INTRODUCTION

Appendices to the Beaufort Sea Oil and Gas Development/Northstar Project Environmental Impact Statement (EIS) consist of Appendices A through P. In order to allow the reader of both the Draft EIS (DEIS) and Final EIS (FEIS) to quickly use the appendices, we have continued the lettering of the appendices where we left off in the DEIS. The last appendix in the DEIS was Appendix J. The first new appendix to the FEIS is Appendix K. The last appendix to the FEIS is Appendix P. Appendices A, C, D, and E of the DEIS are printed in this FEIS because they have been revised since their publication in the DEIS. Those appendices that were not modified between the DEIS and FEIS (Appendices B, F, G, H, I, and J) are not re-published in this FEIS. These include the Biological Assessment (Appendix B), a draft version of the National Pollutant Discharge Elimination System (NPDES) permit (Appendix F), NPDES Fact Sheet (Appendix G), the Ocean Discharge Criteria Evaluation (Appendix H), the Section 103 Evaluation (Appendix I), and the draft version of the Underground Injection Control permit (Appendix J).

APPENDICES A THROUGH P

APPENDIX L

RESPONSE TO PUBLIC COMMENTS

This section presents responses to comments on the Northstar Draft Environmental Impact Statement (EIS) received during the official public comment period. The responses are presented in numerical order, beginning with federal letters (F1-F426) and followed by state letters (S1-S10). Responses to comments are identified by the comment number (F1-1 through F426-1). Responses were only prepared for those letters where comments had been identified by the U. S. Army Engineer District, Alaska (Corps) (i.e., no responses were prepared for letters S7, F255, F260, F357, and F405).

Several letters addressed to the State of Alaska contained comments regarding the EIS. Some of these letters were forwarded to the lead and cooperating federal agencies by the State of Alaska for informational purposes and are included in Appendices K and L as letters S1 through 10. Comments pertaining to the EIS have been bracketed and responses to comments have been prepared. These letters will also be addressed by the State of Alaska, as appropriate, in their decision making processes for this project.

Responses were drafted to meet National Environmental Policy Act, Council on Environmental Quality, and Corps guidelines. In some cases, the response to comment may direct the reader to another response. This was done to alert the reader to where additional information on the issue could be found. Connections between responses were only provided when it was determined to grant the most benefit to the originator of the comment.

A number of comments resulted in changes to the Draft EIS. Such changes are referenced in the response to comment. Changes made were intended to correct, clarify, or improve the information contained in the Final EIS.

In recognition of their government to government responsibilities, the federal agencies acknowledge the comments which are presented in the Inupiat Community of the Arctic Slope letter and are specifically addressed in this Appendix L (see Response to Comments - F420-7 through F420-85).

RESPONSE TO PUBLIC COMMENTS

Comment Number	Response to Comment
Federal Letters	
F1-1	We acknowledge your support of the project.
F2-1	We acknowledge your support of Alternative 2.
F3-1	We acknowledge your support of the project.
F4-1	We acknowledge your support of Alternative 2.
F5-1	We acknowledge your support of Alternative 2.
F6-1	We acknowledge your support of Alternative 2.
F7-1	We acknowledge your support of Alternative 2.
F8-1	We acknowledge your support of Alternative 2.
F9-1	We acknowledge your support of the project.
F10-1	We acknowledge your support of Alternative 2.
F11-1	We acknowledge your support of Alternative 2.
F12-1	We acknowledge your support of the project.
F13-1	We acknowledge your support of the project.
F14-1	We acknowledge your support of Alternative 2.
F14-2	We acknowledge your opinion that the Northstar subsea pipeline should be as short as possible as a cautionary approach to offshore Arctic development. The cooperating agencies will consider your recommendation as they determine their respective preferred alternatives.
F15-1	We acknowledge your support of Alternative 2.
F16-1	The only geodetic control monument near the pipeline corridor or Seal Island is located about 3 miles south of Point Storkersen on the west side of Fawn Creek. The Alternative 2 pipeline route would be approximately 1 mile east of this monument on the east side of Fawn Creek, thus no impacts to the monument are expected. No other pipeline route alternative is located within a mile of this marker.
F17-1	We acknowledge your support of the project.
F18-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension. For information regarding the concurrent review of state permits and the DEIS comment period, refer to response to comments F404-181 and F404-182.
F19-1	We acknowledge your support of Alternative 2.
F20-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F21-1	We acknowledge your opposition to the project.
F22-1	We acknowledge your support of Alternative 2.
F23-1	We acknowledge your support of Alternative 2.
F24-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public

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	comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F25-1	We acknowledge your support of Alternative 2.
F26-1	We acknowledge your opposition to the project.
F26-2	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F27-1	We acknowledge your opposition to the project related to global warming and the use of alternative energy sources. An in-depth presentation of the subject of global warming and alternative energy sources is presented in response to comments F404-21 and F404-27. We have also added a discussion on the Northstar Project's effects on global climate to Section 10.4.2.
F27-2	An oil spill related to the Northstar Project is not inevitable. From the data provided in Section 8.5.2 of the EIS, the most likely number of oil spills (greater than 1,000 barrels) is zero. Section 8.6 of the EIS describes oil spill containment/cleanup methods and discusses limitations to spill response. These limitations are summarized in the new Table 8-8 in the EIS. In June 1998, BPXA completed an "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska" which provides detailed information pertaining to spill response planning. In response to ADEC's request for additional information, BPXA issued an addendum to the Northstar ODPCP in September 1998. As noted in comment F422-16, the state has final responsibility for approval of the Northstar ODPCP.
F27-3	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F28-1	We acknowledge your support of Alternative 2.
F29-1	We acknowledge your opposition to the project.
F29-2	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F30-1	We acknowledge your support of Alternative 2.
F31-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension. For information regarding the concurrent review of state permits and the DEIS comment period, refer to response to comments F404-181 and F404-182.
F32-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with the support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F32-2	We agree that a complete citation is needed. The references were clarified in Section 6.9.2.2, and your comments on the Biological Assessment have been forwarded to the USFWS and NMFS for their use in drafting their Biological Opinions (Appendix M).

Comment Number	Response to Comment
F32-3	We agree that the reference should be corrected. The reference was corrected in Section 6.9.2.2, and your comments on the Biological Assessment have been forwarded to the USFWS and NMFS for their use in drafting their Biological Opinions (Appendix M).
F32-4	While it is possible that oil caused the whale "disappearance", the unprecedented loss of 14 killer whales (1991 count) from the 36 in the AB resident pod (photographed in September 1988) in Prince William Sound can not definitively be linked to oil exposure during the *Exxon Valdez* spill. Loughlin et al. (1994) specifies that "because carcasses were not found, no conclusive evidence exists to confirm that the animals had died or that the cause of death was a result of exposure to *Exxon Valdez* oil." Dahlheim and Matkin (1994) conclude that the missing whales died from a combination of natural causes, a result of fisheries interactions, or the oil spill. However, Dahlheim and Matkin (1994) do suggest that the fact that the spill occurred at the same time as the loss of whales is strong coincidental evidence supporting the oil spill as the causative agent. Due to the disagreement over the degree of toxicological hazard posed to whales by oil, opposing professional perspectives were presented in the Biological Assessment.
F32-5	The text in Sections 8.7.2.1 and 8.7.2.2 has been changed to more clearly state the expected impacts from an oil spill. See changes to Sections 8.7.2.1 and 8.7.2.2. Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS for their use in drafting their Biological Opinions (Appendix M).
F32-6	We referenced the Lease Sale 170 EIS because it contained the professional opinion of MMS scientists on issues relevant to the Northstar Project EIS. Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS for their use in drafting their Biological Opinions (Appendix M).
F33-1	We acknowledge your support of the project.
F34-1	We do not concur with your comment expressing disagreement with DEIS conclusions that potential impacts on subsistence whale hunting may occur as a result of the project. The discussion of construction impacts in Section 9.8.2.2 of the DEIS indicated that if certain types of construction and support activities occur during the fall bowhead migration, deflection of bowhead migration of up to 25 miles (40 km) could occur. Such a deflection could jeopardize whaling success and cause a significant impact to the fall harvest of bowhead whales by Nuiqsut whalers. In addition to the potential deflection of bowhead whale migration, Inupiat whaling captains have testified to other noise-related effects on whale behavior, making whales more difficult to hunt (see Section 7.3.1.2). A text modification has been made to clarify the project schedule and location as it relates to whale migration (see Section 7.3.2.2 for revised text). We continue to believe there is potential for significant impacts to subsistence whale hunting based on the whaling captains' testimony as it relates to behavioral responses to noise and western science data.
F34-2	We acknowledge your suggestion that a re-evaluation of the merits of the Environmentally Preferred Alternative (Alternative 5) should be undertaken in light of the information provided in comments to the DEIS. The lead agency chose to identify its Environmentally Preferred Alternative (Alternative 5) in the DEIS for purposes of soliciting public comment. Section 1505.2(b) of NEPA requires that, in cases where an EIS has been prepared, the Record of Decision (ROD) must identify all alternatives that were considered, " . . .specifying the alternative or alternatives that were considered to be environmentally preferable." The NEPA process provides a federal agency with the opportunity to state its Environmentally Preferred Alternative and its preferred alternative, in the DEIS, the FEIS, and the ROD. In each case, the alternatives could change should new information be brought forward by the public or other agencies to support a revision. The subsequent re-evaluation of alternatives carried forward is undertaken as a part of the NEPA process. The lead agency will re-evaluate the Environmentally Preferred Alternative based on comments received on the DEIS and as a normal part of its EIS development process.
F34-3	We disagree with your concern that the DEIS does not account for mitigation measures incorporated into

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	the project. Refer to response to comment F34-9 for more information.
F34-4	The "Northstar Project Area" is considered larger than the narrow corridor extending from Seal Island to Pump Station No. 1 for several reasons. During the early phases of this project, the cooperating agencies determined that the Northstar Project Area, for the purposes of this EIS, would encompass an area bound by lands just south of Pump Station No. 1, to a point approximately 10 miles (16 km) north of the Northstar Unit, and encompass all existing oil infrastructure present at the time along the east-west axis. Such an area was believed to be large enough to capture most all direct environmental impacts of the proposed project. It was also selected as a reasonable area from which to gather appropriate environmental data, particularly on the physical environment in consideration of extremely limited data available for the narrow corridor itself. Indirect impacts to subsistence, socioeconomics, and migratory species would occur far beyond the designated "Project Area." The physical extent of broader effects is noted when they are described in each section of the EIS. A broader view also was considered appropriate because this is the first offshore oil and gas development/production facility in the Alaska Beaufort Sea and the EIS may be used as a baseline NEPA document for other proposals within the Northstar Project Cumulative Development Area (see Chapter 10, Figure 10-1).
F34-5	We agree that the term "unit" does have a specific legal meaning with respect to oil and gas leases which is inappropriate for this EIS. The portion of state lands located between ANWR and NPRA is commonly referred to as either "state lands", or "Alaska acreage available for oil and gas leasing" by the Alaska Department of Natural Resources. We agree that to eliminate confusion concerning these lands, a change is warranted to the EIS.
F34-6	We disagree that the text, as it relates to the broader review of the Beaufort Sea oil and gas development in the DEIS (Chapter 3), could more fully explain the purpose of this part of the EIS and its legal significance with respect to NEPA. It is stated in Section 3.1 that the EIS took a broad view because the Northstar Development Project is the first proposed for the Alaska Outer Continental Shelf and that future development and production activities are likely.
F34-7	We acknowledge your comment that an explanation is needed of the approach used to discuss the physical, biological, and human environments separately. See response to comment F34-35.
F34-8	We acknowledge your comment about potential inconsistencies that may exist between the Executive Summary and the text of the DEIS. All sections of the EIS have been rechecked for consistency.
F34-9	We disagree with your concern that the DEIS does not account for mitigation measures incorporated into the project. The DEIS does account for mitigation measures that have been incorporated as part of project design. These measures are presented in Table 1-1 of the EIS and discussed in appropriate sections throughout the document.
F34-10	We acknowledge your disagreement with selection of the West Dock pipeline route (Alternative 5) as the Environmentally Preferred Alternative. Refer to response to comment F34-2 and Section 11.9 in the EIS and note that, pursuant to NEPA guidelines, the Environmentally Preferred Alternative does not take into account project cost considerations as a selection criteria.
F34-11	Each of the four action alternatives was selected because it met the "reasonableness criteria" under NEPA, as well as addressing at least one significant environmental issue. These alternatives were intended to provide a contrast for analysis and public review. For example, how one values certain environmental resources or impacts will determine a preference for certain alternatives. Alternative 1 - No Action, is favored by those who oppose the project because of concerns with overall environmental
F34-11 (Cont.)	impacts. Clearly, they favor avoiding all risk of environmental impacts over the proposed oil development project. Alternative 2, is supported by the applicant and many in the oil industry because it contains the shortest undersea pipeline route and the lowest overall project cost. Some public comments supporting this alternative indicate a preference to minimize the probability of undersea oil spills. In contrast, some individuals support Alternative 5 because they place greater importance on minimizing terrestrial and wildlife impacts over a longer undersea pipeline route and associated greater disturbance to benthic habitat that pipeline construction will cause. There are other reasons why one alternative may be favored over another. The point is that each alternative was intended to provide a contrast for purposes of comparison. The difference in how the criteria were applied was intentionally done to

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	highlight the strengths and weaknesses of each alternative. Categorizing impacts as "minor" does not mean that the impacts are the same for each alternative, because the term encompasses a wide range of possible effects up to "significant." Some commentors may disagree with the finding of "minor" impacts and some will see more differences than similarities between alternatives based on their values and perspective.
F34-12	We agree that the shore crossing transition has been thoughtfully designed. However, shoreline erosion remains a concern because the landfall is subject to subsidence and storm forces that do not impact other segments of the pipelines. The local permafrost conditions present at the proposed landfalls near Point Storkersen and Point McIntyre are likely to experience more subsidence than the proposed landfill at West Dock causeway (Alternative 5). Similarly the shoreline transitions for the proposed landfalls under Alternatives 2, 3, and 4 are surrounded by adjacent natural shorelines, while the causeway landfall (Alternative 5) is built of gravel which is replenished as required; therefore, the landfalls for Alternatives 2, 3, and 4 are more subject to erosion than Alternative 5. We agree that the causeway will erode during major storm events, but believe that the erosion will be more uniform than would occur at other coastal landfalls. Differential erosion rates along the coastal areas would be attributable to the use of non-frost susceptible soils that would be placed within the otherwise permafrost-ridden natural shoreline. Engineering assessments validate that the setback from shore and protecting gravel berm (Alternatives 2, 3, and 4) would be sufficient to shield the valve pad and valve enclosure building from predictable natural events.
F34-13	Although we agree with the statement that the issue of permafrost thaw subsidence at the landfall sites for Alternatives 2, 3, and 4 is not expected to become a major concern, the excavation and replacement of 3 ft (0.9 m) of native material from below the pipelines at Point Storkersen and Point McIntyre only limits the potential for concern. It does not eliminate the possibility of strain problems as a thaw bulb grows around and below the buried pipelines. The pipeline pig inspection activities will enable pipeline operations staff to monitor any subsidence and pipeline movements observed, but would not alter the thermal regime as thawing progresses. The engineering studies cited on page 5.3-43 of the DEIS (Miller and McClelland-EBA) lead us to believe that the West Dock landfall would avoid subsidence caused by melting given the negligible exposure to permafrost soils at that landfall.
F34-14	Although portions of the West Dock causeway have experienced ice pile-up at times in the past, the construction of an additional 50 ft (15.2 m) of width along the western side of the causeway where the pipelines would be installed should provide adequate ice override protection, given that the adjacent water depth is 5 ft (1.5 m) or less from the proposed landfall to the shoreline. This shallow water depth will minimize the likelihood of appreciable ice pileup since the threatening ice will be groundfast after mid-winter. An additional engineering study would be required to assure that the 50 ft (15.2 m) of additional width proposed is an appropriate level of setback to provide sufficient pipeline safety.
F34-15	The widening of the West Dock causeway as part of Alternative 5 was described in the DEIS and fully considered in the environmental evaluation of that alternative. For example, in DEIS Section 4.5 of the Executive Summary, the last bulleted item in the eight point listing of distinguishing characteristics for this alternative mentions the causeway widening and its consequences. To assure that this covering of seabed area with gravel is consistently considered as important an impact as the disturbances caused by the excavation and backfill of the pipeline trench, we have added 5.5 acres (2.2 hectares) to the disturbed seafloor total noted throughout the EIS. This takes into account the 50 ft (15.2 m) width addition along 0.9 miles (1.44 km) of causeway. The revised total acreage referenced for Alternative 5 is 36.7 acres (14.9 hectares), andwas altered in various ways in the FEIS. The environmental impacts caused by covering this portion of seafloor are expected to be minor, generally in line with the disturbances caused by excavating similar areas of seafloor. However, the seafloor area covered by gravel would not return to typical soft-bottom habitat as the subsea pipeline trench area would.
F34-16	We agree that the strudel scour impact potentials are essentially the same for all action alternatives. See response to comment F34-47.
F34-17	Total offshore pipeline corridor lengths and estimated seafloor areas disturbed are presented for each action alternative on Figure 11-1. As indicated on page 6.3-11 of the DEIS, the benthic community is

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	tolerant of similar naturally occurring perturbations from ice gouging, strudel scour, and severe storms. Since impacts of trenching would be short-term and minor, an increased pipeline length of 50% does not represent a critical contrast between alternatives. The primary intent of Chapter 11 is to highlight important environmental differences among the alternatives. Differences in the estimated construction cost are also presented for each of the alternatives. It is not clear from the comment what can be quantified to compare differences in "construction risk" between alternatives. We agree that the increased offshore pipeline lengths associated with Alternatives 4 and 5 correspond to a higher chance of extending pipeline construction to two seasons. However, no increase in environmental impacts would be anticipated for extending pipeline construction, through a particular route, from one winter season to two since the total pipeline route (i.e., corridor length disturbed) would be the same. A comparison of alternatives on this issue would require knowledge of the time needed to construct particular lengths of the offshore pipeline and expected increased construction costs. There is still a degree of uncertainty in this construction time and cost information due to the lack of historic data. For the Ocean Discharge Criteria Evaluation, there are no differences among Alternatives 2 through 5.
F34-18	Access and construction were considered for all alternatives. The designs of Alternatives 3, 4, and 5 consolidate access and construction into a narrow, developed corridor. The trade-offs of having a narrow corridor with a shorter pipeline route were evaluated. It is recognized that road access for Alternatives 3, 4, and 5 may present different problems than road access for Alternative 2, depending on the alternative chosen and the time of year for which access may be necessary. However, no problems have been identified as insurmountable. It is unclear why the Western Gas Injection road issue was mentioned in the comment; however, permit stipulations are likely to remain the same for the service road if this corridor is used for the new pipeline, thus adding protection for wildlife in the area. Only Alternative 5 would have road access to the shoreline transition for the pipeline.
F34-19	An extensive literature review of reports, journal articles, and scientific papers was conducted during the preparation of the DEIS. However, the goal of the EIS was to be analytical, not encyclopedic. Analysis of the key issues that bear on the decision making process was made using the referenced materials in the DEIS, and not on unnecessary background information.
F34-20	The comment expresses disagreement with the statement that bowheads are sensitive to seismic survey sounds because of their expected hearing sensitivity in the seismic energy band. The concern is that this idea is erroneous because bowheads produce loud sounds. However, all evidence on mysticete auditory sensitivity indicates that the inner ears for species in this group are well adapted for low-frequency hearing (Ketten, 1993). Right whales, closely related to bowheads, are good examples of a case in which anatomical analysis of cochlear mechanics and histology indicate low-frequency auditory adaptations. Bowheads produce the majority of their sounds in the 100 to 400 Hz frequency range (Wursig and Clark, 1993:176 and 189; Greene, 1997:3-12 to 3-41; Richardson et al., 1995:Table 7-1). The contention that bowheads produce sounds at intensities of 200 dB re 1 μPA is unfounded. They do produce loud sounds but usually in the 155 to 165 dB range and sometimes as high as 180 to 185 dB. In either case, evidence showing that a species which produces loud transient signals and has an auditory system adapted for loud low-frequency sound, does not support the conclusion that very loud, human-made, rapid onset, transient sounds are not harmful or disturbing. In humans, the ear is protected from loud, self-made sounds by an involuntary reflex mechanism that dampens the transfer of energy to the ear. However, this mechanism is not applicable for protecting whales.
F34-21	The DEIS does state that some bird densities are declining, as indicated by long-term studies, but these studies do not state that there is a correlation between decreases and disturbance from oil field activities. Densities of some species in the Point McIntyre Reference Area, used in early years of studies as an example of undisturbed tundra habitat, have shown declines in density over time which have not been directly related to oil field development. Data from various studies have indicated that some birds exhibit a degree of avoidance of oil field structures such as roads and pads. Other species have shown an attraction to facilities such as roads and

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	this is likely due to the creations of impoundments adjacent to the roads. Both of these situations and degrees of impact are discussed in Section 6.7.1.5.
F34-22	We offer additional clarification to address your comment that many years of studies of bird use of North Slope oil fields indicate that bird densities have not been affected, and that numbers of some species have increased. The DEIS states that impacts of ice roads for construction adjacent to existing roads and pipelines would be less than ice roads through undisturbed tundra. This is primarily due to bird species that show an avoidance tendency to roads and pipelines and have already been displaced from areas adjacent to existing structures. The magnitude of the difference in impacts between undeveloped tundra and tundra adjacent to existing roads would likely be measurable. We believe this is a valid assumption based on data from research in the Prudhoe Bay area (Troy, 1988:47). Bird densities in specific areas surrounding Prudhoe Bay have been affected by oil field development even though populations have not been adversely affected. Displacement of birds from areas as a result of placing fill for roads and pads would be considered a measurable impact on birds. Avoidance of areas adjacent to oil field facilities has been demonstrated and would be considered a measurable impact on birds.
F34-23	We disagree with the comment regarding exaggeration by the DEIS concerning noise impacts to subsistence whaling.
F34-24	We disagree with the comment that whale migration and subsistence hunting will not be adversely affected by the Northstar Project. The risks exist. We do believe that these impacts can be mitigated (see Section 11.10) to reduce the risk.
F34-25	Your statement that only a very small proportion of the migratory bowheads will travel close enough to shore to come within range of sounds coming from the Northstar Project is generally correct. Most construction sounds produced by activities on the island itself are not expected to propagate very far and be detectable above natural background noise levels beyond ranges of several kilometers. However, certain activities, such as pile driving and hammering, can generate high sound levels that can be considerably greater than ambient (Spencer, 1996; Greene, 1987). The worst case impact of such high noise level activities would happen when a combination of events occurred simultaneously. This includes a high noise level activity such as pile driving or hammering, low ambient noise conditions so that the activity's noise is detectable at greater than normal range, and whales migrating within 6.2 to 9.3 miles (10 to 15 km) of the site. See changes to text in Section 9.8.2.1.
F34-26	Timing of island construction activities helps place the potential impact of island construction noise into perspective. Scheduling the activities during periods when whales are not expected to be in the region, greatly reduces the chances that migrating bowheads will be exposed to detectable levels of island construction noise. Given the construction schedule, the expected migration flux and distribution of whales, and the expected distribution of ambient noise levels, it is expected that less than 1% to 2% of the animals would be exposed to noise levels greater than ambient in a third octave band. See changes to Section 9.8.2.1.
F34-27	We acknowledge your comment regarding the timing of barge and vessel traffic. See response to comment F34-26.
F34-28	We acknowledge your comment regarding the timing of slope protection work. See response to comment F34-26.
F34-29	We acknowledge your comment regarding the timing of operations and sound levels. See response to comment F34-26.
F34-30	This comment seems to contradict some of the work by Richardson et al. in 1997 and 1998, as well as the results of the LGL and Greeneridge Sciences 1987 report for Shell Western E&P Inc. Richardson et al. (1988) (the report on the Northstar Marine Mammal Monitoring Program conducted in 1997) showed that few, if any, whales were seen during aerial surveys within 12.4 miles (20 km) of the seismic vessel. The Shell Western E&P Inc. monitoring results, although a small sample size, also describe no whales within 8.1 miles (13 km) of an active drillship. Although it could be argued that these results are not proof of long-term displacement, they do agree and support the conclusion that animals are displaced away from the site of industrial activity. It should also be noted that these were not statistically derived results. No statistics were needed to show that whales were avoiding an active industrial site. Thus, these

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	results fall under the heading of consistent and obvious as opposed to statistical, and are therefore of greater weight in the evaluation of whether or not displacement is likely to occur. It should be clarified that, for this project, long-term is defined as lasting more than 15 years.
F34-31	Although seismic activities are not a part of the Northstar Project, such activities may be conducted during the life of the project to further delineate the reservoir. Seismic survey activities are among the loudest in the region and are of concern to local residents and governmental agencies. Therefore, information related to seismic activities and a description of their effects to subsistence harvest of marine mammals are presented to the reader in Section 7.3. It is important to note that an impact analysis of seismic activities on marine mammals was not included in the Environmental Consequences section of Chapter 9. Noise generated by seismic activity is not the same as noise generated by most construction and operational activities. The only construction signals that seem to have characteristics similar to those of
F34-31 (Cont.)	a seismic signal are from pile driving and hammering - sharp onset, short duration, high peak level, impulsive sounds. Furthermore, previous work exposing whales to both "continuous" and seismic industrial noises indicates that whales respond differently to the two types of signals (Malme et al., 1983, 1984).
F34-32	We agree with your points on the economic benefits of the Northstar Project. See Section 7.6.2.2 for changes to text. See Sections 7.6.2.1, 7.6.2.2, and 7.6.3 of the EIS for changes to text resulting from new calculations based on state revenue forecasts.
F34-33	It is true that the EIS preparation process has been on-going for over 2.5 years. The complexity of BPXA's project proposal has contributed to this EIS development time. In particular, numerous changes to the BPXA proposed project have delayed closure of the EIS development process. However, these changes have resulted in a project proposal with fewer environmental impacts.
F34-34	A new section on adverse environmental effects which cannot be avoided; local, short-term uses versus long-term productivity; and irreversible and irretrievable commitments of resources was prepared that summarizes the information contained elsewhere in the EIS. See new Section 11.8.12.
F34-35	CEQ regulations at 40 CFR 1508.14 have been interpreted by the cooperating agencies to mean that "human environment" will be comprehensively evaluated within the EIS to include potential effects of the Northstar Project on the natural and physical environment, and the relationship of that environment to people. For this EIS, the agencies have met this requirement by organizing the analysis by theme (i.e., Chapter 5, Physical Environment; Chapter 6, Biological Environment; and Chapter 7, Human Environment). Thus, Chapter 6 covers the biological components of the "human environment" and Chapter 5 covers the natural physical components of the "human environment." Chapter 7 describes the social, economic, and cultural effects on the "human environment." In addition, Chapter 3 describes some of the manmade physical components of the "human environment" (i.e., oil field facilities).
F34-36	The DEIS does not state that the gas design rate is 500 MMscfd but rather "approximately 500 million standard cubic feet per day of produced gas and approximately 100 million standard cubic feet per day of additional gas from the Central Compressor Plant (CCP), located onshore in the Prudhoe Bay Unit, would be injected into the reservoir (gas cycling) to maintain pressure and maximize production" (page ES-2). From page 3.1-2 of Appendix A (Final Project Description - Revision 1: March 27, 1997) of the DEIS, it is stated that 100 MMscfd of gas from shore will be added to produced gas to make a total peak gas injection of 600 MMscfd; hence, the produced gas subsequently added to the gas from shore must be 500 MMscfd.
F34-37	We acknowledge your comment that the Technical Appendices in Appendix E are no longer correct. They have been updated with information received from the State of Alaska Pipeline Office. See the revised Appendix E for the correct information.
F34-38	The Summary Table ES-14 presents data from Table 6.7-3, which is more generic as to the impacts on birds and also summarizes and incorporates information in the text of Sections 6.7.2.1 and 6.7.2.2. The purpose of the Executive Summary is to concisely summarize the relevant information in both tables and text so the reader can evaluate and compare all the alternatives.

