SECTION 2.0
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 over the next 20 years within the Alpine Satellite Development Plan (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 each alternative, with details of the applicant's proposed action and the hypothetical Full-Field Development (FFD) scenario. 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. Finally, Section 2.8 provides a description of the need for further analysis under the NEPA.

The proposed action consists of the CPAI Development Plan for five satellite[1] production pads north, south, and west of the existing Alpine Central Processing Facility (APF) that is herein referred to as APF-1 at Colville River Delta (CD-1). In addition, reasonably foreseeable development within the Plan area that could occur in the next 20 years has been evaluated and is termed Full-Field Development. FFD could result in additional production pads, roads, airstrips, pipelines, and processing facilities constructed in the Plan Area if sufficient oil or gas accumulations exist.

Four action alternatives, the Alternative A **(**the applicant's proposed action) and Alternatives B, C, and D, which also fulfill the purpose and need of the proposed action, are evaluated. In addition, Alternative E, the No-Action Alternative, will serve as a benchmark, enabling the public and decision makers to compare the magnitude of environmental effects of the action alternatives.

The alternatives introduced in Table 2.1-1 cover the full range of reasonable development scenarios. The BLM has not yet formulated a preferred alternative. After consideration of environmental, economic, technical, and other factors, including agency and public comment, the BLM will identify a preferred alternative in the Final EIS. This alternative may be any of the five alternatives presented here, or it may be a new alternative combining different elements from the other alternatives.

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[1] In oil and gas terminology, a "satellite" is a smaller hydrocarbon accumulation that cannot be reached from existing facilities through directional drilling and that itself cannot economically support separate processing facilities. Development of a satellite is typically achieved by means of a production pad that flows recovered hydrocarbons by pipeline to another facility for processing. Processing includes the removal of water and gas from the produced oil before transport to the sales oil line.

TABLE 2.1-1 ALTERNATIVES

Alternatives	Themes
A	**Applicant's Proposed Action** This is the CPAI project as proposed; FFD is consistent with CPAI project features.
B	**Conformance with Stipulations** All activities (CPAI proposal and FFD) must be conducted and facilities sited in complete accordance with the ROD for the Northeast National Petroleum Reserve-Alaska (Northeast NPR-A) IAP/EIS development stipulations.
C	**Alternative Access Routes** This alternative includes alternative road routes and bridge locations to those proposed in the CPAI Development Plan and FFD following the same infrastructure suggestions. A road connection to Nuiqsut and higher pipelines is included.
D	**Roadless Development** This alternative has two Sub-Alternatives. Under Sub-Alternative D-1, the production pads and APFs (under the CPAI Development Plan and FFD) would be developed with gravel airstrips. Gravel roads would be limited to those roads necessary for access from the airstrips to the drill sites. Under Sub-Alternative D-2, the APFs would be developed with gravel airstrips and the production pads would be developed with gravel helipads.
E	**No Action** No new oil and gas production or processing facilities would be developed in the Plan Area. Production, operation, and eventual abandonment would occur at the existing facilities (CD-1 and CD-2).

2.2 DEVELOPMENT OF ALTERNATIVES

This section describes how Alternatives A through D were developed.

2.2.1 Overview

Alternatives to CPAI's proposed action (other than the No-Action Alternative) were developed by the BLM by considering public comments at scoping, tribal consultation, and the purpose and need of the proposed action, including options for accomplishing the production objectives of CPAI's proposed five-pad development. These alternatives address specific concerns associated with the individual components of the proposed development. This "component approach" addresses a range of alternatives for individual project elements, such as production pad access by gravel road or gravel airstrip, power lines on power poles or Vertical Support Member (VSM)-mounted cable trays, and specific roadway routing and river crossing locations. These components were combined into complete project 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, while roadless development Alternative D includes other components intended to minimize surface disturbance. This presentation of complete project alternatives is intended to facilitate the analysis and presentation of impacts, but the identification of the environmentally preferable and agency preferred alternatives might involve a combination of components from different alternative development scenarios.

2.2.2 CPAI Development Plan Alternatives

Alternatives to the CPAI proposed action were developed based on scoping comments received from the public and from federal, state, and local government agencies. Most comments focused on specific options for different project design components (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. In addition, some potential design components were identified as potential mitigation measures but were not considered as themes for alternatives.

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 project (CPAI's five-pad development) and to FFD. This produced the set of alternatives introduced in Section 2.1 and described in more detail in the following text.

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

Five production pads, CD-3 through CD-7, would be built, and produced fluids would be transported by pipeline for processing at the APF. The five proposed pad locations correlate with former CPAI exploratory well locations, as indicated in Table 2.2.2-1. 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. A bridge across the Nigliq Channel near CD-2 would accommodate road traffic and the pipelines. CD-6 and its access road and pipelines would be within a 3-mile setback from Fish Creek, in which the BLM's ROD for the Northeast NPR-A IAP/EIS (BLM and MMS 1998b) (Stipulation 39[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 within the setback. Additional exceptions will be required to locate oil infrastructure within 500 feet of some water bodies (Stipulation 41). In addition, if the BLM adopts this alternative, it will, to the extent necessary, modify the Northeast NPR-A IAP/EIS (Stipulation 48) to allow roads connecting to a road system outside the NPR-A. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 5 feet above the tundra. Power lines in general would be supported by cable trays placed on the pipeline VSMs, cable trays would not hang below the pipelines. The power line from CD-6 to CD-7 would be suspended from power poles. Industry and local residents would use the gravel roads.

TABLE 2.2.2-1 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 formation 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 formations 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 complete accordance with Northeast NPR-A IAP/EIS development stipulations. 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 facilities. Airstrips would be required at CD-3, CD-5, and CD-6. Traffic on gravel roads would be open to industry and closed to local residents. The bridge crossing the Nigliq Channel near CD-2 would be for pipelines only. Power lines would be buried in roads or at the toe of the slope of road, everywhere there is a road. Where there are no roads, power lines would be buried in tundra adjacent to the pipelines. Power lines 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.

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. Gravel roads would connect all pad locations with existing Alpine Facilities CD-1 or CD-2, and a spur road would be constructed to Nuiqsut. All pad locations would be the same as those in Alternative A, and this alternative would provide for the same exceptions or modifications to the Northeast NPR-A IAP/EIS as for Alternative A. The bridge crossing of the Nigliq Channel would be farther south, near CD-4, and would carry vehicles and the pipelines. Power lines 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. Use of roads on BLM lands would be unrestricted; all other roads would be open to industry and local residents only.

2.2.2.4 Alternative D – Theme: Roadless Development

In Alternative D all gravel roads were eliminated and the production pads would be accessible only by air, ice road, and low-pressure vehicles. 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 1 (D-1), fixed wing aircraft access, and Sub-Alternative 2 (D-2), helicopter access. All pad locations would be the same as those for Alternative A, and this alternative would provide for the same exceptions or modifications to the Northeast NPR-A IAP/EIS as for Alternative A. 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. Power lines 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.

2.2.3 Full-Field Development Plan Concept

The concept of combining alternative development components into discrete development scenarios based on common themes also was applied to the identification of alternatives 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. This involved 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 CPAI Development Plan alternatives were used to construct comparable hypothetical FFD alternatives. The resulting FFD alternatives 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 hypothetical FFD presented here is for analytical purposes only. 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 without further environmental review. 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 CPAI Development Plan. 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 site-specific 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.

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 APFs 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 APFs. 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 APFs 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 their leases of the FFD would not support more than a total of 12 production pads within the Plan Area, 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 Alternatives show a circle around each hypothetical pad location. 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 hypothetical FFD-scenario**.** Figure 2.2.3-1 is a map presenting the locations of the existing Alpine facilities (CD-1 and CD-2), the locations of proposed production and processing pads, and the approximate locations of hypothetical production and processing pads. The FFD production pads would be similar to those described for the CPAI Development Plan, and the processing facilities would be similar to the APF. Other infrastructure in each alternative—roads, pipelines, power lines, etc.—is anticipated to be similar to that described for the CPAI Development Plan. Each FFD production pad 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 hypothetical processing facilities would connect to the APF 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.

This EIS focuses on production of oil due to the current lack of market for gas sales in the near future. However, production of gas will occur as part of oil production. Gas separation and handling equipment employed for the scenarios analyzed will be nearly identical to that for sales production of gas. Pipeline routes, pad locations, and most other infrastructure will be identical to that needed for oil production. It is anticipated that any additional equipment needs will fit within the footprints of any of the proposed pads and that no other stand alone facilities will be needed for gas production. In summary, the impacts of any gas production reasonably foreseeable are within the scope of analysis for the oil production.

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

2.2.3.1 Alternative A – Full-Field Development Plan

For the FFD scenario, two additional APFs (with production facilities) and 22 additional production pads could be constructed in the study area. Gravel roads would connect all pads except four in the lower Colville River Delta (downstream from the existing APF) 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 NPR-A IAP/EIS and ROD would be necessary to allow placement of facilities in certain areas.

Alternative B – Full-Field Development Plan

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 Alternative B. This 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 hypothetical new APFs, 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 APFs, and at production pads not connected by roads to a APF.

Alternative C – Full-Field Development Plan

For the FFD scenario, airstrips would be built at the two hypothetical APFs. Gravel roads would connect all pads, including those in the lower Colville River Delta. Power lines 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 Alternative A would generally apply.

Alternative D – Full-Field Development

As with the Five-Pad Development, Alternative D - FFD 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 CPAI Development Plan under Alternative D would apply. There are two options to this alternative:

D-1 – Airstrips

Alternative D-1 would use fixed wing aircraft to provide access to the proposed production pads and under FFD to hypothetical production pads and APFs. 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 CD would be limited to the winter season.

D-2 – Helipads

Alternative D-2 would use helicopters to provide access to the proposed production pads and under FFD to hypothetical production pads and APFs. 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. Retaining the proposed use of a single drill rig and adopting the winter-only drilling program would result in a significantly extended project development schedule. 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-CD-7) to approximately 100 years. The associated intensity of manpower and resource use (water, gravel, etc.) would be reduced on a per-season 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 (Figure 2.3.1.1-1). They would be constructed with a minimum side slope of 2-feet horizontal to 1-foot vertical (2H:1V). Potential for erosion exists, and necessary protection measures would be designed for the road side slopes. 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 4 feet (Peratrovich, Nottingham & Drage, Inc. [PN&D] 2002b). 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. 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 using a 5-foot average depth to account for topographic variations, and a sideslope of approximately 3H: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 single-lane 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 50-year (Q_{50}) return period floodwater surface elevation plus 3 feet of freeboard (Phillips Alaska, Inc. [PAI] 2002a). Because of the lower land elevations in the lower Colville River Delta and areas in close proximity to Harrison Bay, roads in these areas are assumed to have an average gravel thickness of 10 feet to provide the design freeboard above flood and storm surge levels. In addition to flooding and storm surges, other hydrologic factors will be designed, including scour protection, ice jams, storm surges, 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 power lines	X			
Install module piles	X			
Install bridge foundations	X			
Construct bridges			X	
Work gravel to pad			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. For example, CPAI may build the entire pipeline in one season, but that may not be possible for logistic or other resource restraints.

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 necessary to allow large trucks to conveniently dump their load, turn around, and return to the gravel source.

The volume of gravel required to construct the typical North Slope road cross section (Figure 2.3.1.1-1) is approximately 46,000 cubic yards per mile of roadway. If gravel were hauled using trucks with a

40-cubic-yard capacity (typical for a B-70 haul unit), it would take approximately 1,150 truck round-trips per mile of road built.

Roads would be built 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

Normal field operations would require approximately one round trip via truck from an APF every two or three days. 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 to 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

At the completion of the economic life of the production facilities, unused roadways would be abandoned in place by CPAI. If as part of the overall abandonment plans for the Alpine Field, responsible state, federal, or tribal agencies or bodies require removal of roads, CPAI would develop appropriate plans to do so.

2.3.2 Pipelines

2.3.2.1 Pipeline Design

Pipelines connecting production pads to processing facilities would consist of elevated 14- to 24-inch-diameter three-phase (oil, water, gas) production lines, 8- 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. For each pipeline with a range of diameters stated, the smaller diameter pipelines are proposed to serve single production pads and the larger diameter pipelines are proposed along alignments that serve multiple production pads. 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 required of the chemicals would depend upon 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 hypothetical FFD APFs. 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. These are devices that allow 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 APFs.

New pipelines would be constructed so that the bottom of the pipe elevation is a minimum of 5 feet above the tundra. Two alternatives consider a minimum of 7 feet above the tundra, measured at the VSMs. Actual clearances could be greater than the minimum due to topography and due to 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 (Q_{200}) return period plus 3 feet of freeboard (CPAI 2002Ba). The span between VSMs would be approximately 55 feet. Pipeline design will 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 APF pads, pipelines will parallel the roads. Pipelines generally would be placed 350 to 1,000 feet from the access road, 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 crane-slung dry auger. 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 vary, from 10 inches to 18 inches, and up to 24 inches at small stream crossings. Pier piles supporting pipeline bridges such as those proposed between CD-1 and CD-3 would range from 30 inches to 36 inches in diameter. Pipeline bridge abutment piles would range from 24 inches to 30 inches in diameter. After the VSM is 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 one day. As soon as the pile is frozen in place, construction can continue and loads can be applied.

Horizontal pipe support cross beams, or horizontal support members (HSMs) (Figure 2.3.2.1-1), 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 VSM members. 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 VSMs. 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 is 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 such that erosion does not occur during the discharge. After testing, the water would be discharged in accordance with the General NPDES Permit for Oil and Gas Extraction on the North Slope of the Brooks Range, Permit number AKG 330000, 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 via 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 via an injection well.

2.3.2.3 Pipeline Operation

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

Production Pipeline

The production line is 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 the APF 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 the APF 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, through an existing seawater supply pipeline from Kuparuk to the APF. Under FFD the seawater supply pipeline would be extended from the APF to the hypothetical APFs.. The seawater would be distributed from each APF 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 the APF operations center. Deoxygenation at the existing Oliktok 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 (MI)Pipeline

The MI pipeline would transport MI from the APF or, in the case of FFD, from a hypothetical APF 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.

Lift Gas Pipeline

The lift gas line would carry natural gas from the existing APF, or in the case of FFD, from a hypothetical APF 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 passes through valves into the production tubing. Lift gas is injected to reduce the density of the produced fluids and thus help “lift” them to the surface facilities.

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. Since the ambient temperature is below freezing during most of the year, external corrosion is anticipated to be limited.

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

Abandonment of the proposed pipelines could include demolition and removal of the facilities and restoration of disturbed ground. There is currently no estimate available of the economic life of the Plan Area oil fields, 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.

Abandonment plans would be developed at the time of abandonment in consultation with appropriate local, state, and federal agencies and would be subject to Federal (BLM and/or USACE) and State approval. This approach would allow consideration of new technologies and innovations in abandonment and revegetation techniques, as well as ensuring that the plans reflect the public interests.

