shoaling. Total fresh water requirement = 661 million gallons.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Physical: Aquatic – Water Resources (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
SPILLS: Oil spills may affect water bodies near pipelines or roads and pads. A VLVS is more likely to affect these water bodies than will very small to medium spills, most of which are confined to the roads and pads. Oil spill impacts may persist for several years until oil remaining after cleanup weathers. A saltwater spill may affect the water body for a few months to few years, depending upon the input of fresh water to dilute and flush out the salt water.	**SPILLS:** Same as Alternative A, except that there would be fewer spills from gravel roads because of the reduction in the miles of roads between CD-1 to CD-3, and CD-1 to CD-6. Thus, the likelihood and impacts from vehicle spills will be less than in Alternative A. Also, the road, pipeline, and pad would be out of the Fish Creek Buffer Zone, thus reducing potential impacts on Fish Creek.	**SPILLS:** Same as Alternative A, except that then potential for spills to reach Fish Creek would be reduced by moving most of the pipelines and the roads out of the Fish Creek Buffer Zone.	**SPILLS:** Same as Alternative A, except that there would be no spills from gravel roads, and spills from ice roads are likely to be cleaned up before ice melts in spring. Thus, the likelihood and impacts from vehicle spills will be less than in Alternatives A, B, or C.	**SPILLS:** Same as Alternative A, except that then potential for spills to reach Fish Creek would be reduced by moving most of the pipelines and the roads out of the Fish Creek Buffer Zone.
CUMULATIVE IMPACTS: Development of oilfield facilities, associated transportation systems, and at settlements has and will continue to affect water resources. These impacts are most likely to be related to road development**,** currently approximately 570 miles (including the Dalton Highway) on the North Slope outside of villages. Development of the ASDP contributes up to 26 miles of additional road to the cumulative total of roads. No cumulative impact on North Slope water supplies from withdrawal of water for construction and operation of any of the alternatives is expected because the annual yield (runoff and refill of lakes) is many times greater than the amount withdrawn. Localized and temporary impacts may occur at those lakes used for water supply.				
Physical: Aquatic – Surface Water Quality				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Potential surface water quality impacts that could occur during construction and operation include accidental release of fuels and other substances, including oil spills; reductions in dissolved oxygen and changes in ion concentrations in lakes used for water supply; and increases in terrestrial erosion and sedimentation causing higher turbidity and suspended solids concentrations.	Would have fewer sources of potential impacts on surface water quality than Alternative A because of the movement of several production facilities outside sensitive resource areas and reduction in total miles of roads to be constructed. Facilities would be located farther from water bodies compared to Alternative A, reducing the chance of accidental releases migrating into a nearby water body. Reduced potential for dust fallout and upslope impoundments compared to Alternative A would result in fewer incidences of turbidity impacts.	Would have more sources of potential impacts on surface water quality than Alternative A because of the increased roads requiring more gravel placement. Increased miles of ice roads compared to Alternative A would raise the chance that ice roads would be routed across lakes, potentially affecting dissolved oxygen concentrations. Increased area potentially affected by thermokarst erosion, dust fallout, and upslope impoundments compared to Alternative A, leading to increased impacts on water quality from increased turbidity.	Would have fewer sources of potential impacts on surface water quality than Alternative A because of the decreased gravel placement. Increased miles of ice roads compared to Alternative A, resulting in increased water withdrawal and increased potential that ice roads would be routed across lakes, potentially affecting dissolved oxygen concentrations. Decreased area potentially affected by thermokarst erosion compared to Alternative A, reducing the potential for turbidity impacts caused by erosion and sedimentation. Minimal potential for dust fallout and upslope impoundments compared to Alternative A, resulting in less potential for turbidity impacts.	Would have more sources of potential impacts on surface water quality than Alternative A because of the increased roads. Increased miles of ice roads compared to Alternative A would raise the chance that ice roads would be routed across lakes, potentially affecting dissolved oxygen concentrations. Increased area potentially affected by thermokarst erosion, dust fallout, and upslope impoundments compared to Alternative A, leading to increased turbidity impacts.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Physical: Aquatic – Surface Water Quality (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
SPILLS: Oil spills may affect water bodies near pipelines or roads and pads. A VLVS is more likely to impact these water bodies than will very small to medium spills, most of which are confined to the roads and pads. Spills that reach surface water bodies, depending upon the type of material spilled, may result in reduced dissolved oxygen concentrations, increased salt concentrations, and increased toxicity to aquatic organisms. The concentrations may exceed state water quality standards for a few days to a few years, depending upon the size and dynamics of the receiving water body, rate of dilution, and/or weathering of the spilled material.	**SPILLS:** Same as Alternative A, except that there would be fewer spills from gravel roads because of the reduction in the miles of roads between CD-1 to CD-3, and CD-1 to CD-6. Thus, the likelihood and impacts from vehicle spills will be less than in Alternative A. Also, the road, pipeline, and pad would be out of the Fish Creek Buffer Zone, thus reducing potential impacts on Fish Creek.	**SPILLS:** Same as Alternative A, except that the potential for spills to reach Fish Creek would be reduced by moving most of the pipelines and the roads out of the Fish Creek Buffer Zone. Also, there are even fewer miles of gravel roads than in Alternatives A or B.	**SPILLS:** Same as Alternative A, except that there would be no spills from gravel roads, and spills from ice roads are likely to be cleaned up before ice melts in spring. Thus, the likelihood and impacts from vehicle spills will be less than in Alternatives A or B.	**SPILLS:** Same as Alternative A, except that the potential for spills to reach Fish Creek would be reduced by moving most of the pipelines and the roads out of the Fish Creek Buffer Zone.
CUMULATIVE IMPACTS: Impacts from development of the ASDP and other reasonably foreseeable actions to surface water quality across the North Slope would be additive, and are also expected to be localized, limited in extent and persistence, and have minimal impact on the environment. Such impacts are not expected to be cumulative.				

Physical: Aquatic – Estuarine Waters and Water Quality				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Since the pad, road, and pipeline locations are not near the coast, no expected impacts on the physical conditions or processes within the estuarine and nearshore environment are expected.				
SPILLS: Large to VLVS to major creeks (e.g., Fish and Judy creeks and Ublutuoch River)) and rivers (e.g., Nigliq Channel, Colville River Delta) may affect estuarine water quality by reducing dissolved oxygen concentrations, increasing salt concentrations, and increasing toxicity levels. The impacts are most likely to come from spills from pipelines crossing the rivers and creeks and may persist from a few days to several years, depending on the material spilled and the dynamics of the water body and nearshore sediment accretion, erosion, and transport processes.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that pipeline crossings of Ublutuoch River and Nigliq Channel are farther upstream, which may reduce the amount of spilled material that reaches the estuarine environment.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: The ASDP is not expected to contribute to cumulative impacts on marine and estuarine water quality. Spills from other oil and gas developments on marine or estuarine waters or along streams draining into such water bodies could affect those waters. The extent of such contamination would be related to the size of the oil spill. Because spill frequency and volume are expected to be low, cumulative impact from oil spills is not considered to be an additive cumulative impact.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