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	The judgement terms in Table ES-14 are used for comparison of project Alternatives where it was appropriate to provide a level of impact (none, negligible, minor, significant) such as was provided for Terrestrial Mammals, Noise-related Impacts. When the degrees of impact were similar across Alternatives 2, 3, 4, and 5, no judgement term was given.
F34-39	The purpose of Tables ES-14 and 11-1 is to summarize environmental characteristics of each action alternative to facilitate comparison of the alternatives. These comparison tables would not be meaningful if they simply reiterated information presented in the 22 impact tables located throughout Chapters 5 through 9. The impact level terminology (none, negligible, minor, significant) used in the impact tables is not appropriate in Tables ES-14 and 11-1 because the purposes of these tables is to highlight differences among alternatives. For example, impacts to resources which are similar among two or more alternatives are described and compared to those which are different among other alternatives. In this manner, the differences among alternatives are readily apparent to the reader.
F34-40	In the event Outfall 001 comes on line prior to the completion of the UIC well, sanitary and domestic wastes will be discharged through Outfall 001c (a component of Outfall 001). These wastes will be treated prior to discharge. Such wastes will be disposed of through the UIC well following its completion. Thereafter, discharges from Outfall 001c are permitted only when the UIC well is temporarily unavailable (e.g., due to maintenance). We acknowledge your comment on the Biological Assessment and it has been forwarded to USFWS and NMFS for the drafting of their Biological Opinions. The suggested changes to the Biological Assessment were incorporated into the EIS. See changes to Section 3.5.3.4 of the Executive Summary and Section 4.4.2.2 of the EIS.
F34-41	The label "Gas Pipeline" on the pipeline between the CCP and Pump Station 1 for Alternatives 3, 4, and 5 of Figure ES-6 (DEIS Executive Summary) has been deleted. Figure 11-1 is similar to Figure ES-6 and has also been changed.
F34-42	Table ES-11, Onshore and Offshore Pipeline Corridor Comparison, has a category for disturbed seafloor area, to which the disturbance caused by the fill placed under Alternative 5 along the West Dock causeway has been added. Approximately 5.5 acres (2.2 hectares) of seafloor will be covered with the 290,000 to 300,000 cubic yards (221,000 to 229,000 m^3) of fill anticipated, which increases the quantity shown under Alternative 5 to a new total of 36.7 acres (14.8 hectares). Other changes made to properly denote this inclusion of the disturbed seafloor area with the areas disturbed by excavation have been made in the FEIS. Following review of public comments, construction of approximately 0.3 miles (0.5 km) of new road for accessing the shore landfall for Alternative 4 has been eliminated. Access to the Alternative 4 landfall is by soft tired vehicles or helicopter (as for Alternatives 2 and 3).
F34-43	The suggested text on trenching equipment has been added to Section 3.4.2.7. It should be noted that this was only recently suggested as an option by the applicant.
F34-44	We agree that the addition of this criterion will more fully describe the environmental and engineering options. See Section 3.4.2.7 for revised text.
F34-45	The text in Chapter 3 has been revised to reflect information presented in the comment. See Section 3.4.2.7 for changes to text. However, it is not clear from the comment what is meant by the "significant disadvantage" associated with the curves in offshore routes of Alternatives 4 and 5. No text changes were made to the Executive Summary, Chapter 5, or Chapter 11 because construction costs (the only quantifiable criterion for comparison cited in the comment) are already included in the comparison of alternatives. Comparison of alternatives in Chapter 11 is intended to highlight the important environmental issues and principal differences among the alternatives.
F34-46	Pipeline upheaval buckling is controlled by pipeline depth of cover and backfill thickness. Pipeline upheaval buckling is a criterion when determining pipeline trenching requirements. As a criterion, it has been added to the other criteria (e.g., reduction in ice gouging hazard) listed in EIS Section 4.2.5.
F34-47	We agree that the general probability of strudel scour impacts on the various pipeline routing alternatives is approximately equivalent, with no relative advantage to any of the action alternatives. The impacts

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	and risks of strudel scour are reviewed in an engineering design study entitled, "Strudel Scour Evaluation", TN 415, INTEC Engineering, Inc., May 1998. The phrasing of narrative discussion under Section 4.2.5, page 4-25 of the DEIS, and at the strudel scour section on page 5.6-32 of the DEIS, leave an impression that Alternatives 4 and 5 were preferable when considering this physical environment phenomenon. The wording of these sections has been altered in the FEIS.
F34-48	The comment states that the facility will "not have a snow melter in which to place contaminated snow." However, the NPDES Permit Application (Rev. 2.0, 13-March-98, pg. 31) for the facility states "Uncontaminated snow may be deposited on the sea ice adjacent to Seal Island, where it will gradually melt into the Beaufort Sea during the spring breakup. Uncontaminated snow is defined as having no discoloration or petroleum/chemical odor. Certain locations such as wellheads and parking areas are particularly susceptible to minor spills and leaks, thus the snow from these areas will always be placed in the melt tank and thawed for proper disposal. Additionally, contaminated snow or snow mixed with gravel will not be deposited onto the adjacent sea ice. Snow that is collected from these areas will be placed in a melt tank with the resulting liquid either being injected into a permitted disposal well or, if necessary, transported off-site for proper disposal at a permitted facility." In addition, the Project Description (Appendix A) states in Section 6.2.13 that "Snow with the potential for testing as hazardous will be segregated and melted in a designated bin . . ." Information provided by BPXA in September 1998 indicates that during production operations (years 3 through 15) the facility will have "a portable or fixed snow melter to provide onsite disposal as outlined in the Final Project Description."
F34-49	BPXA has identified the need to increase the available emergency power supply, and thus has re-sized the two diesel power generators to be installed during construction upward from 1,230 kW to 2,600 kW each. See revision to Section 3.5.3.3 in the Executive Summary, Section 4.4.2.4 in the EIS, and Sections 2.2.2.4 and 3.3.1.6 in Appendix A. In addition, Table 5.4-12 has been modified to include this upgrade.
F34-50	BPXA's subsea pipeline installation will result in some excess spoils (approximately 5,000 cubic yards [3,823 m^3]). These spoils are due to expansion of dredged materials and to the volume occupied by the pipeline itself. Such spoils will be left on the ice surface in a thin layer(s) for eventual dispersion back onto the seafloor. Should these spoils settle back onto the seafloor in mounds, natural ice activity and other oceanographic processes would disperse these mounds over a period of several years or less. The methods of spoils disposal, spoils dispersion, spoils volumes and storage zones, and the effects on the seabed upon dispersion are discussed in the EIS in the Executive Summary (Section 3.5), Section 4.2.7, Section 5.5.2.2, and Appendix I. The comment requests that the EIS make note of the fact the Northstar test trench program demonstrated that the wave, current, and ice regime in the nearshore zone proved effective in removing trench spoils over a brief period of time. Section 5.5.2.2 has been modified to include this information. As part of the subsea pipeline installation, the EPA may require monitoring of soils/sediments/plumes as with the preconstruction test trench study; the specifics of such a monitoring requirement, if any, are not available.
F34-51	Widening of West Dock by an additional 50 ft (15.2 m) should provide adequate ice override protection. See response to comment F34-14. Separately, the DEIS reference on page ES-107 to ". . . would cross the natural shoreline buried in this fill" is confusing since the pipelines' landfall is to be buried within gravel fill, but the crossing at the natural shoreline is aboveground atop VSMs. This sentence has been altered to more clearly reflect the aboveground pipeline installation from the West Dock landfall onward to the coastal shoreline.
F34-52	As suggested, the shore crossing valve pad sizing and shutdown valve contingency design selected for Alternative 3 could be altered to emulate the proposed remote shutdown valve and larger gravel pad for Alternative 2. The onshore quantity of gravel use would increase slightly, and various other elements of the alternatives' project costs and impacts would shift in minor ways. Overall, it does not appear that the relative acceptability or cumulative impacts of Alternative 3, 4, or 5 would be seriously affected by reassembling the facets of the selected alternative descriptions cited. The appropriate regulatory agencies would again review the individual details of any alternative other than Alternative 2, should one

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	be selected, to assure that the best overall array is implemented in optimizing the sub-elements of a preferred alternative.
F34-53	The information cited in the comment is mentioned in the DEIS on page 5.6-32. Refer to response to comment F303-3.
F34-54	We agree that Section 5.4 requires some clarification. Lisburne and the Deadhorse Power Plant air emission rates were included in the air analysis performed for the DEIS because of their size and proximity. Milne Point, Badami, and Pump Station No. 1 were not included primarily because of their emission size and distance (Q/D ratio for air modeling) relative to the Northstar Project. The "allowable emission rates" are permitted emission rates (rather than actual emission rates). Thus the air modeling performed for the EIS should be conservative. Short-term and long-term emission rates are provided in Table 5.4-6 due to air dispersion modeling. See Section 5.4.2.2 for new text.
F34-55	The central compressor tie-in and Pump Station No. 1 will require an operations permit. See revised text in Section 5.4.2.2.
F34-56	We agree that the Northstar Project (construction and operation) will contribute less than 1% of the existing regional carbon dioxide emissions, resulting in a negligible incremental contribution to global carbon dioxide emissions. Section 5.4.2.2 includes an insert describing Northstar Project measures proposed to reduce the emission of greenhouse gases. Also see an expanded Section 10.4.2 which presents a discussion of the cumulative effects of the Northstar Project on global climate change. Additional information on global warming can also be found in response to comment F404-21.
F34-57	The table title has been changed. See revisions to Table 5.3-2.
F34-58	See Sections 5.3.2.2, 6.3.2.2, and 6.4.2.2 for changes to text.
F34-59	See Section 5.6.2.2 for clarification that annual geometry pigging is proposed for the first 5 years, and every 2 years thereafter, to note movement or bending of the crude oil pipeline by measuring pipeline curvature. Thaw subsidence, strudel scour, upheavals in the trench, or even simple consolidation of the subgrade could result in strain that might yield such curvature. Quality (roundness) will be evaluated by caliper pig runs which occur before the geometry or other inspection pigs are run through the pipeline.
F34-60	We disagree that the shorefall design has been ignored or that long-term thaw subsidence was minimized. There is a discernable difference in the relative total thaw subsidence amounts expected at the native material shorefalls under Alternatives 2, 3, and 4, versus negligible subsidence, partly caused by simple soil consolidation over time, at the transition to the manmade gravel structure, i.e. the West Dock causeway shorefall in Alternative 5. As mentioned in response to comment F34-13, review of the materials cited on page 5.3-43 of the DEIS leads to the conclusion that the West Dock landfall would avoid subsidence caused by melting given the negligible exposure to permafrost soils at that landfall. Refer to response to comment F34-13.
F34-61	The extra thick pipeline walls selected for offshore burial zones give a number of practical benefits, but the important factor of improved resistance to floatation during the pipelines' initial burial was not mentioned in the DEIS's narrative discussion in the first paragraph of page 5.6-32. This reduced buoyancy does not apply directly to the issue of ice gouging. The comment is also correct in noting that INTEC Engineering, Inc.'s Technical Note 410, Ice Keel Protection, describes the applicable assumptions and parameters of ice keel gouging with regard to structural pipe deformation and failure (specifically for dual pipelines placed in the Northstar area) much more thoroughly than the referenced discussions in the EIS. The design parameters cited include "the pipelines' properties, the soil characteristics, and the depth of the pipeline below the mudline." Conservative input value selections were made in setting up the modeling program for the assumed soil strength and the aspect ratio of the ice keel shape. The gouge formula developed yields a maximum predicted ice gouge depth dependent on the total miles of trench exposed to such gouging as well as the gouges' normal orientation with respect to the alignment of the buried pipelines. Given that this level of structural evaluation and site-specific design studies should again be performed for any subsequent project involving subsea pipeline burial, it does not seem necessary to alter the text to the suggested

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	language.
F34-62	As stated in Section 6.3, effects on hard-bottom communities from burial and installation of the island's slope protection system concrete mats would be a minor impact; however, this habitat would be recolonized once construction is complete.
F34-63	The impact to wildlife associated with Alternative 2 compared with Alternatives 3, 4, and 5 would likely be measurable. The magnitude of this difference was quantified by acres of tundra affected by ice roads, number of nests occurring within the pipeline corridor, and number of threatened spectacled eider nests along each route. The impact of routine helicopter inspections would be expected to be somewhat greater for a route through undeveloped tundra and remote from roads, such as Alternative 2 and portions of Alternative 3, when compared with routes adjacent to existing roadways and pipeline. This is because helicopter inspections in the later case would be flown over an existing industrial area and many inspections could be conducted by vehicle. Overall, as stated in the DEIS text on page 6.7-20, the impacts to birds from operations are similar for Alternatives 2, 3, 4, and 5. Impacts to caribou from helicopter overflights were also considered minor for Alternative 2 and 3 and negligible for Alternatives 4 and 5 based on the amount of undeveloped tundra crossed on each route. The statement regarding "8 of 10 common tundra nesting shorebirds have displayed some degree of avoidance of oil field facilities such as roads and pads" is an accurate statement based on several years of data in the Prudhoe Bay area. The conclusions of the TERA (1993b) report do not infer that this is only associated with one particular road or type of facility. This reference is used here to indicate that there is some level of impact to birds from oil field structures and general disturbances associated with the oil field activities.
F34-64	Text in the Executive Summary specifying the presence of a check valve at Pump Station No. 1 has been changed to indicate the use of a remotely controlled shut-down valve. Corrections also have been made to text in Chapter 8 pertaining to leak detection systems.
F34-65	Discussions in Section 7.3.2 regarding potential effects of noise on subsistence harvests of bowhead whales primarily focus on vessel traffic between Seal Island and Prudhoe Bay dock facilities, and on drilling activities. Section 9.5.1.1 includes a section on noise associated with seismic activities, primarily because the majority of research in the Beaufort Sea associated with whale response to noise has focused on seismic exploration activities. However, the discussion also addresses whale response to drilling and aircraft noise. Although seismic activities are not a part of the Northstar Project, such activities may occur during the life of the project to further delineate the reservoir. Seismic survey activities are among the loudest noises in the region and are of concern to local residents and government agencies. Therefore, information related to seismic survey activities and their impacts to marine mammals, including the bowhead whale, are presented in Chapter 9. BPXA's intent to develop and adhere to a negotiated Conflict Avoidance Agreement is noted, and may be included as a mitigation measure in the ROD issued after completion of FEIS. See changes to Sections 7.3.2.2 and 9.5.1.1.
F34-66	We believe the presentation on industrial noise and its effect on whales is well stated and in a general way clarifies the apparent potential impact of the Northstar Project on whales and whalers. Through the project schedule, BPXA has tried to schedule construction and operational activities to drastically reduce the chances that these activities will occur during migration and whaling. This scheduling does avoid most of the whale migration. See changes to text in Section 9.8.2.1.
F34-67	The definition of long-term for this EIS is more than 15 years. The comment that there has been no discernable impact on whale migration is not entirely correct given the summation of Richardson (1997 and 1998). In fact, there is some rather strong evidence to the contrary based on distributions with and without seismic activities. See response to comment F34-30 and changes to Section 7.3.
F34-68	This section in the EIS has been revised to better explain why noise from large vessels and tugs was

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	considered as a potential impact on whales and subsistence. See Section 7.3.2.2 for revised text.
F34-69	The impact level terminology (none, negligible, minor, significant) used in Table 7.8-1 is not used in Tables ES-14 and 11-1 because the purpose of these tables is to highlight differences among alternatives. Differences in impacts to visual aesthetics are associated with onshore pipeline locations and length which are described in Tables ES-14 and 11-1 for comparative purposes. For example, visual impacts which are similar among two or more alternatives (i.e., Alternatives 4 and 5) are described and compared to those which are different among other alternatives. See response to comment F34-39.
F34-70	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and statistics used in the calculations. Table 8-4 has been revised to indicate that there have been no crude oil spills greater than 1,000 barrels on the North Slope since 1970 (additional information showed that this spill was actually from TAPS). Additional discussion of project design features that would aid the prevention and/or limit the volume of a spill has been added to Section 8.5.3.
F34-70 (Cont.)	Evaluation of oil spill impacts assumed that no spill response occurred and did not include how likely it was for an oil spill to occur. These issues were addressed separately in Chapter 8. While reading Section 8.7, it is important for the reader to keep in mind that the impacts presented would only occur if: 1) there was a large (greater than 1,000 barrels) oil spill, 2) there was no oil spill response, and 3) the spill occurred at the specific location or time of year that coincided with use of the area by sensitive resources. The impacts were characterized in this way to clearly divide the discussions of likelihood of an oil spill from the consequences. Project design and typical operating procedures help to minimize the probability of an oil spill, but do not change the potential impacts if a spill does occur. See the response to comment F34-73 for a discussion of tundra impacts from cleanup equipment.
F34-71	See revisions to Sections 8.5.3 and 8.6 for the correct title of the oil spill contingency plan.
F34-72	In Chapter 8 of the DEIS, evaluation of impacts from an unplanned oil spill is separate from the estimation of how likely a spill is to occur. While the probability of an oil spill varies slightly for the four action alternatives, the impacts of an oil spill would be the same for each alternative due to the close proximity of the four pipeline routes. The same resources would be affected by an oil spill, no matter which alternative is chosen. As indicated by the comment and by Tables 8-6 and 8-7 of the EIS, Alternatives 4 and 5 have a longer offshore pipeline segment and a correspondingly larger oil spill probability. However, the difference between oil spill probabilities calculated for Alternatives 4 and 5 compared to Alternatives 2 and 3 is only 1%. It is apparent that no meaningful difference exists between alternatives for spill probabilities. We agree that the spill statistics used to calculate oil spill probabilities for the Northstar Project do not consider project-specific mitigation measures. See Section 8.5.2 for clarification of oil spill statistics used in probability calculations. Unfortunately, there is no way to quantify the reduction of oil spill probabilities expected from the rigorous project design. This is why the information listed in paragraph three of the comment was presented throughout the EIS. Specifically, Section 8.5.3 describes project refinements reducing oil spill probability and severity. It is not clear in the fourth paragraph of the comment what is meant by "timing of a potential leak and repair." A pipeline rupture could occur at any time of the year and would result in volumes of oil being spilled comparable to a chronic leak during solid ice conditions. In Chapter 8 of the EIS, impacts for spills occurring at different times of the year are discussed. BPXA has indicated that the pipeline valves will be closed as soon as a leak is detected, so repair of the pipeline is not discussed (the focus in Chapter 8 of the EIS being the impacts of spilled oil on the environment rather than technical variables associated with repair or financial losses incurred as a result of delayed production).
F34-73	We agree that tundra damage can be lessened with the use of alternative methods of transportation aside from requiring vehicle access for maintenance and spill response. See the revised text in Section 8.7.1.1. Chapter 11 and the Executive Summary have been extensively rewritten in response to public comments.

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	Refer to those chapters for revised text.
F34-74	Section 8.6.2 of the EIS is intended to describe weather/ice conditions that could hinder spill response activities and the possible length of time that those conditions could exist. Data presented in the comment indicates that, for offshore areas, broken ice conditions may be present for a maximum of 8 weeks (2 months) during freezeup and 5 weeks (1 month plus) during breakup. See the revised text in Section 8.6.2 that indicates a maximum of 3 months of broken ice conditions are possible, rather than 4 months. This information is also presented in Table 8-8.
F34-75	We agree that onshore and offshore spills require different spill responses. See response to comment F34-73 regarding tundra damage.
F34-76	We do not believe it is necessary to add these words at this location. Section 8.7 of the EIS specifies that all oil spill impact analyses assume no spill response is possible. This is not to be confused with the evaluation of spill response impacts, which are described independently of the oil spill impacts. Oil spill impacts were described for the "non-response" scenario due to project scoping concerns expressed about severe weather delaying or preventing response. The reduction of impacts from an oil spill would be commensurate with the speed and success of spill response actions.
F34-77	The paragraph already discusses oil being encapsulated in ice. However, the sentence referenced in the comment has been clarified in Section 8.4.2.
F34-78	We agree that to be technically accurate the language of the referenced sentence should be changed. See revised text in Section 8.4.3.
F34-79	The information contained in your comment has been incorporated into Section 9.8.2.2 to clarify the text.
F34-80	We have updated Chapter 10 to reflect the issuance of permits and the construction that occurred during 1998.
F34-81	We agree and this information will be used in updating Chapter 10 of the EIS.
F34-82	Chapter 10 has been significantly rewritten based on both agency and public comments. As a result, there was no need to provide this level of detail on the Sandpiper Unit. See Section 10.3.3.2.
F34-83	We agree, and we note that the Secretary of the Interior, on October 7, 1998, approved the scheduling of lease sales on the NPRA. All of this information will be used in updating Chapter 10 of the EIS.
F34-84	We state "future federal lease sales could. . ." and it could be stated that offshore lease sales are "much less likely under federal ownership . . ." The possibility exists in either case.
F34-85	This comment has very little to do with Land Use and Cumulative Impacts to the Human Environment Section; therefore, no changes were made.
F34-86	We have updated Chapter 10 in response to comments. Pete's Wicked is listed in Table 10-2 as a foreseeable project and it is also shown on Figure 10-2. The proximity of Pete's Wicked to the routes of Alternatives 2 and 3 would consolidate environmental impacts in this area, should this prospect go forward. Section 10.5.2 summarizes the cumulative impacts of the Northstar Project on land use. The onshore facilities associated with Alternative 2 are not located within an existing developed area compared to Alternatives 3, 4, and 5 which would bring the pipeline closer to existing infrastructure. For this reason, the cumulative impacts associated with Alternative 2 are considered greater than with the other alternatives. Should potential development occur in Gwydyr Bay, a pipeline landfall at Point Storkersen (Alternatives 2 or 3) could minimize the cumulative impacts at that development. Pipeline landfall at Point Storkersen could be considered a potential benefit should future oil development occur in Gwydyr Bay.
F34-87	Erosion at any of the potential natural shoreline landfalls would be expected to be contained within safe bounds, or at least replaced by the implementation of subsequent maintenance. The West Dock causeway is likely to have more limited, ongoing erosion compared to landfalls for Alternatives 2, 3, or 4. The environmental concerns noted are appropriate and not overstated. Refer to response to comment F34-12.

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F34-88	Following review of public comments, the construction of approximately 0.3 miles (0.5 km) of new road for accessing the shoreline landfall for Alternative 4 has been eliminated. Access to the Alternative 4 landfall is by soft tired vehicles or helicopter (as for Alternatives 2 and 3).
F34-89	The widening of the causeway was evaluated in the preparation of the DEIS, but the seafloor coverage was not included as part of the disturbed seafloor area totals. The revised total acreage consistently referenced for Alternative 5 is 36.7 acres (14.9 hectares), which was corrected in various sections in the FEIS in response to comment F34-15.
F34-90	Section 2.3.1.9 discusses sediment chemistry as related to nearshore water quality degradation from river-borne suspended particulate matter. It is inaccurate to infer from this discussion that chemical baseline information of disposal site sediments has been characterized. Although various studies have examined Beaufort Sea sediments, there is insufficient data in the area of the 1996 test trenching activities for the specific evaluation of the effects of previous disposal.
F34-91	Appendix I was not revised for the FEIS; therefore, changes suggested in the comment have not been made. A specific objective of the sediment sampling program (October 30, 1996 Final Report by Woodward-Clyde titled "The 1995 Northstar Unit Sampling Program") was to determine to what extent drilling waste contaminants were present in seafloor surface sediments. On page 1 of Woodward-Clyde's report it is stated that ". . . where drilling wastes have been discharged, elevated barium concentrations were found in active depositional areas near both islands, but nowhere else in the study area."
F34-92	Appendix I was not revised for the FEIS; therefore, changes suggested in the comment have not been made. Due to the location of the disposal areas, seaward of the barrier islands (and in water depths ranging from 5 to 35 ft [1.5 to 10.7 m]), grounding of ice is not a critical concern for inhibiting thawing. Thawing of the ice would proceed shoreward from the outer edges as exposed surfaces are melted and broken off by ocean currents. Grounded ice would also continue to melt from the addition of thermal energy from ambient air and absorption of solar radiation. Also, river over-flooding of the sea ice accelerates ice melting near the coast. Two references are available to support these statements: 1. Cox, Gordon F.N, and W.S. Dehn. "Summer Ice Conditions in the Prudhoe Bay Area, 1953-75." International Conference on Port and Ocean Engineering under Arctic Conditions, Proceedings. Quebec, Canada. 1981. 799-808. 2. Eranti, E. and G.C Lee. "Ice Problems." Cold Region Structural Engineering. New York: Mcgraw-Hill Book Company, 1986. 45-185.
F34-93	As noted in the comment, several of the island construction completion dates listed on Figure 3-1 are incorrect. In the FEIS these dates have been altered to those cited by BPXA. The maximum (economic) depth for a gravel/sand island with a protective gravel berm in the Beaufort Sea, as cited by Masterson et al. in their presentation at the 23rd Offshore Technology Conference in 1991 (Table 4, page 17) was 20 meters, or approximately 65 feet. Beyond this depth, the volume of gravel required becomes quite large and the entire island structure is uneconomic although the hauling costs may
F34-93 (Cont.)	only be slightly more per cubic yard for islands farther from shore. The DEIS mentioned a water depth limitation of "about 50 ft (15.2 m)" in the first bullet on page 3-30, but this was altered in the FEIS to "about 65 ft (19.8 m)." The upper cut-off depth indicated on Figure 3-6 of 70 ft (21.3 m) for the consideration of gravel islands is still reasonable and will be retained. Site-specific analysis and costing should be applied to confirm whether this projected cost parameter, water depth, is still workable if and when future developments are evaluated at offshore water depths of 65 to 70 ft (19.8 to 21.3 m) or even deeper. The various design purposes of the submerged berm are best described in the DEIS on page 4-40, second paragraph. It will significantly aid in minimizing the likelihood of ice override, resulting in the 1996 design study conclusion that "the 100-year ice pile-up would reach a low elevation (+12 ft [3.7 m], MSL) on the sheet pile wall" (CFC/Vaudrey, page 5). This is only 6 ft (1.8 m) up on the 21-ft (6.4 m) tall sheet