The TAPS Right of Way (ROW) Renewal EIS for the trans-Alaska oil pipeline was used as guidance for developing pipeline abandonment measures. Based on TAPS it is assumed that abandonment could include:

- All aboveground pipelines, valves, and supporting structures would be removed to a depth of one foot below the existing grade.
- 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.
- APFs 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 CPAI Development Plan (Figure 2.3.3.1-1). 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 two typical sizes of production pads. The smaller pad (approximately 9.1 acres) would be for a road-connected drilling operation, and the larger pad (approximately 11.6 acres) would be used in the roadless pad scenario. 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). Production pads with no road access back to CD-1 during drilling would require additional pad space for a mud plant. A typical pad with a generic trunk and lateral piping configuration is presented in Figure 2.3.3.1-2. This design is similar to that used for other recent production pad developments such as Tarn and Meltwater, east of NPR-A (CPAI 2003a). The existing APF CD-2 production pad presented in Figure 2.3.3.1-3. 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 minimum production pad thickness would be 5 feet to maintain a stable thermal regime (see 2.3.1.1, Road Design, for discussion on thermal stability). Production and processing facility pads would use a 5-foot minimum thickness, compared to roads and airstrips that would have a 4-foot minimum thickness. The extra pad thickness provides additional insulation to offset heat generation associated with the increased intensity of activity at production and process pads. 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 cubic yards. Side slopes would be at least 2H:1V. Potential for erosion would be evaluated on a pad specific basis, and if necessary side slope protective measures would be designed. Gravel quantity estimates in this section are based on a 6-foot pad thickness with side slopes that are approximately 3H:1V.

The existing production pads have been designed to accommodate a 200-year (Q_{200}) return period flood event water surface elevation plus 1 foot of freeboard (PAI 2002a). Conceptual design for the proposed and hypothetical pads 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 of 200 feet). Based upon the elevation of the existing CD-1 pad, and elevations at the location of proposed CD-3 and hypothetical production pads north of CD-1 and CD-2, an average pad thickness of 14 feet was used to estimate gravel quantities and acres of cover at these locations (Production Pads CD-3, CD-12, CD-14, CD-19, CD-20, CD-21 and CD-29).

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. All permanent towers would be triangular self-supporting towers with 9-foot-wide bases. The temporary tower would be pile supported and guyed. 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 CD-18, CD-19, CD-20, and CD-22; and 200-foot towers at CD-17, CD-21, CD-26, and CD-29.
- Spill response equipment container
- Temporary tanks, in secondary containment, to support drilling operations:
  - Two 16,800-gallon (400-barrel [bbl]) brine
  - One 8,400-gallon (200-bbl) cuttings and mud
  - A drill rig diesel fuel tank built-in as part of the drill rig structure
- 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 tank to facilitate well work
  - Well testing equipment

- The storage tanks for a "non-roaded" production pad would include temporary tanks, in secondary containment, to support drilling operations:
  - Two 16,800-gallon (400-bbl) brine
  - Two 25,200 gallon (600-bbl) brine
  - One 8,400-gallon (200-bbl) cuttings and mud
  - One 25,200-gallon (600-bbl) fresh water
  - A drill rig diesel fuel tank built-in as part of the drill rig structure

- 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:
  - 5 X 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 (beutonite 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) capacity diesel fuel tank
    - One 4,200-gallon (100-bbl) capacity 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 tank 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 for trucks to turn around and would enable the placing and compacting of successive lifts to proceed efficiently until the pad is 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 is 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. This is 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 the APF from Kuparuk. Construction crews for CPAI's five proposed production pads would be housed at the APF or at Nuiqsut. In FFD, construction crews might also be housed at a new APF. Estimated North Slope manpower required for the proposed project during the construction phase is provided in Table 2.3.3-1. This 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 CPAI Development Plan 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	60
Winter 2005/2006	550	75
Summer 2006	300	60
Winter 2006/2007	400	75
Summer 2007	100	60

TABLE 2.3.3-1 CONSTRUCTION AND DRILLING MANPOWER REQUIREMENTS (cont'd)

Time Period	Construction Craft and Staff Personnel	Drilling Personnel
Winter 2007/2008	350	75
Summer 2008	250	60
Winter 2008/2009	250	75
Summer 2009	10	60
Winter 2009/2010	100	75
Summer 2010	200	60
Winter 2010/11	200	75

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 CPAI Development Plan. 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 the APF to the production pads by tank truck on gravel or ice roads, or to non-roaded 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 windwalls and arctic winterization. The enclosure also retains heat to protect the mud pumps and associated engines, mud mixing and cleaning equipment and the 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 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 permitted lakes.

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 well at the APF or other North Slope operating units or at a new Class II disposal well at one of the production pads; and reapplication of washed/tested gravels onto production pad and/or road surfaces. Associated regulatory guidance is described in Section 2.3.11.6. 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).

Estimated North Slope manpower required for the proposed project during the drilling phase is provided in Table 2.3.3-1. This 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 for the different project 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 of the production pads because operations personnel would be based at APFs. Approximately 100 gallons per-day-per-person of wastewater would be generated during production operations, resulting in an additional 1,000 to 1,500 gallons per day 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 gallons per day of additional potable water would be necessary. The additional wastewater and fresh water would be generated at and disposed through the APF, or for FFD through the APF and the new APFs.

Operations personnel would visit production pads as dictated by the activity level or spill prevention requirements. Manpower requirements for operations at each of CPAI's five proposed production pads are presented in Table 2.3.3-2. Personnel would travel via gravel roads, making up to two round trips per day (one per 12-hour shift) to each production pads. 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 once every 3 days (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 CPAI Development Plan alternatives except for roadless pads where 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 dependant upon 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 shelters

Roadless sites would have remote freeze protection of surface piping and well bores, remote monitoring of well annulus, and more extensive use of visual, infrared, gas detection, or camera surveillance than roaded sites.

TABLE 2.3.3-2 OPERATIONS MANPOWER REQUIREMENTS

Field Personnel	CD-3	CD-4	CD-6	CD-5	CD-7
Estimated Startup Date	June 2006	Oct. 2006	Nov. 2008	Jan. 2010	Nov. 2010
CPAI Operator	0.5	0.25	1.0	0.25	0.25
CPAI Maintenance	0.5	0.1	1.0	0.1	0.1
Contract Operator	0.5	0.25	0.0	0.25	0.25
Contract Maintenance	0.5	0.1	0.0	0.1	0.1
Heavy Equipment Operator	0.4	0.25	2.5	0.1	0.1
Heavy Equipment/Vehicle Repair	0.2	0.1	1	0.0	0.1
Incremental Number of 12-hour positions per production pad	2.6	1.1	5.5	0.8	0.9
Cumulative Number of 12-hour positions per production pad	2.6	3.7	9.2	10.0	10.9

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
  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, and 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 will 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 the APF, by a generator at CD-6, and by power generation at new APFs. Facility upgrades would be required at CD-1 to provide power to the production pads of the CPAI Development Plan alternatives. Communications systems between the production pads and APFs 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

Production pads would be abandoned after the economic life of the satellite had passed. Aboveground facilities would be removed. Removal would be in accordance with state and federal agency approved abandonment plans. Equipment could be retrofitted for other North Slope use, or removed from the North Slope for subsequent re-use or scrap. The gravel pads are proposed to be abandoned in place. Just as with roads, the ultimate fate of the gravel pad will not be known until closer to end of the production pad life. Land managers and permitting agencies may choose to leave the gravel pads in place or they may require that gravel be removed and the tundra be 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 eight inches in diameter or larger. The seawater, sales oil lines, and MI lines of sufficient diameter will 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 all pipelines except the products pipeline. The 2-inch products pipeline would be too small for use of a pig. 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.

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 is 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, and can identify areas where the pipeline insulation is damaged or saturated with water (CPAI 2003f).

TABLE 2.3.4-1 PIPELINE MONITORING AND SURVEILLANCE

Pipeline	Type of Surveillance or Monitoring	Frequency	Regulatory Requirement
Three-Phase infield	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	Annual	NA
Seawater	Surveillance (No Road = Aerial, Road = Ground Based)	Weekly	ROW Lease
	Surveillance (Ground Based)	Annual	ROW Lease
	Mainline Valve Inspections	Twice per year	ROW Lease
	Relief Valves	Annual	ROW Lease
	Corrosion coupons	Twice per year	ROW Lease
(If p/l buried)	Rectifiers	Six times per year	ROW Lease
(If p/l buried)	Cathodic protection survey	Annual	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	Annual	ROW Lease
	Telecommunication Systems	Annual	ROW Lease
Miscible Injectant	Surveillance (No Road = Aerial, Road = Ground Based)	Routine – at least monthly during operations	NA
	Pressure loss monitoring	Routine	NA
	Mainline Valve Inspections	Twice per year	NA
	Relief Valves	Annual	NA
(If over 8-inch in diameter)	Instrumented pigging	Once every 5 years	NA
	Maintenance pigging	As needed	NA

TABLE 2.3.4-1 PIPELINE MONITORING AND SURVEILLANCE (cont'd.)

Pipeline	Type of Surveillance or Monitoring	Frequency	Regulatory Requirement
Products	Surveillance (Aerial)	Weekly	ROW Lease
	Surveillance (Ground Based)	Annual	ROW Lease
	Mainline Valve Inspections	Twice per year	ROW Lease
	Relief Valves	Annual	ROW Lease
	Corrosion coupons	Twice per year	ROW Lease
(If p/l buried)	Rectifiers	Six times per year	ROW Lease
(If p/l buried)	Cathodic protection survey	Annual	ROW Lease
	Maintenance pigging	Monthly	ROW Lease
	CPM leak detection: application	Once every 5 years	ROW Lease
	CPM leak detection: temperature transmitters	Annual	ROW Lease
	Telecommunication Systems	Annual	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)	Annual	ROW Lease
	Mainline Valve Inspections	Twice per year	49 CFR 195.420
	Relief Valves	Annual	49 CFR 195.428
	Corrosion coupons	Twice per year	49 CFR 195.579(b)
(If p/l buried)	Rectifiers	Six times per year	49 CFR 195.573(c)
(If p/l buried)	Cathodic protection survey	Annual	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	Annual (operator defined)	49 CFR 195.444
	Telecommunication Systems	Annual (operator defined)	49 CFR 195.408

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 Alpine, 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, snow machine, boat, etc. (CPAI 2003a). BLM approval of an exception to Stipulation 24(i) in the Northeast NPR-A 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 Kuparuk, 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. Shallow-draft 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 tundra travel vehicles 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 able to respond 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 (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. To expedite response to a spill event in the Delta, CPAI is proposing two river access points. The East Ulamnigiaq Channel would be accessed by a gangway to a floating dock at CD-3. The Nigliq Channel would be accessed by a boat ramp to be located at either CD-2 or CD-4.

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 Mines

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 the Clover Potential Gravel Source (referred to as Clover) (Figure 2.3.3.1-1). 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, with an approved reclamation plan that would be modified to reopen the mine. Clover would require a separate permit and reclamation plan.

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 will 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, permitting, temporary staging areas, removal of overburden, blasting and excavation of gravel, and rehabilitation of the site. Rehabilitation would consist of regrading and landform construction, water recharging, and revegetation monitoring. If the mine site is within a floodplain, the rehabilitation plan also could address creation of fish and wildlife habitat areas.

The use of these 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 were to be transported over the Colville River Delta from the ASRC Mine Site (Figure 2.3.3.1-1). Equipment required to mine the large quantities of gravel needed for the project 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 (Tom Mortensen Associates [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 cubic yards 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, 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, or recharge 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

Gravel airstrips would be constructed at roadless production pads, at isolated groups of interconnected pads, and, in the FFD scenario, at the new APFs to allow year-round access during drilling and operation phases. 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 4-feet thick and would have side slopes of at least 2H:1V. Potential for erosion would be evaluated for each airstrip, and if necessary side slope protection measures would be designed. For impact analysis, tundra coverage and gravel quantities are estimated using a 5-foot average thickness except for those airstrips located in the lower Colville River Delta or other coastal areas, which are assumed to be 14-feet thick. All airstrip quantities and acres covered are calculated using a 3H:1V side slope. 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, Otter, or DC-6 aircraft to a long airstrip approximately 5,000 feet by 100 feet used by 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.

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 two to three days. In the case of helicopter-supported production pads, the same frequency would apply for the helicopters.

For CPAI projects, during a one-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 HERC helicopters. Air traffic estimates for construction of the APF were higher. For purposes of analysis, this EIS will analyze impacts of air traffic associated with new APF**s** based on history at the APF (see Figure 2.3.5-1). Heaviest traffic would occur during construction. After construction is complete and drilling and production has started, the number of flights would decline. Once drilling has ceased, air traffic at a new hypothetical APF may decline; however, it may remain unchanged if the APF is used to support drilling hypothetical nearby production pads.

The anticipated flight path over the Colville River Delta to the airstrip at CD-3 and the distance that aircraft would be at elevations less than 1,000 feet above mean sea level are provided in Figure 2.3.5-2. Flight paths to other airstrips in the FFD scenario would depend upon prevailing winds but would generally align with the orientation of the airstrips and maximize the distance traveled over marine waters (instead of tundra) to the extent practicable.

Abandonment of airstrips would 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 field shutdown: infrastructure would either be left in place for public use or the gravel removed and the tundra revegetated.

Unscheduled helicopter traffic, overwhelmingly in summer, will likely occur. It is not part of CPAI's proposal, though. Rather, this traffic will largely be associated with scientific studies and monitoring of development. The frequency of this traffic and the areas in which it will 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).

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 to transport equipment and supplies to a roadless development site. Vehicles would conduct these activities from the nearest production or APF pads or gravel or ice roads.

Low-pressure vehicles, such as Rolligons, Tuckers, and **N**odwells, 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 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 clean-up operations if the clean up will be expedited and the use of the vehicle will prevent further environmental damage from the spill.

CPAI also can obtain approval from BLM to use such vehicles on federal lands. Such use would have to comply with Northeast NPR-A 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 an unroaded site could entail many miles of tundra travel at any time except for the period between break-up and July 15. 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 different types of river access are proposed. Access via a boat ramp is proposed for Nigliq Channel access from either CD-2 or CD-4. Access to the East Ulamnigiaq Channel via a floating dock and gangway are proposed for CD-3. There may be additional boat ramp facilities required for spill response under FFD, these facilities would be similar in design to the proposed facilities. .

2.3.8.1 Boat Ramp

One boat ramp is proposed for either CD-2 or CD-4. 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 Alpine spill response fleet. The potential CD-2 location would include a 3,200-foot-long and 22-foot-wide, minimum 4-foot-thick, gravel-access road and a 630-foot-long concrete-launch ramp. 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. The potential locations and access road route for CD-2 are presented in Figure 2.3.8.1-1. The potential location and access road route for CD-4 are presented in Figure 2.2.4.1.1.-3

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. The proposed location and access road routing is presented in Figure 2.4.1.1-2

2.3.9 Bridges and Culverts

The decision 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 drill rig.

Pipeline-only bridges carry much-reduced loads, which allow 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.

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.

Exact road-bridge crossing lengths would 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 bridge design for short crossings is shown in Figure 2.3.9.1-1. Long crossings could span approximately 130 feet between piers. CPAI's bridge design for long crossings is shown in Figure 2.3.9.1-2. Bridge structural design would account for the higher magnitude, lower frequency floods, and ground protection armor would protect against the more frequent, 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 have removable guardrails, again to accommodate the occasional wide loads. Decking material would be constructed out of timber or 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 2.3.9.1-2).

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 2.3.9.1-2). The pipelines would be installed on the downstream side of the bridge structure in areas where there is a 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 would require further refinement 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 will be 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 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 due to 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 diameter, as culverts in place of corrugated metal pipe type culverts. The line pipe culvert has more structural strength and has had a much better record of survivability and service.

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

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, 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. 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 two feet of the thaw-unstable native soils below the gravel road structure (McDonald G.N. 1994). 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.

2.3.9.3 Bridge and Culvert Operations and Abandonment

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 once the economic life of the oil fields had passed. 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 at or below the lowest anticipated scouring elevation from either natural scouring or a flood-induced event. The area of bridge abutments would be re-vegetated in manner similar to that of the roadbed after gravel removal.