<table>
<tr><th colspan="5">Physical: Atmospheric Environment – Climate and Meteorology</th></tr>
<tr><th colspan="5">ALL ACTION ALTERNATIVES</th></tr>
<tr><td colspan="5">Greenhouse gas emissions would occur during construction and drilling activities from operation of fossil fuel combustion equipment. GHG emissions would also occur over a longer period from operations. The impact of GHG emissions upon the air quality of the region would be minimal.</td></tr>
<tr><td colspan="5">SPILLS: No detectable impacts from spills.</td></tr>
<tr><td colspan="5">CUMULATIVE IMPACTS: While it is difficult to estimate GHG emissions from future oil and gas production activities in northern Alaska precisely, GHG emissions would conservatively continue to be proportional to the oil production rate at approximately the same ratio as now. Based on that assumption, not taking into account combustion and emission control technology improvements, the regional GHG emission associated with future cumulative production, including the ASDP, would be approximately the same as the 1996 North Slope emission levels. This is approximately 27 percent higher than current levels (since the 1999 North Slope production rate was approximately 1.1 MMbbl of oil per day).</td></tr>
<tr><th colspan="5">Physical: Atmospheric Environment – Air Quality</th></tr>
<tr><th colspan="5">ALL ACTION ALTERNATIVES</th></tr>
<tr><td colspan="5">Construction and Operations would result in air emissions in the region. The emissions would not have a lasting effect on air quality.</td></tr>
<tr><td colspan="5">SPILLS: Localized impact may occur from oil spills and from some volatile hazardous materials, primarily from VOCs released to the atmosphere. The potential impacts may be greater if the hydrocarbon is sprayed under high pressure as a mist into the air. There would be no impacts from saltwater spills.</td></tr>
<tr><td colspan="5">CUMULATIVE IMPACTS: The cumulative effects of all projects affecting the North Slope of Alaska in the past and occurring now have caused generally little deterioration in air quality, which achieves national standards. Production levels for the foreseeable future are not anticipated to be higher than the 1996 level. Thus, while the ASDP and reasonably foreseeable North Slope projects are additive, they are not expected to have synergistic cumulative impacts on air quality.</td></tr>
<tr><th colspan="5">Physical: Atmospheric Environment – Noise</th></tr>
<tr><th colspan="5">ALL ACTION ALTERNATIVES</th></tr>
<tr><td colspan="5">Generally, the equipment in the Plan Area would operate at a decibel level of about 70 dBA for less than 1,000 feet. During drilling, the potential noise impacts would be limited to the vicinity of the power generation engines and drilling rig engines, which would have equipment decibel ratings of about 85 dBA and 110 dBA, respectively. During peak periods of construction and drilling, noise levels would be considerably higher than during operations, but would be short-term and would not occur for all proposed satellite pads at the same time. Noise impacts to residents of Nuiqsut would be negligible.</td></tr>
<tr><td>SPILLS: Releases of oil or salt water under pressure may result in a local increase in noise of the escaping liquid and gas. Much or the response equipment is motorized, and the local noise levels will increase from both the equipment and the people involved, compared to noise levels from normal operations. The increased noise levels will be localized and would cease as the spill response ends.</td><td>SPILLS: Same as Alternative A.</td><td>SPILLS: Same as Alternative A.</td><td>SPILLS: The noise levels may be greater at the cleanup site(s) because there may be more aircraft support instead of trucks and other ground vehicles used to transport people, materials, and machinery to the site(s). Also, the aircraft, especially helicopters will be transporting people, materials, etc. from central locations to the site and thus flying over the tundra.</td><td>SPILLS: Same as Alternative A.</td></tr>
<tr><td colspan="5">CUMULATIVE IMPACTS: The ASDP would result in negligible incremental increases in localized ambient noise from construction and operations equipment and aircraft. From the cumulative perspective, noise effects from infrastructure and activities related to past, present, and reasonably foreseeable actions are localized and short term, and the sources of noise are not geographically concentrated.</td></tr>
</table>

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Terrestrial Vegetation and Wetlands				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
306 acres covered by fill and mining, 1,152 acres altered by indirect impacts. Ice road construction would disturb 1,816 acres and may damage underlying vegetation from direct damage or as a result of long-term compaction by use of roads for several years (e.g., by crushing tussocks). In the Colville River Delta, the highest surface area impacts are to Wet Sedge Meadow vegetation (0.5%). In the NPR-A portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (0.3%).	241 acres covered by gravel fill and mining, 2,116 acres altered by indirect impacts. In the Colville River Delta, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (0.4%). In the NPR-A portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (0.1%).	For Sub-Alternative C-1: 409 acres covered by fill and mining, 3,647 acres altered by indirect impacts. In the Colville River Delta, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (1.1%). In the NPR-A portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (0.4%). For Sub-Alternative C-2: 410 acres covered by gravel fill and mining, 3,695 altered by indirect impacts. The highest surface area impacts are to Tussock Tundra (0.5%) and Wet Sedge Meadow Tundra (0.2%).	For Sub-Alternative D-1: 272 acres covered by gravel fill and mining, 2,501 acres altered by indirect impacts. For Sub-Alternative D-2: 93 acres covered by gravel fill and mining, 784 acres altered by indirect impacts.	For Alternative F: 316 acres covered by gravel fill and mining, 3,150 acres altered by indirect impacts. In the Colville River Delta, the highest surface area impacts are to Wet Sedge Meadow Tundra vegetation (0.6%). In the NPR-A portion of the Plan Area, the highest surface area impacts are to Tussock Tundra vegetation (0.3%).
SPILLS: Most very small to medium spills would have no to negligible effects on terrestrial vegetation and wetland habitats because these spills are generally confined to the gravel pads and roads. Large to VLVS spills to wetlands and tundra may affect the exposed habitats. Spills of oil and/or salt water may affect the tundra vegetation directly and/or the underlying soils, making the soils unsuitable for tundra vegetation survival. The impacts may persist longer for salt water than for oil, which weathers. The loss of vegetation as a result of spilled material and/or from cleanup actions may expose soil and underlying permafrost to thermokarsting as well as wind erosion processes. Saltwater spills may have a smaller impact in wetland and wet tundra habitats occupied by halophytic (salt-loving) plants than in habitats farther from the coast and the Colville River estuary. The impacts on wetlands and tundra habitats would generally be limited to the directly exposed areas and would not have regional-level impacts on the habitats or the resources that depend on these habitats.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that a VLVS may take longer to contain and clean up if it occurs when there is no ice road access, thus increasing the time that the spilled material may affect the vegetation and wetlands	**SPILLS:** Same as Alternative A.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Terrestrial Vegetation and Wetlands (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
CUMULATIVE IMPACTS: Cumulative effects of past actions on vegetation have generally been minor. Impacts on the vegetation of Alaska's North Slope from the ASDP and past, present, and future oil and gas exploration and development in the Plan Area are expected to be additive with respect to the impacts, present and future, from other oil and gas activities outside the Plan Area. The affected area continues to be a very small fraction of the total North Slope acreage. It is not expected that synergistic impacts to vegetation would occur by affecting additional acres, nor would any effects (whether beneficial or adverse) occur to vegetation as a result of additional acres developed. In addition to oil and gas development projects that would directly affect North Slope vegetation, global climate change could alter the species composition**.**				