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	pile wall, which confirms the BPXA comment that " . . . analysis indicates that the 100-year ice pile event will not overtop the steel sheetpile wall that surrounds the island." Yet, since an event with a recurrence frequency greater than 100 years could occur (though highly unlikely) during Northstar's anticipated production life, it is still reasonable to make the statement included in the sixth paragraph on page 5.6-30 of the DEIS, which says, "Over the expected 15-year life of the production island and facilities, it is possible that ice could at some point overtop the perimeter wall and reach the island work surface." Abandonment of a gravel island in place at the end of an oil field's production life, to continue to provide an artificial reef for benthic organisms, is a potential course of action. It is unclear at this time what will be the most appropriate level of infrastructure demolition once the Northstar reservoir becomes depleted. The demolition and disposal of large steel or concrete structures could be both more difficult and more expensive than the dredging and leveling of the gravel island. Permitting agencies are required to review abandonment plans and will approve what is allowable under current stipulations and regulations at the time of abandonment.
F34-94	We agree it is highly unlikely that bowhead whales would be effected by noise resulting from the installation of island slope protection, since this activity will most likely occur during the winter to early summer months. The Biological Assessment is an independent, stand alone document that was provided to the public as Appendix B to the DEIS. It is not being revised. Rather, the USFWS and NMFS are preparing their respective Biological Opinions (Appendix M) based on the Biological Assessment. The Corps has forwarded your comment to the USFWS and NMFS for their consideration.
F34-95	We agree with the comment that bowhead whales would not be exposed to sounds from the Northstar Project Area during the spring migration. The Biological Assessment is an independent, stand alone document that was provided to the public as Appendix B to the DEIS. It is not being revised. Rather, the USFWS and NMFS are preparing their respective Biological Opinions (Appendix M) based on the Biological Assessment. The Corps has forwarded your comment to the USFWS and NMFS for their consideration.
F34-96	Both PLUMES and CORMIX employ model components that may be classified as "empirical" or "theoretical." An "empirical" component relies heavily on results collected during laboratory or in-situ tests, while a "theoretical" component generally relies on the fundamental physics of fluid mechanics. The comment is correct in that both PLUMES and CORMIX rely on empirical and theoretical components. However, PLUMES is described in the NPDES Fact Sheet (Appendix G) and the ODCE (Appendix H) as empirical because of its heavy use of such components, while CORMIX is described as theoretical because of its employment of components which generate solutions from first principles.
F34-96 (Cont.)	We disagree with the portion of the comment that states: "Whether one model is more 'empirical' or 'theoretical' than the other is irrelevant. Both have been tested extensively and proven reliable, within the usual accuracy expectations for fluid mixing phenomena, any mention of which was notably absent from the Draft NPDES Fact Sheet." The NPDES Fact Sheet clearly states "Whether PLUMES or CORMIX models are used in many applications is often a matter of user preference, given both sets of models have been extensively verified, are EPA endorsed, and were designed specifically for wastewater discharges. Both models provide similar results when applied appropriately to the same situation, and each model has advantages and disadvantages for particular uses. In the case of the project, either model performs adequately with no problematic limitations." The NPDES Fact Sheet continues with: "In this Fact Sheet, both models are employed to analyze the discharges to provide a greater degree of confidence, verify Mixing Zone Application results, better identify any problems associated with the discharges, and assess the mixing zone performance on a worst-case basis."
F34-97	The comment implies that the Beaufort Sea oceanography cannot be both highly complex and well understood. We disagree. The oceanography of the Beaufort Sea is complex. Simultaneously, it is understood well enough to support modeling and simulation efforts required for the NPDES.
F34-98	The EPA agrees the phrase "radioactive substance" should be replaced with "radioactive waste." The use of the phrase "radioactive substances" was in error. The EPA is well aware that radioactive substances will be placed in the well from two sources: Naturally Occurring Radioactive Materials and radioactive tracers used for required, periodic mechanical integrity testing of the well. The EPA will affect this

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	change in the UIC permit.
F34-99	The aquifer exemption associated with the proposed Northstar permit addresses only those portions of aquifers into which or beneath which the Class I wells will inject waste. In effect, this means the Area of Review for these wells. The Area of Review is as was requested by BPXA and agreed to by the EPA. The EPA understands that aquifer exemptions on the North Slope have historically extended to the unit boundaries. Such areally extensive exemptions are not, the EPA believes, necessary for injection operations. At Northstar, the EPA intends to exempt only those portions of aquifers needed to allow Class I injection under the permit conditions. BPXA has expressed some concern that a duplication of effort will occur when BPXA requests an Area Injection Order for Enhanced Oil Recovery (EOR) from the Alaska Oil & Gas Conservation Commission. While the EPA appreciates BPXA's concerns, the EPA anticipates no duplication of effort. The EOR request would include information on the aquifers or portions of aquifers likely to be affected by EOR injections. The oil producing formations that would be most affected by EOR injection are located away from and deeper than the proposed Class I disposal zones and aquifers proposed for this exemption. In fact, the EPA does not anticipate that any aquifer exemptions will be necessary for Class II disposal or EOR injection at Northstar.
F34-100	The EPA agrees that the UIC Permit arguably should not have directly specified a “9.63-inch (24.46 cm) string” even though that is what BPXA proposed in Appendix F of the application. This will be replaced by the phrase “intermediate casing” in the UIC Permit. The EPA appreciates BPXA's efforts to reduce costs while simultaneously improving the prospects for mechanical integrity. At the same time, the EPA realizes that BPXA might decide to again change the well design to allow for the simultaneous injection of fluids into two different zones.
F34-101	The additional resources suggested in the comment have been reviewed. Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Section 8.5.2.2 now includes a qualitative discussion of why platform oil spill probabilities associated with Northstar are lower than suggested by the MMS OCS database.
F34-102	The EPA agrees that the permit should clearly reference the application upon which it is based and note that Appendix F as “revised August 1997" specifies a 13.63-inch (34.62 cm) surface casing and 9.63-inch (24.46 cm) intermediate casing. The EPA will add a reference to a casing program approved by the EPA in accordance with Class I well construction practices.
F34-103	The EPA agrees that the well design no longer includes a glycol circulation string as at Badami, and Part II, D, 2 (Continuous Monitoring Devices) will be changed. The final permit will not include the phrase, “and to monitor the volume of glycol in the annulus between the tubing and the long string casing.”
F34-104	The EPA agrees the reference identified is incorrect. BPXA has identified a typographical error in the draft permit. The reference in Part II, C, 3 (Mechanical Integrity), c, (1) and (2) to 2.b is incorrect. The reference will be changed to 3.b(2).
F34-105	The EPA agrees that BPXA will have a need to inject both drill cuttings and produced water during much of the operation when drilling waste generation is anticipated to be decreasing as produced water volumes increase.
F34-106	The EPA is not convinced that the fracture propagation would be insignificant at high rates of produced water injection above formation pressure. Likewise, the EPA remains unconvinced that BPXA will “need to be able to inject the produced water above the fracture gradient.” BPXA has at Northstar two distinct stratigraphic intervals into which they may inject. The upper interval, in the lower Sagavanirktok formation, appears to have the right properties to accept high injection rates of clean liquids (i.e., liquids without solids) at well below the formation fracture pressure. The lower interval, spread over the Prince Creek/Ugnu and Schrader Bluff formations, is less permeable but can be utilized for injecting thin slurries above the formation parting pressure or clear liquids below the formation parting pressure. BPXA has defined “conventional fluid injection” as any injection other than the cuttings slurry. The

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	EPA's use of the phrase "conventional fluid injection" is limited to injection below fracture pressure. The draft permit may be, however, unclear as to its intent. The EPA intends to authorize injection (of slurry, primarily) above fracture pressure provided the injection rate does not exceed 3,000 barrels in any 24-hour period or injection at any rate, provided the injection pressure does not exceed the fracture gradient. The EPA understands that this may be difficult during the period of project development when produced water volumes are expected to increase rapidly and yet some drilling waste injection will still be occurring. In response, the EPA wrote to BPXA on September 22, 1998, to suggest that several options be considered. These include: filtering of some waste streams, utilizing a separate injection well for produced water disposal, dually completing a Class I well so that conventional injection can occur in one zone and injection above formation parting pressures in another, or continuously monitoring fracture propagation at the higher rates requested by BPXA. The EPA understands that BPXA is still considering these and other possible alternatives.
F34-107	The maximum rate of 3,000 barrels/day was imposed to limit the growth of fractures while BPXA is injecting above the formation fracture pressure. Injection below fracture pressure is allowed at much higher rates.
F34-107 (Cont.)	BPXA has been involved with the EPA throughout the development of the draft permit (contrary to their comment, however, our meeting on July 8 was not for the purpose of "negotiating" the injection rate or any other permit condition. It was, in our view, strictly an opportunity for BPXA, as a primary interested party, to get clarifications and to provide to us their "pre-comment" comments). BPXA is aware that, while the EPA was initially concerned about injection over fracture pressure, the EPA agreed to authorize it if the rate would be limited or if fracture propagation monitoring were employed. This "trade-off" between rate and pressure was discussed at length. As noted above, BPXA can inject as much as they need to inject provided the injection pressure does not exceed the formation fracture pressure. BPXA may also inject up to 3,000 barrels/day at greater pressures. The EPA understands that this may present some operational challenges during part of the project and have suggested several options for BPXA to consider, as described above.
F34-108	The EPA concurs and has requested such clarification. However, the EPA believes the proposed volumetric monitoring system will satisfy the permit requirements. The proposed permit requires only that BPXA "provide for continuous, recorded measurement of the discharge volume." It does not specify how that is to be done. The application indicated (Exhibit 8-1 and Figure G-2) that "meters" would be installed in each of the waste lines, including the discharge from the ball mill. The clear implication is that some sort of flow meters would be installed in the lines between the respective discharge pumps and the wellhead. It is the EPA's understanding that the system will be configured somewhat differently than is shown in Exhibit 8-1 and Figure G-2.
F34-109	The Drake Field flowline was an experimental pipeline built to test technologies that potentially could be useful in Arctic regions. It was tested for only one week using oil, it was never used for production, was left in place for 18 years, then officially abandoned. At that time, a limited survey on the condition of the pipeline found no apparent damage. Additional information about the Drake Field pipeline is provided in Section 3.4.2.7.
F34-110	On the contrary, we believe the document meets NEPA requirements.
F35-1	We acknowledge your support of Alternative 2.
F36-1	We acknowledge your support of Alternative 2.
F37-1	We acknowledge your opinion that the DEIS is inadequate.
F37-2	Spill response limitations under prevailing environmental conditions are discussed in EIS Section 8.6.2, on page 3-29 of the Northstar ODPCP, and in Tactic L-7 of the Alaska Clean Seas Technical Manual.
F38-1	We acknowledge your support of Alternative 5.
F39-1	We acknowledge your support of the project.

Comment Number	Response to Comment
F40-1	We acknowledge your support of the project.
F41-1	We acknowledge your support of the project.
F42-1	We acknowledge your support of the project.
F43-1	We acknowledge your support of the project.
F44-1	We acknowledge your support of the project.
F45-1	We acknowledge your support of the project.
F46-1	We acknowledge your support of the project.
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F73-1	We acknowledge your support of the project.
F74-1	We acknowledge your support of the project.
F75-1	We acknowledge your support of the project.
F76-1	We acknowledge your support of the project.
F77-1	We acknowledge your support of the project.

Comment Number	Response to Comment
F78-1	We acknowledge your support of Alternative 2.
F79-1	We acknowledge your support of Alternative 2.
F80-1	We acknowledge your support of Alternative 2.
F81-1	We acknowledge your support of Alternative 2.
F82-1	We acknowledge your support of Alternative 2.
F83-1	We acknowledge your support of the project.
F84-1	We acknowledge your support of the project.
F85-1	We acknowledge your support of the project.
F86-1	We acknowledge your support of the project.
F87-1	We acknowledge your support of the project.
F88-1	We acknowledge your support of the project.
F89-1	We acknowledge your support of the project.
F90-1	We acknowledge your support of Alternative 2.
F91-1	We acknowledge your support of the project.
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F95-1	We acknowledge your support of the project.
F96-1	We acknowledge your support of the project.
F97-1	We acknowledge your support of the project.
F98-1	We acknowledge your support of Alternative 2.
F99-1	We acknowledge your support of the project.
F100-1	We acknowledge your support of the project.
F101-1	We acknowledge your support of the project.
F102-1	We acknowledge your support of the project.
F103-1	We acknowledge your support of Alternative 2.
F104-1	We acknowledge your support of the project.
F105-1	We acknowledge your support of the project.
F106-1	We acknowledge your support of the project.
F107-1	We acknowledge your support of the project.
F108-1	We acknowledge your support of the project.
F109-1	We acknowledge your support of Alternative 2.
F110-1	We acknowledge your support of the project.
F111-1	We acknowledge your support of the project.
F112-1	We acknowledge your support of the project.
F113-1	We acknowledge your support of the project.
F114-1	We acknowledge your support of the project.
F115-1	We acknowledge your support of Alternative 2.

Comment Number	Response to Comment
F116-1	We acknowledge your support of Alternative 2.
F117-1	We acknowledge your support of the project.
F118-1	We acknowledge your support of Alternative 2.
F119-1	We acknowledge your support of the project.
F120-1	We acknowledge your support of the project.
F121-1	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension. For information regarding the concurrent reviews of state permits and the DEIS comment period, refer to response to comments F404-181 and F404-182.
F122-1	We acknowledge your support of the project.
F123-1	We acknowledge your support of the project.
F124-1	We acknowledge your support of Alternative 2.
F125-1	We acknowledge your support of Alternative 2.
F126-1	We acknowledge your support of Alternative 2.
F127-1	We acknowledge your support of Alternative 2.
F128-1	We acknowledge your support of the project.
F129-1	We acknowledge your support of the project.
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F140-1	We acknowledge your support of the project.
F141-1	We acknowledge your support of the project.
F142-1	We acknowledge your support of Alternative 2.
F143-1	We acknowledge your support of Alternative 2.
F144-1	We acknowledge your support of Alternative 2.
F145-1	We acknowledge your support of Alternative 2.
F146-1	We acknowledge your support of the project.
F147-1	We acknowledge your support of the project.
F148-1	We acknowledge your support of the project.
F149-1	We acknowledge your support of the project.

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F150-1	We acknowledge your support of the project.
F151-1	We acknowledge your support of the project.
F152-1	We acknowledge your support of the project.
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F170-1	We acknowledge your support of the project.
F171-1	We acknowledge your support of the project.
F172-1	We acknowledge your support of the project.
F173-1	We acknowledge your support of the project.
F174-1	We acknowledge your support of Alternative 2.
F175-1	The requested volumes were mailed on August 3, 1998.
F175-2	The request for the spill plan was sent to DGC, which distributed copies of the Northstar ODPCP and ACS technical manuals as per the request.
F175-3	BPXA is currently in the process of investigating tundra restoration for gravel pads and roads no longer needed for production operations at depleted reservoirs. They are actively pursuing remediation on one oil field in order to form a uniform Abandonment Plan for later use. The Northstar Project will be grouped with other fields, such as Prudhoe Bay, and be a small part of a large remediation process. The cost for abandonment is unknown at this time and is largely dependent upon remediation methods and requirements that will be available when abandonment is implemented.
F175-4	The State of Alaska extended the public comment period for ACMP review and review of state permits to September 30, 1998. The Corps, with support of the cooperating agencies, extended the public comment period for the DEIS to August 31, 1998 (refer to response to comment F18-1).
F176-1	We acknowledge your support of the project.
F177-1	We acknowledge your support of the project.
F178-1	We acknowledge your support of the project.

Comment Number	Response to Comment
F179-1	We acknowledge your support of the project.
F180-1	We acknowledge your support of the project.
F181-1	We acknowledge your support of the project.
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F208-1	We acknowledge your support of the project.
F209-1	We acknowledge your support of the project.
F210-1	We acknowledge your support of the project.
F211-1	We acknowledge your support of the project.
F212-1	We acknowledge your support of the project.
F213-1	We acknowledge your support of Alternative 2.
F213-2	We acknowledge your support of Alternative 2.
F213-3	We acknowledge your comment regarding the extensive research that has taken place on the North Slope. Several studies have documented impacts on wildlife in the oil fields, such as the avoidance of oil

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	fields by caribou cows with calves during the post-calving period. Low elevation pipelines have also affected the ability of caribou to move through the oil fields. Generally, impacts to wildlife in Prudhoe Bay have been minor.
F214-1	We acknowledge your support of the project.
F215-1	We acknowledge your opinion that the DEIS does not provide adequate environmental solutions. We have reviewed and rewritten Chapter 10 to provide a more thorough and accurate assessment of cumulative risks. Chapter 11 has been revised to include a list of proposed mitigation measures that will be considered by the agency decision makers. See Section 11.10.
F215-2	We acknowledge your opposition to the project. Cumulative effects that would likely result from the Northstar Project are discussed in Chapter 10.
F215-3	We acknowledge your opinion regarding investment in renewable energies. By law, regulatory agencies must respond to and evaluate submitted DPP proposals. Refer to response to comment F404-27.
F216-1	Section 8.6 of the DEIS describes oil spill containment/cleanup methods and discusses limitations to spill response. In June 1998, BPXA completed an "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska" which provides detailed information pertaining to spill response planning. Limitations to spill response are specified on page 3-29 of the ODPCP. Tactic L-7 of the Alaska Clean Seas Technical manual describes reductions to spill response activities. Cleanup of the worst case spill scenario, a drilling blowout during broken ice conditions, has been analyzed by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)." All three documents have been reviewed and found consistent with Chapter 8 of the EIS. In response to ADEC's request for additional information, BPXA issued an addendum to the Northstar ODPCP in September 1998. As noted in comment F422-16, the state has final responsibility for approval of the Northstar ODPCP.
F216-1 (Cont.)	A new Table 8-8 has been added to the EIS that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP and ACS Technical Manual, and conditions which reduce oil recovery efficiency. See changes made to Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled "Summary of Oil Spill Cleanup Limitations" for oil spill response information. An oil spill from the Northstar Project is not inevitable. As indicated in Section 8.5.2 of the EIS, the estimated oil spill probabilities show that the most likely number of spills greater than 1,000 barrels is zero.
F216-2	We acknowledge your opposition to the project.
F216-3	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F217-1	This is a duplicate comment. See response to comment F216-1.
F217-2	We acknowledge your opposition to the project.
F217-3	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F218-1	We acknowledge your support of the project.
F219-1	We acknowledge your support of the project.
F220-1	We acknowledge your support of the project.

Comment Number	Response to Comment
F221-1	We acknowledge your support of the project.
F222-1	We acknowledge your support of the project.
F223-1	We acknowledge your support of the project.
F224-1	We acknowledge your support of the project.
F225-1	We acknowledge your support of the project.
F226-1	We acknowledge your support of the project.
F227-1	We acknowledge your support of the project.
F228-1	We acknowledge your support of the project.
F229-1	We acknowledge your support of the project.
F230-1	We acknowledge your support of the project.
F231-1	We acknowledge your support of the project.
F232-1	We acknowledge your support of the project.
F233-1	We acknowledge your support of the project.
F234-1	We acknowledge your support of Alternative 2.
F235-1	We acknowledge your support of Alternative 2.
F236-1	We acknowledge your support of the project.
F237-1	Section 6.5 of the DEIS describes the affected environment and environmental consequences of the Northstar Project on beluga whales, ringed seals, bearded seals, spotted seals, and polar bears. The impacts of oil on these marine mammals are discussed in Section 8.7.2.3. The impacts of noise on these marine mammals are discussed in Section 9.5.1 and in the environmental consequences portion of this chapter (Section 9.8.2).
F237-2	The Corps or other permitting agencies may require BPXA to perform research and short-term or long-term monitoring of marine mammal stocks in the project area as part of this DPP review process. However, it is unknown at this time what those requirements or mitigation measures may be. It is not within the scope of the EIS to plan any monitoring or research projects which will occur as a result of this project. However, there may be future monitoring associated with different permits that will need to be acquired or this monitoring may be independent of the Northstar Project (see Mitigation Measures, Section 11.10). In addition, ongoing regional monitoring of ringed seals and bowhead shales sponsored by MMS provides updated baselines by which permitting agencies can make informed decisions about the need for future site-specific monitoring.
F237-3	The environmental impact of the Northstar Project on non-endangered marine mammals and other marine biota as a result of increased tanker traffic in Port Valdez, in the Alyeska Pipeline Terminal shipping lanes, and in tanker routes is outside the project area defined in Section 1.1. Therefore, this impact is out of the scope of this EIS, particularly because the number of tankers per year is not expected to increase due to Northstar. There might be a slight increase in the future, but this increase would not be solely due to Northstar oil. There are other North Slope onshore projects, and this increase may be offset by an overall decrease in production now occurring. These issues regarding impacts to threatened or endangered marine mammal species along the tanker routes are addressed in the Biological Assessment (Appendix B of the DEIS).
F237-4	This is a general statement about the effect ice has on the distribution of animals and it is not meant to infer that all ringed seals come onto the landfast ice in the winter. More details on the biology of ringed seals are provided in Section 6.5.1.2.
F237-5	We agree that the cited reference is less certain about the meaning of the observed data. We have revised Section 6.5.1.2 accordingly.
F237-6	This section is a list of options and important criteria considered for the project. The ability to minimize

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	impacts to marine mammals, fish, and birds was a general criteria used to select these options, although it does not specifically apply to all species. Impacts to ringed seals from trenching and construction activities would have short-term effects, such as displacement, and are possible in the area around the trenching and construction activity. There is a potential for this displacement to have adverse impact certain animals, such as newly-born pups. Permits for "Small Take Authorization" under Section 101 (a)5 of the Marine Mammal Protection Act can be applied for to cover these activities. Specific impacts to marine mammals are discussed in Sections 6.5.2 and 6.9.2 of the EIS.
F237-7	The referenced section explains the proposed construction activities for trenching and laying the offshore pipeline. The environmental impact of this activity is discussed in Section 4.0 and Table ES-14 of the Executive Summary. Impacts of offshore pipeline construction on marine mammals are discussed in Section 6.5.2.2 of the EIS. As discussed in this section, the open trench is expected to freeze shortly after the pipe is laid, and ringed seals are not expected to be attracted to the trench or trenching activities due to noise and human activity. However, the Marine Mammal Commission has postulated that ringed seals may take advantage of the thinner ice to establish breathing holes after the pipe is laid and the trench refrozen.
F237-8	There will be no thermal discharges from Seal Island. A listing of the discharges is described in Table 4-6, with more detail provided in the draft NPDES Permit (Appendix F of the EIS). The maximum temperature of discharges is expected to be no more than 12.6°F (7°C) above ambient seawater and is not expected to affect the ice sheet nor violate water quality standards for temperatures outside the 16.4-ft (5 m) mixing zone.
F237-9	Information requested in this comment is presented in the Section 103 Evaluation, Appendix I of the EIS. In Section 2.3.1.7 of Appendix I, chemical characteristics of sediments are discussed. Section 2.5 of Appendix I discusses the need for ocean disposal of marine sediments as negative impacts to wetlands from saline sediment disposal would be substantially greater than the temporary impacts associated with ocean disposal.
F237-10	We agree that seals may be attracted to Seal Island due to the increased presence of fish and benthic organisms. See Section 6.4.2.2 for revised text.
F237-11	Table ES-14 is a summary table of major impacts by Project Alternative and is not intended to list all of the potential impacts to all species. Impacts of noise and oil spills on seals are discussed in the EIS in Sections 6.5.2.2, 8.7.2.3, 9.8.2.1, and 9.8.2.2. More information is provided in the section summary tables. Not all of this information could be carried forward to Tables 11-1 and ES-14.
F237-12	We disagree with your interpretation of the data in Kelly et al. (1988). The text in Section 9.5.1.3 states that "The extent to which displacement occurs in response to localized industrial activities has not been determined, and there is no clear evidence that seals leave the areas of disturbance or redistribute themselves permanently elsewhere" based on the data from the disturbance studies from the Beaufort Sea (Kelly et al., 1986). Kelly et al. (1988) did not clearly establish that seals were permanently displaced from the area as a result of the noise.
F237-12 (Cont.)	The reference cited by the comment (Kelly et al., 1988) is from a study on noise and marine mammals and reports on earlier work conducted in 1981 through 1987. Most of the pertinent data had previously been presented in Kelly et al. (1986) which was cited in the text. The EIS acknowledges that there will be minor negative impacts from the displacement of ringed seals by the noise and activity around Seal Island.
F237-13	The referenced text is speaking specifically to the loss of habitat within a seal's territory for one season due to noise of reconstructing Seal Island. As stated in the text in Section 6.5.1.2, the territory of the ringed seal can be relatively large, averaging 0.96 to 1.20 square miles (2.5 to 3.1 km^2) per seal in comparison to the less than 0.096 square miles (0.25 km^2) directly affected by the trenching and reconstruction of Seal Island. Displacement of seals from one or more of their breathing holes or lairs within a territory from manmade noise is expected to affect a portion of several individual seal territories adjacent to the pipeline corridor and around Seal Island during construction.

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F237-14	The estimated number of ringed seals affected by the island construction and trenching of the offshore pipeline is a general estimate based on an average density and an assumed distance on either side where the ringed seals would be affected. This estimate is not meant to represent a precise number, but to generally represent an order of magnitude of seals potentially affected. There is no obligation for the applicant or the federal agencies to know the precise number of seals disturbed by the project. Anything more than a general estimate would require site-specific information that is not presently available. The state will provide an evaluation of the adequacy of the Northstar ODPCP.
F237-15	A table has been added to Chapter 8 of the EIS that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP and Alaska Clean Seas Technical Manual, and conditions which reduce oil recovery efficiency. See changes made to Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled "Summary of Oil Spill Cleanup Limitations". The purpose of Chapter 8 is to focus the discussion of oil spill impacts on the physical, biological, and human environments, assuming no oil spill response occurs. It is not intended to comprehensively analyze BPXA's spill response capabilities. The state will evaluate the adequacy of the Northstar ODPCP as part of their review process.
F237-16	As specified on Page W-1 of the ACS Technical Manual (June 1998), ACS has obtained permits from the Alaska Department of Fish and Game and the USFWS to allow ACS to haze birds and terrestrial mammals during an oil spill. A USFWS permit is needed to haze species listed on the Federal endangered species list (Steller's and Spectacled eiders). ACS defers to BPXA for hazing of marine mammals (polar bears, walruses, whales, and seals) since BPXA has the necessary permits. See Section 8.6.3.3 for changes to text indicating the authorization requirement for hazing marine mammals
F237-17	This chapter specifically addresses the effects of noise. The reference to the hypothetical need to kill a polar bear is in regards to a possible human-bear encounter in which the bear is destroyed in defense of life. The avoidance of bears from areas due to noise would help prevent this situation. It is not meant to infer that this would be a planned response for problem bears, for which one would need a permit.
F237-18	We agree that additional description is needed. See Section 9.8.2.2 for changes to text.
F237-19	We agree that this information should be added to the EIS. See Section 9.5.1.3 for changes to text.
F237-20	We acknowledge your comment regarding the need for more discussion of cumulative effects on polar bears and ringed seals. See the new section on polar bears and ringed seals (Section 10.5.3) in the EIS.
F238-1	We acknowledge your support of the project.
F239-1	Response was made by letter from the Corps to the USFWS (dated July 31, 1998) during the consultation process. The Biological Opinion prepared by the USFWS (Appendix M) does not include information on the bull trout.
F239-2	The letter from the Corps to the USFWS dated July 31, 1998, provided tanker spill probability information to meet this request. Based on this information, the Corps' conclusions regarding potential effects to endangered species did not change.
F239-3	We acknowledge your comment regarding the need for analyses of oil spill risk specific to the Northstar Project.
F239-4	It is assumed that the USFWS factored NPRA oil into the baseline when preparing its analysis for the Northstar Biological Opinion.
F239-5	Information was provided to the USFWS by letter and through the consultation process. The USFWS Biological Opinion will be completed on February 5, 1999.
F240-1	We acknowledge your support of the project.
F241-1	We acknowledge your support of the project.
F242-1	We acknowledge your support of the project.
F243-1	We acknowledge your support of the project.