2.3.10 Traffic

Seasonal air and ground traffic estimates for the CPAI Development Project are presented in Table 2.3.10-1 below. These traffic estimates are pertinent to Alternatives A, B, and C. Traffic for Alternative D is presented separately with the discussion of 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 5-pad CPAI Development Project. The extent of FFD traffic would be determined by how many of the hypothetical production pads and processing facilities 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 production and process pads, and up to 45 mph on roads.

TABLE 2.3.10-1 CPAI DEVELOPMENT PROJECT – TRAFFIC ESTIMATES

	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 2004/05	6000 (0-14,600)	70 (0-235)	0	0	0	0
Summer 2005	740 (0-2300)	180 (0-500)	0	0	0	0
Winter 2005/06	5800 (0-20,000)	60 (0-245)	0	70 - 90	0	0
Summer 2006	1600 (600-3100)	340 (200-615)	390 - 450	0	16	24
Winter 2006/07	3900 (0-12,100)	70 (0-165)	0	70 - 90	16	24
Summer 2007	3000 (2,900-3000)	45	390 - 450	0	16	24
Winter 2007/08	4000 (0-11,700)	50 (0-145)	390 - 450	70 - 90	16	24
Summer 2008	8000 (7500-8200)	100 (95-105)	780 - 900	0	32	24
Winter 2008/09	2800 (0-7600)	50 (0-2050)	390 - 450	70 - 90	32	24
Summer 2009	0	0	390 - 450	0	32	24
Winter 2009/10	1000 (0-6700)	50	780 - 900	70 - 90	32	24
Summer 2010	6600 (6300-6700)	85 (80-100)	780 - 900	0	64	24
Winter 2010/11	600 (0-3400)	45	780 - 900	70 - 90	64	24

Source: CPAI 2003L

Notes:

- One-way aircraft flights between Kuparuk 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 applicable to Alternatives A, B, and C

Summer = May through September

Winter = October through April

1000 (0-3600) = Average (low-high) monthly estimates

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 the APF. An additional 1.2 to 2.5 megawatts (MWs) of power generation capacity would be provided from CD-6 and would also serve CD-7. Facility upgrades would be required at the APF 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 CPAI Development Plan, and at all non-roaded 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 power line between CD-6 and CD-7. Overhead power lines would be strung on 60-foot poles spaced 250 feet apart. Borings for power pole installation would be two feet in diameter. 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 power line would occur during the winter, installing the power line 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.

2.3.11.3 Communications

Communications systems between the production pads and the APF and FFD APFs 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 processing facility radio communications.

2.3.11.4 Fresh Water

Fresh water would be required for ice road construction, for potable water use to support construction, drilling, and operating camps, and for drilling and drilling mud use. Fresh water or seawater could be used for hydrostatic testing. The fresh water demands of Alternatives A, B, and C are comparable, with approximately half of the total water needs being for ice road construction, and about equal amounts being used for potable water and drilling water. 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 gallons per person per day, and the construction, drilling, and operations manpower estimates presented above. Drilling water requirements are estimated to be 38,000 gallons of water per drilling day. 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 330000. 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.

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 gallons per person per day, or 10,000 gallons per day. 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 gallons per day 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 in closest proximity to each production pad are identified in Table 2.3.11-1. Wastewater would be treated and discharged in compliance with the general NPDES Permit for Oil and Gas Extraction on the North Slope of the Brooks Range, permit number AKG 330000, which covers discharges of domestic wastewater from temporary camps or an individual NPDES permit. Domestic wastewater discharges associated with the general NPDES permit will be limited and monitored according to the following effluent limitations in Table 2.3.11-2.

Similar limitations would apply under an individual 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.

TABLE 2.3.11-1 PROXIMITY OF PRODUCTION PADS AND PROCESS FACILITIES TO MAJOR STREAMS

Facility	Nearest Major Stream	Approximate Distance (miles)
CD-3	Tamayayak Channel	<1.0
CD-4	Nigliq Channel	<0.5
CD-5	Nigliq Channel	2
CD-6	Fish Creek	2
CD-7	Judy Creek	3
CD-8	Fish Creek	<0.5
CD-9	Judy Creek	2
CD-10	Fish Creek	<0.5
CD-11	Colville River	1.5
CD-12	Sakoonang Channel	1
CD-13	Ublutuoch River	2
CD-14	Tamayayak Channel	<1.0
CD-15	Nigliq Channel	<1.0
CD-16	Colville River	3
CD-17	Ublutuoch River	2
CD-18	Colville River	1.5
CD-19	Kupigruak Channel	<0.5
CD-20	Elaktoveach Channel	<1
CD-21	Colville River	<0.5
CD-22	Tingmeatchsiovik	<0.5
CD-23	Judy Creek	1
CD-24	Judy Creek	1.5
CD-25	Fish Creek	3
CD-26	Judy Creek	2
CD-27	Kalikpik River	<0.5
CD-28	Kogru River	4
CD-29	Kogru River	<0.5
APF-2	Judy Creek	<1.0
APF-3	Kalikpik River	2

TABLE 2.3.11-2 DOMESTIC WASTEWATER EFFLUENT LIMITATIONS

Parameter (units)		Daily Minimum	7-day Average	30-day Average	Daily Maximum
Flow, gallons per day		---	---	---	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.

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 discharged onto the tundra through a filter medium to remove any solids. The tundra would be protected such that erosion does not occur during the discharge. The water would be discharged in accordance with the permit requirements. If seawater were used it could be injected into the reservoir to maintain reservoir pressure or disposed via 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 via an injection well.

Approximately 100 gallons per day per person of domestic wastewater would be generated during production operations. This would result in an additional 1,000 to 1,500 gallons per day 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 the APF, or for FFD through the APF and the hypothetical APFs. 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 I disposal well or mixed with seawater and injected into the oil reservoir formation by a Class II well for enhanced oil recovery (PAI and BP Exploration [Alaska] 2002). Existing Class I disposal well WD-2 can receive non-hazardous and RCRA-exempt fluids.[2]

The CPAI Development Project includes at least one and possibly more Class II disposal wells. Existing Alpine Class II well CD 1-19A is used 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 BP Exploration [Alaska] 2002). Proposed Class II disposal wells at production pads would be used for disposal of similar materials. Specific production pads that would include a new injection well have not been identified. Thus the potential impacts from installing and operating a Class II disposal well at each production pad location is evaluated in this document.

FFD would include both a Class I and a Class II disposal well at each hypothetical process facility (APF-1 and APF-2), and would include additional Class II disposal wells at hypothetical production pads. Because the number and location of additional Class II disposal wells is unknown, the potential impacts from locating a Class 2 injection well at each hypothetical production pad 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 upon 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 incinerator in accordance with procedures in *Alaska Waste Disposal and Reuse Guide* (PAI and BP Exploration [Alaska] 2002). Residual solid waste that cannot be incinerated would be transported to the existing landfill located 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. In addition, two new APFs similar to Alpine are considered in the FFD alternatives, APF-1 and APF-2. It is anticipated that, similar to the APF, the pads supporting the hypothetical APFs also would host production wells. The APFs for the FFD scenario would be designed, built, and operated in a manner analogous to the existing APF.

2.3.12.1 Existing Alpine Processing Facility

The 36.3-acre APF pad includes a crude oil processing plant, housing for employees, maintenance facilities, a production pad, and a drill equipment storage area. Adjacent to it is a 5,000-foot-long airstrip (CPAI 2002Ba). Figure 2.3.12.1-1 presents a plot plan of the existing APF.

2.3.12.2 Alpine Capacity Expansion

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

[2] Class 1 (non-hazardous wells) can accept non-hazardous wastes, sanitary and domestic wastewater, and RCRA-exempt wastes (40 CFR 144.6). Class 1 (hazardous) wells can accept hazardous wastes. Class 2 wells are designated for oil and gas production wastes that are brought to the surface from down hole sources. However, fluids which are not from down hole sources can be commingled with wastewater or storm water and injected in a Class 2 well for enhanced oil and gas recovery.

The upgrades that are independent of the CPAI Development Plan include Alpine Capacity Expansion (ACX) Project 1 and 2. The first phase, ACX Project 1 (ACX1), planned for construction to begin in 2004, would increase the APF produced water handling capacity. 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 CPAI Development Plan 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, or ACX3, is necessary to operate the five production pads proposed in the CPAI Development Plan. ACX3, planned for offsite construction of modules in 2006 and sea lift to the North Slope in 2007, would increase gas handling capacity from 180 million standard cubic feet per day (mmscfd) to 270 or 360 mmscfd. Timing of these expansions is presented below in Table 2.3.9-1 along with the proposed drill site production schedule. ACX3 is related to the CPAI Development Plan and is analyzed in this EIS.

Separate from ACX-3, the CPAI Development Plan also proposes to add a new 31,500-gallon (750 bbl) corrosion inhibitor storage tank, in secondary containment, at the APF. 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
2008	CD-1, 2, 3, 4, and 6	ACX3	Gas: 270 or 360 mmscfd

Source: CPAI 2003j

2.3.12.3 Full-Field Development APFs

New APFs would have to be built if additional production pads were developed farther to the 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 APFs would likely have structures, equipment, personnel, and air traffic similar to that at the APF and would have a footprint roughly equal in size. For purposes of analysis, the BLM has assumed that hypothetical APF-1 and APF-2, in all alternatives other than the No-Action Alternative, would be comparable in size and other design aspects to the APF. The size of the FFD APF pads could be reduced relative to the APF, dependent on whether or not they are road-connected to the existing Alpine facilities and dependent upon 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 the APF. 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 infrastructure and equipment at the isolated sites within NPR-A (PAI, 2002c).

The following infrastructure is currently installed at the APF, and is assumed to reflect what would be installed at the hypothetical APFs.

- 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 (ADECb 2003)
- 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)(ADECb, 2003)
- 5000-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 1 disposal well
- Class 2 disposal well
- Emergency response center
- Medical clinic
- Spill response equipment (PAI 2002c)

Processing facility buildings, and other occupied structures will be designed to building codes appropriate for each facility, and will 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, are prohibited within 500 feet of a waterbody or within distances specified for certain areas identified in ROD stipulation 39 (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 which is described in Section 2.3.3.2 for production pads.

2.3.13 Project Specific Procedures

In addition to the project features common to all alternatives described above, there are additional project specific procedures that would be followed in all alternatives. These project 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 NPR-A 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 hypothetical FFD project. 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 hypothetical FFD project. Except where specifically indicated in the description of the alternative, components of alternatives are the same as those for the Alternative A.

2.4.1 Alternative A – Applicant's Proposed Action

2.4.1.1 Alternative A – CPAI Development Plan

Five production pads, CD-3 through CD-7, would be built and produced fluids would be transported by pipeline to be processed at the APF. 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 the Clover Potential Gravel Source. A bridge across Nigliq Channel near CD-2 would accommodate road traffic and the pipelines. CD-3 would be the only new pad with an airstrip. CD-6 would be within a 3-mile setback from Fish Creek in which the BLM's ROD for the Northeast NPR-A IAP/EIS (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 and pipeline within the setback. Additional exceptions would be required to locate oil infrastructure within 500 feet of some waterbodies (Stipulation 41). Also, if the BLM adopts this alternative, it will, to the extent necessary, modify the Northeast NPR-A IAP/EIS (Stipulation 48) to allow roads connecting to a road system outside the NPR-A. Aboveground pipelines would be supported on VSMs and would be at elevations of at least 5 feet above the tundra. Power lines would be supported by cable trays placed on the pipeline VSM, except for a power line suspended from poles between CD-6 and CD-7.

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 2.4.1.1-1). The top of the ridge lies above typical spring break-up water levels. The remaining 20 percent is on discontinuous sections of the ridge that maintain, though not as prominently, separation of the Nigliq and Sakoonang channel drainage paths. Road segments along the discontinuous ridge could be provided with culverts, and side slope protection, geotextile, revetment, and other protection measures 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 narrow point between two basins.

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 and local residents would both use the roads.

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 and CD-4 to the APF would consist of an 18-inch-diameter, three-phase (oil, water, and gas) production line, an 8-inch-diameter gas MI line, a 10-inch-diameter water line, and a 6-inch-diameter lift gas line. The pipelines to CD-3 would include a 2-inch-diameter products line (PAI 2002a).

Pipelines connecting to CD-5 and CD-6, and CD-7 would consist of a 24-inch-diameter three-phase (oil, water, and gas) production line, a 10-inch-diameter gas MI line, a 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 2.4.1.1-2. 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 boat or via small aircraft or helicopter, using the gravel airstrip (CPAI 2003a).

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. The proposed top-of-pad elevation as required for thermal design (approximately 5-feet thick) is less than the thickness needed for the design flood event. A pad thickness of 14 feet was assumed based on the top elevation of existing pads at CD-1 and CD-2, and the base elevation at the CD-3 location.

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

	PRODUCTION PADS		AIRSTRIPS AND APRON/TAXIWAYS		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	267	11.6	474	28.2	741	39
CD-4	83	9.1	0	0.0	83	9.1
CD-5	82	9.1	0	0.0	82	9.1
CD-6	82	9.1	0	0.0	82	9.1
CD-7	83	9.1	0	0.0	83	9.1
Total	**597**	**48.0**	**474**	**28.2**	**1071**	**76.2**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness roads; except at CD-3 which is assumed to have 14-foot thick production pad, airstrip, apron/taxiway and road from production pad to airstrip; 3H:1V side slopes
- Total may not be exact because of rounding

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 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 2.4.1.1-3 through 2.4.1.1-6. Production pads would be situated at least 200 feet from surrounding water bodies (PAI 2002a).

Crews based at the APF 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 road system during the construction and development-drilling phase of the project, 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 the APF and Kuparuk 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 permitted lakes and river channels 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 2.4.1.1-7 shows authorized lakes within the Plan Area. Water use for exploration and development activities and for ice road/pad/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/airstrips follows in Table 2.4.1-2.

TABLE 2.4.1-2 ALTERNATIVES 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: Annual Ice Road (miles) and Water Usage (million gallons)
2005	26	0	31
2006	33	5	38
2007	91	5	96
2008	24	5	29
2009	47	5	52
2010	5	5	10

Source: CPAI 2003e

Bridges and Culverts

A road and pipeline bridge approximately 1,200-foot-long would cross the Nigliq Channel. An approximately 140-foot long road bridge would be built across the Ublutuoch River. 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 2.4.1.1-3). The roadside slopes are projected to be 3H: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 facilities. 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 project phases—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	163	26.2
CD-2 to CD-5	4.3	199	32.6
CD-5 to CD-6	10.8	496	81.2
CD-6 access spur	0.2	7	1.2
CD-6 to CD-7	7.0	321	52.5
TOTAL	**25.8**	**1,187**	**194.1**

Notes:

- 32-foot road width covers area at least 52 feet wide
- Gravel volume calculation assumes 5-foot average thickness, 3H:1V side slope
- Coverage calculation assumes 62-foot wide toe of slope-to-toe of slope road width, 3H:1V side slope

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

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-1 - CD-3	6.4	A	619
CD-1 - CD-4	4.3	B	411
CD-1 – CD-2	2.4	C	232
CD-2 - CD-5	4.2	C	405
CD-5 - CD-6	10.9	C	1043
CD-6 access spur	0.2	B	19
CD-6 - CD-7	7.1	C	683
TOTAL	**33.1**		**3,412**

Notes:

A = Pipelines include 18-inch produced fluids, 8-inch MI, 10-inch water, 6-inch lift gas and 2-inch products

B = Pipelines 18-inch produced fluids, 8-inch MI, 10-inch water, and 6-inch lift gas

C = Pipelines include 24-inch produced fluids, 10-inch MI, 14-inch water, and 6-inch lift gas

Construction/Operations Schedule

CPAI proposed to construct the facilities on a schedule as 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, production pad, and pipelines typically would be completed in the first and second winters after project approval 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 startup of oil production would be completed in the second year.