Biological: Fish				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Potential impacts to winter habitat and feeding and spawning areas include increased access to these areas by roads. Water withdrawal for ice road construction could create overcrowding and reduce dissolved oxygen in lakes, with fish mortality a possible result. Construction of ice roads or airstrips on fish overwintering areas could cause freezing to the bottom and block fish movement. Low dissolved oxygen could also result from suspension of oxygen-demanding materials during construction of the Nigliq Channel bridge. Bridge approaches at the Nigliq Channel and Ublutuoch River would extend into the floodplain terrace(s), altering flow and blocking fish passage during flood stage. The long network of roads could result in alteration of regional surface hydrology, including interruption of fish movements.	Because the road system of Alternative B would be shorter than that of Alternative A, impacts would be on a smaller scale. Vehicle bridges across the Nigliq Channel and Ublutuoch River would not be constructed. No facilities would within the 3-mile Fish Creek Buffer Zone.	Total water demands for Alternative C ice roads, and thus the potential for impact on fish, would be far greater than for Alternative A because the length of roads in Alternative C is greater than in Alternative A, and power lines in Alternative C do not parallel roads. The road to CD-3 could divert floodwaters to the east across the Delta, subjecting fish to altered hydrological conditions. In Alternative C-2: impacts of the pipeline-only bridge over the Nigliq Channel would be far less severe than those of the road and pipeline bridge in Sub-Alternative C-1; and ice road water demands would be greater than for Sub-Alternative C-1.	Construction impacts would be less than for Alternative A because no roads are proposed, and the pipeline crossing of the Nigliq Channel would be accomplished by HDD. Potential impacts to fish from ice roads would be greater than for Alternative A.	Similar to Alternative A except bridges at the Nigliq Channel and Ublutuoch River would span main channels and floodplains to the secondary terraces and therefore would have little effect on river flow during normal flood stages; potential impacts to Fish Creek drainage are reduced by substantially reducing lengths of road and pipeline within the 3-mile Fish Creek Buffer Zone; and potential fish passage impacts at Lake L9323 in Alternative A are mitigated by relocating the road to the east of the lake and crossing watercourses with bridges.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Fish (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
SPILLS: Most very small to medium spills would have negligible or no impacts on fish or their habitat because these spills are generally confined to the gravel pads and roads. Large to VLVS spills to flowing waters or wetlands and tundra ponds/lakes may affect fish through increased toxicity levels, decreased dissolved oxygen concentrations in confined water bodies, and/or increasing salt concentrations in freshwater habitats. There may be indirect impacts on the fish through reduction or contamination of their food resources. Spills, especially of oil, that reach the Colville River Delta/Nigliq Channel estuarine areas may affect fish in these habitats. If the spills occur during the period when the rivers are ice-covered, the oil and/or salt water may affect the fish aggregated in deep pools. The impacts of spills on fish populations are likely to be localized and not cause regional population-level impacts. Even VLVSs are unlikely to affect the marine fish populations of Harrison Bay.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that likelihood of impacts to fish in the Colville River Delta/Nigliq Channel estuarine habitats may be less because the Nigliq Channel crossing is farther upstream than in other alternatives.	**SPILLS:** Same as Alternative A, except that likelihood of impacts on fish in the Nigliq Channel downstream of the HDD crossing during the ice-covered period may be greater if a slow, undetected leak from the buried pipeline into the ice-covered Nigliq Channel occurs and remains undetected for several weeks or months.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: The combined impacts on fish from the ASDP and other past, present, and future projects, while additive, are not expected to affect the viability of fish species or populations. Overall, cumulative impacts from blocking fish passage in North Slope freshwater habitats are and would be low to moderate under the proposed action. The cumulative impact of increased human access to fish populations (for example, along new roads and highways) is expected to be minor and additive. Wide-ranging increased impacts on arctic fish populations found on the North Slope would not be anticipated. Also, synergistic impacts to fish from disturbance are not anticipated.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Birds – Waterfowl and Loons				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Impacts on waterfowl and loons 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 resulting from lost productivity are not quantified by this analysis An estimated 77 waterfowl and 10 loon nests displaced by habitat loss, alteration, or disturbance. More displacement from habitat loss and alteration than from disturbance. Would reduce Plan Area nesting by 1% for waterfowl and <1% for loons.	An estimated 91 waterfowl and 9 loon nests displaced by habitat loss, alteration, or disturbance. More nests affected at CD-3 and CD-5 than other three sites. Would reduce Plan Area nesting by 2% for waterfowl and <1% for loons.	An estimated 78 and 81 waterfowl and 10 loon nests displaced by habitat loss, alteration, or disturbance for Sub-Alternatives C-1 and C-2. More nests affected at CD-3 and CD-5 than other three sites. Would reduce Plan Area nesting by 1% for waterfowl and <1% for loons. More displacement from habitat loss and alteration than from disturbance. Local access could affect amount of hunting mortality.	For Alternative D-1, an estimated 102 waterfowl and 12 loon nests displaced by habitat loss, alteration, or disturbance. For Alternative D-2, an estimated 38 waterfowl and 5 loon nests displaced by habitat loss, alteration, or disturbance. Would reduce Plan Area nesting by 2% for waterfowl and 1% for loons. More displacement would result from disturbance (70%) than from habitat loss and alteration. More potential disturbance at CD-3 and CD-5 than other three sites.	An estimated 79 waterfowl and 10 loon nests displaced by habitat loss, alteration, or disturbance. More displacement from habitat loss and alteration than from disturbance. Would reduce Plan Area nesting by 1% for waterfowl and <1% for loons. More nests affected at CD-3 and CD-5 than other three sites.
SPILLS: Most very small to medium spills would have no to negligible impacts on waterfowl and loons, including yellow-billed loons, or their habitat because these spills are generally confined to the gravel pads and roads. Large to VLVS spills to flowing waters or wetlands and tundra ponds/lakes may affect nesting waterfowl and loons. Spills of oil that reach the Colville River Delta/Nigliq Channel estuarine areas may affect pre-nesting, molting, and staging birds. The impacts may result from direct oiling, ingestion of oiled food, and secondary exposure of eggs and chicks through oiled parents. The impacts are not likely to be detectable at the population level.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except the likelihood of impacts on waterfowl and loons in the Colville River Delta/Nigliq Channel estuarine habitats may be less because the Nigliq Channel crossing is farther upstream than in other alternatives.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects on bird populations on the North Slope. It is expected that the effects on waterfowl and loon populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Increased harvests, especially from subsistence hunting, resulting from increased access to remote areas via new roads, could be a serious cumulative factor. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Birds – Ptarmigan				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
An estimated 3 ptarmigan nests would be displaced by habitat loss or alteration. Most impacts from habitat loss and mortality resulting from collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. Adds 26 miles of roads for potential collisions. Local access to the NPR-A could affect amount of hunting mortality.	An estimated 5 ptarmigan nests displaced by habitat loss or alteration. Most impacts from habitat loss and mortality resulting from collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. Adds 11 miles of roads for potential collisions.	An estimated 5 ptarmigan nests displaced by habitat loss or alteration (C-1 and C-2). Most impacts from habitat loss and mortality resulting from collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. Adds 42 miles of roads for potential collisions. Local access to Colville River Delta and the NPR-A could affect amount of hunting mortality.	For Sub-Alternative D-1, an estimated 9 ptarmigan nests displaced by habitat loss or alteration. For Sub-Alternative D-2, an estimated 3 ptarmigan nests displaced. Most impacts from habitat loss and mortality resulting from collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. These alternatives have no roads.	An estimated 4 ptarmigan nests displaced by habitat loss or alteration. Most impacts from habitat loss and mortality resulting from collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. Adds 27 miles of roads for potential collisions.
SPILLS: Most very small to medium spills would have no to negligible impacts on ptarmigan or their habitat because these spills are generally confined to the gravel pads and roads. Impacts are unlikely unless larger spills flood over or spray on a nest site or on the food resources (insects and vegetation). Because of the low density of ptarmigan, only I or 2 nests or birds are likely to be affected even in a VLVS.				
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope. It is expected that the effects on ptarmigan populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Increased harvests, especially from subsistence hunting, resulting from increased access to remote areas via new roads, could be a serious cumulative factor. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				
Biological: Birds – Raptors and Owls				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Little chance of affecting nesting habitats for ground-nesting species because of low nesting densities. Towers, pipeline, and power lines would provide vantage. Most use of area during late summer when raptors forage in Delta on juvenile birds.	Same as CPAI Alternative A	Same as CPAI Alternative A Additional power lines may benefit raptors.	Same as CPAI Alternative A	Same as Alternative A
SPILLS: Most very small to medium spills would have no to negligible impacts on raptors or owls or their habitat because these spills are generally confined to the gravel pads and roads. No impacts on nests and nesting birds from larger spills unless the spilled material is sprayed over the tundra in areas where these birds tend to nest on elevated sites. There may be some impact on birds if their prey is living but oiled, or if they scavenge oiled dead prey.				
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope. It is expected that the effects on raptor and owl populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Birds – Shorebirds				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
An estimated 346 shorebird nests displaced by habitat loss or alteration. More nests affected at CD-6 and CD-3 than for other three sites. Would reduce Plan Area nesting by <1% for shorebirds.	An estimated 232 shorebird nests displaced by habitat loss or alteration. More potential nests affected at CD-3 than for other four sites. Would reduce Plan Area nesting by <1% for shorebirds.	An estimated 525 (C-1) or 506 (C-2) shorebird nests displaced by habitat loss or alteration. More potential nests affected at CD-3 than for other four sites. Would reduce Plan Area nesting by 1% for shorebirds.	For Sub-Alternative D-1, an estimated 219 shorebird nests displaced by habitat loss or alteration. For Sub-Alternative D-2, an estimated 68 shorebird nests displaced by habitat loss or alteration. More nests affected at CD-3 and CD-4 than for other three sites. Would reduce Plan Area nesting by <1% (both D-1 and D-2).	An estimated 360 shorebird nests displaced by habitat loss or alteration. More nests affected at CD-6 and CD-3 than for other three sites. Would reduce Plan Area nesting by <1% for shorebirds.
SPILLS: Most very small to medium spills would have no to negligible impacts on shorebirds or their habitat because these spills are generally confined to the gravel pads and roads. Larger spills that are released to flowing water bodies or to flooded tundra and/or are sprayed into the atmosphere upwind of shorebird nesting habitat may affect local concentrations of nesting shorebirds. Large to VLVS spills to the rivers that transport the oil to the Colville River Delta/Nigliq Channel and Harrison Bay intertidal areas may affect staging shorebirds directly or their prey resources, resulting in potential local decreases in population size for the year.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that the likelihood of oil reaching the shorebirds' intertidal staging or tundra nesting habitat is somewhat lower because the Nigliq Channel crossing is farther upstream than in the other alternatives.	**SPILLS:** Same as Alternative A, expect that a VLVS may take longer to clean up if it occurs when there is no ice road access, thus increasing the time that spilled oil may affect birds.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope. It is expected that the effects on shorebird populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Birds – Seabirds (Gulls, Jaegers, and Terns)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
An estimated 3 seabird nests displaced by habitat loss, alteration, or disturbance. More displacement resulting from habitat loss and alteration than from disturbance. Would reduce Plan Area nesting by 1% for seabirds.	An estimated 11 seabird nests displaced by habitat loss, alteration, or disturbance. More displacement resulting from disturbance than than habitat loss and alteration. Would reduce Plan Area nesting by 1% for seabirds.	An estimated 14 (C-1) or 15 (C-2) seabird nests displaced by habitat loss, alteration, or disturbance. More displacement resulting from habitat loss and alteration than from disturbance. Would reduce Plan Area nesting by 1% for seabirds.	For Sub-Alternative D-1, an estimated 14 seabird nests displaced by habitat loss, alteration, or disturbance. For Sub-Alternative D-2, an estimated 5 seabird nests displaced by habitat loss, alteration, or disturbance. Would reduce Plan Area nesting by 1% (D-1) or <1% (D-2). More displacement resulting from disturbance (70%) than from habitat loss and alteration.	An estimated 13 seabird nests displaced by habitat loss, alteration, or disturbance. More displacement resulting from habitat loss and alteration than from disturbance. Would reduce Plan Area nesting by 1% for seabirds.
SPILLS: Most very small to medium spills would have no to negligible impacts on seabirds or their habitat because these spills are generally confined to the gravel pads and roads. Large to VLVS to flowing waters, especially at flood stages, may affect wetland and tundra ponds/lakes used by nesting seabirds and waterfowl. Large and VLVS spills, mostly from pipelines to the major rivers may reach the Colville River Delta/Nigliq Channel estuarine habitats and Harrison Bay to potentially affect the habitat, prey resources, and/or the seabirds directly. The impacts are not likely to have local or regional population-level impacts.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that the likelihood of oil reaching the seabirds' habitat is somewhat lower because the Nigliq Channel crossing is farther upstream than in the other alternatives.	**SPILLS:** Same as Alternative A, expect that a VLVS may take longer to clean up if it occurs when there is no ice road access, thus increasing the time that spilled oil may affect birds.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope. It is expected that the effects on seabird populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Increased harvests, especially from subsistence hunting, resulting from increased access to remote areas via new roads, could be a serious cumulative factor. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Birds – Passerines				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
An estimated 206 passerine nests displaced by habitat loss or alteration. More nests affected at CD-6 than for other four sites. Would reduce Plan Area nesting by <1% for passerines.	An estimated 132 passerine nests displaced by habitat loss or alteration. More nests affected at CD-3 than at other four sites. Would reduce Plan Area nesting by <1% for passerines.	An estimated 305 (C-1) or 298 (C-2) passerine nests displaced by habitat loss or alteration. More potential nests affected at CD-3 and CD-6 than at other three sites. Would reduce Plan Area nesting by 1% (C-1 and C-2).	For Sub-Alternative D-1, an estimated 121 passerine nests displaced by habitat loss or alteration. For Sub-Alternative D-2, an estimated 38 passerine nests displaced by habitat loss or alteration. More potential nests affected at CD-3 and CD-4 than at other three sites. Would reduce Plan Area nesting by <1% (D-1 and D-2).	An estimated 215 passerine nests displaced by habitat loss or alteration. More nests affected at CD-6 than at other four sites. Would reduce Plan Area nesting by <1% for passerines.
SPILLS: Impacts are unlikely unless the spill floods over or sprays on a nest site or on the food resources, mostly insects and vegetation. Because of the relatively high density of passerines, especially lapland longspur, tens to hundreds of nests or birds may be affected, especially in a VLVS.				
CUMULATIVE IMPACTS: The additive impacts of past, present (including ASDP), and reasonably foreseeable future activities are not expected to cause pervasive cumulative impacts, including impacts from synergistic effects to bird populations on the North Slope. It is expected that the effects on passerine populations of facilities for future projects, though additive, would be substantially less than those of past projects because of the smaller areas involved. Disturbance in conjunction with predators attracted to development areas such as common ravens and glaucous gulls may exacerbate reduced productivity as described by the NRC (2003).				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Terrestrial Mammals				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Alternative A would involve the changing of habitats used by terrestrial mammals in several ways. Approximately 241 acres of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 65 acres excavated to obtain gravel. Noise and human activity associated with construction, industry vehicle traffic, aircraft traffic, and activity on facilities and pipeline routes during operations may disturb caribou, moose, muskoxen, and grizzly bears in the vicinity of infrastructure. This may cause animals to move away from infrastructure (i.e., displacement). Pipelines will be elevated 5 feet and separated from roads by >300 feet. This should allow passage of caribou and other terrestrial mammals. The road/pipeline combination may delay or deflect caribou crossing, especially if traffic levels are >15 vehicles/hour. If local hunting occurs on the roads, crossing may be impeded because of increased avoidance of human activity. Impacts as described are relevant to individual animals. Hunting by local residents on the oilfield roads will increase the mortality of caribou and possibly moose, muskoxen, and grizzly bears. All of the impacts described above are relevant to individual animals. It is unlikely these impacts will have a negative impact at the population level.	Approximately 204 acres of undeveloped lands that provide habitat for terrestrial mammals will be covered with gravel fill and 37 acres excavated to obtain gravel. Disturbance, obstruction of movements, and mortality impacts will be of less magnitude than in Alternative A because of the smaller amount of road/pipeline combinations and associated lower levels of vehicle traffic. Disturbance and hunting mortality from local resident access will not occur since roads would be restricted to industry use.	Approximately 323 acres (C-1) and 324 acres (C-2) of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 86 acres excavated to obtain gravel (C-1 and C-2). Disturbance, obstruction of movements, and mortality impacts would be of greater magnitude than in Alternative A because of the larger amount of road/pipeline combinations and associated higher levels of vehicle traffic. Pipelines elevated to 7 feet would mitigate obstruction of movements. Disturbance and hunting mortality from local resident and other public access would occur. The potential impacts of hunting mortality described for Alternative A would occur to a greater extent in Alternative C because of the unrestricted public access.	Approximately 221 acres (D-1) and 71 acres (D-2) of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 51 acres (D-1) and 22 acres (D-2) excavated to obtain gravel. Disturbance, obstruction of movements, and mortality impacts would be of lesser magnitude than Alternative A because of the lack of road/pipeline combinations, associated vehicle traffic, and elevation of pipelines to 7 feet. Disturbance and obstruction of movement at airstrips or helipads would occur. Disturbance and hunting mortality from local resident access via roads would not occur because of the absence of roads.	Approximately 251 acres of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 65 acres excavated to obtain gravel. Disturbance, obstruction of movements, and mortality impacts would be comparable to Alternative A. Pipelines elevated to 7 feet would mitigate obstruction of movements.
SPILLS: Most very small to medium spills would have no to negligible impacts to terrestrial mammals or their habitat because these spills are generally confined to the gravel pads and roads. Large and VLVS spills, mostly from pipelines and especially those that spray into the atmosphere and/or occur when the tundra is flooded may affect the habitat, prey resources, and/or the terrestrial mammals directly. The impacts may affect the local populations for a few months to a few years, depending upon the distribution and abundance of the species and its reproductive cycles. There would not likely be a detectable local or regional population level impact. The larger mammals (e.g., bears, caribou, muskoxen, wolves, and foxes would likely leave the affected area to avoid the spilled oil and the presence of the response crews and equipment, thus reducing the potential levels of impacts to these animals.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Terrestrial Mammals (cont'd)				
CUMULATIVE IMPACTS: Past, present, and reasonably foreseeable future activities, including the ASDP proposed development, are not expected to affect the viability of mammal populations. However, some populations may be reduced in number to such an extent as to have an adverse impact on subsistence users. Cumulatively, non-oil and gas activities and spills would have little impact on terrestrial mammals. Cumulative effects on caribou calving distribution are likely to be long term over the life of the oilfields, but would occur locally within 3 to 4 kilometers (1.8 to 2.5 miles) of roads or other facilities situated within calving areas. Cumulative impacts that would obstruct wildlife movements would be minor (USACE 1999), and synergistic effects at the herd level would not be anticipated. Cumulative oil development on the North Slope would likely result in increased abundance of arctic foxes near development areas. The cumulative effects on muskoxen, moose, wolves, wolverines, and small mammals from oil and gas development on the North Slope would be local and short term, within 1 to 2 miles of the exploration or development facilities, with no adverse effects on populations.				
Biological: Marine Mammals				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Construction of, and traffic on, a bridge over the Nigliq Channel and other rivers could cause some disturbance of spotted seals and beluga whales. Aircraft traffic in and out of the Plan Area could also disturb some marine mammals. Construction and operational noise in winter could disturb some denning polar bears. Hunting by local residents on the oilfield roads could increase the mortality of polar bears that are onshore. All of the impacts described above are relevant to individual animals. It is unlikely these impacts would have a negative impact at the population level.	Limited roads, including no road over the Nigliq Channel, suggests there would be less disturbance from vehicles and more disturbance from aircraft traffic than in Alternative A. There would not be access by local residents, so increased hunting harvest would not occur.	Impacts to marine mammals under Alternative C (Sub-Alternatives C-1 and C-2) would be similar to those in Alternative A. The road accompanying the pipeline between CD-1 and CD-3 could increase disturbance in that area. The unrestricted access to BLM lands could result in greater polar bear mortality from road kills and defense of life and property kills. The pipeline only bridge over the Nigliq Channel with Sub-Alternative C-2 would reduce potential impacts (disturbance and hunter access) compared to Sub-Alternative C-1. The lack of road connection to CD-1, CD-2, CD-3, and CD-4 with Sub-Alternative C-2 would limit access to the northern Colville River Delta areas compared to Sub-Alternative C-1.	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 could cause disturbance of marine mammals as described for Alternative A.	Construction of, and traffic on, a bridge over the Nigliq Channel and other rivers could cause some disturbance of spotted seals and beluga whales. Aircraft traffic in and out of the Plan Area could also disturb some marine mammals. Construction and operational noise in winter could disturb some denning polar bears. Hunting by local residents on the oilfield roads could increase the mortality of polar bears that are onshore. All of the impacts described above are relevant to individual animals. It is unlikely these impacts would have a negative impact at the population level.
SPILLS: There would be no impact from saltwater spills because the spilled material will be the same as the marine receiving waters. A VLVS of oil may reach the marine environment and expose some ringed and spotted seals or polar bears in Nigliq Channel, Harrison Bay, or the nearshore Beaufort Sea. The impact at the local population level would be minor. There would be little or no impact to populations of beluga whales because they are generally offshore beyond the likely distribution of the spilled oil. A few belugas may be affected if they are in the Colville River Delta or Nigliq Channel during an oil spill.				
CUMULATIVE IMPACTS: Past, present, and reasonably foreseeable future activities, including the ASDP proposed development, are not expected to affect the viability of mammal populations. However, some populations may be reduced in number to such an extent as to have an adverse impact on subsistence users. Cumulatively, non-oil and gas activities and spills would have little impact on terrestrial mammals. Cumulative effects on caribou calving distribution are likely to be long term over the life of the oilfields, but would occur locally within 3 to 4 kilometers (1.8 to 2.5 miles) of roads or other facilities situated within calving areas. Cumulative impacts that would obstruct wildlife movements would be minor (USACE 1999), and synergistic effects at the herd level would not be anticipated. Cumulative oil development on the North Slope would likely result in increased abundance of arctic foxes near development areas. The cumulative effects on muskoxen, moose, wolves, wolverines, and small mammals from oil and gas development on the North Slope would be local and short term, within 1 to 2 miles of the exploration or development facilities, with no adverse effects on populations.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