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F244-1	We acknowledge your support of the project.
F245-1	We acknowledge your support of the project.
F246-1	We acknowledge your support of the project.
F247-1	We acknowledge your support of the project.
F248-1	We acknowledge your support of the project.
F249-1	We acknowledge your support of the project.
F250-1	We acknowledge your support of the project.
F251-1	We acknowledge your support of the project.
F252-1	We acknowledge your support of the project.
F253-1	We acknowledge your support of Alternative 2.
F254-1	We acknowledge your support of the project.
F256-1	We acknowledge your support of the project.
F257-1	We acknowledge your support of the project.
F258-1	We acknowledge your support of the project.
F259-1	We acknowledge your support of the project.
F261-1	We acknowledge your support of the project.
F262-1	We acknowledge your support of the project.
F263-1	We acknowledge your support of the project.
F264-1	We acknowledge your support of the project.
F265-1	We acknowledge your support of the project.
F266-1	We acknowledge your support of the project.
F267-1	We acknowledge your support of the project.
F268-1	We acknowledge your support of the project.
F269-1	We acknowledge your support of the project.
F270-1	We acknowledge your support of the project.
F271-1	We acknowledge your support of the project.
F272-1	We acknowledge your support of the project.
F273-1	We acknowledge your support of the project.
F274-1	We acknowledge your support of the project.
F275-1	We acknowledge your support of the project.
F276-1	Section 10.5 of the EIS describes the cumulative effects of the Northstar Project on bowhead whales, ringed seals, and polar bears.
F276-2	We acknowledge your opinion regarding investment in alternative energies. Refer to response to comment F404-27. By law, regulatory agencies must respond to and evaluate submitted DPP proposals.
F276-3	We acknowledge your opposition to the project. By law, regulatory agencies must respond to and evaluate submitted DPP proposals.
F277-1	We acknowledge your opposition to the project. By law, regulatory agencies must respond to and evaluate submitted DPP proposals.
F277-2	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were

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	used to calculate oil spill probabilities for Northstar. Additional discussion has been included in Section 8.5.3 regarding BPXA's project design features that would aid the prevention and/or limit the volume of an oil spill. As indicated in Sections 8.7.2.5 and 8.8, a large offshore oil spill could result in significant impacts to bird populations.
F277-3	We acknowledge your concern that oil spills associated with offshore oil drilling may impact critical bird nesting areas. Insufficient information was given in the comment to ascertain why the statement "95% of the oil could be washed ashore" was made. This number was not presented in the DEIS. As indicated by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)", 30% of the oil spilled during a blowout would evaporate or remain suspended as tiny droplets in the atmosphere. Of the remaining 70% of oil spilled during a blowout, the amount of oil that could be washed ashore would depend on sea, wind, and ice conditions, as well as the effectiveness of oil spill response activities. Possible limitations of oil spill response are described in Section 8.6 of the EIS. A new Table 8-8 has been added to the EIS, which summarizes weather/environmental conditions (including ice, wind, and temperature) that could reduce oil recovery efficiency.
F277-4	The depth of cover is over twice the 100-year predicted ice gouge depth and 3.5 times the deepest ice gouge observed at the project area. This depth of cover provides a large safety factor against pipeline damage due to ice gouging and strudel scour. The comment's request to require a double-walled pipeline would not necessarily protect against ice gouging or strudel scour as well as the proposed design that incorporates additional wall thickness. See text added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS for discussion of double-walled pipeline design vs. BPXA's proposed design.
F277-5	Discussions on pipeline leak detection have been ongoing throughout the summer and fall of 1998 between BPXA and ADEC, Division of Spill Prevention and Response. The Badami Best Available Technology submittal for pipeline leak detection was the basis for choosing a combination of Pressure Point Analysis and Mass Balance Line Pack Compensation for the Northstar pipeline. This system was chosen by considering system performance, response time, reliability, and overall cost-benefit (INTEC, 1998:1). BPXA's proposed leak detection system threshold of 0.15% of throughput exceeds the state requirement of 1% of throughput. BPXA has proposed to perform through ice inspection every 30 days during the winter to detect pipeline leaks smaller than the detection system's threshold of 0.15%. Maximum estimated oil spill volumes are shown in Table 8-5. See revisions to Sections 8.5.1 and 8.5.3 for clarification of the winter (solid ice) inspection methodology and the probability of detecting a leak using this technique. Final approval of spill detection methodology is the responsibility of MMS and the state.
F277-6	We acknowledge your support of Alternative 1 - No Action.
F278-1	We acknowledge your support of Alternative 2.
F279-1	We acknowledge your support of the project.
F280-1	We acknowledge your support of the project.
F281-1	We acknowledge your support of the project.
F282-1	We acknowledge your support of the project.
F283-1	We acknowledge your support of the project.
F284-1	We acknowledge your support of the project.
F285-1	We acknowledge your support of the project.
F286-1	We acknowledge your support of the project.
F287-1	We acknowledge your support of the project.
F288-1	We acknowledge your support of the project.
F289-1	We acknowledge your support of the project.

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F290-1	We acknowledge your support of the project.
F291-1	We acknowledge your support of the project.
F292-1	We acknowledge your support of the project.
F293-1	We acknowledge your support of the project.
F294-1	We acknowledge your support of the project.
F295-1	We acknowledge your support of the project.
F296-1	We acknowledge your support of the project.
F297-1	We acknowledge your support of the project.
F298-1	We acknowledge your support of the project.
F299-1	We acknowledge your support of the project.
F300-1	We acknowledge your support of the project.
F301-1	We acknowledge your support of the project.
F302-1	We have re-analyzed all the impacts to marine mammals, birds, terrestrial mammals, and threatened or endangered species and have made several changes in impact levels based on your suggestions. These changes were incorporated throughout the document. The qualifiers to the impact levels, such as "generally," have been dropped.
F302-2	We have checked all uses of the word "local" in the document to see if it was accurately applied to the project area and we have changed the term in instances when it appeared to be used too broadly and used other, more appropriate terms. The use of "local" was not dropped entirely from the text since it does refer to the project area that was established to encompass the existing oil fields.
F302-3	We acknowledge the USFWS' concern about the probability of an oil spill related to Northstar. Oil spill probabilities for Northstar have been revised in Section 8.5.2 of the EIS. Additional information has been included in Section 10.7 regarding the cumulative probability of an oil spill greater 1,000 barrels occurring on the North Slope. The estimated contribution of Northstar to the cumulative probability is less than 2%.
F302-4	Figures 8-4a and 8-4b contain certain probabilities of contact from an oil spill by land segment (refer to Table 8-3). As noted, these probabilities are quite small and vary in value by land/sea/ice segment. It is unlikely that all of these segments will be contacted to the same extent, based on predominant currents and weather conditions in both summer and winter.
F302-5	All of these issues are addressed in Sections 6.5, 6.7, and 8.7.2 of the EIS. See changes made to Section 8.7.2.3 in response to this comment, as well as response to comments F302-112, F302-114, and F302-115.
F302-6	We disagree with your comment on the adequacy of the discussion of the cumulative impacts of oil spills. Oil spill impacts were considered in the cumulative effects analysis, and are addressed in Chapter 8. Effects of major oil spills can be very devastating, but they are also problematic and may not occur at all. The probability of oil spills, however, can be addressed in the cumulative sense by recognizing that the cumulative probability of oil spills will increase with the contribution of the Northstar Project, as indicated in Section 10.7 of the EIS. Discussion has been added to Section 10.7 regarding the cumulative probability of two or more large oil spills occurring within a 5-year period. This time period was evaluated to address the possible additive effects by a second disturbance to resources not fully recovered from an initial oil spill.
F302-7	Discussions on pipeline leak detection have been ongoing throughout the summer and fall of 1998 between BPXA and ADEC, Division of Spill Prevention and Response. The Badami Best Available Technology submittal for pipeline leak detection was the basis for choosing a combination of Pressure Point Analysis and Mass Balance Line Pack Compensation for the Northstar pipeline. This system was chosen by considering system performance, response time, reliability, and overall cost-benefit (INTEC, 1998:1). BPXA's proposed leak detection system threshhold of 0.15% of throughput exceeds the state

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	requirement of 1% of throughput. BPXA has proposed to perform through ice inspection every 30 days during the winter to detect pipeline leaks smaller than the detection system's threshold of 0.15%. See revisions to Sections 8.5.1 and 8.5.3 for clarification of the winter (solid ice) inspection methodology and the probability of detecting a leak using this technique. Final approval of spill detection methodology is the responsibility of MMS and the state.
F302-8	See text added to Sections 3.4.2.7, 4.2.5 and 4.3 of the EIS for discussion of double-walled pipeline design (including leak detection) versus BPXA's proposed design.
F302-9	A new Table 8-8 has been added to Chapter 8 that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP and ACS Technical Manual, and conditions which reduce oil recovery efficiency. See changes to Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled "Summary of Oil Spill Cleanup Limitations." The purpose of Chapter 8 is to focus the discussion of oil spill impacts on the physical, biological, and human environments, assuming no oil spill response occurs. It is not intended to comprehensively analyze BPXA's oil spill response capabilities. The state will evaluate the adequacy of the Northstar ODPCP as part of their review process.
F302-10	See response to comment F302-9.
F302-11	See response to comment F302-9.
F302-12	See response to comment F302-9.
F302-13	See changes to Section 1.4.4 of the EIS.
F302-14	See changes to Section 3.2.1 of the EIS.
F302-15	See changes to Section 3.4.1.2 of the EIS.
F302-16	The applicant must remove all of the constructed facilities, including Seal Island, upon completion of the process of oil extraction, unless otherwise permitted by the appropriate agencies. The EIS does not provide much detail regarding abandonment of the various facilities because these plans have not been formulated. This subject is discussed in Sections 3.4.2.8 and 4.4.2.7. The EIS states that BPXA will be required to develop a Northstar Abandonment Plan when the reservoir is depleted. The plan will require approval by the Corps, MMS, and ADNR before implementation. All of the alternatives' removal plans would be essentially the same, and it is unknown what future uses for Seal Island and its production facilities might be suggested 15 or more years from now.
F302-17	Use of the gravel materials which make up the (closed) adjacent Kuparuk River State No. 1 exploration site's airstrip and pad to supplement or decrease the amount of gravel mined from the new gravel site would probably be advantageous in terms of mitigating existing environmental impacts from the earlier project. In addition, the cost efficiency of acting to properly restore the existing ARCO site while wintertime overland access is available could be substantial. It is likely that no more than 20,000 to 25,000 cubic yards (15,290 to 19,114 m^3) of gravel materials could be retrieved from these existing facilities. The effect of using these materials would be to limit cumulative gravel uses by the oil development operators on the North Slope. The retrieval and use of these materials would not be cost-effective with the use of pit-run materials from the new site, but this may not be the primary factor in deciding to carry forward with their reuse. If the appropriate state agencies, BPXA, and ARCO agree to this restoration, it could be incorporated into the Northstar gravel mining program.
F302-18	The number of polar bear den sites depicted on Figure 6.5-1 are few (5 total). After reviewing Figures 8-4a and 8-4b, it was determined that a smaller scale map would not provide any additional resolution.
F302-19	We agree that a description of polar bear use of the proposed project area is needed in this section. See revisions to Section 6.5.1.5.
F302-20	See revisions to Section 6.5.1.5.
F302-21	We agree and have made revisions to Section 6.5.1.5 with the assistance of the USFWS.

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F302-22	We agree and have made revisions to Section 6.5.1.5 with the assistance of the USFWS. The paragraph in question is actually paragraph 4, not paragraph 5. See revisions to Section 6.5.1.5.
F302-23	This is a general statement regarding expected noise levels at the Kuparuk River mine site and is not meant to infer that any marine mammals have habituated to industrial noise.
F302-24	Information was added to text in Section 6.5.1.5.
F302-25	Mitigation measures intended to avoid or minimize disturbance to denning polar bears are being considered by the cooperating agencies. See Section 11.10.
F302-26	We agree with the suggested change on denning habitat. The observation of denning in the Kuparuk River Delta has not been verified. See response to comment F302-27 and changes to text in Section 6.5.2.1.
F302-27	The reference to density has been deleted and occurrence of polar bears near the gravel source is cited. See changes to Section 6.5.2.2.
F302-28	See changes to Section 6.5.2.2.
F302-29	See Section 6.5.2.2 for changes to text.
F302-30	We agree with the suggestion. See Section 6.5.2.2 for changes to text regarding open water around Seal Island.
F302-31	Mitigation measures intended to avoid or minimize disturbance to denning polar bears are being considered by the cooperating agencies. See Section 11.10.
F302-32	This mitigation measure is being considered by the cooperating agencies. See Section 11.10.
F302-33	Suggested text on oil impacts to polar bears has been added. See changes to Sections 6.5.2.2 and 8.7.2.3.
F302-34	See changes to Section 6.5.3.
F302-35	We agree that the map shading does need improvement. The sea duck molting areas of Simpson Lagoon and Gwydyr Bay have been altered to improve the illustration. See Figure 6.7-1.
F302-36	See changes to text in Section 6.7.1.1. Also refer to changes to Section 8.7.2.5 made as a result of comment F302-116.
F302-37	We agree that Seal Island appears to be located within a sea duck migration corridor. We have added, as suggested, additional discussion on this issue. Discussion of the potential collision hazard created by new structures on the island has also been added. See changes to Section 6.7.2.2. Also, refer to Section 11.10 which includes mitigation measures. The cooperating agencies are considering requiring the applicant to support a bird collision study on the island.
F302-38	See Section 6.7.1.1 for changes to text.
F302-39	See revisions to Table 6.7-3.
F302-40	The months when there is the largest concentration of birds in the project area have been addressed. See changes to Section 6.7.1.
F302-41	Common eiders do nest mostly on barrier islands, and this additional information was added to the text. See changes to Section 6.7.1.2.
F302-42	See Section 6.7.1.2 for changes to text.
F302-43	The yellow-billed loon is not a major species in the project area and it was felt that further detail on the natural history of this bird was not warranted.
F302-44	With the assistance of the USFWS, we have added new text. See changes to Section 6.7.1.3.
F302-45	See revisions to Section 6.7.1.5.
F302-46	With the assistance of the USFWS, we have revised the text in Section 6.7.2.2, Operation Impacts.
F302-47	The statement is referring to birds in the offshore waters. The impact of boats, tugs, and barges on sea

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	ducks would be minor. See Section 6.7.2.2 for changes to text.
F302-48	The elevation of helicopter flights to Seal Island used in the analysis is 200 to 500 ft (61 to 152.4 m). See Section 6.7.2.2 for changes to the text regarding impacts of helicopters to nesting birds.
F302-49	See response to comment F302-48 for changes to the text regarding helicopter overflights.
F302-50	See response to comment F302-48 for changes to the text regarding helicopter overflights.
F302-51	See response to comment F302-48 for changes to the text regarding helicopter overflights.
F302-52	See response to comment F302-48 for changes to the text regarding helicopter overflights.
F302-53	See Section 6.7.2.2 for changes to text.
F302-54	The issue box was moved to more clearly define the discussion of noise effects versus structure effects.
F302-55	A statement on shorebird displacement and productivity was added to Section 6.7.7.2.
F302-56	See response to comment F302-55.
F302-57	See revisions to text made under comment F302-37.
F302-58	See changes to the text in Section 6.7.2.2 regarding normal planned maintenance. Normal planned maintenance would include non-time critical repairs and maintenance of structures and the pipeline.
F302-59	With the assistance of the USFWS, we have revised the text on helicopter overflights and their potential effects on birds. See changes to the text in Section 6.7.2.2.
F302-60	We have re-evaluated the impacts to birds based on helicopter overflights, and habitat loss from gravel fill and the presence of a pipeline. See Section 6.7.3 for revised text.
F302-61	See revisions in Section 6.7.2.2.
F302-62	See response to comment F302-60.
F302-63	See Section 6.8.1.1 for clarification.
F302-64	Alternative 2 from Point Storkersen to K Pad crosses the largest areas of undeveloped tundra and there would be no road along this route. Impacts to caribou movement would be greater if an access road were near the pipeline (Curatolo and Murphy, 1986:218). Pipelines 5 ft (1.5 m) above ground level have not been shown to be a blockage to caribou movement. See revisions to Section 6.8.2.2.
F302-65	We concur with the concern regarding development of new pipeline corridors in undeveloped tundra areas within the oil fields. An elevated pipeline would have a minor impact on caribou movement relative to the absence of a pipeline. However, a pipeline elevated 5 ft (1.5 m) above ground level has not been shown to adversely affect movement of caribou. Likewise, there is no evidence that an elevated pipeline (without an access road) across undeveloped tundra would adversely affect tundra-nesting birds, although some minor displacement is expected. The number of birds affected by the pipeline would be greatest for Alternative 2 due to the distance through undeveloped tundra. For Alternative 2 and portions of Alternative 3, helicopter inspection flights over the pipeline in areas not accessible by roads would potentially have a minor impact on some species of birds and a minor impact on caribou from disturbance. Although Alternatives 4 and 5 would be located for the most part adjacent to existing roads, helicopter overflights may still be necessary to inspect the pipeline under Alternatives 4 and 5.
F302-66	See Section 6.9.1.2 for changes to text.
F302-67	See Section 6.9.1.2 for changes to text.
F302-68	See Section 6.9.1.2 for changes to text.
F302-69	See Section 6.9.1.2 for changes to text.
F302-70	The spectacled eider range extends to the east as far as Okpilak River Delta. Confirmed and suspected nesting areas for Steller's eiders were also added to Figure 6.9-4.

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F302-71	New information was added to Figure 6.9-4 regarding Steller's eider breeding distribution. Additionally, new information on this breeding was inserted in the text. See Section 6.9.1.3.
F302-72	The potential for spectacled eiders to collide with structures on Seal Island is low; the environmental impact is minor. See changes to Table 6.9-2 and to text in Section 6.9.2.2. Mitigation measures are given in Section 11.10.
F302-73	See changes to Section 6.9.1 which clarify the definitions of impact as defined by the ESA.
F302-74	The number of eider nests or broods are likely underestimated along the alternative routes. Additional text has been added to clarify this point. See changes to the text in Section 6.9. Comment 1. The reference was changed to TERA, 1996:3-9, which did summarize 4 years of data. Comment 2. The Prudhoe Bay area has not been thoroughly sampled for spectacled eider nests and there is little data on the actual number of eiders within the corridors along the alternative pipeline routes. Comment 3. The numbers of nest and broods within 1 mile (1.6 km) of the pipeline corridor referenced in the text was deleted.
F302-75	Helicopter impacts on eiders should be discussed in greater detail. See changes to the text in Section 6.9.2.2. Impacts to common eiders from helicopter overflights are discussed in the revised Section 6.7.3 as a result of response to comment F302-60.
F302-76	We have revised Section 6.9.2.2 as recommended. In this section we have also clarified the impact rating as defined by the ESA.
F302-77	This section addresses only operational impacts. The 1,600 helicopter flights would only be during construction; therefore, it would be a construction impact. Construction impacts, including helicopter flights, are discussed in Section 6.9.2.2. For clarification, the issue box in Section 6.9.2.2 was edited.
F302-78	See revisions in Table 6.9-2.
F302-79	If spectacled eiders continue to occur in the vicinity of oil field facilities, it does represent direct evidence that there is some level of tolerance to these activities, although some impacts could be occurring. Since pre-development data are not available on abundance or density of these eiders in the project area, little can be concluded regarding impacts. See changes to text in Section 6.9.2.2.
F302-80	Statement was changed on further review of the referenced document. See Section 6.9.2.2 for changes to text.
F302-81	We agree with your comments on spectacled eider density and impacts from disturbance. See Section 6.9.2.2 for changes to the text.
F302-82	See Section 6.9.3 for changes to text.
F302-83	We agree that the referenced statement should also be included in the summary. See Section 6.9.3 for changes to text.
F302-84	See revisions to Section 7.3.1.1.
F302-85	See revisions to Section 7.3.1.1.
F302-86	Figure 7.3-1 in the DEIS is a season round figure for three communities using a standard approach during a common time period. It does not seem appropriate to update Figure 7.3-1 (Yearly Cycle for Primary Resources) for Nuiqsut based on 1 year of harvest data that does not address the nuances of the seasonal round (yearly cycle for harvest of subsistence resources). Furthermore, the 1 year of data presented in
F302-86 (Cont.)	Brower and Opie (1997) does not address hunting efforts by season and does not report harvested pounds per species (two elements typically used in a seasonal round). As noted on Figure 7.3-1, the "patterns indicate desired periods for pursuit of each species based on the relationship of abundance, hunter access,

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	seasonal needs, and desirability." Brower and Opie (1997) did not explicitly address these relationships; they report harvest numbers for a single year. Although harvest numbers may reflect seasonal round criteria, there may be other factors involved that make it difficult simply to use harvest data to change the seasonal round data presented on Figure 7.3-1. For example, based on Brower and Opie (1997), bowhead hunting is not reported, as Nuiqsut did not harvest any bowheads in 1994. This skews the percentages for all of the other resource categories as marine mammals dropped from approximately 33% of Nuiqsut's harvest to 2%. Brower and Opie (1997) do not discuss bowhead hunting effort (e.g., there were no bowheads harvested because there was no effort or because of some other factor). In addition, see response to comments F302-84 and F302-85.
F302-87	The data presented in Brower and Opie (1997) do not match the data categories presented in Table 7.3-1 (e.g., Annual Usable Pounds Harvested and Percent of Households Harvesting Resources). Brower and Opie (1997) do not present findings in "usable pounds" but rather in number of species harvested and percent of edible pounds of subsistence harvest. It would not be meaningful to include the "percent of edible pounds of subsistence harvest" on Table 7.3-1, as it would result in a very low percent of marine mammals (i.e., 2%) harvested for 1994/95, as Nuiqsut did not harvest any bowheads in the fall of 1994. Thus, it would require additional information in the table, which would change the table structure and data for all three communities. In all data sources (e.g., SRB&A and ISER, 1993; Braund, 1997; Pedersen, 1995a and 1995b; and Brower and Opie) marine mammals include polar bears.
F302-88	See Section 8.7.3.1 for changes to text.
F302-89	See response to comment F302-88 and revisions to Section 8.7.3.1.
F302-90	This is a general statement regarding the occurrence of polar bears in the area. More detailed information is presented in Section 6.5.1.5.
F302-91	See revisions to Table 8.1.
F302-92	See revisions to Section 8.3.3, Table 8.1.
F302-93	See revisions to Table 8.1.
F302-94	See revised Table 8-1, which includes suggested changes.
F302-95	See Section 8.3.3 for changes to text.
F302-96	See changes to Section 8.3.4.
F302-97	See revisions made to Section 8.4.1. Due to the complex interactions of competing physical and chemical processes, it is not possible to quantify the degree to which weathering would affect properties of the oil slick in particular spill scenarios without modeling specific to the scenario conditions. The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea
F302-97 (Cont.)	During Periods of Broken Ice (June 1998)" provides oil slick characteristics for six different spill scenarios on pages 66 through 120. A computerized oil spill behavior model (S.L. Ross Oil Spill Model) was used, with laboratory data, for Northstar and Point McIntyre crude oils to predict changing oil slick parameters over time, such as area, thickness and volume, evaporation rate, dispersion rate, and maximum in-water oil concentration. This detailed report provides information for the worst case type of oil spill: a well blowout (largest spill volume) during broken ice conditions (most difficult response situation).
F302-98	The statement is not meant to suggest that this situation would lessen the impact to the offshore area. The impact to the physical environment in the offshore areas is presented in Section 8.7.1.3 for oceanography and marine water quality, and in Section 8.7.1.4 for sea ice. Impacts to biological resources in the offshore areas are presented in Section 8.7.2.1 for plankton and marine invertebrates, Section 8.7.2.2 for fish, and Section 8.7.2.3 for marine mammals.
F302-99	This section describes the "Seasonal Conditions Affecting Oil Fate and Behavior" and discussing spill response here is inappropriate.

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F302-100	Because adequate information was available from the MMS, a site-specific spill trajectory model was not developed for the Northstar Project. The comprehensive analysis performed by MMS for Lease Sale 170 provided an opportunity to minimize duplicative technical efforts by using a model already constructed for the area. Northstar-specific trajectories were generated by the MMS using this spill model. The Northstar-specific subset of data from the Lease Sale 170 oil spill model presents a valid estimate of oil movement and resource areas likely to be contacted. Model input data (such as winds and currents) incorporated into the MMS model is consistent with information that would be used in a site-specific Northstar model. As can be seen on Figure 4-1, Seal Island lies close to the center of the two OCS leases Y-0179 and Y-0181. Use of modeling data for an oil spill originating in these lease areas provides a worst case estimate of the maximum areal extent of oil movement and resource areas likely to be contacted. An oil spill originating from the pipeline inside the barrier islands (nearer shore) would not be exposed to the stronger currents present near Seal Island and, therefore, would not be spread as far away from the point of spill.
F302-101	We acknowledge the USFWS' opinion that environmental risks of potential oil spills associated with the Northstar and Liberty projects are unacceptably high. See response to comment F302-3 for clarification of spill probabilities. Also see response to comment F302-9 for a discussion of oil spill response techniques and limitations.
F302-102	We acknowledge your comment regarding liability in the event of a large spill.
F302-103	We disagree that a separate analysis is necessary. Section 8.4.3 specifies that the Oil Spill Risk Analysis assumes that no oil spill response occurs. Oil spill trajectories are modeled for transport caused by wind, ice, and currents, regardless of the effectiveness of spill response operations. As indicated in Section 5.6.1.2, historical data in the project area recorded since 1953 has been reviewed for the EIS. Breakup can begin as early as mid-June, with most breakup periods beginning in early July. Freezeup has begun as early as mid-September, with the average start of freezeup occurring in mid-October. Page 8 of "Oil Spill Risk Analysis" (Anderson et al., 1997) indicates that summer trajectories
F302-104	See the revisions made to Sections 8.4.2, 8.4.3, and 8.6.2. The areal coverage of marine waters was determined using spill volumes of 1,000 barrels and those shown on Table 8-5. Assumptions included a 25% evaporation rate and an oil slick thickness ranging from 1 to 5 mm.
F302-105	Polygons shown on Figures 8-5a and 8-5b correspond to ice/sea segments on Figure A-1 of the Oil-Spill Risk Analysis for Lease Sale 170.
F302-106	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Discussion has been added to Section 8.5.2.3 to clarify differences between offshore pipelines in the Gulf of Mexico or Pacific Ocean and those proposed for Northstar.
F302-107	Text in Section 8.6 (before Section 8.6.1) was changed as a result of response to comment F404-69. See changes made to Sections 8.6 and 8.6.2 for clarification of delays in spill response due to explosion or fire dangers.
F302-108	Text at the end of Section 8.6.1 was changed as a result of response to comment F411-4. See changes in this paragraph for clarification of the time line associated with microbial degradation. Text at the end of Section 8.4.1 was changed as a result of response to comment F411-1. See the paragraph added at the end of Section 8.4.1 which compares microbial degradation rates for the Beaufort Sea and Prince William Sound. This paragraph specifies that lower temperatures on the North Slope would limit the success of hydrocarbon metabolizing microbes.
F302-109	See revisions made to Section 8.6.2.
F302-110	The suggested sentence was added to Sections 8.6.3.1, 8.6.3.2, and 8.6.3.3.
F302-111	See changes made to Section 8.6.3.4 which support the need for research and development of new oil spill cleanup technology.
F302-112	With the assistance of the USFWS, we have revised Table 8-9.