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 power lines			X											
Install module piles	X													
Install pipeline bridge foundations	X													
Construct pipeline bridges			X											
Work gravel to pad		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		X		X				
Install VSMs for pipelines	X													
Install pipelines	X													
Install power lines	X													
Install module piles	X													
Work gravel to pad		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 power lines					X									
Install module piles					X									
Install bridge piers at Nigliq Channel					X									
Install bridge foundations					X									
Construct bridges					X									
Work gravel to pad						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 power lines											X			
Install module piles									X					
Install bridge foundations														
Construct bridges									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
Work gravel to pad										X				
Install surface facilities											X			
Set modules											X			
Production startup												X		
CD-5														
Lay gravel for road														
Lay gravel for production pad									X					
Drilling											X	X	X	
Install VSMs for pipelines									X					
Install pipelines									X					
Install power lines									X					
Install module piles									X					
Work gravel to pad										X				
Install surface facilities											X			
Set modules														
Production startup												X		

2.4.1.2 Alternative A – Full-Field Development Plan

Two hypothetical APFs (each including production facilities) and 22 hypothetical production pads 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, CD-14, CD-19, CD-21, and CD-22), 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 NPR-A IAP/EIS and 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 a FFD scenario for each alternative. The scenario describes the potential development that would be associated with hypothetical production pads and APFs. The design of the hypothetical FFD 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 hypothetical pads to two hypothetical processing facilities and to the APF.

Suitable gravel sources within the NPR-A remain an uncertainty. The only identified source thus far is the Clover Potential Gravel Source (Figure 2.3.3.1-1). 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.

Alternative A - FFD Quantity Estimates

In Alternative A the five proposed production pads CD-3, 4, 5, 6, and 7 and hypothetical production pads CD-8, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, and 22 would tie-in by pipeline to the APF. Hypothetical production pads CD-9, 17, 23, 24, and 26 would tie-in by pipeline to hypothetical APF-2. Hypothetical production pads CD-25, 27, 28, and 29 would tie-in by pipeline to hypothetical APF-3. Under Alternative A, airstrips and winter ice roads, rather than gravel roads, would provide access to CD-3, 14, 19, 20, 21, and 29. A gravel road network would interconnect all other pads and APFs.

Estimated areas that would be covered by gravel and volume of gravel required to construct the hypothetical facilities are presented below 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)**
CD-8	83	9.1	0	0.0	83	9.1
CD-9	83	9.1	0	0.0	83	9.1
CD-10	83	9.1	0	0.0	83	9.1
CD-11	83	9.1	0	0.0	83	9.1
CD-12	211	10.8	0	0.0	211	10.8
CD-13	83	9.1	0	0.0	83	9.1
CD-14	267	13.6	474	28.2	741	41.8
CD-15	83	9.1	0	0.0	83	9.1
CD-16	83	9.1	0	0.0	83	9.1
CD-17	83	9.1	0	0.0	83	9.1
CD-18	83	9.1	0	0.0	83	9.1
CD-19	267	13.6	474	28.2	741	41.8
CD-20	267	13.6	474	28.2	741	41.8
CD-21	267	13.6	474	28.2	741	41.8
CD-22	83	9.1	0	0.0	83	9.1
CD-23	83	9.1	0	0.0	83	9.1
CD-24	83	9.1	0	0.0	83	9.1
CD-25	83	9.1	0	0.0	83	9.1
CD-26	83	9.1	0	0.0	83	9.1
CD-27	83	9.1	0	0.0	83	9.1
CD-28	83	9.1	0	0.0	83	9.1
CD-29	211	10.8	474	28.2	685	39.0
APF-2	332	36.3	131	18.8	463	55.1
APF-3	332	36.3	131	18.8	463	55.1
TOTAL	**3482**	**294.2**	**2632**	**178.6**	**6114**	**472.8**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads; 3H:1V side slopes
- 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)
CD-8 to CD-6/5 road	2.5	114	18.7
CD-7 CD-9	2.8	130	21.2
CD-10 to CD-6/5 road	4.3	198	32.5
CD-4 to CD-11	2.5	303	18.8
CD-2 to CD-12	3.0	365	33.6
CD-13 to CD-5/6 road	5.0	231	37.9
CD-15 to CD-13/16 road	3.9	180	29.1
CD-13 to CD-16	7.2	331	54.1
CD-17 to CD-7/9 road	7.3	334	54.5
CD-16 to CD-18	8.7	399	65.3
CD-6 to CD-22	10.4	477	78.0
APF-2 to CD23	5.5	253	41.4
CD-23 to CD-24	6.6	303	49.6
CD-25 to APF-2	7.8	359	58.7
CD-24 to CD-26	9.1	420	68.7
CD-27 to APF-3/CD-25 road	8.9	408	66.7
CD-28 to APF-3	9.8	449	73.4
APF2 to CD-6/7 road	5.8	267	43.7
APF3 to CD-25	10.7	494	80.7
TOTAL	**121.8**	**6,016**	**926.6**

Notes:

- 32-foot driving surface on roads
- Gravel volume calculation assumes 5-foot average thickness, Ten feet or lower for delta roads
- Coverage calculation assumes toe of slope-to-toe of slope width of 62 feet (3H:1V slope)

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

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-8 to CD-6/5 line	2.5	A	242
CD-9 to CD-7	2.7	B	260
CD-10 to CD-6/5 line	4.5	A	433
CD-11 to CD-4	2.2	A	215
CD-12 to CD-2	3.1	A	295
CD-13 to CD5/6 road	4.7	B	451
CD-14 to CD-3/1 pipeline	1.5	B, D	143
CD-15 to CD-13/16 road	4.0	A	387
CD-16 to CD-13	7.1	B	680
CD-17 to CD7/9 line	7.1	A	685
CD-18 to CD-16	8.7	A	840
CD-19 to CD-14	6.0	B, D	575
CD-20 to CD-19	4.3	A, D	412
CD-21 to CD-19	5.2	A, D	503
CD-22 to CD-6	10.6	A	1,016
CD-23 to APF-2	5.4	B	517
CD-24 to CD-23	6.8	B	650
Spine, CD-25 to APF-2	7.8	C	753
CD-26 to CD-24	9.0	A	860
CD-27 to APF-3/CD-25 road	8.9	A	854
CD-28 to APF-3	10.0	B. D	965
CD-29 to CD-28	11.1	A, D	1,069
Spine, APF-3 to CD-25	10.7	B, C	1,029
Spine, APF-2 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 ALTERNATIVES 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	CD-11 & 12	14	N/A	14
	2012	CD-14	16	5	21
	2013	CD-19	21	7	28
	2014	CD-20	27	5	32
	2015	CD-21	28	6	34
2016 to 2018	2016	CD-8	7	NA	7
	2017	CD-10	9	NA	9
	2018	CD-22	15	NA	15
2019 to 2022	2019	APF-2 & CD-9	18	NA	18
	2020	CD-17	9	NA	9
	2021	CD-23	6	NA	6
	2022	CD-24 & 26	17	NA	17
2023 to 2026	2023	APF-3 & CD-25	29	NA	29
	2024	CD-27	19	NA	19
	2025	CD-28	20	NA	20
	2026	CD-29	30	13	43
2027 to 2030	2027	CD-13	9	NA	9
	2028	CD-15	11	NA	11
	2029	CD-16	8	NA	8
	2030	CD-18	23	NA	23

Notes:

Assumptions/Rationale:

- 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 and Clover mine sites
- Assumes ice roads annually to all sites not connected via gravel road

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 proposed project to conform completely to Northeast NPR-A IAP/EIS development stipulations. (See Appendix D.) Accordingly, Alternative B would alter CPAI's proposal on BLM-managed lands by:

- Moving proposed permanent oil infrastructure to a distance at least 3 miles from Fish Creek (Stipulation 39[d]). This requires that CD-6 and associated roads and pipelines be moved from within the setback.
- Moving proposed permanent oil infrastructure to a distance of at least 500 feet from waterbodies, excepting essential pipeline and road crossings (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 NPR-A (Stipulation 48). Road connection between CD-6 and CD-7, on the one hand, and other facilities, on the other hand, are eliminated

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

Roads would be built to connect CD-4 to the APF 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 to be built 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**,** since gravel roads would not connect back to the APF. 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 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 Table 2.4.2-3. Lengths and diameters of pipelines are shown in Table 2.4.2-4.

Alternative B - Construction/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.

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

	Production Pads		Airstrips and Apron/Taxiways		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	267	11.6	474	28.2	741	39.8
CD-4	83	9.1	0	0.0	83	9.1
CD-5	105	11.6	132	18.8	237	30.4
CD-6	105	11.6	136	19.6	241	31.2
CD-7	83	9.1	0	0.0	83	9.1
TOTAL	**643**	**53.0**	**742**	**66.6**	**1385**	**119.6**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness for airstrips, apron/taxiways and roads, except for CD-3 facilities
- 3H:1V side slopes
- Total may not be exact because of rounding

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	60	5	65
2010	0	5	5

Notes:

Assumptions/Rationale:

- 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 and Clover mine sites
- Assumes ice roads annually, during construction and drilling, to all sites not connected via gravel road

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	163	26.6
CD-6 to CD-7	6.5	297	48.6
TOTAL	**10.0**	**460**	**75.2**

Notes:

- 32-foot road driving surface
- Gravel volume calculation assumes 5-foot average thickness
- Area coverage calculation assumes 3H:1V slopes, resulting in toe of slope-to-toe of slope width of 62 feet for 5-foot thick roads

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 - CD-3	6.4	A, C	619
CD-1 - CD-4	4.3	A	411
CD-2 - CD-5	4.0	B, C	387
CD-5 - CD-6	9.9	B ,C	955
CD-6 - CD-7	6.9	A, C	659
CD-1 – CD-2	2-4	C	232
TOTAL	**34.0**		**3263**

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 = Pipelines include 2-inch products supply

2.4.2.2 Alternative B – Full-Field Development (FFD) Plan

Alternate B - FFD Description

Alternative B for FFD would alter the hypothetical FFD scope to conform completely to Northeast NPR-A 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 waterbodies. 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 would eliminate hypothetical CD-29.

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 #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 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, hypothetical APF-2 is located within the 3-mile setback around Fish Creek. Under Alternative B, this APF probably would not be developed, since the resource that would justify its construction would be economically unreachable from outside the setback. Without an APF in this area of the Plan Area, smaller oil accumulations would become uneconomic. In this EIS's hypothetical scenario, CD-17 and CD-26 probably would be uneconomic to develop. The economic analysis of this Alternative in Chapter 4 will analyze the impact of the elimination of hypothetical APF-2.

To ensure thorough analysis of FFD, however, Chapter 4 also will assume that an APF can be located just outside the 3-mile Fish Creek setback. Figure 2.4.2.2-1 reflects this scenario. On it, APF-2 has been relocated and has absorbed hypothetical CD-9. CD-8 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 NPR-A 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 32 and 48.

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

While FFD would not be altered from that described for Alternative A east of the Nigliq Channel, Alternative B's FFD would differ substantially west of the channel. Each production pad under this scenario would have its drilling product processed at the same APF as in Alternative A, though the pipeline routes between the pads and APF would change. Production pads on Kuukpik land would be accessed 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 NPR-A would be required at APF-3**,** CD-18, CD-22, and CD-24, in addition to the one built at CD-6 as part of this alternative's scenario for development of CPAI's proposal. Ice roads would be necessary to access isolated pads and road segments every winter during construction and drilling, and periodically thereafter for well work over 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 hypothetical 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)**
CD-8	83	9.1	0	0.0	83	9.1
CD-9	0	0.0	0	0.0	0	0.0
CD-10	83	9.1	0	0.0	83	9.1
CD-11	83	9.1	0	0.0	83	9.1
CD-12	211	10.8	0	0.0	211	10.8
CD-13	83	9.1	0	0.0	83	9.1
CD-14	267	13.6	474	28.2	741	41.8
CD-15	83	9.1	0	0.0	83	9.1
CD-16	83	9.1	0	0.0	83	9.1
CD-17	83	9.1	0	0.0	83	9.1
CD-18	105	11.6	115	16.1	220	27.7
CD-19	267	13.6	474	28.2	741	41.8
CD-20	267	13.6	474	28.2	741	41.8
CD-21	267	13.6	474	28.2	741	41.8
CD-22	105	11.6	115	16.1	220	27.7
CD-23	83	9.1	0	0.0	83	9.1
CD-24	105	11.6	131	18.8	236	30.4
CD-25	83	9.1	0	0.0	83	9.1
CD-26	83	9.1	0	0.0	83	9.1
CD-27	83	9.1	0	0.0	83	9.1
CD-28	83	9.1	0	0.0	83	9.1
CD-29	0	0.0	0	0.0	0	0.0
APF-2	332	36.3	0	0.0	332	36.3
APF-3	332	36.3	132	18.9	464	55.1
TOTAL	**3254**	**282.3**	**2389**	**182.7**	**5643**	**465.0**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and access roads, except 14-foot thickness in lower delta
- 3H:1V side slopes
- 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)
CD-8 to CD-10	4.3	198	32.3
CD-10 to CD-5 road	3.8	176	28.7
CD-11 to CD-4	2.5	115	18.8
CD-12 to CD-2	3.1	380	35.0
CD-13 to CD-5	5.6	256	41.8
CD-15 to CD-13/16 road	3.8	175	28.6
CD-16 to CD-13	5.5	254	41.5
CD-17 to APF-2/CD-7 road	7.2	331	54.2
CD-23 to CD-24	6.7	307	50.2
CD-25 to APF-3	10.7	494	80.7
CD-26 to CD-17	13.5	619	101.2
CD-27 to APF-3/CD-25 road	8.9	408	66.7
CD-28 to APF-3	9.8	449	73.5
APF-2 to CD-7	4.5	207	33.8
TOTAL	**89.9**	**4,369**	**687.0**

Notes:

- 32-foot wide road driving surface
- Gravel volume calculation assumes 5-foot average thickness, except 10-foot for lower delta roads
- Coverage estimate assumes 3H:1V, for a 62-foot toe of slope-to-toe of slope width

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

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number Of VSMs
CD-8 to CD-10/22	2.7	A, D	256
CD-9 to CD-7	0	None, no CD-9	0
CD-10 to CD-5	3.8	B, D	363
CD-11 to CD-4	2.2	A	215
CD-12 to CD-2	3.2	A	303
CD-13 to CD-5	5.6	B, D	534
CD-14 to CD-3/1	1.5	B, D	143
CD-15 to CD-13/16	3.9	A, D	375
CD-16 to CD-13	7.2	B, D	688
CD-17 to APF-2/CD-7	7.3	B	697
CD-18 to CD-16	8.7	A, D	840
CD-19 to CD-14	6.0	B, D	575
CD-20 to CD-19	4.3	A, D	412
CD-21 to CD-19	5.2	A, D	503
CD-22 to CD-10	9.5	A, D	908
CD-23 to APF-2	5.5	B, C, D	523
CD-24 to CD-23	6.8	A, D	653
CD-25 to CD-23	7.3	C	702
CD-26 to CD-17	13.2	A	1,266
CD-27 to APF-3/CD-25	8.9	A	854
CD-28 to APF-3	9.8	A	938
CD-29 to CD-28	0	None, no CD-29	0
APF-3 to CD-25	10.7	B, C	1,029
APF-2 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 Annual Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	CD-11 & 12	14	NA	14
	2012	CD-14	16	8	24
	2013	CD-19	21	7	28
	2014	CD-20	27	5	32
	2015	CD-21	28	6	34
2016 to 2018	2016	CD-8	23	NA	23
	2017	CD-10	6	NA	6
	2018	CD-22	15	NA	15
2019 to 2022	2019	APF-2	14	11	25
	2020	CD-17	22	NA	22
	2021	CD-26	27	NA	27
	2022	CD-23 & 24	29	9	38
2023 to 2026	2023	APF-3	32	NA	32
	2024	CD-25	40	10	50
	2025	CD-27	31	NA	31
	2026	CD-28	31	NA	31
2027 to 2030	2027	CD-13	9	NA	9
	2028	CD-15	11	NA	11
	2029	CD-16	8	NA	8
	2030	CD-18	23	NA	23

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 and Clover mine sites

2.4.3 Alternative C – Alternative Access Routes

Alternative C differs from Alternative A principally by including a 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. (Figure 2.4.3.1-1). This alternative also contrasts with Alternative A by requiring a minimum pipeline height of 7 feet and placing power lines on separate poles rather than on VSMs. There would be no 2-inch products pipelines to production pads. 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 a road it is now considering to Nuiqsut from the Dalton Highway. Production pad and airstrip locations would be the same as those proposed in Alternative A. Exceptions to the same Northeast NPR-A IAP/EIS stipulations as in Alternative A would be required. Use of roads on BLM lands would be unrestricted. Industry and local residents would have access to other roads.