<table>
<tr><th colspan="5">Biological: Threatened and Endangered Species – Bowhead Whale</th></tr>
<tr><th colspan="5">ALL ACTION ALTERNATIVES</th></tr>
<tr><td colspan="5">Potential impacts would be limited to major spills. Bowhead whales generally do not occur in the nearshore Beaufort Sea, north of the Plan Area. During spring and fall migrations, bowheads are far offshore in the lead system of the Beaufort Sea.</td></tr>
<tr><td colspan="5">SPILLS: There would be no impact on bowhead whale individuals or populations as they are generally offshore beyond the likely distribution of the spilled oil.</td></tr>
<tr><td colspan="5">CUMULATIVE IMPACTS: Past, present, and reasonably foreseeable future oil and gas activities are not expected to cause cumulative impacts to bowhead whale populations. However, cumulative impacts may occur as a result of non-development activities such as approved hunting or loss/injury from encounters with fishing nets and vessels at sea.</td></tr>
<tr><th colspan="5">Biological: Threatened and Endangered Species – Spectacled Elder</th></tr>
<tr><th>ALTERNATIVE A</th><th>ALTERNATIVE B</th><th>ALTERNATIVE C</th><th>ALTERNATIVE D</th><th>ALTERNATIVE F</th></tr>
<tr>
<td>Impacts to spectacled eiders associated with construction and operation of Alternative A include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Additional impacts from lost productivity are not quantified by this analysis.
An estimated 1.7 nests affected by habitat loss, alteration, and disturbance, reducing nesting by 4% for Plan Area spectacled eiders.
Less than 1% of available habitats in the Colville River Delta used by spectacled eiders for nesting (Aquatic Sedge with Deep Polygons and Nonpatterned and Patterned Wet Meadow) would be affected by gravel fill-related activities. Less than 1% of available habitats in the NPR-A used by spectacled eiders for nesting (Deep and Shallow Open Water with Islands, Old Basin Wetland Complex, and Patterned Wet Meadow would be affected. More nests would be affected at CD-3 than at the other four sites. Local road access could affect hunting mortality.</td>
<td>An estimated 1.9 nests affected by habitat loss, alteration, and disturbance, reducing nesting by 4% for Plan Area spectacled eiders.
More displacement resulting from disturbance than from habitat loss and alteration. <0.6% of available habitats in the Colville River Delta used by spectacled eiders would be affected by gravel fill-related activities. < 0.5% of available habitats in the NPR-A used by spectacled eiders would be affected. More nests affected at CD-3 than other four sites.</td>
<td>An estimated 0.9 nests affected by habitat loss, alteration, and disturbance, reducing nesting by 2% for Plan Area spectacled eiders.
More displacement resulting from habitat loss and alteration than from disturbance. <1.5% of available habitats in the Colville River Delta used by spectacled eiders would be affected. <0.5% of available habitats in the NPR-A used by spectacled eiders would be affected. More potential nests affected at CD-3 than other four sites.
Local access could affect amount of hunting mortality.</td>
<td>For Sub-Alternative D-1 an estimated 2 nests would be affected by habitat loss, alteration, and disturbance.
For Sub-Alternative D-2 an estimated 0.7 nests would be affected by habitat loss, alteration, and disturbance.
More displacement from disturbance (70%) than from habitat loss and alteration. <1% of available habitats in the Colville River Delta used by spectacled eiders would be affected. <0.5% of available habitats in the NPR-A used by spectacled eiders would be affected. More potential disturbance at CD-3 than other four sites.
Most displacement from disturbance in the Colville River Delta.</td>
<td>Impacts on spectacled eiders associated with construction and operation of Alternative F include habitat loss, alteration, or enhancement; disturbance and displacement; obstructions to movement; and mortality. Additional impacts of lost productivity are not quantified by this analysis.
An estimated 1.7 nests affected by habitat loss, alteration and disturbance, reducing nesting by 4% for Plan Area spectacled eiders.
More displacement from disturbance (53%) than from habitat loss and alteration. <0.7% of available habitats in the Colville River Delta used by spectacled eiders would be affected by gravel fill-related impacts. <0.6% of available habitats in the NPR-A used by spectacled eiders would be affected. More potential disturbance at CD-3 than other four sites.</td>
</tr>
</table>