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F302-113	See changes to Section 8.7.2.2.
F302-114	See response to comments F302-5, F302-112, and F302-115. Also see changes made to Section 8.7.2.3.
F302-115	With the assistance of the USFWS, we have revised Sections 6.5, 6.7, and 8.7.2 in response to comments F302-5, F302-112, and F302-114.
F302-116	We agree that revisions are necessary. See Section 8.7.2.5 for changes to text.
F302-117	See Section 8.7.2.5 for changes to text.
F302-118	The discussion in Section 8.7.2.5 addresses impacts to birds from an oil spill on land. See Section 8.7.2.5 for changes to the oil spill impacts to habitat types text regarding habitat along the Alternative 2 onshore pipeline route.
F302-119	See Section 8.7.2.6 for changes to text.
F302-120	Marine mammals and marine habitats have been added to the list of bullets in Section 8.8.
F302-121	The suggested text has been added. See changes to Section 9.5.1.5.
F302-122	We have provided the citation in the EIS. The study cited has a very limited number of observations and left many questions unanswered. See changes to Section 9.5.3.
F302-123	We have addressed this issue in our revisions to Section 6.9.2.2.
F302-124	With the assistance of the USFWS, we have revised this statement to refer to sea ducks within the flight corridor. See changes to Section 9.8.2.1.
F302-125	See Section 9.8.2.1 for revised text on oldsquaw density in Gwydyr Bay and Simpson Lagoon.
F302-126	See Section 9.8.2.1 for changes.
F302-127	See response to comment F302-126 and Section 9.8.2.1 for changes.
F302-128	See revisions to Section 9.8.2.2 for clarification of polar bear avoidance benefits. The change in natural behavior, in this case, would be the initial attraction to Seal Island due to human activity. Noise from generators and compressors could make the facilities less attractive to inquisitive bears.
F302-129	Chapter 9 describes the impacts of noise and it is not appropriate to discuss the issue of an artificial food source in this chapter. Gulls and ravens could be attracted to Seal Island and increased survival of these birds could affect other species. It would be unlikely that the presence of Seal Island would affect the survival of a substantial number of gulls or ravens and, thereby, adversely affect the productivity of other species. See changes to the text in Section 6.7.2.2 and changes to Table 6.7-3. We did revise Table 9-1 to reflect that noise attraction of gulls and ravens to Seal Island could increase their productivity and adversely impact their prey species.
F302-130	The statement was changed on further review of the document. See Section 9.8.2.1 for changes to text resulting from response to comment F302-80.
F302-131	See Section 9.9 for changes to the text.
F302-132	See Section 9.9 for changes to the text.
F302-133	This impact does not warrant inclusion in the summary, as it is an indirect effect as a result of the project. The summary in Section 9.9 highlights the major noise impacts of the project. However, because the increased productivity and distribution of gulls and ravens could result from an artificial food source on Seal Island, this could be an environmental consequence of the project. New text was developed and inserted in Section 6.7.2.2 and a revision was made to Table 9-1 as a result of response to comment F302-129.
F302-134	See Section 10.3.3.4 for changes to text.
F302-135	The impact of oil spills is considered separately from cumulative impacts because spills are problematic and may not occur. The probability of oil spills is addressed in the cumulative sense by recognizing that the cumulative probability of oil spills will increase with the contribution of Northstar, as indicated in Section 10.7. Discussion has been added to Section 10.7 regarding the cumulative probability of two or

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	more large oil spills occurring within a 5-year period. This time period was evaluated to address possible additive effects by a second disturbance to resources (such as birds) not fully recovered from an initial oil spill.
F302-136	With the assistance of the USFWS, we have prepared a new section in the EIS which addresses this issue. Although there is an increased cumulative probability of an oil spill and the related adverse impacts to polar bears with the addition of the Northstar Project, the contribution to this probability from Northstar is low (less than 2%). Because the cumulative probability of an oil spill on the North Slope is high, however, the effect is considered significant. Within the life of the Northstar Project, using the mean subsistence harvest for this region, the harvest of polar bears would be approximately 540 individuals. The estimate of polar bears impacted from a large oil spill, assuming no response, would be up to 30 bears. See new Section 10.5.3 for discussions of cumulative impacts on polar bears. Section 10.7 has been revised to clarify Northstar's contribution to the cumulative oil spill probability on the North Slope.
F302-137	The issue of caribou avoidance, productivity, and habitat loss is not considered a significant loss to caribou. Therefore, no changes to the text in this section are warranted.
F302-138	The issue of Lapland longspur decreasing in abundance due to increases in oil field facilities, such as roads and pads, is not considered a significant impact. Therefore, no changes to the text in this section are warranted.
F302-139	The displacement of tundra nesting shorebirds from areas near an elevated onshore pipeline with no access road is not considered a significant impact. Therefore, no changes to the text are warranted.
F302-140	The NSB Coastal Zone Management Plan, Section 2.4.4.(a), states that: "Vehicles, vessels,and aircraft that are likely to cause significant disturbance must avoid areas where species that are sensitive to noise or movement are concentrated at times when such species are concentrated. Concentrations may be seasonal or year-round, and may be due to behavior (e.g., flocks or herds) or limited habitat (e.g., polar bear denning, seal haul-outs). Horizontal and vertical buffers will be required where appropriate. Concern for human safety will be given special consideration when applying this policy." The policy is quite general and does not specify "sensitive species." Its inclusion in this policy is not appropriate. The land use change would also not be significant. The bulleted paragraph has been deleted.
F302-141	Section 11.8.3 has been rewritten in light of the most likely altitude of the helicopter overflights. Wildlife disturbance is not considered "business as usual" but, to some degree, is an unavoidable consequence of any development in the project area.
F302-142	See response to comment F302-141.
F303-1	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Extreme weather conditions cited in the comment are presented in Section 8.6 and the new Table 8.8 as factors that would limit oil spill cleanup efficiency, but have no effect on oil spill probability. Project design features that would aid in the prevention of an offshore pipeline oil spill, such as pipeline burial depth to avoid damage from ice gouges and strudel scour, are discussed in Section 8.5.3.
F303-2	The depth of cover is over twice the 100-year predicted ice gouge depth and 3.5 times the deepest ice gouge observed at the project area. This depth of cover provides a large safety factor against pipeline damage due to ice gouging and strudel scour. The comment's request to require a double-walled pipeline would not protect against ice gouging or strudel scour as well as the proposed design that incorporates additional wall thickness. An evaluation of double-walled pipe integrity (versus that of a single-walled pipe) indicated that such a design would prove to be more susceptible to failure than that of a smaller, single-walled pipe. See response to comment F402-1, for additional discussion of double-walled pipeline design versus BPXA's proposed design.

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F303-3	We disagree that the DEIS-referenced analysis of available ice gouging data (TN 410, Ice Keel Protection) and INTEC's calculations of maximum predicted 100-year ice gouge depth by ice keels has been inadequate. The pipelines would be buried at least double the deepest depth of predicted gouges, and 3.5 times the depth of the deepest observed ice gouge in the vicinity of the proposed route (TN 410). The pipelines' wall thicknesses have been increased for all sections of pipe placed under the seafloor, partly to assure that the potential crushing forces are withstood. Choosing to place the pipelines at an even deeper burial depth would unnecessarily increase the environmental, safety, and fiscal impacts of the pipeline trenching work because of the complications of handling and replacing those additional soils. Strudel scour erosion is also an important design and pipeline maintenance issue, but the impacts anticipated for each of the pipeline alignments are minor. Maximum strudel scour depths observed near the project area are 5.7 ft (1.7 m), a depth which has been corrected in the EIS. The Northstar Project pipelines have been designed to withstand the strains that would be imposed by a major strudel scour occurring directly above the pipe. Annual pipeline maintenance would include replacement of any bedding materials disturbed, were a scour event to occur. The deepest scour ever reported was 39 feet (12 m) in diameter, and 14.1 feet (4.3 m) deep. This extreme scour would not harm the pipelines as they are currently designed and proposed for installation.
F303-4	As shown in Table 8-5, the maximum volume of oil that could be spilled each day is 100 barrels, with a total offshore volume of 8,200 barrels over a time period of 35 days. This worst-case calculation assumes a maximum design flow rate of 65,000 barrels of oil flowing in the pipeline and a leak detection limit of 0.15% of flow. See revisions made to Section 8.5.1 for clarification of visual detection methods to be used during solid ice conditions.
F303-5	As indicated by S.L. Ross et al. in “Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)”, 30% of the oil spilled during a blowout would evaporate or remain suspended as tiny droplets in the atmosphere. Of the remaining 70% of the spilled oil, the amount washed ashore would depend on sea, wind, and ice conditions, as well as the effectiveness of the oil spill response activities.
F303-6	We acknowledge your support of Alternative 1 - No Action.
F304-1	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Extreme weather conditions cited in the comment are presented in Section 8.6 and the new Table 8.8 as factors that would limit oil spill cleanup efficiency, but have no effect on oil spill probability. Project design features that would aid in the prevention of an offshore pipeline oil spill, such as pipeline burial depth to avoid damage from ice gouges and strudel scour, are discussed in Section 8.5.3.
F304-2	The depth of cover is over twice the 100-year predicted ice gouge depth and 3.5 times the deepest ice gouge observed at the project area. This depth of cover provides a large safety factor against pipeline damage due to ice gouging and strudel scour. The comment's request to require a double-walled pipeline would not protect against ice gouging or strudel scour as well as the proposed design that incorporates additional wall thickness.
F304-3	We disagree that the DEIS-referenced analysis of available ice gouging data (TN 410, Ice Keel Protection) and INTEC's predictive calculations of maximum predicted 100-year ice gouge depth by ice keels has been inadequate. The pipelines would be buried at least double the deepest depth of predicted gouges, and 3.5 times the depth of the deepest observed ice gouge in the vicinity of the proposed route (TN 410). The pipelines' wall thicknesses have been increased for all sections of pipe placed under the seafloor, partly to assure that the potential crushing forces are withstood. Choosing to place the pipelines at an even deeper burial depth would unnecessarily increase the environmental, safety, and fiscal impacts of the pipeline trenching work because of the complications of handling and replacing those additional soils. Strudel scour erosion is also an important design and pipeline maintenance issue, but the impacts anticipated for each of the pipeline alignments are minor. Maximum strudel scour depths observed near the project area are 5.7 ft (1.7 m), a depth which has been corrected in the EIS. The Northstar Project

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	pipelines have been designed to withstand the strains that would be imposed by a major strudel scour occurring directly above the pipe. Annual pipeline maintenance would include replacement of any bedding materials disturbed, were a scour event to occur. The deepest scour ever reported was 39 feet (12 m) in diameter, and 14.1 feet (4.3 m) deep. This extreme scour would not harm the pipelines as they are currently designed and proposed for installation.
F304-4	As shown in Table 8-5, the maximum volume of oil that could be spilled each day is 100 barrels, with a total offshore volume of 8,200 barrels over a time period of 35 days. This worst-case calculation assumes a maximum design flow rate of 65,000 barrels of oil flowing in the pipeline and a leak detection limit of 0.15% of flow, and complete drainage of pipeline contents after a leak has been detected and pipeline valves shut. See revisions made to Section 8.5.1 for clarification of visual detection methods to be used during solid ice conditions.
F304-5	As indicated by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)", 30% of the oil spilled during a blowout would evaporate or remain suspended as tiny droplets in the atmosphere. Of the remaining 70% of the spilled oil, the amount washed ashore would depend on sea, wind, and ice conditions, as well as the effectiveness of the oil spill response activities.
F304-6	We acknowledge your support of Alternative 1 - No Action.
F305-1	We acknowledge your opposition to the project.
F306-1	We acknowledge your opposition to the project.
F307-1	We acknowledge your support of the project.
F308-1	We acknowledge your opposition to the project.
F308-2	We acknowledge your opinions regarding polar bears and Steller sea lions. Steller sea lions are not present in the project area, but are present along tanker transportation routes and are addressed in the Biological Assessment (Appendix B). Impacts of the project to polar bears and threatened and endangered species in the project area are discussed in Sections 6.5 and 6.9, respectively.
F309-1	We acknowledge your support of the project.
F310-1	We acknowledge your support of the project.
F311-1	We acknowledge your support of the project.
F312-1	We acknowledge your support of the project.
F313-1	We acknowledge your support of the project.
F314-1	We acknowledge your support of the project.
F315-1	We acknowledge your support of the project.
F316-1	We acknowledge your support of the project.
F317-1	We acknowledge your support of the project.
F318-1	We acknowledge your support of the project.
F319-1	We acknowledge your support of the project.
F320-1	We acknowledge your support of the project.
F321-1	We acknowledge your support of the project.
F322-1	We acknowledge your support of the project.
F323-1	We acknowledge your support of the project.
F324-1	We acknowledge your support of the project.
F325-1	We acknowledge your support of the project.
F326-1	We acknowledge your support of the project.

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F327-1	We acknowledge your support of the project.
F328-1	We acknowledge your support of the project.
F329-1	We acknowledge your support of the project.
F330-1	We acknowledge your support of the project.
F331-1	We acknowledge your support of the project.
F332-1	We acknowledge your support of the project.
F333-1	We acknowledge your support of the project.
F334-1	We acknowledge your support of the project.
F335-1	We acknowledge your support of the project.
F336-1	We acknowledge your support of the project.
F337-1	We acknowledge your support of the project.
F338-1	We acknowledge your concern about oil spill impacts.
F338-2	We acknowledge your opinions regarding the extreme arctic conditions. We agree that a great deal of thought should go into this project.
F338-3	We acknowledge your support of Alternative 1 - No Action.
F339-1	We acknowledge your support of the project.
F340-1	We acknowledge your support of the project.
F341-1	We acknowledge your support of the project.
F342-1	We acknowledge your support of the project.
F343-1	We acknowledge your support of the project.
F344-1	We acknowledge your support of the project.
F345-1	We acknowledge your support of the project.
F346-1	We acknowledge your support of the project.
F347-1	We acknowledge your support of the project.
F348-1	We acknowledge your support of the project.
F349-1	We acknowledge your support of the project.
F350-1	We acknowledge your concern about oil spills and oil spill cleanup.
F350-2	We acknowledge your concern about noise.
F350-3	We acknowledged your concerns about cumulative effects.
F350-4	We acknowledge your opposition to offshore development.
F350-5	As part of the ROD or issuance of permits, mitigation measures and stipulations on noise levels during whaling season may be required. See Section 11.10 for a list of potential mitigation measures being considered.
F350-6	We acknowledge your concern regarding project impacts on local people. We recognize this situation as an "Environmental Justice" issue. See response to comment F421-3. It is the intent of the United States government to recognize and fulfill its legal obligations to identify, protect, and conserve trust resources of federally recognized Indian tribes and tribal members and to consult with tribes on a government-to-government basis whenever plans or actions affect tribal trust resources, trust assets, or tribal health and safety. Four tribal governments were included in the EIS process for Northstar. See new Section 1.4.8 of the EIS for information on government-to-government coordination in the Northstar EIS process.
F350-7	We acknowledge your concern. On September 22, 1998, this comment was forwarded to the DGC for

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	review by the State of Alaska.
F350-8	We acknowledge your opposition to rapid change.
F350-9	We acknowledge your concern. On September 22, 1998, this comment was forwarded to the DGC for review by the State of Alaska.
F351-1	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension. For information regarding the opportunity for public involvement in the proposed project, refer to response to comment F404-182.
F351-2	The State of Alaska extended the public comment period for the ACMP consistency review and state permits to September 30, 1998. For information regarding the concurrent review of state permits and DEIS public comments, refer to response to comment F404-181.
F352-1	We acknowledge your opposition to offshore development.
F352-2	We acknowledge your belief that the oil industry does not have the ability to clean up spilled oil.
F352-3	The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" presents recovery effectiveness for different blowout oil spill scenarios. See response to comment F302-9 for an explanation of why the report is separate from the EIS.
F352-4	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F352-5	We acknowledge your opposition to offshore development.
F352-6	We acknowledge your concerns regarding local peoples' compensation for North Slope development.
F352-7	We acknowledged your concern about the rate of development.
F352-8	We acknowledge your support for Alternative 1 - No Action and the belief that eventually technology will be developed that will allow onshore access to this oil.
F352-9	We acknowledge your comment regarding NSB Coastal Management policies. Policies 2.4.3(d), 2.4.4(g), and 2.4.4(h) are addressed in Section 7.5 of the EIS and policy 2.4.6(f) is addressed in Section 5.6. Policy 2.4.4(f) is addressed in Chapter 8 and the ODPCP, which is not part of the EIS.
F352-10	Migratory path deflections of the bowhead whale associated with noise and activity has been documented through Traditional Knowledge and studies by western science. Such information is provided in Sections 6.9 and 9.5 of the EIS and the Biological Assessment (Appendix B). A reference to this information was added to Section 8.7.2.7. Variability in noise sources, source locations, and animal behavior precludes prediction of specific deflection patterns in all cases. Therefore, available data were used to predict the expected range of deflection under various project activities and to identify related impacts to the species and to subsistence harvesting.
F352-11	We acknowledge your comment regarding NSB Coastal Management policy. The emergency countermeasures requirement of this policy is addressed in Section 8.6 of the EIS. Policy requirements regarding plans for a relief well are briefly addressed in Section 8.5 and the ODPCP, which is not part of the EIS.
F352-12	To a certain extent, Chapter 8 of the DEIS addressed these issues. However, the purpose of the Northstar ODPCP is to address these issues, and the ODPCP is not part of the EIS.
F352-13	We acknowledge your comment regarding NSB Coastal Management policy. Design of offshore drilling/production structures and pipelines is addressed in Chapter 4 of the EIS. Potential geophysical

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	hazards and their environmental consequences are addressed in Chapter 5 of the EIS.
F352-14	NSB Coastal Management Policy 2.4.6(f) is addressed in Chapters 4 and 5 of the DEIS. Project design, siting, and construction aspects are addressed in Chapter 4. Relative aspects of the affected environment and environmental consequences are discussed in Chapter 5. A substantial amount of Traditional Knowledge related to these topics was gathered as part of the EIS process. The use of Traditional Knowledge in the EIS is presented in Table 1-3.
F352-15	The Biological Assessment was written for the USFWS and NMFS and is intended to present a more technical discussion of oil and noise impacts than the DEIS's Chapters 8 and 9. These two agencies will prepare Biological Opinions based on the Biological Assessment. Therefore, for a more detailed discussion of the effects and impacts of oil to bowhead whales refer to the Biological Assessment (Appendix B of the DEIS).
F352-16	We acknowledge your concern on the treatment of the effects of oil spills in the EIS. As described in Chapter 1 of the EIS, Chapter 6 is where the physiological and behavioral effects of oil on biological resources is presented. Chapter 8 describes the population level impacts of a spill based on information presented in Chapter 6. Additionally, a more detailed discussion of effects of oil on whales and marine mammals is presented in the Biological Assessment, Appendix B of the DEIS. This information was not repeated in its entirety in Chapter 6 or 8 to avoid redundancy. However, we have added additional cross-references to the Biological Assessment to ensure the reader can find this information.
F352-17	The Biological Assessment is a technical resource document that was written for NMFS and USFWS to be used by their agencies for developing Biological Opinions. Therefore, for a more detailed description of impacts of oil on marine mammals, refer to the Biological Assessment.
F352-18	The Biological Assessment is a technical resource document that was written for NMFS and USFWS to be used by these agencies for developing Biological Opinions. Therefore, for a more detailed description of impacts of oil on marine mammals, refer to the Biological Assessment.
F352-19	Sections 6.5.2.2 and 6.9.2.2 discuss the effects of oil on marine mammals and reference several studies that were presented in the 1994 book by Dr. Tom Loughlin, "Marine Mammals and the *Exxon Valdez*."
F352-20	The effects of oil on terrestrial mammals are discussed in appropriate detail, considering the likelihood of an oil spill to adversely affect terrestrial mammals. Additional information regarding the effects of oil spills has been added to Section 6.8.
F352-21	The Biological Assessment (Appendix B) is a part of the DEIS, and the information was intentionally not repeated in two places. The reader is directed to the Biological Assessment and response to comment F420-50.
F352-22	We acknowledge your opinion that Section 9.5.1.1, Bowhead Whale Response to Noise, is inadequate.
F352-23	The sentence has been rewritten to reflect the fact that the study concluded something, but the sample size was too small to make this conclusion meaningful or to really support this conclusion. See response to comment F420-55. See Section 9.5.1.1 for changes to the text.
F352-24	See Section 9.5.1.1 for revised text.
F352-25	See Section 9.5.1.1 for revised text.
F352-26	See Section 9.5.1.1 for revised text.
F352-27	See Section 9.5.1.1 for revised text.
F352-28	See Section 9.5.1.1 for revised text.
F352-29	See Section 9.5.1.1 for revised text.
F352-30	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.

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F352-31	We acknowledge your support of the project.
F352-32	We acknowledge your comment regarding the impacts of the Northstar Project on biological resources.
F352-33	We acknowledge your opinion that impacts to subsistence whaling are overstated in the DEIS. See response to comment F34-1.
F352-34	We acknowledge your opinion that the DEIS does not reflect the project's environmental mitigation features. Section 11.10, which presents a list of potential mitigation measures in addition to those already integrated into the project's design, has been added to the EIS.
F352-35	We acknowledge your comment regarding the listed environmental mitigation features integrated into the project's design.
F352-36	We acknowledge your disagreement regarding the Environmentally Preferred Alternative.
F352-37	We acknowledge your opinion that the alternatives analysis criteria were applied inconsistently.
F352-38	We acknowledge your concerns regarding the timely completion of the EIS and issuance of required construction permits.
F352-39	It is true that the EIS preparation process has been ongoing for over 2.5 years and that this is a reflection of the rigors of the regulatory process. We disagree that the complexity of BPXA's proposal has not also contributed to this EIS development time. In particular, numerous changes to BPXA's proposed project have delayed closure of the EIS development process. However, these changes have resulted in a proposed project with fewer environmental impacts.
F352-40	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F352-41	We agree that the Beaufort Sea is a very important habitat for the bowhead whale. However, this area is not designated as “critical habitat” for bowhead whales under the ESA. Under the ESA, critical habitat status for specific species does not of itself restrict private property rights of the owner or prevent any particular type of use or development.
F352-42	We acknowledge your opposition to offshore development and your opinion that the best and available technology criteria have not been met.
F352-43	The Corps and all cooperating agencies recognize the importance of the Arctic environment to Native people and their culture. For this reason, great care has been applied to thoroughly analyze the potential environmental impacts of the Northstar Development Project. The Northstar EIS may represent the most comprehensive EIS ever prepared for a North Slope project and the proposed project (if approved) will fully meet all state and federal environmental regulations.
F352-44	Permits being developed for the project do require that discharges from Seal Island meet or exceed Alaska state water quality requirements.
F352-45	We agree that the Beaufort Sea is a very important habitat for the bowhead whale. However, this area is not designated as “critical habitat” for bowhead whales under the ESA. Under the ESA, critical habitat status for specific species does not of itself restrict private property rights of the owner or prevent any particular type of use or development.
F352-46	Government permitting of the Northstar Development Project will in no way alter any treaties between the United States and other nations or national and international commitments concerning management of bowhead whales. The United States, State of Alaska, AEWC, and native organizations will be able to continue their respective activities as usual.
F352-47	The NEPA and permitting processes include numerous points at which public concerns are collected, including scoping meetings, workshops, and public hearings (both oral and written). Many of these concerns have influenced the development of this EIS (e.g., incorporation of Traditional Knowledge). Should the proposed project be permitted, the permits will set forth the standards under which the

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	Northstar Project will be constructed and operated.
F352-48	The document referred to is comment letter F32.
F352-49	More emphasis has been given to king eiders. See revisions to Sections 6.7.1.2, 7.3.1.1, and 8.7.2.5.
F352-50	See Section 7.7.1.1 for changes to text.
F352-51	The decline of the king eider population is discussed in Section 6.7.1.2.
F352-52	See response to comments F352-49 and F352-51.
F352-53	We acknowledge your concerns regarding the discussion on king and common eiders. See response to comment F352-49.
F352-54	This statement refers to birds that remain in the offshore waters during the summer months and does not refer to birds that merely migrate through the coastal area of the central Beaufort Sea during spring and fall migration. See Section 8.7.2.5 for changes to the text.
F352-55	We acknowledge your concern about an oil spill during migration of sea birds. See changes to text in Section 6.7.1.1 and response to comment F302-36.
F352-56	If a spill originating from Northstar were to travel as far as Barrow, there could be impacts to numerous species of birds. However, the chance of oil reaching Barrow is less than 1% and the amount of oil left in the water would be very much reduced in volume by the time a slick reached Barrow. Impacts to bird populations from an oil spill reaching that far could adversely afffect steller's and spectacled eiders, which are both listed as threatened species.
F352-57	The forecast of 90 days for oil from a spill near Seal Island reaching ice/sea segments offshore of Barrow is based on the "Oil Spill Risk Analysis for Lease Sale 170" (Anderson et al., 1997). The analysis addresses a very low threshold of contact (greater than or equal to 0.5%) with the assumption that there is no spill response. The table in Figure 8-5b shows that there is a less than 1% probability that oil would travel such a distance. The likelihood of oil contacting resources such as birds and marine mammals outside the local areas around Seal Island (within 12 miles [19.3 km]) is generally less than 10%. The amount of oil reaching ice/sea segments offshore of Barrow in 90 days would be very small.
F352-58	The term "oil release" has been replaced with "oil spill" throughout the document.
F352-59	The definitions for the terms "nearshore" and "offshore" are given in the glossary, which immediately follows Chapter 13.
F352-60	Impacts to thousands of birds in the lagoons could be minor or significant depending on the species affected. Impacts to threatened or endangered species would be significant. We agree that significant impacts to common eiders and oldsquaws would result from a large oil spill.
F352-61	Table 11-1 refers to a "large spill" and the direct mortality to several bird species could be evident for years. This is not classified as "minor" in the table. If it affected birds on the population level or involved threatened or endangered species, it would be significant.
F352-62	The definitions of minor and significant impacts are presented in Section 1.8; impacts in resource chapters (5-9) have been revised and checked for consistency.
F352-63	We acknowledge your opinion regarding impacts to bird populations. See definitions of impact criteria, Section 1.8 and revised text in Chapters 6 and 8.
F352-64	We agree that eiders are of importance to the subsistence users and that the impacts of a large oil spill would be significant to eiders and to subsistence users. See Chapters 6, 7, and 8.
F352-65	We acknowledge the importance of subsistence to Native peoples.
F352-66	We acknowledge your preference for onshore versus offshore development.
F352-67	A substantial effort was made to incorporate Traditional Knowledge in the EIS. An entire chapter, Chapter 2, was devoted to Traditional Knowledge. A new table (Table 1-3), which lists the location of Traditional Knowledge presented in the EIS, has been added to Chapter 1.

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F352-68	We acknowledge your support of the cooperation between stakeholders to address the issues of concern to the Inupiat people.
F352-69	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F352-70	We acknowledged your opinion that impacts to bowhead whales and other marine mammals are not adequately addressed.
F352-71	It is not appropriate for the EIS to duplicate the ongoing ODPCP review by the state. ADEC will determine if the Northstar ODPCP is in compliance with 18 AAC 75, Oil and Hazardous Substances Pollution Control Regulations. Article 4 of these regulations covers specific ODPCP requirements. State response planning standards are set out in 18 AAC 75.430 through 18 AAC 75.442. 18 AAC 75.430 specifically states "the plan must demonstrate the general procedures to cleanup a discharge of any size, including the greatest possible discharge that could occur, subject to the provisions of AS 46.04.020 and AS 46.09.020."
F352-71 (Cont.)	Section 8.6 of the EIS acknowledges the ongoing review of the ODPCP by state and federal agencies. It also discusses the possible limitations to oil spill response (Section 8.6.2). Since little data is available demonstrating industry's response record during broken ice conditions, Section 8.7 presents an evaluation of impacts assuming no response. Any cleanup measures implemented would serve to lessen these impacts. Table 8-5 presents worst case spill volumes for project-specific spill scenarios. The new Table 8-8 summarizes weather/environmental conditions, spill response techniques, and conditions which would reduce oil recovery efficiency. The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" was reviewed and found to be consistent for the approach used and the conclusions reached in the EIS.
F352-72	We acknowledge your opinion that a careful analysis needs to be performed. This EIS represents that analysis for the Northstar Development Project.
F353-1	The Corps has the responsibility of overseeing the Clean Water Act. The involvement of the Corps in the Northstar Project is described in Section 1.1.
F353-2	We acknowledge your opposition of the project. Section 8.6 of the EIS addresses available methods for oil spill response. Included are accessible containment and cleanup methods, spill response limitations, and response activities for various environmental settings. Emergency procedures for an on oil spill cleanup are presented in BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska". Cleanup of the worst case oil spill scenario, a drilling blowout during broken ice conditions, has been analyzed by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)." The study suggests that in situ burning is a very effective method which can be used on oil spills in ice conditions.
F353-3	We acknowledge BPXA's project features designed to avoid impacts to subsistence whaling.
F353-4	We acknowledge your request to consider mitigation measures with respect to subsistence whaling. Please refer to the new section on mitigation measures, Section 11.10.
F353-5	It is unknown what actions Greenpeace will take regarding the Northstar Project, however, a speaker for Greenpeace spoke on this topic at the Kaktovik public hearing (M. Duchin, p. 21 of transcript [F353]) saying "it is our intention . . . to not interfere at all with any subsistence whaling."
F354-1	We acknowledge your support of the project.
F354-2	We acknowledge your support of Alternative 2.
F354-3	We acknowledge your support of the project.
F354-4	We acknowledge your support of Alternative 2.