Roads constructed across the lower Colville River Delta 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 does not increase design peak water surface elevations 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 the APF would cross three channels. Roads to the four FFD hypothetical production pads in the lower Colville River Delta would include more than two 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 then removal of the end cap before break-up. In some cases, a battery of culverts may not be as efficient as a large multiplate 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 – CPAI Development Plan

Alternative C Description

Figure 2.4.3.1-1 depicts Alternative C for CPAI's proposed pad developments. While 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, it is near CD-4. This bridge leads to a northern spur road toCD-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 the APF 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. Based on estimated elevations based on topographic maps at the proposed CD-3 pad, 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 ALTERNATIVE C – BRIDGE LENGTHS

Road Segment	Channels Crossed	Estimated Lengths (Feet)
CD-1 to CD-3 (6.3 miles)	Sakoonang Tamayagiaq 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.

Alternative C – Quantity Estimates

Table 2.4.3-2 and Table 2.4.3-3 provides the estimated gravel quantities required for production pad, airstrip, and road segments construction under Alternative C. 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 Alternative C. Estimated vehicle traffic and aircraft flights during each of the three project phases—construction, drilling, and operations—are provided in Table 2.3.10-1.

Alternative C - Construction/Operations Schedule

The construction and operations schedule for Alternative C would be essentially the same as that for Alternative A (Table 2.4.1-5). The primary difference would be that for Alternative C, 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-drilling only, and CD-4 drilling would remain in the summer, on a rotation with CD-3.

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

	Production Pads		Airstrips and Apron/Taxiways		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	267	11.6	0.0	0.0	267	11.6
CD-4	83	9.1	0.0	0.0	83	9.1
CD-5	82	9.1	0.0	0.0	82	9.1
CD-6	82	9.1	0.0	0.0	82	9.1
CD-7	83	9.1	0.0	0.0	83	9.1
Nuiqsut Spur	–	–	–	–	–	–
TOTAL	**597**	**48.1**	**0.0**	**0.0**	**597**	**48.1**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads, 5-foot average thickness for airstrips, aprons, and roads, except for 14-foot thickness in lower delta
- 3H:1V side slopes
- Total may not be exact due to rounding

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

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
CD-1 to CD-3	6.2	750	69.0
CD-1 to CD-4 junction	2.5	115	187
CD-4 junction to CD-4	1.0	48	7.9
CD-5 to CD-5 junction	4.3	200	32.6
CD-5 junction to CD-4 junction	3.9	181	29.6
CD-6 to Y	3.8	175	28.7
Spine, Nuiqsut Branch to CD-5 branch	2.3	106	17.3
Spine, Nuiqsut branch to Y	10.2	470	76.8
CD-7 to Y	5.8	265	43.3
Nuiqsut Spur	**0.9**	**42**	**6.9**
TOTAL	**41.0**	**2,352**	**330.9**

Notes:

- 32-foot road width covers area at least 52 feet wide
- Gravel volume calculation assumes 5-foot average thickness
- Coverage calculation assumes 62-foot toe of slope-to-toe of slope width, based on 3H:1V side slope

TABLE 2.4.3-4 ALTERNATIVE C – 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	52	0	52
2006	48	0	48
2007	39	0	39
2008	61	0	61
2009	55	0	55
2010	0	0	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
- Construction estimate includes a 28 mile annual ice road from Kuparuk to CD-1
- Estimates assume gravel supply from the ASRC and Clover mine sites

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

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-3 - CD-1	6.4	A	619
CD-4 - CD-1	4.3	B	411
CD-5 – CD-5 tie-in	4.5	A	436
CD-5 tie-in to CD-1/4	4.2	B	404
Y – CD-5 tie-in	11.6	B	1116
CD-6 - Y	4.0	A	385
CD-7 - Y	6.0	A	577
TOTAL	**41.1**		3948

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

2.4.3.2 Alternative C – Full-Field Development (FFD) Plan

Alternative C - FFD Description

In the FFD scenario for Alternative C, 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 hypothetical pads (CD-14, CD-19, CD-20, and CD-21) requiring multiple channel crossings. To design such roads, the design flood water 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 hypothetical pads in Table 2.4.3-6 are estimated based on the routes shown in Figure 2.4.3.2-1 in the same manner as previously estimated for Figure 2.4.3.1-1.

TABLE 2.4.3-6 ESTIMATED BRIDGE LENGTHS

Road Segment	Channels Crossed	Estimated Lengths (feet)	Segment Total (feet)
CD-1 to CD-14 (1.6 miles)	Tamayayak	1,100	1,100
CD-14 to CD-19 (6.0 miles)	Unnamed Elaktoveach Elaktoveach	400 1,000 3,500	4,900
CD-19 to CD-20 (4.3 miles)	Unnamed Unnamed	150 800	950
CD-19 to CD-21 (5.2 miles)	Unnamed Kupigruak	400 4,800	5,200

In order to have accessible year-round roads to the hypothetical full-field pads in the delta, the road surfaces would be designed to be above conservative estimates of flood levels. Using 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. The roads would require more embankment material than the typical North Slope road to account for these floodwaters. Based on interpretation of topographic map elevations, the embankments would range from 5 to 18 feet. 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 NPR-A 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.

Alternative C - FFD Quantity Estimates

The differences between FFD Alternative A and FFD Alternative C have been described above and can be seen by comparing Figures 2.4.1.2-1 and 2.4.3.2-1. Tables 2.4.3-7 and 2.4.3-8 present the estimated areas covered by the hypothetical FFD Alternative C facilities and the volume of gravel required to develop those hypothetical facilities. Table 2.4.3-9 presents estimated pipeline lengths and diameters. Table 2.4.3-10shows the annual projected water usage for the ice roads associated with FFD Alternative C**,** assuming a hypothetical sequence of development for analysis purposes.

TABLE 2.4.3-7 ALTERNATIVE C - 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)**
CD-8	83	9.1	0	0.0	83	9.1
CD-9	83	9.1	0	0.0	83	9.1
CD-10	83	9.1	0	0.0	83	9.1
CD-11	83	9.1	0	0.0	83	9.1
CD-12	211	10.8	0	0.0	211	10.8
CD-13	83	9.1	0	0.0	83	9.1
CD-14	267	13.6	0	0.0	267	13.6
CD-15	83	9.1	0	0.0	83	9.1
CD-16	83	9.1	0	0.0	83	9.1
CD-17	83	9.1	0	0.0	83	9.1
CD-18	83	9.1	0	0.0	83	9.1
CD-19	267	13.6	0	0.0	267	13.6
CD-20	267	13.6	0	0.0	267	13.6
CD-21	267	13.6	0	0.0	267	13.6
CD-22	83	9.1	0	0.0	83	9.1
CD-23	83	9.1	0	0.0	83	9.1
CD-24	83	9.1	0	0.0	83	9.1
CD-25	83	9.1	0	0.0	83	9.1
CD-26	83	9.1	0	0.0	83	9.1
CD-27	83	9.1	0	0.0	83	9.1
CD-28	83	9.1	0	0.0	83	9.1
CD-29	211	10.8	0	0.0	211	10.8
APF-2	332	36.3	131	18.8	463	55.1
APF-3	332	36.3	131	18.8	463	55.1
TOTAL	**3482**	**294.9**	**262**	**37.5**	**37444**	**332.5**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads, except for 14-foot thickness in lower delta
- 3H:1V side slopes
- Total may not be exact because of rounding

TABLE 2.4.3-8 ALTERNATIVE C - FFD APPROXIMATE GRAVEL QUANTITIES AND COVERAGE ASSOCIATED WITH ROAD SEGMENTS

Road Segments	Length (miles)	Gravel (1,000 cy)	Coverage (acres)
CD-8 to CD-6	4.7	217	35.5
CD-9 to CD-7	2.6	122	19.9
CD-10 to CD-5	3.8	174	28.5
CD-11 to CD-4	2.5	117	19.1
CD-12 to CD-2	3.2	384	35.4
CD-13 to Spine	1.5	70	11.5
CD-14 road to CD-3/1 road	1.5	112	10.3
CD-15 to CD-16/spine road	3.9	178	29.1
CD-16 to Spine	5.6	259	42.4
CD-17 to CD-7/9 road	7.3	334	54.6
CD-18 to CD-16	8.7	399	65.3
CD-19 to CD-14	6.0	726	66.8
CD-20 to CD-19	4.3	525	48.3
CD-21 to CD-19	5.2	636	58.5
CD-22 to CD-6	10.4	477	78.0
CD-23 to APF-2	5.6	257	42.0
CD-24 to CD-23	6.9	318	52.0
CD-25 to APF-2	7.8	359	58.7
CD-26 to CD-24	9.0	414	67.7
CD-27 to APF-3/CD-25 road	8.9	408	66.7
CD-28 to APF3	9.8	449	73.5
CD-29 to CD-28	11.0	1335	122.8
APF-2 to CD-7	5.8	268	43.9
Spine, APF-3 to CD-25	10.7	494	80.7
	147.2	**9074**	**1218.1**

Notes:

- 32-foot wide road driving surface
- Gravel volume calculation assumes 5-foot average road thickness, except for 10-foot in lower delta areas
- Coverage calculation assumes 3H:1V side slopes, or 62-foot toe of slope-to-toe of slope width

TABLE 2.4.3-9 ALTERNATIVE C – ESTIMATED LENGTHS AND DIAMETERS OF PIPELINES

Pipeline Segment	Length (miles)	Pipeline Cross Section	Number of VSMs
CD-8 to CD-6	4.9	A	467
CD-9 to CD-7	2.8	B	267
CD-10 to CD-5	3.8	A	365
CD-11 to CD-4	2.2	A	207
CD-12 to CD-2	3.2	A	303
CD-13 to Spine	1.5	A	144
CD-14 to CD-3/1	1.5	B	142
CD-15 to CD-16 tie-in	4.0	A	386
CD-16 to Spine	7.1	B	682
CD-17 to CD-7/9	7.3	B	697
CD-18 to CD-16	8.7	A	840
CD-19 to CD-14	6.0	B	575
CD-20 to CD-19	4.2	A	402
CD-21 to CD-19	5.2	A	499
CD-22 to CD-6	10.6	A	1,016
CD-23 to APF2	5.4	B	523
CD-24 to CD-23	6.9	B	665
CD-25 to APF-2	7.8	C	753
CD-26 to CD-24	9.0	A	867
CD-27 to APF-3/CD-25	8.9	A	854
CD-28 to APF-3	10.1	B	968
CD-29 to CD-28	11.1	A	1069
APF-3 to CD-25	10.7	B, C	1,029
APF-2 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 2.4.3-10 ALTERNATIVE C - 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	CD-11 & 12	11	NA
	2012	CD-14	8	NA
	2013	CD-19	19	NA
	2014	CD-20	18	NA
	2015	CD-21	19	NA
2016 to 2018	2016	CD-8	12	NA
	2017	CD-10	4	NA
	2018	CD-22	15	NA
2019 to 2022	2019	APF-2 & CD-9	18	NA
	2020	CD-17	9	NA
	2021	CD-23	5	NA
	2022	CD-24 & 26	16	NA
2023 to 2026	2023	APF-3 & CD-25	19	NA
	2024	CD-27	10	NA
	2025	CD-28	10	NA
	2026	CD-29	11	NA
2027 to 2030	2027	CD-13	9	NA
	2028	CD-15	7	NA
	2029	CD-16	5	NA
	2030	CD-18	20	NA

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 and Clover mine sites

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 roads or low ground pressure vehicle tundra travel. The pipeline crossing of the Nigliq Channel would be accomplished using HDD rather than a pipeline bridge. Pipelines would be built 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 NPR-A ROD would be required. For the purpose of analysis, Alternative D is presented as two sub-alternatives. Sub–Alternative 1 (D-1) includes gravel airstrips and access by fixed wing aircraft and ice roads. Sub-Alternative 2 (D-2) includes gravel helipads and year-round access by helicopters and winter access by fixed wing aircraft to ice airstrips, and by vehicles on ice roads. All other project elements are common to both sub-alternatives. 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. During design and installation of the pipeline, elevation changes and pipeline angles would be minimized to reduce slugging potential.

2.4.4.1 Alternative D, Sub-Alternative 1 (D-1) – CPAI Development Plan

Alternative D-1 - CPAI Development Plan

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-acres size used for non-roaded pads

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 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 Alternative D-1. Estimated vehicle traffic and aircraft flights during each of the three project phases - construction, drilling, and operations- are provided in Table 2.4.4-4.

The construction and operations schedule for 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 drilling only, and D-4 would retain summer drilling only, 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 Pads		Airstrips and Apron/Taxiways		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	267	13.6	474	28.2	741	47.8
CD-4	105	11.6	230	31.8	335	43.4
CD-5	105	11.6	132	18.4	237	30.0
CD-6	105	11.6	122	17.0	227	28.6
CD-7	105	11.6	124	17.4	229	29.0
TOTAL	**687**	**60.0**	**1082**	**112.9**	**1769**	**172.9**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads; 5-foot average thickness for airstrips, aprons, and roads, except for 14-foot thickness in lower delta areas
- 3H:1V side slopes
- Total may not be exact because of rounding

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	45	0	45
2006	41	5	46
2007	43	5	48
2008	71	14	85
2009	60	14	74
2010	0	29	29

Notes:

- Estimated based on sequential pad construction
- 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 and Clover mine sites

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 - CD-3	6.4	A	619
CD-1 - CD-4	4.3	A	411
CD-2 - CD-5	4.0	B	387
CD-5 - CD-6	9.7	B	928
CD-6 - CD-7	7.8	A	748
CD-1 – CD-2	2.4	C	232
TOTAL	**34.6**		**3,325**

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 = Pipelines include 14-inch sales oil and 12-inch seawater supply

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 2004/05	6000 (0-18,600)	70 (0-235)	0	0	0	0
Summer 2005	0	240 (0-690)	0	0	0	0
Winter 2005/06	5800 (0-19,800)	60 (0-245)	0	70 - 90	0	0
Summer 2006	0	470 (250-860)	0	30 - 40	0	28
Winter 2006/07	3900 (0-12000)	70 (0-165)	0	70 - 90	16	24
Summer 2007	0	290 (240-300	0	30 - 40	0	28
Winter 2007/08	4000 (0-11,700)	50 (0-145)	390 - 450	70 - 90	16	24
Summer 2008	0	770 (725-790)	0	65-75	0	32
Winter 2008/09	2800 (0-7500)	50 (0-205)	390 - 450	70 - 90	32	24
Summer 2009	0	0	0	30-40	0	32
Winter 2009/10	1000 (0-3600)	50	780 - 900	70 - 90	32	24
Summer 2010	0	635 (600-660)	0	65-75	0	36
Winter 2010/11	600 (0-3300)	45	780 - 900	70 - 90	64	24

Source: CPAI 2003L

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

- 6000 (0 18,600) represents Average (Minimum – Maximum) monthly values
- Round-trip Vehicle Trips per month
- Round Trips - Helicopter flights per month
- One-way Flights - Fixed Wing Aircraft flights per month, includes flights in from Kuparuk to Alpine
- Each construction and drilling related flight assumed to equal 12 vehicle trips
- Operations phase flights assumed to equal 4 vehicle trips

Summer = May through September

Winter = October through April

2.4.4.2 Alternative D, Sub-Alternative 2 (D-2) – CPAI Development Plan

Sub-Alternative D-2 is similar to 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 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 larger; 11.6 acres size used for non-roaded 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 Facility (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. Presently, helicopters that are capable of transporting an emergency drill rig are not available on the North Slope. Implementation of this sub-alternative would require the availability of a helicopter capable of transporting an emergency drill rig during summer, delivering a relief rig to a production pad in winter and leaving it 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. 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 Alternative D-2. Annual water use for ice roads is presented in Table 2.4.4-6 The pipeline lengths and diameters associated with Alternative D-2 would be the same as for Alternative D-1 (Table 2.4.4-3). Estimated aircraft flights during each of the three project phases—construction, drilling, and operations—are provided in Table 2.4.4-7.