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Biological: Threatened and Endangered Species – Spectacled Elder (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
SPILLS: A large to VLVS oil spill, most likely from a pipeline, may affect these birds in the Colville River Delta and Nigliq Channel areas as well as adjacent wetland habitats during their pre-nesting through staging activities. The likely exposure may result from pipeline spills between CD-1 and CD-3 and CD-4 as well as in the Nigliq Channel crossing (bridge or HDD). An oil spill that affects many to most of the nesting birds on the Colville River Delta may result in a detectable decrease in the local population size for a few generations.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that the amount of oil reaching the Colville River Delta habitat may be less from a spill at the Nigliq Channel crossing, which is farther upstream in both Sub-Alternatives C-1 and C-2.	**SPILLS:** Same as Alternative A, expect that a VLVS may take longer to clean up if it occurs when there is no ice road access, thus increasing the time that spilled oil may affect birds.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Some limited cumulative effects are anticipated for spectacled eiders, though these impacts are unlikely to produce significant population effects. The effects on spectacled eiders of various cumulative factors would likely be substantially greater than for any single activity or activities associated with any individual oil and gas lease sale. Disturbance of some individual eiders as a result of both onshore and offshore oil and gas operations would likely be unavoidable over the long term. The effects from typical activities associated with cumulative exploration and development of oil and gas prospects on the North Slope and adjacent marine areas may include small declines in local nesting or loss of small numbers of spectacled eiders, through disturbance effects on survival and productivity, predation pressure enhanced by human activities, and collisions with structures. Increased human access via new roads and highways may result in locally severe increases in subsistence hunting pressures. Alternatively, subsistence hunting may decrease if hunters avoid developed areas.				
Biological: Threatened and Endangered Species – Steller's Elder				
ALL ACTION ALTERNATIVES				
Potential impacts to Steller's eider generally are the same as those described for the spectacled eider. The likelihood of impacts occurring to Steller's eider would be very small because they occur very rarely in the Plan Area. There would be a loss of potential Steller's eider habitat from the Plan Area.				
SPILLS: Oil spills are unlikely to affect these birds because they are rare in the area and those periodically present are a small portion of the population. There would be no population-level impacts even if one to a few birds were exposed to an oil spill.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that the amount of oil reaching the Colville River Delta habitat and thus impacts to the eiders may be less from a spill at the Nigliq Channel crossing. which is farther upstream in both C-1 and C-2 than in other alternatives.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Some limited cumulative effects are anticipated for eiders, though these impacts are unlikely to produce significant population effects. The effects on Steller's eiders of various cumulative factors would likely be substantially greater than for any single activity or activities associated with any individual oil and gas lease sale. Disturbance of some individual eiders as a result of both onshore and offshore oil and gas operations would likely be unavoidable over the long term. The effects from typical activities associated with cumulative exploration and development of oil and gas prospects on the North Slope and adjacent marine areas may include small declines in local nesting or potential loss of small numbers of Steller's eiders, through disturbance effects on survival and productivity, predation pressure enhanced by human activities, and collisions with structures. Increased human access via new roads and highways may result in locally severe increases in subsistence hunting pressures. Alternatively, subsistence hunting may decrease if hunters avoid developed areas.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Socio-Cultural				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Potential impacts on subsistence harvest and use could cause stress and change in community social organization in the village of Nuiqsut and to a lesser degree in Barrow, Atqasuk, and Anatuvuk Pass. To the extent that changes in community social organization occur, changes in community health and welfare could also occur. Economic benefits are expected to occur as a result of Kuukpik and other corporate participation in construction and operations contracting. Minimal employment during construction and operation of village residents is expected. No change in the population growth rate is expected.	Same as Alternative A with the exception of a potential for reduced economic benefits.	Same as Alternative A; exceptions are the potential for increased local economic benefits and increased indirect community health and welfare impacts to the extent that they are caused by increased impacts to the subsistence harvest (resulting from connecting Nuiqsut to the project road system).	Same as Alternative A; exceptions are changes in impacts related to subsistence harvest that could result from the general elimination of roads in the Plan Area.	Same as Alternative A; exceptions are lesser negative effects on subsistence harvest resulting from pipelines elevated to 7 feet and removal of road segments from Fish Creek Buffer Area.
SPILLS: Most very small to medium spills would have no to negligible impacts on socio-cultural characteristics of the North Slope communities. Large to VLVSs may cause social and cultural impacts if there is a substantial influx of people (mostly non-Alaska Natives), resources, and services from non-North Slope locations to conduct spill containment and cleanup operations. Subsistence harvest activities may be disrupted by the response as well as the spill itself, depending upon where and when it occurs relative to the timing and location of subsistence hunting and fishing activities (see Subsistence Harvest below).				
CUMULATIVE IMPACTS: Overall, both additive and synergistic impacts to the socio-cultural characteristics of North Slope communities associated with the ASDP and past, present, and reasonably foreseeable future development may occur. Changes to community structure, cultural values, and community health and welfare predate oil and gas development on the North Slope; however, change in community socio-cultural characteristics has continued during the period of oil development. As the area affected by oil development in the future increases, especially in proximity to local communities, cumulative impacts are likely to increase. For example, Nuiqsut, Barrow, Atqasuk, and Anaktuvuk Pass are currently dependent on subsistence caribou harvest from the CAH and TLH; additional future development may have additive impacts on subsistence harvest from these herds, leading to synergistic impacts on subsistence-harvest patterns (including disruption of community activities and traditional practices for harvesting, sharing, and processing subsistence resources), social bonds, and cultural values.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Regional Economy				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Would provide an annual incremental increase in federal, state, and local tax revenues. This increase would be on the order of 2% to 4% (of 2001 revenues) for the NSB. It would be less than 1% of state tax revenues. NSB and villages would receive benefits from increased economic activity in the region, increased opportunity for grants under the NPR-A Impact Mitigation Program, and from direct employment of local residents. Could be adverse economic impacts on subsistence harvesting activities resulting from increased travel costs and increased travel times.	Same as Alternative A except that potential reduction of between 10 and 30 percent in production from CD-6 caused by moving the production pad outside the 3-mile Fish Creek Buffer Zone. Results in an overall reduction of 4.2% of the total production from CD-3 through CD-7. The economic benefits from Alternative B would be reduced by this factor.	Same as Alternative A, though a road connection to Nuiqsut could facilitate greater employment for local residents.	Same as Alternative A	Same as Alternative A.
SPILLS: Most very small to medium spills would have no to negligible impacts on the local or regional economy. A large to VLVS may generate enough additional temporary employment for cleanup activities to temporarily affect the local and regional Alaska Native economy. The influx of people and demand for services may create a temporary economic strain on the local service providers. An oil spill, likely from the pipeline from CD-3 to CD-1, may affect the Helmericks' commercial fishing operations in the Colville River Delta.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A, except that the amount of oil reaching the Colville River Delta habitat and thus impacts to the eiders may be less from a spill at the Nigliq Channel crossing, which is farther upstream in both C-1 and C-2 than in other alternatives. This may result in less potential impact to the Helmericks' commercial fishing operations, most of which are not near the Nigliq Channel.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Even with the ASDP and other past, present, and reasonably foreseeable activities considered, the oil industry in and near Prudhoe Bay is anticipated to decline over time. This decline would encompass oil exploration, development, and production and its associated direct employment. Associated indirect employment in Southcentral Alaska, Fairbanks, and the NSB and revenues to the federal, state, and NSB governments are also anticipated to decline. The regional economic effects generally would decline corresponding to the decline in production. The ASDP would generate the following average annual revenues for the period 2007 to 2020: $7 million to the NSB; $40 million to the state; and $17 million to the federal government. In total, the cumulative case would generate the following additive average annual revenues: $7 million to the NSB; $66 million to the state; $114 million to the federal government.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Subsistence Harvest and Uses				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Construction and operation of facilities and roads would affect availability of key subsistence resources by deflection or displacement of these resources from customary harvest locations. Access to subsistence resources would be affected by the perception of regulatory barriers, the reluctance to hunt and shoot firearms near industrial facilities, including pipelines, raised road berms, pipelines with snowdrifts in winter that hinders passage, and a preference for animals not habituated to industrial development. Indirect effects would include hunters who go to another area that would result in increased effort, cost, and risks associated with traveling farther. The location of a production facility, pads, roads, and pipelines within the area of Fish and Judy creeks would result in infrastructure close to important subsistence use areas for Nuiqsut.	Moving CD-6 and associated roads outside the 3-mile Fish Creek Buffer Zone and elimination of the Nigliq Channel road bridge would decrease potential impacts to subsistence uses in the area; other impacts would be the same as those in Alternative A.	In addition to impacts of Alternative A, roads and pipelines would be located closer to Nuiqsut. The road connecting Nuiqsut to the development area would provide increased vehicle access to subsistence resources, resulting in increased competition for subsistence resources if more hunters are focused to the roads. At the same time, vehicular traffic on the roads would result in local deflection/disturbance of terrestrial mammals in the vicinity of the roads, and thus reduce availability of subsistence resources. Unrestricted road access to BLM lands would eventually provide increased access to people who do not live in the area and may increase competition for resources.	Similar impact to Alternative A with the exception of less year-round road traffic to affect resource availability and increased air traffic and ice road traffic that could deflect or divert subsistence resources in high traffic areas. Seven-foot pipeline clearance would be less restrictive to movement by subsistence users.	Moving road segments outside the 3-mile Fish Creek Buffer Zone would decrease potential impacts to subsistence uses in the area. A pipeline clearance of 7 feet would be less restrictive to movement by subsistence users. Other impacts would be similar to Alternative A.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Subsistence Harvest and Uses (cont'd)				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
SPILLS: Most oil spills are very small to medium, confined to pads and roads, and would not affect subsistence resources or the harvest and use of these resources. Large to VLVS spills that reach the tundra and/or water bodies may affect subsistence resources (e.g., certain species of plants, fish, birds, and mammals). The impacts to the resources themselves are generally limited to the local area of the spill and would not have detectable regional population-level effects. However, subsistence harvest and use of these resources may be affected over a larger area and for several years. The Alaska Natives' traditional knowledge may guide their harvests and uses more strongly than the technical information from government agencies that the resources are safe for people to use. The impact to local and regional subsistence users may vary depending upon the spilled material, resources affected, and alternative areas or types of resources.	**SPILLS:** Same as Alternative A, except that the access to subsistence resources may be somewhat limited compared to Alternative A because there are no roads from CD-1 to CD-6.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative B, except that there are no gravel roads for the subsistence users to use for access to use areas.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Development already has caused increased regulation of subsistence hunting, reduced access to hunting and fishing areas, altered habitat, and intensified competition from non-subsistence hunters for fish and wildlife (Haynes and Pedersen 1989). Additive impacts that could affect subsistence resources include potential oil spills, seismic noise, road and air traffic disturbance, and disturbance from construction activities associated with ice roads, production facilities, pipelines, gravel mining, and supply efforts. Based on potential cumulative, long-term displacement and/or functional loss, habitat available for caribou may be reduced or unavailable or undesirable for use. Changes in population distribution because of the presence of oilfield facilities or activities may affect availability for subsistence harvest in traditional subsistence use areas of the communities of Barrow, Atqasuk, Nuiqsut, and Anaktuvuk Pass. Overall, impacts to subsistence harvest and use may have synergistic impacts with community health, welfare, and social structure. To the extent that subsistence hunting success is reduced in traditional use areas near communities because of the presence of oilfield facilities and activities, subsistence hunters will need to travel to more distant areas to harvest sufficient resources to meet community needs. Greater reliance on more distant subsistence use areas will result in greater time spent away from the community for some household members and competition for resources with members of other communities. These changes in subsistence patterns may result in stress within households, family groups, and the community.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Environmental Justice				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Disproportionate impacts to minority populations include potential direct and indirect impacts related to subsistence harvest and use. Other impacts identified as potentially disproportionate include spill impacts and potential water quality, air quality, and aircraft noise impacts.	Same as Alternative A	Same as Alternative A, except relaxation of access restrictions that would increase public access to BLM lands and may increase competition for subsistence resources.	Same as Alternative A, except reduction in the use of roads between facilities incorporated in Alternative D could reduce 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.	Same as Alternative A.
SPILLS: Spills could affect water quality and wildlife, resulting in negative impacts to subsistence harvest for Environmental Justice populations.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Environmental Justice effects on Inupiat Natives could occur because of their reliance on subsistence foods, and cumulative effects may affect subsistence resources and harvest practices. Potential effects would focus on the Inupiat communities of Nuiqsut, Barrow, Atqasuk, and Anaktuvuk Pass. Development as contemplated in the cumulative case could cause long-term displacement and/or functional loss of habitat to CAH, TLH, and WAH caribou over the life of proposed development. This could result in a significant impact on access to, and perhaps the availability of, this important subsistence resource. Such impacts would be considered disproportionately high adverse effects on Alaskan Natives. Access to subsistence-hunting areas and subsistence resources and the use of subsistence resources could change if oil development were to reduce the availability of resources or alter their distribution patterns. Any potential effects on subsistence resources and subsistence harvests would be expected to be mitigated, though not eliminated.				