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F354-5	We acknowledge your support of Alternative 2.
F354-6	We acknowledge your request that the project not be delayed further.
F354-7	We acknowledge your support of Alternative 2.
F354-8	We acknowledge your request that the project not be delayed further.
F354-9	We acknowledge your concerns regarding the consequences of project delay.
F354-10	We acknowledge your support of Alternative 2.
F354-11	We acknowledge your analysis of Alternatives 2 and 5 and concur that Alternative 2 presents the least offshore exposure.
F354-12	We acknowledge your analysis of onshore impacts.
F354-13	We acknowledge your request that the project not be delayed further.
F354-14	We acknowledge your support of the project.
F354-15	We acknowledge your concerns regarding project delays and the EIS process.
F354-16	We acknowledge your support of Alternative 2.
F354-17	We acknowledge your support of the project and, specifically, Alternative 2.
F354-18	We acknowledge your support of the project.
F354-19	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F354-20	To fully comply with Executive Order 12898 concerning Environmental Justice, the cooperating agencies took a number of steps to ensure that the residents of the North Slope that could be impacted by the Northstar Project would have every opportunity to provide information and comment. Project scoping meetings were held in those communities that could be impacted by the project, and translators were used to assist with presentations on the project, as well as assisting residents in expressing their comments. Additional public meetings were held in each of these communities to help residents better understand the DEIS and NEPA process. Meetings were also held between the EIS team and whaling captains and other knowledgeable people for the purpose of obtaining Traditional Knowledge. This information was summarized in Chapter 2 of the EIS and in the description of the affected environment and assessment of environmental consequences presented in Chapters 5 though 9 and the Biological Assessment (Appendix B).
F354-21	A comprehensive discussion of noise, oil spills, and other environmental impacts is found in Chapters 6, 8, and 9. Additional discussions revising these chapters are found in the FEIS.
F354-22	Through the NSB participation as a cooperating agency and public involvement (scoping, commenting), the EIS process is expected to address AEWC concerns.
F354-23	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F354-24	Executive Order 12898 requires that federal agencies make achieving Environmental Justice part of their mission by identifying and addressing disproportionately high and averse human health, or environmental effects on minority populations. The agencies have attempted to do so in this EIS. It is clear that residents of the North Slope will bear the brunt of any adverse environmental effects from this project. Project engineering and mitigation (to be specified in the ROD) are intended to eliminate or reduce any adverse effects upon the residents of the North Slope. It is also recognized that residents of

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	the North Slope will receive a higher proportion of the benefits from Northstar, compared to other residents of Alaska and the United States.
F354-25	We acknowledge your opposition to offshore development.
F354-26	We acknowledge your support of Alternative 2.
F354-27	We acknowledge your support of Alternative 2.
F354-28	Selection of the Environmentally Preferred Alternative does not include cost. Alternative 5 is feasible, as are all other alternatives. Its identification, however, as the Environmentally Preferred Alternative, only considered impacts to the physical, biological, and human environments.
F354-29	Pipeline access is an issue with Northstar since all action alternatives propose an undersea pipeline, as well as an onshore pipeline. With the exception of Alternative 5, where the onshore pipeline follows a portion of the West Dock Causeway, access might be a problem since no new roads or causeways will be built.
F354-30	We acknowledge your request that the project not be delayed further.
F354-31	We acknowledge your support of Alternative 2
F354-32	We acknowledge your analysis of Alternatives 2 and 5 and support of Alternative 2.
F354-33	We acknowledge your support of Alternative 2.
F354-34	As older oil fields such as Prudhoe Bay decline, smaller fields, including some located offshore which were once thought to be uneconomical, have become more attractive to developers and producers. These small fields can now be safely developed with new advances in technology.
F354-35	The intention of assessing cumulative impacts is to examine the impact on the environment which results from the incremental impact of the action in addition to past, present, and reasonably foreseeable future actions. Chapter 10 of the EIS serves this purpose under NEPA. Chapter 10 has been rewritten in response to comments. Also see response to comments F404-8, F404-21, and F413-16.
F354-36	We have addressed the referenced local effects in Chapter 7.
F354-37	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F354-38	Discussions on pipeline leak detection have been ongoing throughout the summer and fall of 1998 between BPXA and ADEC, Division of Spill Prevention and Response. The Badami Best Available Technology submittal for pipeline leak detection was the basis for choosing a combination of Pressure Point Analysis and Mass Balance Line Pack Compensation for the Northstar pipeline. This system was chosen by considering system performance, response time, reliability, and overall cost-benefit (INTEC, 1998:1). BPXA's proposed leak detection system threshold of 0.15% of throughput exceeds the state requirement of 1% of throughput. BPXA has proposed to perform through ice inspection every 30 days during the winter to detect pipeline leaks smaller than the detection system's threshold of 0.15%. Maximum estimated oil spill volumes are shown in Table 8-5. See revisions to Sections 8.5.1 and 8.5.3 for clarification of the winter (solid ice) inspection methodology and the probability of detecting a leak using this technique. Final approval of spill detection methodology is the responsibility of MMS and the state.
F354-39	We received a number of comments asking for more technical information on the Northstar pipelines to be included in the EIS. There is a separate technical review process that includes requests for public comments on the technical aspects of the Northstar pipelines. This process is defined in Alaska Statute 38.35 and is the responsibility of the State Pipeline Office. The State Pipeline Office received the Northstar Right-of-Way Lease application in June 1996. A public notice in June 1996 stated that the applications were on file with the state and requested comments on the pipeline project.

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	Comments on the pipeline were accepted at the DEIS scoping meetings that were held in March, April, and May 1996. Public hearings were held in July 1998 in Nuiqsut, Barrow, Kaktovik, Fairbanks, and Anchorage on the Northstar Project where comments on the pipelines were also accepted. The state also requested public comments during their ACMP process which is ongoing. This process ends once a consistency determination is made. At the end of the pipeline technical review, the state will issue the Commissioners Analysis with draft Right-of-Way leases and a preliminary decision for public comment. Only after this entire process is complete can the state issue the Right-of-Way leases for the Northstar pipelines.
F354-40	See response to comment F404-70.
F354-41	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and the use of MMS OCS and CONCAWE spill statistics in these calculations. See response to comment F302-100 for discussion of the oil spill trajectory model information used for Northstar.
F354-42	We disagree that the EIS should include BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska." Chapter 8 of the EIS was intended to be a focal point for discussions of the effects of oil spills on the physical, biological, and human environments. It was not intended to be an oil spill plan. However, the BPXA document is available to the public for viewing through the State of Alaska.
F354-43	We acknowledge your commitment to spill prevention evidenced by the mitigation features incorporated into the design.
F354-44	We acknowledge your concern over delays affecting this year's construction schedule.
F354-45	It is true that the EIS preparation process has been on-going for over 2.5 years. The complexity of BPXA's project proposal has contributed to this EIS development time. In particular, numerous changes to BPXA's proposed project have delayed closure of the EIS development process. However, these changes have resulted in a project proposal with fewer environmental impacts.
F354-46	We acknowledge your support of Alternative 2.
F354-47	We acknowledge your concern over project delays.
F354-48	We acknowledge your comment regarding operating procedures of oil cleanup in ice conditions.
F354-49	We acknowledge your comment regarding operating procedure of oil cleanup in broken ice conditions.
F354-50	We acknowledge your comment regarding realistic maximum operating limits for oil spill response.
F354-51	We acknowledge your comment regarding limitations and benefits of oil spill cleanup in more than 50% ice cover.
F354-52	We acknowledge your comment regarding the time period over which ice grows.
F354-53	We acknowledge your comment regarding the conditions required for ice to stabilize.
F354-54	We acknowledge your analysis of the S.L. Ross et al. (June 1998) report and the ability to respond to spills during periods of prolonged darkness.
F354-55	We acknowledge your support of the project.
F354-56	We acknowledge your comment; however, it is not known how much Northstar oil will be directed to Fairbanks refineries.
F354-57	We acknowledge your support of Alternatives 2 and 3 with the shortest offshore portions.
F354-58	We acknowledge your support of Alternative 2.
F354-59	We acknowledge your support of Alternative 2.
F354-60	We acknowledge your support of the project.
F354-61	We acknowledge your comment regarding the economic impact of the project.

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F354-62	We acknowledge your support of completing the project without time extension.
F354-63	We acknowledge your support of the statement that the shortest distance between two points is a straight line.
F354-64	We acknowledge your support of Alternative 2.
F354-65	We acknowledge your support of the project, specifically, Alternative 2.
F354-66	While the technology being proposed is not new from a global perspective, it will be new to the Arctic and the North Slope. For these reasons, extensive engineering and testing of the proposed designs have been conducted by BPXA and the State Pipeline Office to ensure that this technology will meet the needs of the applicant, while minimizing environmental risk.
F354-67	In determining the Environmentally Preferred Alternative, the agencies did account for the differences in the offshore pipelines when comparing action alternatives. However, these differences yielded very little change in the probability of an oil spill occurrence, regardless of pipeline length.
F354-68	We acknowledge your support for Alternative 2 and your desire for a timely decision.
F354-69	We acknowledge your statement that the technologies described in the EIS are appropriate to support oil development and production in the Alaskan Beaufort Sea.
F354-70	We agree that a wide variety of important elements of BPXA's project design have been chosen or developed to avoid or minimize the attendant environmental impacts.
F354-71	We acknowledge your opposition to Alternative 5 as the Environmentally Preferred Alternative.
F354-72	The comment is not specific as to the varying criteria applied in the alternatives analysis. BPXA's pipeline mitigation features which are incorporated into the design are detailed in Section 4.2.5. General criteria for selection of onshore pipeline, Section 3.4.2.7, states that selection of onshore pipeline routes should consider environmental issues, project cost, and pipeline access. Factors include maximizing use of existing disturbed areas such as pipeline corridors and roadways. Another criteria is minimizing total pipeline length and expense. In this case, these criteria are in direct conflict and, therefore, other criteria are factored in the selection of the Environmentally Preferred Alternative. All of the criteria, when applied evenly, tend to select routes which do not cross undeveloped tundra.
F354-73	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and the use of MMS OCS and CONCAWE spill statistics in these calculations. Additional discussion of Northstar Project design features that would aid the prevention and/or limit the volume of a spill has been added to Section 8.5.3.
F355-1	We acknowledge your comment regarding the projected economic windfall to the State of Alaska as a result of the Northstar Project.
F355-2	We acknowledge your support of Alternative 2.
F355-3	While the technology being proposed for the Northstar Project is not new in a global sense, it is new for the Alaskan Arctic. For this reason, considerable engineering and testing have been done by BPXA and the State Pipeline Office to ensure that sufficient safeguards are incorporated into this project's design features.
F355-4	This is why the State and Federal Governments have conducted an extensive review of this project's design. Northstar will be the first Alaskan offshore oil development that uses an undersea pipeline for transportation of crude oil.
F355-5	We acknowledge your support of Alternative 2 and your concerns regarding project delays.
F355-6	We acknowledge your comment regarding the economic benefits to the State of Alaska associated with the project.
F355-7	We acknowledge your support of the project. However, we disagree with your opinion regarding the revenue per acre calculation, as it is misleading and does not consider all project costs.
F355-8	We acknowledge your concern over delays adding to the project costs.

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F355-9	We acknowledge your support of Alternative 2.
F355-10	We acknowledge your support of Alternative 2.
F355-11	We acknowledge your support of Alternative 2.
F355-12	We acknowledge your support of Alternative 2.
F355-13	We acknowledge your request to avoid further delays of the project.
F355-14	We acknowledge your opinion that development at Endicott has not impacted the area fishery and whale migrations.
F355-15	We acknowledge your support of Alternative 2.
F355-16	We acknowledge your support of Alternative 2 and your request for no project delays.
F355-17	This comment is correct in the assertion that the Northstar Development will have a small "footprint" compared to older North Slope projects, but your facts are incorrect. While Seal Island was originally a 5-acre (2-hectare) island, it has sloughed and eroded considerably since it was created. BPXA estimates that to restore and stabilize the island will require gravel placement that will produce a subsea "footprint" of 18.1 acres (7.3 hectares). The working surface will be 5.4 acres (2.2 hectares). See Appendix A, Project Description, for more information. It is also incorrect to state that this project design will eliminate air and water discharges. Discharges into air and water will occur, albeit within government standards.
F355-18	We acknowledge your support of Alternative 2.
F355-19	We acknowledge your analysis of Alternatives 2 and 5.
F355-20	We acknowledge your concern regarding the impact of extending the public comment period.
F355-21	We acknowledge your support of the DEIS conclusions recognizing that appropriate technologies are assembled to support oil development production in the Alaskan Beaufort Sea.
F355-22	We acknowledge your analysis of Alternative 5 relative to the applicant's preferred design, Alternative 2.
F355-23	We acknowledge your comment regarding the state-of-the-art technologies utilized in the proposed Northstar pipeline.
F355-24	We acknowledge your concerns regarding project delays and the impacts of the delays.
F355-25	It is true that the EIS preparation process has been on-going for over 2.5 years and that this is a reflection of the rigors of the regulatory process. However, we contend that the complexity of BPXA's proposed project has also contributed to this EIS development time. In particular, numerous changes to the BPXA's proposed project have delayed closure of the EIS development process. These changes have, however, resulted in a project proposal with fewer environmental impacts.
F355-26	We acknowledge your comment regarding oil industry experience in broken and solid ice conditions.
F355-27	We acknowledge your comment regarding the behavior of oil in ice and how oil recovery techniques are affected by ice, specifically, the effect on oil recovery when the ice concentration equals 50%.
F355-28	We acknowledge your comment regarding the decreasing effectiveness of mechanical containment of an oil spill in water as the ice concentration becomes larger than 50%.
F355-29	We acknowledge your comment that in-situ burning has been demonstrated to be an effective response technique in ice-infested water within established physical limitations.
F355-30	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F355-31	Section 10.7 was rewritten to specifically consider the contribution of the Northstar Unit Development. As described in Section 10.7, the cumulative probability of a large oil spill occurring during the life of

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	the Northstar Development Project is 95.2%. Northstar's contribution to the cumulative oil spill probability is less than 2%. We agree that the probability of a large oil spill occurring somewhere on the North Slope is high.
F355-32	We acknowledge your opinion that the potential risks are unacceptable. Refer to response to comment F355-31 for details on the risks resulting from OCS Lease Sale 170. The diversion of investment resources toward the development of sustainable energy supplies remains solely with BPXA and its stockholders.
F355-33	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Extreme weather conditions cited in the comment are presented in Section 8.6 and the new Table 8.8 as factors that would limit oil spill cleanup efficiency, but have no effect on oil spill probability. Project design features that would aid in the prevention of an offshore pipeline oil spill, such as pipeline burial depth to avoid damage from ice gouges and strudel scour, are discussed in Section 8.5.3.
F355-34	We acknowledge your opinion that the oil spill response analysis is inadequate. Section 8.6 on oil spill response informs the reader that the Northstar pipelines would be the first subsea offshore oil and gas pipelines in the Beaufort Sea; therefore, response to a gas pipeline leak has not been previously performed or addressed. Also refer to BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska" which identifies planning, equipment, and personnel required to respond to a gas pipeline leak or rupture. The information given in the EIS is based on the best scientific data available.
F355-35	We disagree that the EIS should include BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska." Chapter 8 of the EIS was intended to be a focal point for discussions of the effects of oil spills on the physical, biological, and human environments. It was not intended to be an oil spill plan. The BPXA ODPCP is available to the public for review.
F355-36	See response to comment F404-72 for a discussion of in situ burning.
F355-37	The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" presents recovery effectiveness for different blowout oil spill scenarios. See the response to comment F404-70 for an explanation of why this report was reviewed for consistency with Chapter 8, but not included as part of the EIS.
F355-38	We acknowledge your opinion that this project is reckless and should not proceed.
F355-39	We acknowledge your concern about industrial disturbance to bowhead whales and other marine mammals.
F355-40	Cumulative impacts were addressed in Chapter 10 in accordance with NEPA, which requires analysis of past, present, and reasonably foreseeable future projects. Cumulative effects of the Beaufort Sea Oil and Gas Development/Northstar Project pertain to those associated with project development and operation as they relate to impacts to the environment. Chapter 10 has been rewritten in response to comments.
F355-41	Oil spill effects on bowheads are discussed separately from cumulative effects and can be found in Sections 6.9 and 8.7.2.7. Oil spill impacts were not considered in the cumulative effects analysis, and are not considered a chronic impact of development. Effects of major oil spills can be very devastating at certain times of the year, but they are also very problematic and may not occur at all. The probability of oil spills, however, can be addressed in the cumulative sense by recognizing that the cumulative probability of oil spills will increase with the contribution of the Northstar Project, as indicated in Section 10.7.
F355-42	Computer models known as Global Climate Models (GCMs) are used to investigate the Earth's changing climate. These are used frequently in studies related to the correlation between increases in the greenhouse gases and atmospheric temperatures ("global warming"). In particular, many of these models suggest that increases in temperature due to greenhouse gases will not be equally distributed globally but are likely to be accentuated at higher latitudes, such as in the Arctic, where the temperature rise may be more than double the global average. Warming during the winter months is expected to be

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	greater than warming during the summer. In concert with these models, temperatures have warmed throughout much of Alaska since at least the mid-1970s. Most of the observed warming has occurred during winter and spring. Overall temperature increases have been in the range of 3.6°F (2°C), and the pattern has been similar to that predicted by the GCMs based on the increase in atmospheric greenhouse gases. Other data (e.g., from well boreholes) also indicate a warming trend. Whether or not the Arctic climate will continue to warm is uncertain, although both GCMs and logic suggest that this is likely with the continued increase of atmospheric greenhouse gases. Some caution is necessary, however, because other factors still may operate to cause short- or long-term cycles or change.
F355-42 (Cont.)	Assuming the current warming trend continues, it is reasonable to expect some reduction in the thickness of sea ice and duration of the ice season. This reduction is still a matter of scientific debate because it is related to projected temperature increases in the Arctic, which depend on the GCM employed. Hence, the ramifications for ice-dependent species is not yet quantified. While the connection between the burning of fossil fuels and consequent increase in greenhouse gases is fairly well accepted by the scientific community, results such as sea level rise with coastal inundation and increases in storm frequency and severity are still a matter of scientific uncertainty, particularly with respect to degree of impact. Over the long-term, global warming could have substantial impacts in the form of degradation of permafrost that underlies parts of Alaska. Differential thawing of permafrost can have significant negative effects on construction and engineering activities. With a warmer climate, the depth of annual thaw of the top of the permafrost likely would increase during the summer. Expansion of this zone of annual thaw, referred to as the active layer, would reduce stability and make terrain more susceptible to slumping and erosion. In the continuous permafrost across most of the North Slope, however, mean surface temperatures currently are below -5° C, and only warming of the permafrost is expected with no widespread thawing, except perhaps locally on some south facing slopes. Because this permafrost should remain largely in place during the time of the proposed project, it appears likely that effects of global change on the proposed project would be minimal. As discussed in some detail in response to comment F404-21, the incremental contribution of Northstar, including the production, transportation, processing, and consumption of Northstar crude and derived products, to the annual global production of carbon greenhouse gases is almost immeasurable. Moreover, on a regional basis, Northstar will contribute less than an estimated 1% of the greenhouse gases produced locally from human activities on the North Slope. We have added a new discussion on climate change and the project's cumulative effects to Chapter 10.
F355-43	Chapter 4 of the Executive Summary does contain an accurate summary of information presented in Section 11.3. It was stated that adoption of Alternative 1 - No Action would result in Seal Island remaining in its current condition and no environmental disturbance associated with the Northstar Project would occur. For the other action alternatives such potential environmental disturbances, including oil spills, noise, and construction and operational impacts have been extensively documented in the EIS.
F355-44	We acknowledge your observation that existing development on the North Slope has not impacted wildlife.
F355-45	We acknowledge your support of Alternative 2 and your request for no project delays.
F355-46	We acknowledge your support of the applicant's design, Alternative 2.
F355-47	We acknowledge your support of a timely approval of Alternative 2.
F355-48	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was

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	reached as a balance between requests for extensions and a significant number of requests for no extension.
F355-49	We acknowledge your concerns regarding the public involvement in the EIS process.
F355-50	The intention of assessing cumulative impacts is to examine the impact on the environment which results from the incremental impact of the action when added together to past, present, and reasonably foreseeable future actions. Chapter 10 of the EIS serves this purpose under NEPA.
F355-51	We acknowledge your support of Alternative 1 - No Action.
F355-52	We acknowledge your concerns regarding project delays.
F355-53	We acknowledge your support of Alternative 2.
F355-54	We acknowledge your support of the project and request for no delays.
F355-55	We acknowledge your support of Alternative 2.
F355-56	We acknowledge your observation that North Slope oil development has not impacted wildlife.
F355-57	We acknowledge your request for no further project delays.
F355-58	We acknowledge your support of Alternative 2.
F355-59	We acknowledge your concern over delays and their impact on your livelihood.
F355-60	We acknowledge your concern over delays impacting the viability of the project.
F355-61	We acknowledge your support of Alternative 2.
F355-62	We acknowledge your support of Alternative 2.
F355-63	We acknowledge your support of Alternative 2 and opposition to public comment period extensions.
F355-64	We acknowledge your support of Alternative 2.
F355-65	We acknowledge your support of Alternative 2.
F355-66	We acknowledge your support of Alternative 2.
F355-67	We acknowledge your opinion that Alternative 2 represents the favorable alternative in terms of worker safety.
F355-68	We acknowledge your request for no further project delays.
F355-69	We acknowledge your support of Alternative 2.
F355-70	We acknowledge your support of Alternative 2 and your request for no further project delays.
F355-71	We acknowledge your support of Alternative 2.
F355-72	We acknowledge your support of Alternative 2 and your request for no further project delays.
F355-73	We acknowledge your support of Alternative 2 and request for no further project delays.
F355-74	We acknowledge your support of Alternative 2 and request for no further project delays.
F355-75	We acknowledge your support of Alternative 2 and request for no further project delays.
F355-76	We acknowledge your support of Alternative 2.
F355-77	We acknowledge your concern over delays and their impacts.
F355-78	We acknowledge your support for moving forward with the project without delay.
F355-79	We acknowledge your analysis of the project alternatives and support for Alternative 2.
F355-80	We acknowledge your support of Alternative 2.
F355-81	We acknowledge your opinion that the DEIS is inadequate. The DEIS does not exhaustively describe most of the detailed engineering that has been performed. As stated in the DEIS, the State Pipeline Office has reviewed and evaluated the various system designs. For more information, refer to response

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	to comment F354-39.
F355-82	We disagree with your opinion that oil spill impacts have been downplayed and that the EIS should contain BPXA's ODPCP. BPXA's ODPCP is available to the public for review.
F355-83	We acknowledge your opinion that the DEIS is inadequate with respect to impacts to fish, wildlife, and habitats.
F355-84	The intention of assessing cumulative impacts is to examine the impact to the environment which results from the incremental impact if the action when added together to past, present, and reasonably foreseeable future actions. Chapter 10 of the DEIS serves this purpose under NEPA and has been rewritten in response to comments. Refer to response to comment F404-21 for impacts to global climate.
F355-85	We acknowledge your opinion that the Northstar EIS should not be used for tiering future NEPA reviews.
F355-86	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F355-87	These effects are identified and discussed in Section 6.8.
F355-88	Pipeline integrity and potential impacts from ice gouging, strudel scour, ice override, and coastal erosion are addressed in Chapter 5 of the EIS. Engineering evaluations (including those from the State Pipeline Office) are summarized in the EIS, and applicable documents are referenced in Appendix E. All referenced documents are available to the public.
F355-89	We acknowledge your opinion that the DEIS should describe the analysis of the alternative pipeline technologies considered. Additional discussion has been included in Section 8.5.3 regarding specific project design features that would aid the prevention and/or limit the volume of a spill. The depth of cover is over twice the 100-year predicted ice gouge depth and 3.5 times the deepest ice gouge observed at the project area. This depth of cover provides a large safety factor against pipeline damage due to ice gouging and strudel scour. The comment's request to require a double-walled pipeline would not necessarily protect against ice gouging or strudel scour as well as the proposed design that incorporates additional wall thickness. See text added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS for discussion of double-walled pipeline design vs. BPXA's proposed design.
F355-90	Issues that were identified during scoping meetings, and those that were identified during the preparation of the DEIS were addressed. The depth of information used to analyze potential impacts included the use of "western science" as well as Traditional Knowledge from local residents. The analysis revealed that risks to offshore pipeline segments due to strudel scour were generally similar for all action alternatives. Risks associated with permafrost thawing were found to be similar among Alternatives 2, 3, and 4, but lowest for Alternative 5. Figure 5.6-8 has been modified to show facility locations relative to strudel scour density.
F355-91	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and the use of MMS OCS and CONCAWE spill statistics in these calculations. Project design features that would aid the prevention of an oil spill due to site-specific hazards are discussed in Section 8.5.3. Additional pipeline design information is available in the INTEC technical documents listed in Appendix E.
F355-92	We acknowledge your concerns regarding BPXA's ODPCP. We disagree that the ODPCP should be presented in the EIS.
F355-93	The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" presents recovery effectiveness for different blowout oil spill scenarios. The numbers cited are summarized on page 4 of the Executive Summary of that report. The S.L. Ross et al. report was released after publication of the DEIS. We have reviewed this document and found its findings to be consistent with Chapter 8 of the EIS. Section 8.7 describes the impacts expected for migrating whales or birds in the event of an oil spill for

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	which no response occurs. This allows evaluation of biological impacts separate from the discussion of the oil recovery efficiencies anticipated for different response scenarios. See response to comment F404-70 for an explanation of why this report was reviewed for consistency with Chapter 8, but not included as part of the EIS.
F355-94	We acknowledge your opinion that the EIS downplays the magnitude of oil spills impacts.
F355-95	We acknowledge your opinion that cumulative impacts have been inadequately addressed. Chapter 10 has been rewritten in response to comments. The potential infrastructure for any development of oil field near Gwydyr Bay are not mapped because there were no plans to develop this field prior to the release of the DEIS. Since then, applications have been submitted to develop Pete's Wicked - Gwydyr Bay, and this is shown on Figure 10-2. The pipeline for this project is proposed to go south from that field to T Pad.
F355-95 (Cont.)	There could be some expansion of the known reservoir at Northstar through further delineation of the field, but all drilling would still occur from Seal Island with extended reach drilling as opposed to building new island/facilities or using Northstar Island. The production and transport of the oil would not be expected to change from that described in the EIS. If other satellite fields near Northstar were located and require additional infrastructure not included in the EIS, an additional NEPA document would be required prior to development.
F355-96	The indicated statement in the text is in reference to the cumulative effects of onshore facilities and the pipeline routes for Alternative 4 and 5 on subsistence hunting access or game availability. No hunting is permitted along these routes. The onshore facilities for these alternatives would be built on existing fill or immediately adjacent to other pipelines where hunting access is already restricted.
F355-97	The question of Northstar itself having an impact on any global climate change due to emissions of greenhouse gases is addressed in response to comment F404-21. The overall conclusion from this particular response to comment is that Northstar will have an immeasurable incremental contribution to the annual global greenhouse gas emissions budget derived from the production and consumption of fossil fuel products. See Chapter 10 for an expanded discussion on the project's cumulative effects on the climate. The issue of global climate change was not raised in any of the Public Scoping Meetings (Agency - April 1, 1996; Barrow - March 25, 1996; Kaktovik - March 26, 1996; Fairbanks - March 28, 1996; Valdez - April 2, 1996; Anchorage - April 3, 1996; Nuiqsut - May 7, 1996).
F355-98	We acknowledge your support of Alternative 1 - No Action.
F355-99	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F355-100	We acknowledge your belief that projects such as Northstar are critical to your company's future in Alaska.
F355-101	We acknowledge your support of Alternative 2.
F355-102	We acknowledge your support of the project.
F356-1	According to S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)", research and spill response experience have demonstrated that in situ burning is a very effective method which can be used on oil spills in broken ice conditions. Oil spilled in waters which are largely covered by ice will remain relatively thick and contained, resulting in removal efficiencies which can exceed 90% (page 54). However, it should be noted that estimated effectiveness for in situ burning given in Table S-2 of the S.L. Ross et al. report ranges from 0 to 14%.