The construction and operations schedule for Alternative D-2 is prolonged compared to that for Alternative A (Table 2.4.1-5). The primary difference would be that for 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 drilling only. Assuming a one-rig program 20 wells per production pad, and three wells per year per rig means seven years of drilling at CD-3 before beginning drilling at CD-4, etc, and a total of approximately 33 years of drilling for the 5-pad CPAI Development Project.

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

	Production 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	267	13.6	33	2.0	300	15.6
CD-4	105	11.6	9	1.3	114	12.9
CD-5	105	11.6	9	1.3	114	12.9
CD-6	105	11.6	9	1.3	114	12.9
CD-7	105	11.6	9	1.3	114	12.9
TOTAL	**687**	**60.0**	**69**	**7.2**	**756**	**67.2**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads except 14-foot thickness for CD-3; 5-foot average thickness for helipads, aprons, and roads; 3H:1V side slopes
- Total may not be exact because of rounding

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: Annual Ice Road (miles) and Water Usage (million gallons)
2005 to 2010	2005	CD-3	6	0	6
	2006	CD-3		6	6
	2007	CD-3	0	6	6
	2008	CD-3	0	6	6
	2009	CD-3	0	6	6
	2010	CD-3	0	6	6
2011 to 2015	2011	CD-3, CD-4	6	8	14
	2012	CD-3, CD-4	6	8	14
	2013	CD-4	0	14	14
	2014	CD-4	0	14	14
	2015	CD-4	0	14	14
2016 to 2018	2016	CD-4	0	14	14
	2017	CD-4, CD-6	18	14	32
	2018	CD-4, CD-6	18	14	32
2019 to 2022	2019	CD-6	0	32	32
	2020	CD-6	0	32	32
	2021	CD-6	0	32	32
	2022	CD-6	0	32	32
2023 to 2026	2023	CD-6, CD-5	13	19	32
	2024	CD-6, CD-5	13	19	32
	2025	CD-5	0	32	32
	2026	CD-5	0	32	32
2027 to 2030	2027	CD-5	0	32	32
	2028	CD-5	0	32	32
	2029	CD-5, CD-7	22	32	54
	2030	CD-5, CD-7	22	32	54

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 and Clover mine sites
- 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 2004/05	6000 (0-4,600)	36 (0-183)	70 (0-235)	0		0	0	0	0
Summer 2005	0	65 (5-305)	180 (0-500)	0		0	0	0	0
Winter 2005/06				390 - 450	38	13-26	0	0	0
Summer 2006	0			0	134	0	0	85	0
Winter 2006/07				390 - 450	34	13-26	32	84	0
Summer 2007	0		0	0	85	0	0	14	0
Winter 2007/08				390 - 450	34	13-26	32	36	0
Summer 2008	0			0	85	0	0	14	0
Winter 2008/09				390 - 450	34	13-26	48	36	0
Summer 2009	0		0	0	85	0	0	14	0
Winter 2009/10			0	390 - 450	34	13-26	48	36	0
Summer 2010	0			0	80	13-26	0	84	0
Winter 2010/11	600 (0-3300)	36	70 (0-200)	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.

[1] Round-Trip Vehicle Trips per month

[2] Round Trips - Helicopter flights per month

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

Summer = May through September

Winter = October through April

2.4.4.3 Alternative D-1 – Full-Field Development (FFD) Plan Sub-Alternative D-1

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 APFs, 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 this alternative 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.

Alternative D-1 - FFD Quantity Estimates

The differences between FFD Alternative A and FFD Alternative D-1 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 hypothetical FFD Alternative D 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)**
CD-8	105	11.6	131	18.3	236	29.9
CD-9	105	11.6	131	18.3	236	29.9
CD-10	105	11.6	131	18.3	236	29.9
CD-11	83	9.1	0	0.0	83	9.1
CD-12	267	13.6	474	28.2	741	41.8
CD-13	105	11.6	131	18.3	236	29.9
CD-14	267	13.6	419	25.5	686	39.1
CD-15	105	11.6	131	18.3	236	29.9
CD-16	105	11.6	131	18.3	236	29.9
CD-17	105	11.6	131	18.3	236	29.9
CD-18	105	11.6	131	18.3	236	29.9
CD-19	267	13.6	474	28.2	741	41.8
CD-20	267	13.6	474	28.2	741	41.8
CD-21	267	13.6	474	28.2	741	41.8
CD-22	105	11.6	131	18.3	236	29.9
CD-23	105	11.6	131	18.3	236	29.9
CD-24	105	11.6	131	18.3	236	29.9
CD-25	105	11.6	131	18.3	236	29.9
CD-26	105	11.6	131	18.3	236	29.9
CD-27	105	11.6	131	18.3	236	29.9
CD-28	105	11.6	131	18.3	236	29.9
CD-29	267	13.6	474	28.2	741	41.8
APF-2	332	36.3	131	18.8	463	55.1
APF-3	332	36.3	131	18.8	463	55.1
TOTAL	**3924**	**337.4**	**5016**	**479.1**	**8940**	**816.4**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads, 5-foot average thickness for airstrips, aprons, and roads, except for 14-foot thickness in lower deltas
- 3H:1V side slopes
- 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
CD-8 to CD-6/5 line	2.1	A	199
CD-9 t0 CD-7	2.8	B	267
CD-10 to CD-6/5 line	3.8	A	363
CD-11 to CD-4	2.2	A	215
CD-12 to CD-2	3.2	A	303
CD-13 to CD-5/6	5.6	B	534
CD-14 to CD-3/1 pipeline	1.5	B	143
CD-15 to CD-13/16	3.9	A	375
CD-16 to CD-13	7.2	B	688
CD-17 to CD-7/9 line	7.3	A	697
CD-18 to CD-16	8.7	A	840
CD-19 to CD-14	6.0	B	575
CD-20 to CD-19	4.3	A	412
CD-21 to CD-19	5.2	A	503
CD-22 to CD-6	10.6	A	1,016
CD23 to APF-2	5.5	B	523
CD-24 to CD-23	6.8	B	653
CD-25 to APF-2	7.8	C	753
CD-26 to CD-24	9.0	A	860
CD-27 to APF-3/CD-25	8.9	A	854
CD-28 to APF-3	9.8	B	938
CD-29 to CD-28	11.2	A	1,071
APF-3 to CD-25	10.7	B, C	1,029
APF-2 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: Annual Ice Road (miles) and Water Usage (million gallons)
2011 to 2015	2011	CD-11 & 12	14	611	20
	2012	CD-14	16	18	27
	2013	CD-19	21	23	39
	2014	CD-20	27	29	50
	2015	CD-21	28		57
2016 to 2018	2016	CD-8	7	36	43
	2017	CD-10	10	46	56
	2018	CD-22	18	56	74
2019 to 2022	2019	APF-2 & CD-9	18	71	89
	2020	CD-17	17	79	96
	2021	CD-23	21	86	107
	2022	CD-24 & 26	42	103	145
2023 to 2026	2023	APF-3 & CD-25	37	123	160
	2024	CD-27	40	134	174
	2025	CD-28	42	145	187
	2026	CD-29	41	157	198
2027 to 2030	2027	CD-13	10	162	172
	2028	CD-15	11	164	175
	2029	CD-16	11	170	181
	2030	CD-18	25	183	208

Notes:

- Estimate based on sequential pad construction, utilizing CD-1 to CD-2 gravel road 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 and Clover mine sites

The construction and operations schedule for 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 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 drilling only, and CD-4 would retain summer drilling only, with the drill rig seasonally switching between CD-3 and CD-4.

2.4.4.4 Alternative D-2 – Full-Field Development Plan

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 in 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 facilities 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.

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 upon winter only drilling. This results in a substantially extended schedule compared to Alternatives A through D-1 - 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 three 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 and drilling workers, traffic, water for ice roads, etc., but would continue that lower level over 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)**
CD-8	105	11.6	9	1.3	114	12.9
CD-9	105	11.6	9	1.3	114	12.9
CD-10	105	11.6	9	1.3	114	12.9
CD-11	83	9.1	0	0.0	83	9.1
CD-12	267	13.6	33	2.0	300	15.6
CD-13	105	11.6	9	1.3	114	12.9
CD-14	267	13.6	33	2.0	300	15.6
CD-15	105	11.6	9	1.3	114	12.9
CD-16	105	11.6	9	1.3	114	12.9
CD-17	105	11.6	9	1.3	114	12.9
CD-18	105	11.6	9	1.3	114	12.9
CD-19	267	13.6	33	2.0	300	15.6
CD-20	267	13.6	33	2.0	300	15.6
CD-21	267	13.6	33	2.0	300	15.6
CD-22	105	11.6	9	1.3	114	12.9
CD-23	105	11.6	9	1.3	114	12.9
CD-24	105	11.6	9	1.3	114	12.9
CD-25	105	11.6	9	1.3	114	12.9
CD-26	105	11.6	9	1.3	114	12.9
CD-27	105	11.6	9	1.3	114	12.9
CD-28	105	11.6	9	1.3	114	12.9
CD-29	267	13.6	33	2.0	300	15.6
APF-2	332	36.3	131	15.0	463	55.1
APF-3	332	36.3	131	15.0	463	55.1
TOTAL	**3,924**	**337.4**	**604**	**70.3**	**4,528**	**407.6**

Notes:

- Gravel volume assumes 6-foot average thickness for production pads, 5-foot average thickness for helipads, aprons, and roads; 3:1 side slopes.
- Total may not be exact because of rounding.

2.4.5 Alternative E – No Action

Under this alternative, 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.

2.5 COMPARISON OF FEATURES OF ALTERNATIVES

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

TABLE 2.5-1 COMPARISON OF COMPONENTS OF THE ALTERNATIVES

	Alternative A **CPAI Proposed Action**	**Alternative B** **Conform to BLM IAP/EIS**	**Alternative C** **Alternative Road Access**	**Alternative D** **Roadless Development**	
				D-1 **Fixed Wing Aircraft Access**	**D-2** **Helicopter Access**
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 setback for Fish Creek FFD Setbacks potentially eliminate or relocate production pads and APFs	Five Proposed Pads as CPAI proposed FFD No restrictions on locations	Five Proposed Pads as CPAI proposed FFD No restrictions on locations	
Gravel Quantity and Acreage (includes associated airstrips and aprons)	Five proposed pads 1,071,000 cy 76.2 acres FFD 6,114,000 cy 472.8 acres	Five proposed pads 1,385,000 cy 119.6 acres FFD 5,693,000 cy 465.0 acres	Five proposed pads 597,000 cy 48.1 acres FFD 3,744,000 cy 332.5 acres	Five proposed pads 1,769,000 cy 172.9 acres FFD 8,940,000 cy 816.4 acres	Five proposed pads 756,000 cy 67.2 acres FFD 4,528,000 cy 407.6 acres
	Five proposed pads 410 FFD 940	Five proposed pads 420 FFD 1050	Five proposed pads 410 FFD 810	Five proposed pads 480 FFD 2830	Five proposed pads 800 FFD Not calculated, extends 100 years
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 2830	Five proposed pads 800 FFD Not calculated, extends 100 years

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

	Alternative A **CPAI Proposed Action**	**Alternative B** **Conform to BLM IAP/EIS**	**Alternative C** **Alternative Road Access**	**Alternative D** **Roadless Development**	
				D-1 **Fixed Wing Aircraft Access**	**D-2** **Helicopter Access**
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 APF-1 APF-2				
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 setback for Fish Creek 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 None FFD None	
Users of road	Industry and local residents	Industry	Unrestricted on BLM lands, Industry and local residents elsewhere	NA	

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

	Alternative A CPAI Proposed Action	**Alternative B** Conform to BLM IAP/EIS	**Alternative C** Alternative Road Access	**Alternative D** Roadless Development	
				D-1 Fixed Wing Aircraft Access	**D-2** Helicopter Access
Vehicle Trips by Industry, Monthly Vehicle Round Trips during construction	Five Proposed Pads Winter 2004/05: 6000 Summer 2005: 750 Winter 2005/06: 5800 Summer 2006: 2050 Winter 2006/07: 3900 Summer 2007: 3450 Winter 2007/08: 4450 Summer 2008: 8900 Winter 2008/09: 3250 Summer 2009: 500 Winter 2009/10: 1950 Summer 2010: 7600 Winter 2010/11: 1600 FFD Probably roughly within the same range as above for winter and summer; in proportion to the number of pads developed in a given year			Five Proposed Pads Winter 2004/05: 6000 Summer 2005: 0 Winter 2005/06: 5800 Summer 2006: 0 Winter 2006/07: 3900 Summer 2007: 0 Winter 2007/08: 4450 Summer 2008: 0 Winter 2008/09: 3250 Summer 2009: 0 Winter 2009/10: 1950 Summer 2010: 0 Winter 2010/11: 1600 FFD Probably roughly within the same range as above; in proportion to the number of pads developed in a given year	Five Proposed Pads Winter 2004/05: 6000 Summer 2005: 0 Winter 2005/06: 450 Summer 2006: 0 Winter 2006/07: 500 Summer 2007: 0 Winter 2007/08: 500 Summer 2008: 0 Winter 2008/09: 500 Summer 2009: 0 Winter 2009/10: 500 Summer 2010: 0 Winter 2010/11: 1100 Five pad continues about 20 years. FFD Roughly within the same range as above every winter