Social Systems: Cultural Resources				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Cultural resources are situated in the vicinity of the production pads, the road/pipeline ROW, and the ASRC Mine Site. Construction of project facilities or pads within 1/4 mile of a cultural resource could result in direct effects including damage to or destruction of the resource The integrity of subsurface, surface, and aboveground cultural resources could be affected by construction activities. One cultural resource (TLUIHAR-082) is less than 1/4 mile from the CD-4 production pad, and one cultural resource (HAR-055) is less than 1/4 mile from the ASRC Mine Site.	Same as Alternative A, though less risk of impacts to unknown resources because less gravel will be excavated	Same as Alternative A, though more risk of impacts on unknown resources because more gravel will be excavated	Same as Alternative A, except the absence of roads would eliminate potential impacts on cultural resources associated with road construction, and there would be less risk of impacts on unknown resources because less gravel will be excavated.	Same as Alternative A.
SPILLS: Most oil spills are very small to medium, confined to pads and roads, and would not affect cultural resources. Most cultural resources have been identified before development of the CPAI Development Plan and the location of physical facilities have been planned to avoid impacts to the cultural resources. Thus, most large to VLVSs would not impact known cultural resources. A large to VLVS spill, especially of oil, that is sprayed into the atmosphere and carried downwind or that occurs during a flooding event may be dispersed over the tundra and/or water bodies to affect cultural resources some distance from the spill site. These spills may affect the cultural resource(s) for a few months to a few years, depending upon the persistence of the spilled material and the type of resource exposed.				