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F356-2	We acknowledge your concern about maintaining whaling without disruption. The importance of the bowhead whale to the Inupiat people is addressed in DEIS Chapter 7.3.
F356-3	We acknowledge your comment regarding this project leading to additional development in the Beaufort Sea. We agree that oil development in the Arctic is likely to continue. Chapter 10 of the EIS, Cumulative Effects, describes current and foreseeable oil development projects.
F356-4	We acknowledge your concern regarding the need to work with elders and local people to address their concerns. Similar comments have been addressed in response to comments F404-129, F404-130, F404-131, and F421-3.
F356-5	Refer to Section 9.8.2 of the EIS which discusses the impacts of noise to bowhead whales. This section includes information about impacts of aircraft disturbances, helicopter traffic, and barge and vessel traffic between the mainland and Seal Island to bowhead whales.
F356-6	We acknowledge your concern regarding unpredictable ice conditions.
F356-7	We acknowledge your concern regarding flooding in nearshore areas.
F356-8	King eiders have been given more emphasis in the text in Sections 6.7.1.2 and 8.7.2.5 in part based on their importance to subsistence for local residents.
F356-9	Chapter 7.3 describes the dependence of Nuiqsut families on subsistence resources and activities.
F356-10	We acknowledge your comment regarding impacts to the environment. Chapter 10, which has been rewritten in response to comments, addresses the cumulative effects of the Northstar development on the Arctic environment.
F356-11	We acknowledge your comment regarding living with the results of this project.
F356-12	We acknowledge your comment regarding sea and ice conditions in the nearshore area.
F356-13	We acknowledge your comment regarding deep areas near Cross Island and Beechy Point being important to subsistence.
F356-14	We acknowledge your concern over development and its impact upon subsistence food resources.
F356-15	The impacts of the project to bowhead whale migration are discussed in Section 6.9, Section 9.8, and the Biological Assessment (Appendix B). It is expected that under unusually quiet conditions some whales would avoid an area within 6 miles (9.7 km) of Seal Island as a result of industrial noise from the project.
F356-16	If an action alternative is selected, the FEIS must identify the potential mitigation measures being proposed by all agencies. Then, in the ROD, the decision maker chooses the appropriate mitigation following public comment. Limitation of drilling activities will be considered among the array of potential mitigation measures aimed at reducing impacts on bowhead whales. See Section 11.10 on potential mitigation measures.
F356-17	It appears that the comment shows concern about the responsiveness of the NSB to the wishes of the community in the Borough's issuance of permits. The Borough does have an independent authorization process which will govern its approval or disapproval of the Northstar Development Project. This process, which will include a public review of a BPXA rezone application and Master Plan, is described in Section 7.5.1.3.
F356-18	We acknowledge the difference between impacts that may exist between Barrow and Nuiqsut whaling communities. Sections 7.2 and 7.3 contain information, including Traditional Knowledge from Nuiqsut whaling captains, regarding bowhead whale subsistence activities.
F356-19	Impacts to plankton, marine invertebrates, and fish from offshore pipeline construction are described in Sections 6.3 and 6.4.
F356-20	Section 8.6 of the EIS addresses available methods for oil spill response. Included are accessible containment and cleanup methods, spill response limitations, and response activities for various environmental settings. Specific information, such as equipment and procedures on oil spill cleanup are presented in BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska." Cleanup of the worst case oil spill scenario, a drilling blowout during

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	broken ice conditions, has been analyzed by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)."
F356-21	We acknowledge your comment regarding ice movement.
F356-22	For this project, there will be no causeways or other structures built along the shoreline that would interfere with fish migration. The pipeline will be buried below the seafloor and will not create any bottom irregularities that would present an obstacle to fish. This project would have no adverse effects on the quality of subsistence foods, including fish, under normal operations. If a large oil spill were to occur, there is a potential for June 1998cant impacts to the availability and quality of subsistence foods in areas affected by the spill.
F356-23	Impacts to wildlife are discussed in Chapter 6. Impacts to subsistence are discussed in Section 7.3.
F356-24	This comment appears to refer to the detection of crude oil spills from the pipeline, rather than that of a diesel spill. The minimum leak detection threshold for the leak detection system would allow an oil spill rate of 100 barrels (4,095 gallons [15,501 liters]) per day, which is 0.15% of an anticipated peak flow rate of 65,000 barrels per day. Based on the design assumption that visual inspection would detect an onshore leak within a week, a maximum of 680 barrels (28,560 gallons [108,452 liters]) would be spilled to the tundra environment. Offshore pipeline leaks could result in much higher volumes of oil being spilled due to the increased time between leak detection surveys (Table 8-5). Text has been added to Sections 8.5.1 and 8.5.3 of the EIS to clarify the proposed winter inspection methodology and the probability of detecting a leak using this technique. Leaks greater than 0.15% of flow rates would be automatically detected, production would cease, and pipeline segments would be isolated by automatic valves. Final approval of the leak detection system and visual inspection techniques is the responsibility of the MMS and the state.
F356-25	We acknowledge your concern over development impacts on your way of life. If an action alternative is selected, the FEIS must identify the potential mitigation measures being proposed by all agencies. Then, in the ROD, the decision maker chooses the appropriate mitigation following public comment. Limitation of drilling activities will be considered among the array of potential mitigation measures aimed at reducing impacts on bowhead whales. See Section 11.10 on potential mitigation measures.
F356-26	See response to comment F356-22.
F356-27	We acknowledge your comment regarding the increase of development in the Arctic.
F356-28	We acknowledge your concern over project impacts to subsistence harvests.
F356-29	Concerns about contamination of subsistence foods by an oil spill are discussed in Section 8.7.3.1. This section concludes that impacts to subsistence from an oil spill could be significant.
F356-30	We acknowledge your concern about oil spill impacts to the environment. See response to comment F356-20 for more information.
F356-31	See Section 6.3 for a description of the effects of the project on plankton and marine invertebrates and Section 7.3 for potential project effects on subsistence use of bowhead whales.
F356-32	We acknowledge your concern about diversion of bowhead whales by the project.
F356-33	We acknowledge your concerns about the cumulative impacts of development on the North Slope. Refer to Chapter 10, which has been rewritten in response to comments, for a complete discussion of cumulative impacts.
F356-34	Section 3.3.2 describes existing onshore oil and gas field facilities, including the number of wells. The visual impacts of the project, including flares, are discussed in Section 7.8. For information on where to find discussion on arctic haze and cumulative effects to air quality, see response to comment F356-35.
F356-35	Section 5.4.1.3 of the EIS discusses arctic haze and the existing ambient air quality for the onshore project area. Section 7.8.1.2 also discusses arctic haze, which is thought to originate from the long-range transport of pollutants from industrialized Europe. Section 10.4.2 discusses the cumulative effects of North Slope oil and gas development on air quality.

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F356-36	The EIS addresses both the potential beneficial effects to NSB residents from revenues generated by the proposed project (see Section 7.6) and potential adverse effects on subsistence and culture (see Sections 7.3 and 7.6).
F356-37	We acknowledge your concern about project impacts on subsistence. The importance of subsistence resources and activities to local residents is addressed in Section 7.3.
F356-38	We acknowledge your concern over ice gouging of the pipeline.
F356-39	We acknowledge your concern about oil spill impacts on the environment. See response to comment F356-20 for direction on where to find more information on oil spill response scenarios in the EIS.
F356-40	The EIS addresses potential effects on subsistence resources and activities (Section 7.3) and cumulative impacts of past, present, and reasonably foreseeable future activities (Section 10.5.1). If an action alternative is selected, the FEIS must identify the potential mitigation measures being proposed by all agencies. Then, in the ROD, the decision maker chooses the appropriate mitigation following public comment. Limitation of drilling activities will be considered among the array of potential mitigation measures aimed at reducing impacts on bowhead whales. See Section 11.10 on potential mitigation measures.
F356-41	We acknowledge your opposition to development in the Arctic.
F356-42	We acknowledge your concern about cumulative impacts of oil development in the Arctic. Chapter 10, which has been rewritten in response to comments, addresses cumulative effects from past, present, and reasonably foreseeable future actions.
F356-43	We acknowledge your opposition to the project.
F356-44	Section 4.4.2.7 addresses requirements for abandonment of the proposed project when the oil reservoir is depleted and production of oil stops. If BPXA's proposed project is approved, they will be required to develop a plan for abandonment of the oil development and production facilities. The plan will require an assessment of environmental consequences of abandonment, and likely include public review. See response to comment F420-6 for more information on abandonment.
F356-45	The nearshore lagoon referred to here is Simpson Lagoon, between the shoreline and the barrier islands, Stump and Long Islands. These waters are shallow enough that ice usually freezes to the bottom and thereby excludes fish during the winter. Because fish are not likely to be present during the winter, construction noise should not impact fish in this area.
F356-46	Section 9.8.2.2 states that no studies have been conducted on the effects of noise on spectacled eiders. As direct studies on the effects of noise on spectacled eiders have not been conducted, evidence about impacts to similar species was used to draw conclusions about spectacled eiders. Section 9.8.2.2 also explains how it is possible to infer from studies of distributions of radio-collared eiders with broods in the Prudhoe Bay and Kuparuk oil fields that spectacled eiders do not universally avoid oil field facilities or high noise areas.
F356-47	We chose to include Alpine, Tarn, and other oil developments in the cumulative impacts chapter of the EIS because all North Slope oil development projects contribute to an overall effect, no matter whether onshore or offshore. This, and other comments have correctly identified that subsistence hunting in the Alpine and Tarn areas will be permitted; therefore, the statement made in Section 10.5.1 of the DEIS that subsistence hunting is likely to experience a significant adverse impact associated with access restrictions associated with the development of Alpine and Tarn is incorrect. This statement has been corrected in the FEIS.
F356-48	We acknowledge your comment that spectacled eiders, king eiders, and other birds nest on the barrier islands.
F356-49	We agree that Figure 8-4a shows that land segment 31 (near Nuiqsut) could be contacted by an oil spill in the winter within 180 days. However, it should be noted that the probability of this occurring is only 2%. Figure 8-4b correctly displays modeling results for the trajectory of an oil spill in the summer. Again, it

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	should be noted that there is only a very small likelihood (1%) that land segments 26, 27, 28, and 29 would be contacted by an oil spill. The probability that an oil spill would contact land segments 30, 31, and 32 is less than 0.5%, so these boxes are not colored on the figure. There are many reasons why there would be seasonal changes in contact, especially of such a small magnitude (1% to 2%). Wind and circulation patterns differ between summer and winter and these are the main features that determine where oil would move.
F356-49 (Cont.)	Probabilities of oil contacting land segments were calculated by MMS from an oil spill trajectory model. This model was constructed to simulate wind-driven and density-induced ocean flow fields and the ice motion field. While data from the model is valuable in estimating the possible geographic extent of an oil spill, this data does not consider cleanup, dispersion, or weathering processes. These factors are important in determining the quantity or properties of oil that might eventually contact land segments.
F356-50	Figure 8-5a shows an oil spill in the winter could contact ice/sea segments 6, 7, 8, and 10. These segments are offshore areas approximately bounded by Nuiqsut and Kaktovik. The ice/sea segments offshore of Barrow (3 and 4) have less than 0.5% probability of contact and are not colored. The comment points out correctly that Figure 8-5b shows an oil spill in summer could contact ice/sea segments from Barrow to approximately the Canadian border. This geographic extent was modeled by MMS using wind and current data. It should be noted that there is only a 1% to 2% probability that ice/sea segments 3, 4, and 5 would be contacted within 90 days and a 1% probability that segment 11 would be contacted within 30 days. This data does not consider oil spill response measures that could limit the extent of area contacted by a spill.
F356-51	We acknowledge your concern about the number of oil spills that have occurred. We note that only four spills greater than 1,000 barrels have ever occurred on the North Slope, and only one involved crude oil. As shown by historic mean and median spill volumes in Table 8-4, smaller spills (typically less than 80 gallons) are much more common than large spills (greater than 1,000 barrels).
F356-52	We acknowledge your comment regarding the absence of knowledge of who will have jurisdiction over subsistence harvests.
F356-53	A substantial effort was made to collect Traditional Knowledge from residents of affected North Slope communities. Individuals who contributed Traditional Knowledge are referenced in Chapters 5 through 9 and the Biological Assessment (Appendix B). See response to comments F404-129, F404-130, F404-131, and F421-3 for more information on how we attempted to integrate Traditional Knowledge into the EIS.
F356-54	We acknowledge your concern about oil development and subsistence. See response to comment F356-22.
F356-55	The EIS addresses oil spill response activities in ice and broken ice conditions, including spill response limitations, in Section 8.6. As indicated by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)", 30% of the oil spilled during a blowout would evaporate or remain suspended as tiny droplets in the atmosphere. Of the remaining 70% of oil spilled, the amount that could be recovered would depend on sea, wind, and ice conditions, as well as the effectiveness of oil spill response activities.
F356-56	We acknowledge your concern about oil spill and ice conditions.
F356-57	Efforts to include local representatives in a more meaningful way in agency and industry decision-making are expanding on many fronts. It is hoped that in the near future, these efforts can be more closely coordinated. At this point, the annual oil industry/subsistence whaler meetings and discussions have provided a productive mechanism for addressing potential offshore conflicts on a season-by-season basis.
F356-58	A substantial effort was made to collect Traditional Knowledge from residents of affected North Slope communities. Individuals who contributed Traditional Knowledge are referenced in Chapters 5 through 9 and the Biological Assessment (Appendix B). See response to comments F404-129, F404-130, F404-131, and F421-3.

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F356-59	We acknowledge your comment that, in some winters, nearshore ice may not freeze to the bottom.
F356-60	See response to comments F356-47 and F396-1.
F356-61	Section 8.6.1 of the EIS addresses available containment and cleanup methods, including oil spill response capabilities in ice and broken ice conditions. Booms and absorbent barriers may be deployed to form physical barriers to assist in preventing migration of the spill. Application of chemical dispersants is an alternative response to containment during summer months. Available containment and cleanup methods are addressed in EIS Section 8.6.1, limitations to containment and cleanup operations are described in Section 8.6.2, and applications in environmental settings are identified in Section 8.6.3.
F356-62	The nutritional and cultural importance of subsistence foods, including maktak, dried fish, and seal, is clear from the testimony of three young girls. The dependence of Nuiqsut residents on subsistence resources is addressed in EIS Section 7.3.
F356-63	See response to comment F356-62.
F356-64	See response to comment F356-62.
F356-65	We acknowledge your concern over cancer and the possibility that oil development might, in some way, be increasing the cancer rate of people living in the Arctic.
F356-66	We acknowledge your concern about air pollutants from oil development.
F356-67	In the event of an oil spill, BPXA will implement the procedures outlined in the (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska."
F356-68	Although Nuiqsut is located in close proximity to the oil and gas fields, there are no refineries for producing commercially saleable refined product on the North Slope. Refined products, such as gasoline and diesel, must be transported back to Nuiqsut for consumption. Recent agreements for a gas supply line from the Alpine facilities to Nuiqsut may begin to address perceived inequities of living close to oil and gas development without getting much direct benefit from the resources.
F356-69	We acknowledge your concern over oil pad abandonment. Refer to response to comments F356-44 and F420-6 for more information on abandonment.
F356-70	We acknowledge your concern over oil spills in winter. See response to comment F356-55.
F356-71	See response to comments F356-49 and F356-50.
F356-72	We acknowledge your concern regarding the potential of oil spills to infiltrate the Kuukpik River. See response to comments F356-49 and F356-50 for information on the probability analysis of spilled oil reaching this area.
F356-73	The phenomenon described by Mr. Ahkiviana is known to western science as ice override, and has been studied for several decades, which, admittedly, does not equal the millennia of observation time afforded to the North Slope peoples. The anticipated production life of the Northstar Project is approximately 15 years. The potential for ice override at the Northstar production island was studied and evaluated by Coastal Frontiers Corporation, who prepared a report in April 1996 entitled, "Ice Criteria for the Northstar Development." The study is available for public review. This study and the excerpted portion dealing with ice override are referenced in the EIS in Section 5.6.2.2. Elements incorporated in the Seal Island design, including the submerged gravel berm, concrete protection matting, and the perimeter sheet pile wall are designed to avoid or withstand ice override occurrences.
F356-74	We acknowledge your concern about oil exploration effects on subsistence.
F356-75	The movement of anadromous fish (Arctic cisco, broad whitefish, and char) is discussed in Section 6.4.1.2, and presented on Figures 6.4-1 and 6.4-2. The Northstar Project will have no causeways or other structures in the nearshore waters that would interfere with the movement of fish along the coast. The pipeline would be buried below the seafloor from Seal Island to landfall.
F356-76	We acknowledge your opinion that the DEIS is inadequate.
F356-77	We acknowledge your opposition to the project.

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F356-78	We acknowledge your concern about knowing who will be responsible for clean-up of any spilled oil. See response to comment F356-81.
F356-79	We acknowledge the importance of subsistence harvesting, lifestyle, and culture to Native people.
F356-80	We acknowledge your opposition to the project.
F356-81	The owner or operator who spills oil is responsible for the cleanup and, in this case, is BPXA. However, BPXA, ARCO, and the Alyeska Pipeline Service Company have established a mutual aid agreement to assist each other with response equipment and personnel in the event of an oil spill. These companies and Exxon Company USA are also members of Alaska Clean Seas (ACS), a non-profit oil spill response cooperative. ACS is a full response organization and currently functions as the focal point for spill response and training for member companies. ACS provides equipment, training, and personnel for oil spill response preparedness, response, and cleanup. The ACS administration offices, response command center, central communications system, and main warehouse are located in Deadhorse. During the open water season, ACS stages response equipment (including vessels) at West Dock and East Dock in Prudhoe Bay, and additional equipment at the confluence of the east and west channels of the Sagavanirktok River. Section 8.6 describes oil spill response and limitations.
F356-82	The Kuukpik Corporation has no ownership in the state and federal leases associated with the Northstar Project. The Corporation may participate in the project through local hire efforts by BPXA. It is reasonable to assume that similar opportunities would become available should oil development occur farther offshore.
F356-83	The referenced Foggy Island work was a seismic survey. Seismic exploration is not planned as part of the construction and operation of the Northstar Project. For impacts of noise on bowhead whales see Section 9.8.2.2.
F356-84	We acknowledge your opposition to the project.
F356-85	We acknowledge your concern about project impacts on local, Native people. We recognize this situation as an Environmental Justice issue. See response to comment F421-3.
F356-86	We acknowledge your concern over potential impacts to subsistence.
F356-87	The cooperating agencies have taken the responsibility and have made extensive efforts to assess the potential environmental consequences of the Northstar Project.
F356-88	We acknowledge your opposition to the project.
F356-89	We acknowledge your opposition to the project.
F356-90	The origins of the sandbags are unknown.
F356-91	We acknowledge your report of whale use in waters between Seal Island and Reindeer Island. This observation is consistent with information contained in this EIS.
F356-92	We acknowledge your opposition to the project.
F356-93	See response to comment F356-81. Water samples have been taken in the project area and future sampling programs are likely to be part of the NPDES and UIC permits.
F356-94	See response to comment F356-35.
F356-95	We acknowledge your opposition to this project and offshore development in general.
F356-96	We acknowledge your opposition to the project.
F356-97	We acknowledge your concern about oil spills and potential effects on marine mammals.
F358-1	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.

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	BPXA submitted an addendum to the Northstar ODPCP in September 1998 in response to ADEC's July 15, 1998 request for additional information. This information, along with the ACS Technical Manual, was reviewed and incorporated where applicable in the FEIS. See response to comment F404-54 for a discussion of inclusion of ODPCP information in the EIS and oil spill cleanup limitations.
F358-2	After careful consideration of requests from the public for an extension of the public comment period on the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F359-1	As is discussed in the comment, the predicted storm surge heights, maximum wave height, and breaking wave height information for waters near Prudhoe Bay is complex and based on somewhat limited local data gathered since 1962. The key wave information referenced is found in Tables 5.5-1 and 5.5-2. One of the principal documents used was the "Hindcast Study of Extreme Surge, Wave and Current Conditions Near Prudhoe Bay, Alaska" by Joy et al., for Exxon, January 12, 1979. Applying Solitary Wave Theory would indicate a theoretical maximum breaking wave at 33.5 ft (10.2 m) MLLW, (Joy et al., 1979:29) which can be compared with the top of the sheet pile protection at only 27 ft (8.2 m) MLLW. The comment does correctly mention that the protective gravel berm (with a toe that is over 230 ft [70 m] out from the sheet pile wall) and the 3:1 slope of the island shore (which sets the wall back 87 ft [26.5 m] from the MLLW shoreline) would have a considerable effect in dissipating wave energy during storms. (See Figure ES-10) It is anticipated that these features would bring this theoretical wave down below the top of the wall before reaching the edge of the island's working deck. As has been discussed in other responses (see response to comment F413-1), the detailed analyses and input parameters of these specialized issues cannot all be included in the Northstar EIS documents. The EIS document is intended to be only a summarization of known information. The proposed design's technical detail is referenced, retrievable, and available within Alaska should anyone wish to review the literature.
F359-2	It is encouraging to receive an experienced, independent opinion that the concrete mat protection system and sheet pile wall should be sufficient to the purposes for which they have been designed. The submerged gravel berm should ground the moving ice pack at some distance from the foreslope of the island and adjacent sheet piles.
F359-3	The ice ridges accumulating around Seal Island annually will generally be shear ridges. Ice pile-up and ride-up events could also, potentially, create circumstances resulting in the encroachment of ice blocks onto the island's gravel slopes or possibly even atop the sheet pile walls.
F359-4	We acknowledge your comment; however, a normal shear zone seaward of Seal Island will result in minimal late winter effect on the buried pipelines and facilities at the island itself. In addition, we recognize that the early to mid-winter ice movements do result in some intermittent ice gouging events, as previous studies have shown.
F359-5	During conceptual and preliminary engineering of the Northstar Project, a detailed ice stress and thickness report was prepared. Short-term stress calculations were performed, treating the thickened ice road as a linear, elastic plate on a fluid foundation. Dynamic and static loads are used for various loading situations and equipment combinations. The pipeline route was assessed taking into account the different boundary conditions resulting from the free edge of the trench. A detailed equipment layout was used to determine the load magnitudes and their relative locations. In addition to representative equipment, soil overburden weights were added to simulate the trenching and effects of stockpiling spoil material near the trench edge. Non-linear creep analysis of the ice is still being conducted to determine the load limitations consistent with avoiding submergence and flooding of the ice surface.
F359-5	A full-scale test trench program was carried out in the spring of 1996, to determine whether the proposed

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(Cont.)	"on ice excavation" technique is viable. The purpose of the test trench was to evaluate ice slotting and through-ice trenching techniques, as well as to gauge production rates, monitor the ice stability, and study the effect of construction on the area's water quality, etc. Test trenching was conducted in late March during the warmest ambient air conditions. The ice sheet deflections at the edge of the ice slot were of particular interest. The creep behavior of the ice was found to be satisfactory for the operations planned. Also, in situ strength tests showed the ice to have nearly double the minimum required strength for safe operation. The test trench program results have been carefully evaluated and it has been concluded that the construction associated risks are reasonable and a safe operation can be conducted with good assurance. A more detailed description of these activities and summary of the results is presented in the Technical Note TN 660, Winter Test Trench Summary, by INTEC. Personnel safety is a paramount consideration, which in turn dictates the need for vigilance. The ice sheet will be monitored and inspected at all times to detect incipient cracks that could lead to unsafe conditions while any activity occurs offshore. As discussed elsewhere (see response to comment F413-3) it is not necessary to present all of these calculations and design studies in the EIS.
F359-6	See response to comment F359-5.
F359-7	The offshore, deep water ice sheet is likely to be thickened somewhat to assure required working strength, but not to the depths mentioned in the comment. A detailed operations plan to accomplish the ice slotting and removal work cited in the EIS has been developed, although it can be modified and improved as more information or suggestions become available. The project schedule, which sets aside 5 to 6 months to accomplish the ice-slotting and pipe-laying efforts described in the EIS, is believed to be adequate. If additional time is required once the field work begins it can be accommodated. Weather, especially bad weather, will dramatically affect and control the execution of any planned program of work out on the ice sheet (see response to comments F359-5 and F359-9).
F359-8	The incremental ice buildup described about the hydraulic excavator's dipper arm is inevitable. The comment is correct in this point. The large temperature differences between the water and the exterior air temperatures will freeze thin layers of sea water to exposed surfaces in seconds. It is also foreseeable that various mechanical or thermal methods can be employed to break the ice off, steam it off, or limit its growth. No discussion is made on this topic in the EIS, but since the available methods need not involve environmentally detrimental results, it does not seem important to the environmental evaluation of the project alternatives. It seems plausible that the icing circumstances can be mitigated and, at worst, the project will require two seasons to complete. This scenario has been discussed in the EIS.
F359-9	The pipeline route (for Alternatives 2 and 3) has been assessed based on route-specific environmental data to determine the potential for ice movement. Almost one third of the route is within the barrier islands, where the ice sheet will be bottomfast and, therefore, not subject to significant movement. Outside the barrier islands the risk of ice movement increases. Between Seal Island and the barrier islands, the ice sheet is landfast and well outside the polar gyro, and not subject to excessive movement. Technical Note TN 740, Pipeline Construction Plan, discusses the effect of small ice movements (up to 2 ft [0.6 m]) on construction. These can be tolerated without the need to move or recut the ice slot.
F359-9 (Cont.)	Weather will be continuously monitored during construction. Differential global positioning equipment will be used for navigation and survey, and will be primarily used to control the ice slot centerline. This equipment is capable of detecting very small (several inches) ice sheet movements. Historically, there is a 5% (1 in 20 years) chance that extreme ice sheet movement will occur. Large ice sheet movement occurs predominantly during breakup in the late spring. Prior to the onset of inclement weather, the pipeline will be end-capped and lowered to the seafloor in the trench. The ice work pad is proposed to be 200 ft (61 m) wide and is considered adequate to permit a new ice slot to be cut and construction to proceed under most circumstances. Contingency plans address the possibility of a two season construction schedule and the consequences and impacts of demobilizing between construction