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

	Alternative A CPAI Proposed Action	**Alternative B** Conform to BLM IAP/EIS	**Alternative C** Alternative Road Access	**Alternative D** Roadless Development	
				D-1 Fixed Wing Aircraft Access	**D-2** Helicopter Access
Gravel Quantity, Lengths, and Acreage for Roads	<u>Five proposed pads</u> 1,187,000 cy 25.8 miles 194.1 acres <u>FFD</u> 6,016,000 cy 121.8 miles 926.6 acres	<u>Five proposed pads</u> 460,000 cy 10.0 miles 75.2 acres <u>FFD</u> 4,369,000 cy 89.9 miles 687.0 acres	<u>Five proposed pads</u> 2,352,000 cy 41.0 miles 330.9 acres <u>FFD</u> 9,032,000 cy 146.3 miles 1,211.2 acres	<u>Five proposed pads</u> 0 cy 0 miles 0 acres <u>FFD</u> 0 cy 0 miles 0 acres	
Bridge at Nigliq Channel	Road and pipeline near CD-2	Pipeline-only near CD-2	Road and pipeline near CD-4	None	
Boat Ramps and Docks	<u>Five proposed pads and FFD</u> Floating Dock at CD-3, Ramp at CD-2 or CD-4				
Airstrips	<u>Five proposed pads</u> CD-3 <u>FFD</u> CD-14, CD-19, CD-20, CD-21, CD-29, APF-2, and APF-3	<u>Five proposed pads</u> CD-3, CD-5, and CD-6 <u>FFD</u> CD-14, **CD-18,** CD-19, CD-20, CD-21, **CD-22,** CD-24, and APF-3	<u>Five proposed pads</u> None <u>FFD</u> APF-2 and APF-3	<u>Five proposed pads</u> At all pads <u>FFD</u> at all pads, CD-11 shares with CD-4	<u>Five proposed pads</u> None, helipads at all pads <u>FFD</u> None, helipads at all pads

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

	Alternative A **CPAI Proposed Action**	**Alternative B** **Conform to BLM IAP/EIS**	**Alternative C** **Alternative Road Access**	**Alternative D** **Roadless Development**	
				D-1 **Fixed Wing Aircraft Access**	**D-2** **Helicopter Access**
Aircraft Flights, 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 Summer 2004: 40 F Winter 2004/05: 70 F Summer 2005: 180 F Winter 2005/06: 150 F Summer 2006: 364 F Winter 2006/07: 184 F Summer 2007: 69 F Winter 2007/08: 164 F Summer 2008: 124 F Winter 2008/09: 164 F Summer 2009: 24 F Winter 2009/10: 164 F Summer 2010: 109 F Winter 2010/11: 159 F			Five Proposed Pads Winter 2004/05: 70 F Summer 2005: 240 F Winter 2005/06: 150 F Summer 2006: 510 F Winter 2006/07: 184 F Summer 2007: 358 F Winter 2007/08: 164 F Summer 2008: 877 F Winter 2008/09: 164 F Summer 2009: 72 F Winter 2009/10: 164 F Summer 2010: 746 F Winter 2010/11: 159 F	Five Proposed Pads Winter 2004/05: 70 F, 36 H Summer 2005: 180 F, 65 H Winter 2005/06: 26 F, 38 H Summer 2006: 219 H Winter 2006/07: 26 F, 118 H Summer 2007: 99 H Winter 2007/08: 26 F, 70 H Summer 2008: 99 H Winter 2008/09: 26 F, 70 H Summer 2009: 99 H Winter 2009/10: 26 F, 70 H Summer 2010: 164 H Winter 2010/11: 96 F,106 H Five-Pad Scenario continues approx 20 years, traffic not estimated.

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

	Alternative A **CPAI Proposed Action**	**Alternative B** **Conform to BLM IAP/EIS**	**Alternative C** **Alternative Road Access**	**Alternative D** **Roadless Development**	
				D-1 **Fixed Wing Aircraft Access**	**D-2** **Helicopter Access**
Other Access	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and power line construction. Annual ice road to CD-3 during drilling and every few years thereafter, low ground pressure vehicles FFD Ice roads to all pads during road, pad, pipeline, and power line 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 power line 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 power line construction. Annual ice roads to non-roaded pads in lower Colville River Delta and to pads or isolated roads in NPR-A not connected by road to Nuiqsut during drilling and every few years thereafter; low-pressure vehicles.	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and power line construction. Ice road to CD-3 during construction, low ground pressure vehicles FFD Ice roads to all pads during road, pad, pipeline, and power line construction. Ice roads to pads during construction; low-pressure vehicles	Five Proposed Pads Ice roads to all pads during road, pad, pipeline, and power line 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 power line construction. Annual ice roads to all pads during drilling and every few years thereafter; low-pressure vehicles	

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

	Alternative A **CPAI Proposed Action**	**Alternative B** **Conform to BLM IAP/EIS**	**Alternative C** **Alternative Road Access**	**Alternative D** **Roadless Development**	
				D-1 **Fixed Wing Aircraft Access**	**D-2** **Helicopter Access**
Miles of Ice Roads	Five Proposed Pads 2005-2010: 256 miles FFD 2011-2015: 129 miles 2016-2018: 31 miles 2019-2022: 50 miles 2023-2026: 111 miles 2027-2030: 51 miles	Five Proposed Pads 2005-2010: 263 miles FFD 2011-2015: 132 miles 2016-2018: 44 miles 2019-2022: 112 miles 2023-2026: 144 miles 2027-2030: 51 miles	Five Proposed Pads 2005-2010: 255 miles FFD 2011-2015: 75 miles 2016-2018: 31 miles 2019-2022: 48 miles 2023-2026: 50 miles 2027-2030: 41 miles	Five Proposed Pads 2005-2010: 327 miles FFD 2011-2015: 193 miles 2016-2018: 173 miles 2019-2022: 437 miles 2023-2026: 719 miles 2027-2030: 736 miles	Five Proposed Pads 2005-2010: 36 miles 2011-2015: 70 miles 2016-2018: 78 miles 2019-2022: 128 miles 2023-2026: 128 miles 2027-2030: 172 miles FFD Not estimated, would extend approx. 100 years.
Pipelines					
Route	Five Proposed Pads As CPAI proposed FFD No restrictions on location	Five Proposed Pads Pipelines near CD-6 moved outside 3-mile setback for Fish Creek FFD Setbacks restrict areas in which pipelines can be placed	Five Proposed Pads Parallel Roads FFD No restrictions on location	Five Proposed Pads Nearly identical to CPAI Proposal FFD No restrictions on location	
Elevation	5-foot minimum	5-foot minimum	7-foot minimum **AT VSMs**	7-foot minimum **AT VSMs**	
Length of Pipeline Corridor Number of VSMs	Five proposed pads 35.5 miles 3412 VSMs FFD 150.1 miles 14,411 VSMs	Five proposed pads 34.0 miles 3,263 VSMs FFD 135.9 miles 13,044 VSMs	Five proposed pads 41.1 miles 3,948 VSMs FFD 148.7 miles 14,278 VSMs	Five proposed pads 34.6 miles 3,325 VSMs FFD 150.1 miles 14,405 VSMs	

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

	Alternative A CPAI Proposed Action	**Alternative B** Conform to BLM IAP/EIS	**Alternative C** Alternative Road Access	**Alternative D** Roadless Development	
				D-1 Fixed Wing Aircraft Access	**D-2** Helicopter Access
Pipeline at Nigliq Channel	On bridge near CD-2	On pipeline-only bridge	On bridge near CD-4	Under channel near CD-2	
Power lines	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' spacing	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 their 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.

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 pipeline 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 the proposed gas sales line. Leaks, especially small leaks, in buried pipeline also are harder to detect than in aboveground pipeline**s**, and consequently more product can reach the environment before a leak is stopped. This can be even more problematic with three-phase pipelines for which leak detection is less sensitive than for crude-oil pipeline**s**. Buried pipeline installation also destroys or disturbs soils and vegetation and disrupts natural drainages. Finally, burying the pipeline would increase the cost of the project.

Because of the environmental risks associated with buried pipelines, burying pipelines in a road or the tundra does not achieve the purpose of the proposed project 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 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.

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 proposed project, 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, because it entails its own risks of adverse impacts, and because it 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 promise 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 their 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 CPAI proposal.

2.6.4 Use of Docks to Develop Facilities

Docks are not a practical alternative means of developing the facilities proposed by CPAI. Using 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 development proposal**.** Winter hauling on ice roads or over the frozen tundra, lakes, and streams is much more practical for both environmental and logistical reasons. Such an approach is the most likely means to develop future proposed facilities in the Plan Area.

2.6.5 Required Local Employment and Training

Local residents would like to benefit from employment in any new oil development activities. CPAI offers some training and employment programs for local residents, and the State of Alaska encourages employment of state residents. The BLM, however, lacks legal authority to direct private companies' training and hiring decisions. Moreover, requiring local employment and training is not necessary to meet the purpose and need for the proposed project as described in Section 1. Therefore, local training and employment has been eliminated from consideration as a detailed alternative.

2.6.6 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 proposed project and are not a reasonable alternative to accomplish those purposes.

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

Nuiqsut Village leaders 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 proposed project, and is not a reasonable alternative**.** However, setbacks of varying widths are required around all waterbodies on BLM-managed public lands and are under consideration as mitigating measures on other lands in the Plan Area**.**

2.6.8 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 proposed project and therefore is not a reasonable alternative to the proposed action. Fewer pads would not be able to produce the oil that the applicant proposed to develop. The economics and technological limitations of North Slope oil development dictate that constructing fewer than the proposed five pads would not be adequate to produce oil from the oil accumulations CPAI proposes to develop. CPAI has designed its proposal with the minimum facilities necessary to produce the discovered oil. For the same reasons, placing production pads at points more distant from the locations proposed by CPAI will make production of the oil economically and technologically infeasible, so it was also eliminated as an alternative to be considered in detail.

2.6.9 Use of a Road to Nuiqsut the State is Considering

The Alaska Department of Transportation and Public Facilities, working with the Alaska DNR, is in the preliminary stages of studying the feasibility of and potential routes for a road to Nuiqsut from the Dalton Highway. It is possible that if such a road were built on a schedule that meets CPAI's development timetable, it could provide access to CPAI's proposed production pads west of the Nigliq Channel and might make a road bridge from Alpine as proposed by CPAI unnecessary.

This EIS considers a road to Nuiqsut from the Dalton Highway as part of the cumulative impact analysis, and some of the road routes projected as part of Alternative C would be consistent with a possible future road development scenario to link CPAI's proposed pads to the potential state road. However, the state road is now no more than a conceptual design. No proposal has been submitted to permitting agencies and no funding has been allocated for detailed design or construction. If permits are granted and funding is allocated, it would still be some years until construction could take place. Construction of a state road is too uncertain and any realistic date for its construction is too far into the future for an alternative dependent upon the state's road to be a reasonable alternative means to achieve the purpose and need described in Section 1.0. If such a road is proposed in the future, it will undergo its own NEPA analysis, and its impact on CPAI's development plans would be considered.

2.6.10 Develop Western Part of Project 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. This 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, 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. It would necessitate the purchase, operation, and maintenance of numerous duplicate pieces of equipment and infrastructure that are already in place at Alpine. Essentially the NOC would be a duplicate of the Alpine facility without the hydrocarbon processing facilities and the camp (although there may need to be a small camp). 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 an NOC. The NSB constructed a similar operations center facility at the Kuparuk River field in the early 1980s. That facility was underutilized and dismantled due to insufficient oil field activity to support it, although Kuparuk had much more oil production than that currently proposed in NPR-A. The projected level of development in the NPR-A would not support the additional expense involved with the NOC. Therefore, an alternative dependent upon a NOC would not be economically viable and was eliminated from detailed analysis as an alternative.

2.6.11 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 impact 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 in order 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 waterbodies 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. While 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 CPAI's proposal (Alternative A) and three action alternatives (Alternatives B, C, and D). 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 CPAI's proposal. 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**
Impacts to physiography could occur primarily during the construction phase and result from changes to landforms by construction of roads, pads, airstrips, and mine sites. If not properly designed and constructed, these project features could adversely affect thermal stability of the tundra and hydrology through thermokarsting and increased ponding. Total area of land intrusive actions = 335 acres.	Same types of impacts as Alternative A. Lesser magnitude of land-intrusive actions than Alternative A resulting from fewer roads, shorter road lengths, and fewer acres involved with gravel mining. Total area of land-intrusive actions = 232 acres.	Same types of impacts as Alternative A. Greater magnitude of land-intrusive actions than Alternative A resulting from additional roads, longer road lengths, and more acres involved with gravel mining. Total area of land intrusive actions = 465 acres.	Same types of impacts as Alternative A. Lesser magnitude of land-intrusive actions than Alternative A resulting from roadless design, less acres for gravel mining, and reliance on airstrips or helipads Total area of land-intrusive actions = **223** acres for Alternative D-1, and 89 acres for Alternative D-2.
Physical: Terrestrial – Geology			
ALL ACTION ALTERNATIVES			
Reduction of petroleum resources in the Plan Area would occur. Because these resources are non-renewable, effects would be permanent. Impacts to lithified resources in the Plan Area would produce no measurable effect.			
Physical: Terrestrial – Soils and Permafrost			
ALL ACTION ALTERNATIVES			
Impacts occurring during the construction and operation phases of Alternative A affecting the mechanical and thermal properties of the soil would also modify permafrost distribution. Less than 1% of the total soil and permafrost system surface area within the Plan Area would be affected.			
Physical: Terrestrial – Sand and Gravel			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Requires 2,257,000 cubic yards of sand and gravel for use as fill for construction of roads, pads, or airstrips. Once used, sand and gravel resources could be available for reuse upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.	Requires 1,845*,000 cubic yards of sand and gravel for use as fill for construction of roads, pads, or airstrips. Once used, sand and gravel resources could be available for reuse upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.	Requires 2,991,000 cubic yards of sand and gravel for use as fill for construction of roads, pads, or airstrips. Once used, sand and gravel resources could be available for reuse upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.	Requires 1,769,000 cubic yards of sand and gravel for Alternative D-1, and 756,000 cubic yards of sand and gravel for Alternative D-2 for use as fill for construction of roads, pads, or airstrips Once used, sand and gravel resources could be available for reuse upon abandonment. Removal of gravel fill is not currently a scheduled phase of abandonment.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Physical: Terrestrial – Paleontological Resources			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 production well drilling, sand and gravel mining, and installation of VSMs, power poles, and bridge piles.	There may be less of a chance for subsurface disturbance due to 28 fewer acres of gravel mining than Alt. A.	There may be more of a chance for subsurface disturbance due to 21 more acres of gravel mining than Alt. A.	There may be less of a chance for subsurface disturbance due to 14 fewer acres for D-1 and 43 fewer acres for D-2 of gravel mining than Alt.1.
Physical: Aquatic – Water Resources			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 road 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 have been minimized by incorporating design features to protect the structural integrity of the road-and pipeline-crossing structures to accommodate all but extreme flood events. CD-7, however, is located in a drained lake basin, which suggests that during high-water periods water could accumulate near the pad.	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 to water resources along these segments.	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.	Same types of impacts as Alternative A, except elimination of gravel roads would reduce the overall impacts to water resources (e.g., fewer impacts to streams and rivers resulting from reduced road and pipeline crossings, fewer impacts to 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 to lakes.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Physical: Aquatic – Surface Water Quality			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 to surface water quality than Alternative A, due to the movement of several production facilities outside sensitive resource areas and reduction in total miles of roads to be constructed. Facilities located distances 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, resulting in lower levels of turbidity.	Would have more sources of potential impacts to surface water quality than Alternative A because of the increased roads requiring more gravel placement. Decreased miles of ice roads compared to Alternative A, lowering the chance that ice roads would be routed across lakes, and potentially affecting dissolved oxygen concentrations. Increased area potentially affected by thermokarst erosion compared to Alternative A, leading to increased impacts to water quality from increased turbidity caused by erosion and sedimentation. Increased potential for dust fallout and upslope impoundments compared to Alternative A, resulting in a potential for greater levels of turbidity.	Would have fewer sources of potential impacts to surface water quality than Alternative A because of the decreased gravel placement. Additional ground disturbance would occur during power line burial. 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, lowering potential for turbidity caused by erosion and sedimentation. Minimal potential for dust fallout and upslope impoundments compared to Alternative A, resulting in less potential for turbidity.