Table 2.7-1 Comparison of Impacts among Action Alternatives (cont'd)

Social Systems: Cultural Resources (cont'd)				
CUMULATIVE IMPACTS: The cumulative effects of the ASDP and other reasonably foreseeable future development, which include disturbance impacts from oil and gas exploration and the Colville River Road, would be expected to affect cultural resources to some degree. These impacts would be additive. Because of the nature of cultural deposits (that is, their generally unpredictable location and context—on surface or near surface), the magnitude of the impact is difficult to estimate. However, it is expected that if current procedures for survey and inventory before exploration and development activities were to be continued, the effect on the resource would be minimal. Before any ground-disturbing activity, industry would be required to evaluate and assess possible cultural resources in the immediate areas of the proposed disturbances.				
Social Systems: Land Use and Coastal Management				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Would result in nearly tripling the total number of acres developed for oil production within the ASDP Area. Construction of CD-6 and associated roads and pipeline requires wavier of BLM stipulation for development within Fish Creek Buffer Zone. Rezoning of land under the NSB LMRs from Conservation to Resource Development would be required.	Would result in an approximate doubling of the total number of acres developed for oil production within the ASDP Area. All facilities and construction will occur outside the Fish Creek Buffer Zone. Rezoning of land under the NSB LMRs from Conservation to Resource Development would be required.	Same as Alternative A, except that it would nearly quadruple the total number of acres developed for oil production within the ASDP Area.	The increase in the total number of acres developed would be less than that of other alternatives because of the absence of roads. Construction of CD-6 and associated roads and pipeline requires wavier of BLM stipulation for development within Fish Creek Buffer Zone. Rezoning of land under the NSB LMRs from Conservation to Resource Development would be required.	The total number of acres developed would be nearly the same as Alternative A.
SPILLS: Most oil spills are very small to medium, confined to pads and roads, and would not affect land uses or coastal zone management policies and regulations. Large to VLVSs may affect the habitats and resources as well as land uses of tundra and water bodies exposed to the spilled material, especially oil. Most of the land use impacts would be localized to the directly exposed area and would last for a few months to a few years, depending upon the persistence of the spilled material. There would not be long term, really extensive impacts to land uses or coastal zone management policies.				
CUMULATIVE IMPACTS: Additive cumulative impacts on land use, habitats, and subsistence on the North Slope would be expected to occur from current and future development and operation of energy, transportation, and utility facilities. The continued development of previously undisturbed areas on the North Slope will change the character of land use, cause increases in noise and disturbance, and potentially adversely affect habitats and subsistence. Most of the cumulative impacts from future development are likely to be localized to the widely dispersed facilities. Long-term impacts on land use and coastal resources are expected to be decreased effectively through stipulations, existing regulations and management practices, coordination, and through future permitting processes including federal, state, and local processes and regulations.				
Social Systems: Recreation				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
There would be no more than local adverse effects to the lightly used recreational resources of the plan area. Recreational opportunities in the Plan Area would remain consistent with the BLM's SPM classification.	Same as Alternative A	Same as Alternative A, though it may increase recreational opportunities for local residents.	Same as Alternative A	Same as Alternative A.
SPILLS: Most oil spills are very small to small, confined to pads and roads, and would not be noticed by people other than industry and local residents. The impacts of these spills on recreational activities would be negligible. Large to VLVS oil spills, especially those that reach tundra or flowing and/or large water bodies, may be visible from roads, elevated areas, or the air. There may be a limited impact on the few recreational users in the spill area, though ground access to these areas is likely to be limited by the response crews for safety reasons.				
CUMULATIVE IMPACTS: Short-term impacts, such as green trails and disturbance from noise and other activities, would not accumulate. Impacts from long-term or permanent facilities such as roads, pipelines, and gravel pads would accumulate and would result in the long-term loss of solitude, quietude, naturalness, or primitive/unconfined recreation, and wilderness-type values. These impacts could be locally adverse to recreational experiences.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Visual				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
Construction and operation would result in adverse effects on visual resources. Facilities and structures associated with operation would introduce contrast to the natural landscape. The presence of drill rigs, pipelines communication towers, and aerial power lines would be the most noticeable effect of construction. Other activities such as pad and road construction would have negligible impacts because the construction activities would occur in winter when viewer sensitivity is not an issue.	High contrasts, but slightly less than Alternative A because of buried power lines, removing need for power poles, and because facilities associated with CD-6 would be moved away from Fish Creek.	High contrasts would be greater than Alternative A because of extensive use of aerial power lines. Additional contrasts would occur from vehicular traffic and fugitive dust along the road that would connect to Nuiqsut.	High contrasts the same as Alternative A.	High contrasts, but slightly less than Alternative A as a result of removing the need for power poles between CD-6 and CD-7, adoption of lighting restrictions, and because additional road segments would be moved away from Fish Creek.
SPILLS: Most oil spills are very small to small, confined to pads and roads, and not visible to people other than industry and local residents. The visual impacts of these spills would be negligible. Large to VLVS oil spills, especially those that reach tundra or flowing and/or large water bodies, may be visible from roads, elevated areas, or the air. There may be a limited impact on local residents and the few recreational users in the spill area.	**SPILLS:** Same as Alternative A, except that the number of viewpoints on roads would be reduced by the reduction in roads compared to Alternative A.	**SPILLS:** Same as Alternative A, except that the potential for spills to reach Fish Creek would be reduced by moving most of the pipelines and the roads out of the Fish Creek Buffer Zone. Also, there are even fewer miles of gravel roads then in Alternatives A or B.	**SPILLS:** Same as Alternative A, except that the number of viewpoints on roads would be eliminated by the lack of roads compared to Alternatives A and B.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Short-term impacts such as green trails would not accumulate and would naturally recover. Impacts from long-term or permanent facilities such as roads, pipelines, gravel pads, and pits would accumulate and would result in the long-term loss of scenic quality. Long-term impacts from future development with a possible life span of over 30 years would affect the visual resources for the North Slope. These impacts would be expected to be greatest within a half-mile radius of each developed site. Pipelines could be elevated above ground level. Except during construction and repair of pipelines, there would be no associated on-the-ground activity. Therefore, long-term impacts to visual resources from pipelines would be expected to be minimal beyond approximately a half mile.				