Physical: Aquatic – Estuarine Waters and Water Quality
ALL ACTION ALTERNATIVES
Since the pad, road, and pipeline locations are not near the coast, no expected impacts to the physical conditions or processes within the estuarine and nearshore environment are expected.

Physical: Atmospheric Environment – Climate and Meteorology
ALL ACTION ALTERNATIVES
GHG 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 negligible.

Physical: Atmospheric Environment – Air Quality
ALL ACTION ALTERNATIVES
Construction and Operations would result in air emissions in the region. The emissions would not have a lasting impact to air quality.

Physical: Atmospheric Environment – Noise
ALL ACTION ALTERNATIVES
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.

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**
268 acres covered by fill, 251 acres altered by indirect impacts. All impacts would be to wetlands. Most impacts in the Colville River Delta are to Patterned and Nonpatterned Wet Meadow. Most impacts in the NPR-A are to Moist Sedge Shrub Meadow and Tussock Tundra. Less than 5% of available habitats would be affected by gravel fill. Additionally, 65 acres would be directly impacted by gravel mining.	188 acres covered by fill, 139 acres altered by indirect impacts. Same as Alternative A. Additionally, 37 acres would be directly impacted by gravel mining.	380 acres covered by fill, 373 acres altered by indirect impacts. All impacts would be to wetlands. Most impacts in the Colville River Delta are to Patterned and Nonpatterned Wet Meadow and Moist Sedge-Shrub Meadow. Most impacts in the NPR-A are to Moist Sedge Shrub Meadow and Tussock Tundra. Less than 5% of available habitats would be affected by gravel fill. Additionally, 86 acres would be directly impacted by gravel mining.	For Alternative D-1: 183 acres covered by fill, 94 acres altered by indirect impacts. For Alternative D-2: 92 acres covered by fill, 94 acres altered by indirect impacts. All impacts would be to wetlands. Most impacts in the Colville River Delta are to Patterned and Nonpatterned Wet Meadow. Most impacts in the NPR-A are to Patterned and Nonpatterned Wet Meadow, Moist Sedge Shrub Meadow, and Tussock Tundra. Less than 5% of available habitats would be affected by gravel fill. Additionally, gravel mining would directly impact 51 acres for D-1 and 22 acres for D-2.
Biological: Fish			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Potential impacts to winter habitat, and feeding and spawning areas including 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.	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.	Construction impacts would be less than Alternative A because no roads are proposed, and the pipeline crossing of the Nigliq Channel would be accomplished by HDD. Impacts to fish from ice roads would be greater than Alternative A.

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**
26 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <0.5% of available habitats in the Colville River Delta used by 80% of nesting waterfowl and loon species (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <1% of available habitats in the NPR-A used by 30% of nesting waterfowl and loon species (Aquatic Sedge Marsh and Moist Tussock Tundra) would be affected. More potential nests affected at CD-3 than other 4 sites.	39 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to disturbance than to habitat loss and alteration. <0.5% of available habitats in the Colville River Delta used by 80% of nesting waterfowl and loon species (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Shallow Open Water with Island habitat in the NPR-A used by 44% of nesting waterfowl and loon species and <0.5% of available Aquatic Sedge Marsh and Moist Tussock Tundra used by 33% of species would be affected. More potential nests affected at CD-3 and CD-5 than other 3 sites.	24 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <1% of available habitats in the Colville River Delta used by 80% of nesting waterfowl and loon species (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Shallow Open Water with Island habitat in the NPR-A used by 44% of nesting waterfowl and loon species and <1% of available Aquatic Sedge Marsh and Moist Tussock Tundra used by 33% of species would be affected. More potential nests affected at CD-3 and CD-5 than other 3 sites. Local access could affect amount of hunting mortality.	For Alternative D-1, 55 potential nests displaced by habitat loss, alteration, or disturbance. For Alternative D-2, 34 potential nests displaced by habitat loss, alteration or disturbance. Most displacement would result from disturbance (70%) than to habitat loss and alteration. <0.5% of available habitats in the Colville River Delta used by 80% of nesting waterfowl and loon species (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Aquatic Sedge Marsh and Moist Tussock Tundra habitat in the NPR-A used by 33% of nesting waterfowl and loon species would be affected. More potential disturbance at CD-3 and CD-5 than other 3 sites.
Biological: Birds – Ptarmigan			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
2 potential nests displaced by habitat loss or alteration. Most impacts from habitat loss and mortality due to collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. 25 mi roads for potential collisions. Local access to NPR-A could affect amount of hunting mortality.	4 potential nests displaced by habitat loss or alteration. Most impacts from habitat loss and mortality due to collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. 10 mi roads for potential collisions.	2 potential nests displaced by habitat loss or alteration. Most impacts from habitat loss and mortality due to collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. 41 mi roads for potential collisions. Local access to Colville River Delta and NPR-A could affect amount of hunting mortality.	For Alternative D-1, 5 potential nests displaced by habitat loss or alteration. For Alternative D-2, 3 potential nests displaced by habitat loss or alteration. Most impacts due to habitat loss and mortality due to collisions with vehicles during winter and early spring when ptarmigan are attracted to roads for grit and early snowmelt. These alternatives have no roads.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Biological: Birds – Raptors and Owls			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Little chance of impacting nesting habitats for ground-nesting species. 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
Biological: Birds – Shorebirds			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. Disturbance impacts not consistently demonstrated for shorebirds. <1% of available moist habitats and <5% of aquatic and wet habitats used by other species in the Colville River Delta would be affected. <1% of available moist habitats in the NPR-A and <5% of aquatic and wet habitats would be affected. More potential nests affected at CD-6 and CD-3 than for other 3 sites.	113 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <1% of available moist habitats and <5% of aquatic and wet habitats used by other species in the Colville River Delta would be affected. <0.5% of available moist habitats in the NPR-A and <5% of aquatic and wet habitats would be affected. More potential nests affected at CD-3 than for other 4 sites.	169 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <1% of available moist habitats and <5% of aquatic and wet habitats used by other species in the Colville River Delta would be affected. <0.5% of available moist habitats in the NPR-A and <5% of aquatic and wet habitats would be affected. More potential nests affected at CD-3 than for other 4 sites.	For Alternative D-1, 115 potential nests displaced by habitat loss or alteration. For Alternative D-2, 87 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <0.5% of available moist habitats and <1% of aquatic and wet habitats used by other species in the Colville River Delta would be affected. <0.5% of available moist habitats in the NPR-A and <5% of aquatic and wet habitats would be affected. More potential nests affected at CD-3 and CD-4 than for other 3 sites.
Biological: Birds – Seabirds (Gulls, Jaegers, and Terns)			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
3 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <5% of available aquatic and wet habitats in the Colville River Delta used by seabirds would be affected. <1% of available aquatic and wet habitats in the NPR-A used by nesting and brood-rearing seabirds would be affected.	5 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to disturbance than to habitat loss and alteration. <5% of available aquatic and wet habitats in the Colville River Delta used by seabirds would be affected. <5% of available aquatic and wet habitats in the NPR-A used by nesting and brood-rearing seabirds would be affected.	3 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <5% of available aquatic and wet habitats available in the Colville River Delta would be affected. <5% of available aquatic and wet habitat in the NPR-A used by nesting and brood-rearing seabirds would be affected.	For Alternative D-1, 7 potential nests displaced by habitat loss, alteration, or disturbance. For Alternative D-2, 4 potential nests displaced by habitat loss, alteration, or disturbance. More displacement due to disturbance (70%) than to habitat loss and alteration. <1% of available aquatic and wet habitats in the Colville River Delta would be affected. <5% of available aquatic and wet habitat in the NPR-A used by nesting and brood-rearing seabirds would be affected.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Biological: Birds - Passerines			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
65 potential nests displaced by habitat loss or alteration. Displacement from habitat loss and alteration. Disturbance impacts not consistently demonstrated for passerines. <1% of available moist and riparian habitats used by passerines in the Colville River Delta would be affected. <1% of available moist and riparian habitats in the NPR-A would be affected. More potential nests affected at CD-6 than for other 4 sites.	57 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <1% of available moist and riparian habitats used by passerines in the Colville River Delta would be affected. <1% of available moist and riparian habitats in the NPR-A would be affected. More potential nests affected at CD-3 than for other 4 sites.	85 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <5% of available moist and riparian habitats used by passerines in the Colville River Delta would be affected. <1% of available moist and riparian habitats in the NPR-A would be affected. More potential nests affected at CD-3 and CD-6 than for other 3 sites.	For Alternative D-1, 57 potential nests displaced by habitat loss or alteration. For Alternative D-2, 44 potential nests displaced by habitat loss or alteration. Displacement due to habitat loss and alteration. <1% of available moist and riparian habitats used by passerines in the Colville River Delta would be affected. <1% of available moist and riparian habitats in the NPR-A would be affected. More potential nests affected at CD-3 and CD-4 than for other 3 sites.
Biological: Terrestrial Mammals			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Approximately 270 acres of undeveloped lands that provide habitat for terrestrial mammals will 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, musk oxen, and grizzly bears in the vicinity of infrastructure. This may cause animals to move away (i.e., displacement) from infrastructure. Pipelines will be elevated five 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 oil field roads will increase the mortality of caribou, and possibly moose, musk oxen, and grizzly bears. It is unlikely these impacts will have a negative impact at the population level.	Approximately 195 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 379 acres of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 86 acres excavated to obtain gravel. 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 seven 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 172 acres (D-1)/ 67 acres (D-2) of undeveloped lands that provide habitat for terrestrial mammals would be covered with gravel fill and 51/22 acres 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 seven 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 due to the absence of roads.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Biological: Marine Mammals			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 oil field 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, suggest 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 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.	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.
Biological: Threatened and Endangered Species – Bowhead Whale			
ALL ACTION ALTERNATIVES			
Potential impacts would be limited to major spills and aircraft noise.			
Biological: Threatened and Endangered Species – Spectacled Elder			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
1 potential nest displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <0.5% of available habitats in the Colville River Delta used spectacled eiders (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <1% of available habitats in the NPR-A used by spectacled eiders (Aquatic Sedge Marsh and Moist Tussock Tundra) would be affected. More potential nests affected at CD-3 than other 4 sites.	1 potential nest displaced by habitat loss, alteration, or disturbance. More displacement due to disturbance than to habitat loss and alteration. <0.5% of available habitats in the Colville River Delta used spectacled eiders (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Shallow Open Water with Island habitat in the NPR-A used by spectacled eiders and <0.5% of available Aquatic Sedge Marsh and Moist Tussock Tundra used by spectacled eiders would be affected. More potential nests affected at CD-3 than other 4 sites.	1 potential nest displaced by habitat loss, alteration, or disturbance. More displacement due to habitat loss and alteration than to disturbance. <1% of available habitats in the Colville River Delta used by spectacled eiders (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Shallow Open Water with Island habitat in the NPR-A used by spectacled eiders and <1% of available Aquatic Sedge Marsh and Moist Tussock Tundra used by spectacled eiders would be affected. More potential nests affected at CD-3 and CD-5 than other 3 sites. Local access could affect amount of hunting mortality.	For Alternative D-1, 2 potential nests displaced by habitat loss, alteration, or disturbance. For Alternative D-2, 2 potential nests displaced by habitat loss, alteration or disturbance. Most displacement due to disturbance (70%) than to habitat loss and alteration. <0.5% of available habitats in the Colville River Delta used spectacled eiders (Aquatic Sedge with Deep Polygons and Patterned Wet Meadow) would be affected. <0.5% of available Aquatic Sedge Marsh habitat in the NPR-A used by spectacled eiders would be affected. More potential disturbance at CD-3 than other 4 sites.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Biological: Threatened and Endangered Species – Steller's Elder			
ALL ACTION ALTERNATIVES			
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.			
Social Systems: Socio-Cultural			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Potential impacts to 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, Atqasut, 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.
Social Systems: Regional Economy			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Would provide an annual incremental increase in federal, state, and local tax revenues. This increase would be on the order of 2 to 4 percent (of 2001 revenues) for the NSB. It would be less than 1 percent 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 to 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 drill pad outside the three-mile setback for Fish Creek. Results in an overall reduction of 4.15 percent of the total production from the Alpine Satellites production units CD-3 through CD-7. The economic benefits from the Alternative B CPAI Development Plan 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

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**
Construction and operation of facilities and roads would affect availability of key subsistence resources due to 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 further. The location of production facility, pads, roads and pipelines within the Fish and Judy creeks buffer area would result in infrastructure close to important subsistence use areas for Nuiqsut.	Moving CD-6 and associated roads outside the Fish Creek 3 mile buffer 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 subsistence availability of resources. Unrestricted road access to BLM lands would eventually provide increased access to people who do not live in the area and increase competition for resources.	Less impact than Alternative A resulting from less road traffic to affect resource availability by associated disturbances. Seven-foot pipeline clearance would be less restrictive to movement by subsistence users. Other impacts would be similar to Alternative A.

Social Systems: Environmental Justice			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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, potential water quality, air quality, and aircraft noise impacts.	Same as Alternative A	Same as Alternative A, except relaxation of access restrictions limitations 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.

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Social Systems: Cultural Resources			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 to unknown resources because more gravel will be excavated	Same as Alternative A, except the absence of roads would eliminate potential impacts to cultural resources associated with road construction and there would be less risk of impacts to unknown resources because less gravel will be excavated.
Social Systems: Land Use and Coastal Management			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 area. Rezoning of land under the NSB Land Management Regulations from Conservation to Resource Development would be required.	Would result in a %approximately doubling 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 Land Management Regulations 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 acre developed would be less than that of other alternatives due to the absence of roads. Construction of CD-6 and associated roads and pipeline requires wavier of BLM stipulation for development within Fish Creek buffer area. Rezoning of land under the NSB Land Management Regulations from Conservation to Resource Development would be required.
Social Systems: Recreation			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
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 of local residents.	Same as Alternative A

TABLE 2.7-1 COMPARISON OF IMPACTS AMONG ACTION ALTERNATIVES (cont'd)

Social Systems: Visual			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
Construction and operation would result in adverse effects to visual resources. Facilities and structures associated with operation would introduce contrast to the natural landscape. The presence of drill rigs, of 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 due to 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 due to 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, would be the same as Alternative A.
Social Systems: Transportation			
ALTERNATIVE A	**ALTERNATIVE B**	**ALTERNATIVE C**	**ALTERNATIVE D**
No adverse effects on public roads or transportation systems. Adds 25.6 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 11.3 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 44.3 miles of new roads in study area. Unrestricted use of project roads on BLM lands, use by industry and local residents only on Sate 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 3.6 miles of new roads in study area for industry use only. Lowest potential secondary effects on wildlife, subsistence, and recreation from increased access.

2.8 INSPECTION AND MONITORING

Federal, state, and NSB agencies will inspect the construction and operation of any facilities that they permit. BLM will 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.

In addition, the permits issued by the agencies may require specific 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 impacting a specific resource, such as eiders or caribou, in an adverse matter and assist in identifying means to mitigate the impact.

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 USACE, USEPA, USCG**,** and the State of Alaska to meet their needs for permitting actions related to the ASDP. If the EIS were 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 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. So also would requests to conduct certain operational, maintenance, and repair activities, such as ice road construction or a request to operate a vehicle on the tundra. Depending on the location and the nature of a future proposal, the BLM, USACE, USEPA**,** and/or USCG will conduct the appropriate NEPA analysis. Future NEPA analysis may be tiered from the ASDP EIS, including the full-field analysis. If all significant impacts and cumulative impacts have been adequately analyzed in the ASDP EIS, then NEPA requirements may be met with an administrative determination (such as the BLM's Determination of NEPA Adequacy). Alternatively, an environmental assessment may be prepared. If additional significant impacts that have not been considered here are associated with a future proposal, a new EIS will be undertaken.