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (CONT'D)

Social Systems: Transportation				
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**	**ALTERNATIVE F**
No adverse effects on public roads or transportation systems. Adds 26 miles of new roads in study area. Use of project roads restricted to industry and local residents. Potential secondary effects on wildlife, subsistence, and recreation from increased access.	No adverse effects on public roads or transportation system. Adds 11 miles of new roads in study area. Project roads would be accessible to industry only. Lesser potential secondary effects on wildlife, subsistence, and recreation from increased access.	No adverse effects on public roads or transportation system. Adds 42 miles of new roads in study area for either Sub-Alternative C-1 or C-2. Unrestricted use of project roads on BLM lands, use by industry and local residents only on state and private lands. Greatest potential secondary effects on wildlife, subsistence, and recreation from increased access.	No adverse effects on public roads or transportation system. Adds 2 miles of new roads (Alternative D-1) in Plan Area for industry use only. Lowest potential secondary effects on wildlife, subsistence, and recreation from increased access.	No adverse effects on public roads or transportation system. Adds 27.5 miles of new roads in Plan Area. Project roads would be accessible to industry, government, and local residents
SPILLS: There would be no impacts from most very small to medium and many large spills because they are confined to the roads or pads. There may be an occasional effect on local residents and industry personnel traveling on the roads if a spill results from a vehicle accident and/or there are oil spill response equipment and support vehicles on the road. A VLVS may result in road closure that affects local residents and/or industry personnel, especially if there is a significant spill response activity mobilized from the roads and pads. The response activities may also use much of the airstrip space.	**SPILLS:** Same as Alternative A, except there are fewer miles of road to be affected. The reduction in amount of road may increase the time it takes to detect a spill, especially a medium to large one, from a pipeline because aerial monitoring may be more difficult, especially in low visibility conditions, than it may be from the road. Also, impacts may be greater in the roadless areas because mobilization of crews to control, contain, and clean up the spills may take longer than if road access was available. .	**SPILLS:** Same as Alternative A, except that mobilization of response crews and equipment from outside the Plan Area for a VLVS may be more rapid in Sub-Alternative C-2 than in any of the other alternatives.	**SPILLS:** Same as Alternative B, except there are almost no roads.	**SPILLS:** Same as Alternative A.
CUMULATIVE IMPACTS: Development of the ASDP along with continued oil and gas development throughout the North Slope will result in substantial increases in both road and air traffic levels throughout the North Slope, particularly on the central oil and gas transportation infrastructure in the Prudhoe Bay area. However, most of the transportation infrastructure on the North Slope is restricted to industry and local resident use and is currently operated at well below capacity. Despite the substantial increase in activity levels, the existing infrastructure, combined with the proposed roads and airstrips serving remote facilities, is expected to be sufficient to accommodate these increased demands for air and overland transportation. Therefore, there are not anticipated to be any adverse cumulative effects on transportation resources on the North Slope.				

2.8 INSPECTION AND MONITORING

Federal, state, and NSB agencies would inspect the construction and operation of any facilities that they permit. The BLM would inspect facilities on the lands it manages to ensure compliance with permit conditions. The other agencies have authority to inspect facilities regardless of land ownership.

The permits issued by the agencies may require specific resource monitoring to ensure that certain environmental protection is being achieved. Monitoring, for example, may measure the impacts of certain oil and gas activities to determine whether they are affecting a specific resource, such as eiders or caribou, in an adverse manner and assist in identifying means to mitigate the impact.

The BLM has asked the Research and Monitoring Team (RMT), formed to comply with the terms of the agency's Northeast National Petroleum Reserve-Alaska IAP/EIS completed in 1998 and currently operating under the sponsorship of the BLM-Alaska's Resource Advisory Committee, to help formulate a monitoring plan for oil and gas development in National Petroleum Reserve-Alaska. The RMT is composed of members with expertise in relevant resource and development issues and representing government (currently BLM, USGS, MMS, USFWS, DOE, State of Alaska, and NSB), academia (currently the University of Alaska Fairbanks), conservation organizations (currently the Audubon Society), industry (currently CPAI), and one member-at-large (currently Richard Glenn of ASRC).

2.9 NEED FOR FURTHER NEPA ANALYSIS

The ASDP EIS is expected to meet the BLM's obligations under NEPA for analysis of development of the five satellite pads and related oil facilities currently proposed by CPAI. The ASDP EIS is undertaken in cooperation with the USACE, USEPA, USCG, and State of Alaska to meet their needs for permitting actions related to the ASDP. If the EIS is deemed adequate for their permitting needs, then no further NEPA analysis would be required for federal permits for development of the applicant's proposed action consistent with the federal agencies' ROD.

Oil development in addition to that authorized in the federal ROD (Northeast National Petroleum Reserve-Alaska IAP/EIS ROD) related to CPAI's proposed action would require additional NEPA analysis to gain federal agency authorization. Development of new pads, pipelines, roads, airstrips, and other facilities would require additional NEPA analysis. Requests to conduct certain operational, maintenance, and repair activities, such as ice road construction or a request to operate a vehicle on the tundra, also would require additional NEPA analysis. Depending on the location and the future proposal's regulatory requirements, the BLM, USACE, USEPA, and/or USCG would conduct the appropriate NEPA analysis. That NEPA analysis could be an EIS or EA. An EA would be prepared for actions that are not anticipated to result in significant impacts. If significant impacts are expected or identified by an EA, the BLM would prepare an EIS. Future NEPA analysis may benefit from the analysis in the ASDP EIS, including the FFD analysis.