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	seasons.
F359-10	We have revised Figure 5.6-8 to show facility locations relative to strudel scour density.
F359-11	The introduction of countermeasures by initiating holes to intercept overflow waters may be workable, and may be tried if experience shows that repair of strudel scour depressions is a regular maintenance issue. The likelihood that any intervention will be necessary is quite low.
F359-12	The buried pipelines would have a high level of structural resistance to the strains caused by strudel scours. See response to comment F303-3.
F359-13	Should the shorefall crossing or portions of the pipeline trenches show evidence of seafloor depletion (removal of sediments over time) those cover materials can be replaced during summer open water periods. Both underwater and shorefall inspections will be made to assure that the design conditions assumed for the Northstar Project are met even as the project ages.
F359-14	The frazil ice creation conditions cited only occur during limited time periods each fall as the Beaufort's saltwater surface freezes over. The amount of sediment likely to be entrained and lost in any one season is likely to be minimal and would be replaced by normal sedimentation processes.
F359-15	We agree that a visual and/or side-scan survey of the pipelines' burial alignment should be performed each year to assure that the backfill has remained in position.
F359-16	Pipeline trenching will progress from the shore towards Seal Island. Ice slotting and trenching will not start until the ice is sufficiently thick for equipment to operate safely on the ice sheet. This process is described in Appendix A, Final Project Description and TN 740, Pipeline Construction Plan. A 200-ft (61 m) wide construction ice pad will be built up to an ice thickness of 8.5 ft (2.6 m) along the proposed pipeline right-of-way. Access to the construction pad will be via the main ice road between the gravel borrow pit and Seal Island. A substantial body of local knowledge exists and practical experience has been gained in the past 20 years in building ice roads on the North Slope. This has been the principal method for hauling gravel, personnel, and equipment to build artificial offshore exploration islands. As the ice builds up along a route during ice road construction, over shallow water depths, the ice may eventually reach the seafloor. In this case, the freezing front may proceed down into the seafloor. The amount of construction equipment movement will be dictated, for the most part, by the rate of excavation. If necessary, traffic patterns can be routed away from the excavation site so that ice loads are evenly distributed.
F359-16 (Cont.)	BPXA has completed a geotechnical soils investigation program near the proposed route (Alternative 2). Boreholes were drilled near the route to characterize the soils at the prerequisite depth. Soils stratigraphy has been determined from geophysical survey information and correlated against the borehole information. In the winter of 1996, a test trench program was carried out along various sections of the proposed offshore route (Alternative 2). The results of the survey and the test trench program are described in Technical Note TN 660, Winter Test Program, and was submitted to the State Pipeline Office (which also witnessed the trench testing). Inside the Barrier Islands at a water depth of approximately 5 ft (1.5 m), the ice is expected to become bottomfast. The test trench program demonstrated that ice-bonded soil beneath the bottomfast ice will remain rectangular for an extended period (several days) after excavation. Slumping was observed and may be expected at other locations, depending on the amount of sand and ice-bonded soil encountered. The amount of slumping was not considered excessive and, based on the geotechnical assessment along the route, is not expected to impede the rate of trenching or pipelaying assumed in the construction schedule.
F359-17	Test trenching was performed offshore in deeper water, at depths between 25 to 30 ft (7.6 to 9.1 m). Slumping was observed (or trench in-filling) soon after, or within several hours of digging the trench. The trench remained stable thereafter. A dedicated clean-out backhoe will be used to clean out slumped material on the trench bottom immediately prior to pipeline installation. Softer sediments will be removed by cutter suction pump so that the trench side walls are not agitated further. Trench volumes

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	have been calculated with an allowance for soils bulking during excavation (see TN 470, Trench and Pipe Stability, by INTEC). Excavation volume calculations include an allowance for this during the hauling of material to temporary stockpiles and back filling. Based on the soils information along the route, the shallowest (severest) side slopes anticipated will be approximately 5:1 (horizontal to vertical). Excavation rates are estimated conservatively as a function of water depth and soil type. Trench excavation is recognized as a critical path activity. However, the schedule makes provision for additional equipment or the redeployment of equipment based on observed equipment performance and trench stability.
F359-18	Most of the offshore pipeline route soils fit the definition of permafrost. This implies that the soil has remained below 32°F (0°C) for 2 or more years. This definition, however, is more applicable to terrestrial soils; for seafloor soils, a more appropriate definition would include the freezing of soil pore water. Because of the salinity of the soil pore water and the low average annual seawater temperature, it is more relevant to address ice-bonded soils which will subside once thawed. The soils that are not ice-bonded will not significantly settle or subside, so they are not an engineering complication for the project. The thaw-sensitive permafrost zones are found at the shore crossing and near the seabed within the shallow Gwydyr Bay area (Reference TN 450, Revision 3, Lagoon Permafrost, INTEC, 1998). Northstar crude oil will be cooled on Seal Island to achieve an average annual temperature of 50°F (10°C). This will limit heat transfer from the uninsulated pipeline to the soil and, thereby, help limit permafrost thaw in the shore crossing and lagoon area (see thermal analysis for the combined oil and gas pipeline flow conditions in TN 450, Revision 3, Lagoon Permafrost Mitigation, INTEC, 1998). The maximum thaw depth for ice-bonded permafrost is predicted to occur in the lagoon area and extend up to 40 ft (12.2 m) beneath the seabed after a hypothetical 20 years of pipeline operation. Thaw depths in the shore crossing area are predicted to be less due to the lower mean annual soil surface temperatures onshore and nearshore. Permafrost beneath the overland portion of the pipeline route is protected from thawing by supporting the pipe on conventional VSMs.
F359-19	There is a potential for the thaw bulb growth around the warm pipelines to be accelerated by the intrusion of seawater into the trench backfill material landward of the shoreline bluff. This is not believed to be an important factor in the shore crossing design, however, due to: 1) the limited convective driving force (free convection due to groundwater density variations and forced convection due to summer tidal variations); 2) limited porosity of the trench backfill material and surrounding thawed permafrost; and 3) the predominance of thawing caused by the natural shoreline retreat. If local permafrost thaw landward of the bluff is found to be a problem (through local shoreline erosion monitoring or pipe geometry monitoring), thermal control techniques, such as the use of thermal siphons, might be required. The goal would be to maintain the soil temperature below the freezing temperature of seawater and, thereby, limit permafrost thawing. Repair or soil replacement action can be taken, if warranted, before any pipeline damage would occur. When thaw-sensitive permafrost melts, the intergranular soil matrix support provided by ice crystals is lost and the soil will settle and consolidate. The amount of consolidation may vary between locations due to different soil types, soil moisture content, and the thickness of the consolidating soil layer. Maximum pipeline load conditions typically result from differential settlement, where one section of pipe loses support adjacent to another section which remains more firmly supported. The maximum that subsidence predicted to occur along the Northstar pipeline route is calculated to be 2 ft (0.6 m) (TN 250, Lagoon Permafrost). The magnitude of this subsidence is limited by the presence of a thaw stable sand/gravel layer which is approximately 15 ft (4.6 m) beneath the proposed pipelines. This soil layer was found to extend through the lagoon and shore crossing area. Differential settlements along the pipeline route are conservatively estimated by assuming the maximum predicted soil settlement acts as a differential settlement between two adjacent thaw-stable soil regions. As mentioned by the comment author, another potential result of thaw subsidence is shoreline erosion. Along much of the Prudhoe Bay area shoreline, thaw-sensitive permafrost recently exposed by natural shoreline erosion melts during summer and is carried away by littoral sediment transport processes.

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	Shorelines with stable beaches, such as the barrier islands or West Dock, are protected by the insulating properties of the stable beach material. The proposed transition to aboveground pipeline is set back from the shoreline at a distance based on historical erosion rates (TN 460, Point Storkersen Shore Approach, Revision 3). If local erosion rates are observed to increase due to permafrost thawing above the pipeline, this may require remedial action to stabilize the shoreline.
F359-20	We agree that the natural, frost-susceptible soil materials left in place under the pipelines are expected to thaw and subside over time, as predicted by the comment. Some subsidence is inevitable and unavoidable. Moreover, the suggested approach of making deeper excavations and installating greater volumes of thaw-stable materials also causes serious site and environmental impacts. The base of excavation elevation chosen, at 3 ft (0.9 m) below the bottom of the pipelines, will already require a "wet excavation," namely the bottom of the excavation will be several feet below the corresponding sea level surface at the time of soil removal. Removing more thaw-unstable soil is both difficult, potentially dangerous, and would result in greater project impacts. As is discussed under response to comment F359-21, the calculated project-life subsidence and maximum resultant differential settlement will not induce pipe strains above allowable limits over the project's lifespan.
F359-21	We agree that the select backfill placed in the shorefall trench would allow some seawater to reach the adjacent thaw-unstable natural soils, but the net differential settlement is not predicted to exceed design allowances.
F359-21	The Northstar Project pipelines would bend and settle in response to soil loadings caused by permafrost thaw subsidence. Maximum pipe bending stresses result from differential settlement of soil beneath a section of pipe and firm soil support under the two adjoining pipe sections. A range of soil settlement section lengths is typically analyzed in an engineering analysis to identify the worst case. Soil settlement lengths, both shorter and longer than this critical span length, result in lower pipe bending stresses. Permafrost thaw subsidence induced stresses for the Northstar pipelines are found to be maximum in the lagoon area for a critical span length of approximately 30 ft (9.1 m). Pipe bending stresses are found to be lower in the actual shore crossing section. This is partly due to the pipe being free to expand axially and, thereby, relieve most of the pipe thermal compressive forces (TN 450, Lagoon Permafrost, Revision 3). Predicted maximum operating stresses are less than the calculated allowable values in all locations.
F359-22	It is not deemed necessary or feasible to size the pipelines' wall thickness to span a gap as large as 185 ft (56.4 m). As is discussed in response to comment F404-43, the pipelines have been designed to span a gap of 90 ft (27.4 m) without buckling, as might occur following an extreme 100-year strudel scour event directly over the buried pipelines. The same pipeline strength will easily span the predicted, smaller zones of differential settlement.
F359-23	See response to comments F359-21 and F359-22. It is not anticipated that fine-grained sediments, or cut-off walls, or thermal siphons will need to be used to keep the thaw settlement experienced at the Northstar pipelines' shorefall within projected design parameters. Should excessive subsidence come to light, such as by the findings of a geometry pigging run, thermal siphons could be installed after the original construction period.
F359-24	It seems clearly to be an overstatement to say that the BPXA proposed, and the State Pipeline Office reviewed, pipeline burial design for the shore falls at Alternatives 2, 3, and 4 "will most probably lead to an oil spill." As has been discussed in comments F359-17 through F359-23, and thoroughly in the referenced design study technical notes, the Northstar Project pipelines have been designed to withstand the pipe strains induced by thaw settlement. We agree that the comparable subsidence values for the trench alignment and shorefall location for Alternative 5 will be smaller than that for the other alternative routes. The pipelines, if buried along the Alternative 5 route, would experience less subsidence and pipe strain than if Alternatives 2, 3, or 4 are selected.
F359-25	According to BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska", techniques to recover the oil will be implemented at the onset of a blowout during solid ice conditions. A response strategy for this type of scenario is evaluated

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	on pages 1-43 through 1-54 of the ODPCP. Recovery procedures include removal of wind-blown deposits of oil scattered over snow and ice by using loaders to remove the top 6 inches (15.2 cm) of snow and placing it into dump trucks. Shovelers in teams would remove oiled snow from hard-to-reach places within the remaining ice rubble. A trimmer would then be used to remove limited quantities of oil-embedded ice. During early summer operations, remaining quantities of oil could be removed using a helicopter to deploy a Heli-torch that burns surface oil.
F359-26	Initial response actions to a blowout event are detailed in BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska." Additional documents are available to the workers that provide levels of instruction for response activities. These include the "Arctic Well Control Contingency Plan", BPXA's "Well Control Manual" and "Emergency Management Plan."
F359-26 (Cont.)	During periods of solid ice, any oil that could not be contained on Seal Island would be limited in its ability to spread by a number of factors including cold temperatures (effecting the pour point of the oil), snow cover on the ice surface and the general roughness of the ice. In the event of a prolonged blowout, an ice-dike could be rapidly constructed at the time of the incident. As an example, construction of a 6 inch (15.2 cm) dike with a radius of 1,000 ft (305 m) could be done in 24 hours, and would provide in excess of 370,000 barrels of storage capacity.
F359-27	Pre-positioning of the CIDS close to Seal Island would not guarantee its availability for use in drilling a relief well. The CIDS would have to be positioned far enough away from Northstar that it would be outside of influence of a blowing out well (from a safety perspective). This may preclude the CIDS from being positioned in a location that would allow it to reach all bottom hole locations. Whether use of a CIDS or some other platform is appropriate, is an issue that is still being considered. The requirement to have a relief well available is being considered by the decision makers as a possible mitigation measure in the event a well blowout occurs (See Section 11.10).
F359-28	The last resort course of action in the event of an uncontrollable blowout would be ignition of the well. The decision to ignite a blowout will be made only after assessing the probability of implementing successful surface control, reviewing potential safety hazards, addressing pertinent environmental considerations, and obtaining necessary agency approvals. We disagree that the EIS should include instructions to be followed in the event of a blowout. Chapter 8 of the EIS was intended to be a focal point for discussions of the effects of oil spills on the physical, biological, and human environments and was not intended to be an oil spill plan. Specific spill response actions to be taken for different spill scenarios are described in the Northstar ODPCP.
F359-29	Abandonment of the gravel and sheet-pile walled Seal Island structure is one of the possibilities to be considered once the Northstar oil field extraction process has been completed. As is noted by the comment, a wide variety of options could be selected. It may be that the island is not to be abandoned, but rather removed before the applicant's responsibilities are deemed to be fully terminated. Instead of debating and deciding now what lease termination course of action would seem to be preferable, it seems more workable and optimal to postpone these decisions until better information regarding the environmental affects and the true array of possible closure options is available. See response to comment F302-16.
F360-1	We acknowledge your opposition to the project.
F360-2	We acknowledge your comment that the Arctic environment is harsh and that oil spills are inevitable and will be difficult to detect. We are of the opinion that this EIS fully addresses these issues.
F360-3	The question of Northstar itself having an impact on global climate is addressed in response to comment F404-21. The overall conclusion from response to comment F404-21 is that Northstar will have an immeasurable incremental contribution to the annual global greenhouse gas emissions budget derived from the production and consumption of fossil fuel products. Unfortunately, this comment does not offer any scientific references addressing the severity of climatic

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	patterns of the last two decades. The issue of agricultural and environmental stability, from a climate perspective, is still a matter of scientific debate. Political and monetary resource issues currently drive the world's economic stability.
F360-4	See response to comment S2-1.
F360-5	We agree with the comment that project impacts have a cumulative effect on the environment and have addressed such issues in Chapter 10. The comment that this project will have adverse and irreversible effects is well taken. We have created a new section in the EIS to discuss these effects. See Section 11.8.12 in the FEIS.
F361-1	We acknowledge your support of Alternative 2.
F362-1	We acknowledge your support of Alternative 2.
F363-1	We acknowledge your support of the project.
F364-1	We acknowledge your support of the project.
F365-1	We acknowledge your support of the project.
F366-1	We acknowledge your support of the project.
F367-1	We acknowledge your support of the project.
F368-1	We acknowledge your support of the project.
F369-1	We acknowledge your support of the project.
F370-1	We acknowledge your support of the project.
F371-1	We acknowledge your support of the project.
F372-1	We acknowledge your support of the project.
F373-1	We acknowledge your support of the project.
F374-1	We acknowledge your support of the project.
F375-1	We acknowledge your support of the project.
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F381-1	We acknowledge your support of the project.
F382-1	We acknowledge your support of the project.
F383-1	We acknowledge your support of the project.
F384-1	We acknowledge your support of the project.
F385-1	We acknowledge your support of the project.
F386-1	We acknowledge your support of the project.
F387-1	We acknowledge your support of the project.
F388-1	We acknowledge your support of the project.
F389-1	We acknowledge your support of the project.
F390-1	We acknowledge your support of the project.
F391-1	We acknowledge your support of the project.

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F392-1	We acknowledge your support of the project.
F393-1	We acknowledge your support of the project.
F394-1	We acknowledge your support of the project.
F395-1	We acknowledge your support of the project.
F396-1	We agree that the referenced statement is incorrect. The ASRC has successfully reached an agreement with ARCO to permit subsistence hunting on the Alpine and Tarn developments. This paragraph has been revised in response to comment F356-47.
F396-2	We acknowledge that ARCO has successfully reached agreement with subsistence users to permit hunting in and around the Alpine and Tarn projects, as long as certain restrictions are followed. Such an agreement has not been reached in the Prudhoe Bay Unit or elsewhere where BPXA is the principal operator of the field. See response to comment F356-47.
F396-3	Refer to response to comment F396-2.
F396-4	Subsistence impacts are more likely with the Northstar Development Project compared to Tarn Development Project because the ADF&G currently prohibits the use of firearms inside the Prudhoe Bay Unit. Outside the Unit, BPXA discourages hunting in and around its oil facilities and currently prohibits hunting by employees and its contractors. See response to comment F356-47.
F396-5	The Northstar Development Project is not in the NPRA and, therefore, conclusions reached in the NPRA EIS do not directly apply to this project. Stipulations on subsistence use in the Northstar Unit may or may not be similar to those proposed for the NPRA. Therefore, it is erroneous to conclude that there will be no impacts to subsistence hunting in the Northstar Unit based on what has been stated for the NPRA.
F397-1	This statement has been deleted and the paragraph revised in response to comment F356-47.
F397-2	See response to comment F356-47.
F397-3	See response to comment F356-47.
F397-4	See response to comment F356-47. Such stipulations will be considered by the agencies as part of their permitting process.
F398-1	We acknowledge your comment regarding the rate of decline of domestic oil production.
F398-2	We acknowledge your comment regarding the reservoir's role in offsetting declining domestic oil production.
F398-3	We acknowledge your comment about the need for domestic oil production regardless of oil field size.
F398-4	We acknowledge that the Northstar Project may lead to increased development of other offshore sites.
F398-5	We acknowledge your support of the project.
F399-1	Elimination of Outfalls 003, 004, and 006 required changes in the NPDES Permit (Appendix F of the DEIS). The disposal of surface runoff waters through the UIC well (Class I industrial waste disposal well) also required changes in the UIC Permit (Appendix J of the DEIS). The elimination of these three discharges does reduce the pollutant loading to the Beaufort Sea. The elimination of Outfall 006 eliminates the need for a 32.8 ft (10 m) mixing zone. The elimination of the Seawater Treatment Plant implies BPXA is no longer proposing to use a waterflood enhanced oil recovery technique.
F399-2	BPXA has officially modified its Final Project Description approach to leveling the bottom of the seabed trench to the final pipe laying elevation by using a hydraulic dredge (submersible agitator pump), as described in the text of this comment. See revisions to Section 3.5.3.1 of the Executive Summary and Section 4.4.2.2 of the EIS for a depiction of this excavation process alteration and its project and environmental advantages.
F399-3	See response to comment F34-49.

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F400-1	We acknowledge your comment that considerable progress has been made to ensure protection of the environment by oil development.
F400-2	We acknowledge your comment regarding the current success of oil development with minimal environmental impact.
F400-3	The issue of oil spill effects on the tundra and subsequent restoration was not considered a major issue in public scoping or through interactions with cooperating agencies. Oil spill in the marine environment was of greater concern and, therefore, more attention was focused on these issues.
F400-3 (Cont.)	The suggested volume of the journal Arctic (September 1978) was reviewed. This volume does have pertinent background information on oil effects in the Arctic, although the work was done over 20 years ago. The reference to Walker (1978) was added to the text. See Section 6.6.2.2 for revisions to text.
F400-4	See response to comment F400-3.
F400-5	The sensitivity of dry tundra to oil spills is noted and we concur with your observations. We have revised Section 8.7.2.4 to incorporate this point. However, the amount of dry tundra in the project area is very limited in comparison to the areas covered by wet and moist tundra. The effects of oil on the wildlife that uses this region during the summer tends to be of a greater concern than the sensitivity of such a small portion of the overall habitat.
F400-6	The environment of the reserve pits would not be considered a good example of the effects of hydrocarbons on invertebrates. We have revised Section 8.7.2.4 by deleting this example and using the work of Hobbie (1984) as a better example.
F400-7	See Section 8.7.2.6 for revisions to text.
F400-8	We acknowledge your opinion that the shortest route of pipeline provides the greatest environmental protection.
F400-9	We acknowledge that the terrestrial habitat removed by this development will be inconsequential to the wildlife populations in the vicinity.
F400-10	The rate of shoreline erosion at each landfall location has been taken into consideration for each alternative and is discussed in Section 5.3.1.6. The selected shoreline approach would be periodically inspected and, if unacceptable erosion had occurred, remedial actions would be taken.
F401-1	The Corps has addressed all of the issues relating to the Northstar Project that have been identified by the cooperating agencies, state resource agencies, the NSB, through the public scoping process, and from comments to the DEIS. Chapter 10, Cumulative Effects, has been extensively revised.
F401-2	This comment is an opinion directed at the Corps regulatory process of permitting wetlands on the North Slope.
F401-3	We have rewritten Chapter 10 in response to comments.
F401-4	See response to comment F302-9. ADEC's "Preliminary Analysis of Oil Spill Response Capability in Broken Ice" (August, 1998) was reviewed and found to be consistent with Chapter 8 of the EIS. Involved agencies will issue separate RODs after completion of the FEIS.
F401-5	We disagree that the Northstar Project EIS must contain a discussion of the potential of expanding a moratorium on offshore leasing to the Beaufort Sea. Such a discussion is considered out-of-scope for this EIS.
F401-6	See response to comments to Greenpeace (F404) and Northern Alaska Environmental Center (F413).
F402-1	See text added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS for discussion of double-walled pipeline design versus BPXA's proposed design.
F402-2	We acknowledge your comment regarding pipeline design.
F402-3	We acknowledge your comment regarding pipeline design.

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F402-4	We acknowledge your comment regarding pipeline design.
F402-5	We acknowledge your comment regarding pipeline design.
F402-6	Given that both the oil and natural gas pipelines are to be 10 inches (25.4 cm) in diameter, and the same wall thickness (see Appendix A, Northstar Final Project Description, page 2.4-1 and Table 2.4-2, Pipelines Description Summary, on page 2.4-16) this extension of the oil pipeline's risk analysis to evaluate the structural performance of the gas pipeline as well seems reasonable. There will probably be some minor differences due to the different products' relative potential for pipe corrosion and the lines' internal operating pressures, but the external structural effects of strudel scour, permafrost thawing and subsidence, and ice gouging should be identical. It seems somewhat optimistic to extrapolate the "low stress" operating circumstances of these subsea pipelines to derive a probability for catastrophic line failure of "essentially zero."
F402-7	The comment notes that full-scale bend tests have been completed that demonstrate that the pipeline will withstand greater than design loads. This information has been incorporated into the discussion in Section 8.5.3 of the EIS.
F402-8	We acknowledge your comment regarding pipeline safeguards.
F402-9	The amount of sedimentation caused by this submersible dredge technique will have to be evaluated to confirm that it does not exceed the "excavation by bucket" technique, but it does seem likely that the overall amount of material disturbed, and the quality of the trench bottom in terms of assuring the provision of a solid, uniform foundation below the pipelines, would be greatly enhanced. Speeding up the completion of trenching and shortening the period of disturbance and risk to associated workers are attractive benefits of this proposed technique as well. Section 3.5.3.1 of the Executive Summary and Section 4.4.2.2 in the EIS has been revised to incorporate this information.
F402-10	We acknowledge your preference for Alternative 2.
F402-11	We disagree that Alternative 2 has a slight advantage over Alternatives 4 or 5 with regard to either strudel scour or ice gouging (see also response to comment F34-16). The lesser distance of offshore trenching for Alternative 2 is offset by its closer proximity to the Kuparuk River Delta. The added trench footage for Alternatives 4 and 5 are virtually parallel with the predominant paths of the ice gouges observed in that general area as stated in TN 410, Ice Keel Protection, Revision 2 (INTEC, February 1997:17), and the deepest gouges are not found at the approximately 10 ft (3.1 m) depth of that run of trench. With regard to potential thaw subsidence in the subsea trenches, it may be that Alternative 2 has some advantage over the longer trench sections proposed in Alternatives 4 and 5. We acknowledge that pipeline installation in the lagoon area will be the easiest, fastest, and safest. Alternatives 4 and 5 will require more time to execute, increasing the likelihood that pipeline installation will take two winter construction seasons, instead of only one.
F402-12	The suggestion of deeper burial and installation of riprap to protect the shore approach for Alternative 5 is probably unnecessary since the shore crossing location need not be close to the West Dock causeway breach and its associated strong currents. The landing point shown is partly representative, not fixed or mandatory. This possible shifting of the shore crossing point to the south, for such important technical reasons, would also avoid worsening the congestion mentioned in the comment. The widening of the causeway described as necessary has been included in the proposed Alternative 5 description. Adding 50 ft (15.2 m) of additional width has been proposed and its subsequent impacts evaluated, though the comment only mentions "20 feet or more." Part of the purpose of this increased width was to provide maintenance and observation access to the new lines from the western side of those lines, not from the east. Therefore, the current access to the existing pipelines atop the causeway is not harmed or impeded. It seems that this comment has not taken this 50 ft (15.2 m) of new causeway width and the new western-side access into account in suggesting that disruption to existing facilities would be considerable.
F402-13	We acknowledge your preference for Alternative 2.

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F402-14	See Section 7.6.2.2 for revisions to the text.
F403-1	We acknowledge your opposition to offshore oil exploration and development.
F403-2	We acknowledge your endorsement of NSB comments F420-1 through F420-85.
F403-3	Impacts to threatened and endangered species from noise and oil spills associated with the Northstar Project are described in Sections 6.9, 7.3, 8.7.2.7, and 9.8.2.2. Although seismic activities are not a part of the Northstar Project, such activities may be proposed during the life of the project to further delineate the reservoir. Seismic survey activities are among the loudest noises in the region and are of concern to local residents and governmental agencies. Therefore, information related to seismic survey activities and their impacts to marine mammals, including the bowhead whale, is presented in Chapter 9. An even more detailed analysis of the impacts of noise and oil spills was prepared in the Biological Assessment, Appendix B, to be used by NMFS and USFWS in developing their Biological Opinions for this project. Additionally, Section 7.3 describes the impacts of the project on subsistence.
F403-4	We disagree that the assessment of noise and oil spill impacts is inadequate. Comprehensive discussions of noise, oil spills, and other environmental impacts are found in Chapters 6, 8, and 9 of the EIS. However, additional discussion on noise impacts to whales and oil spill probabilities has been added to Sections 9.8.2 and 8.5.2, respectively.
F403-5	Section 9.2 presents information and knowledge of local people on the displacement of bowheads due to noise disturbance from industry; Section 7.3, addresses potential impacts to subsistence whale hunting which may result from industrial noise and incorporates statements of North Slope residents. Section 9.2.3 has been revised to address inconsistencies between the two chapters. Also see response to comment F403-3. Information presented in Section 9.8.2.2 explains that the local residents' beliefs and experiences have led them to the assumption that displacement will occur as a result of Seal Island operations.
F403-6	We acknowledge your concern that North Slope residents will bear the direct impacts of any oil spill associated with the Northstar development. See Section 8.7.3 for a discussion of oil spill impacts on the human environment. See response to comment F421-3 for discussion of project public involvement efforts.
F403-7	If oil became mixed into the spring lead system during the spring migration of bowhead whales, adverse impacts to the whales could occur. However, as noted in Section 8.7.2.7, there is less than 1% probability that an oil spill from the Northstar Project would travel over 200 miles (321.8 km) and reach the Chukchi lead system. Refer to Sections 6.9 and 8.7.2.7 for a discussion on the effects of oil on bowhead whales and to Sections 7.3 and 8.7.3.1 for the impacts of an oil spill event on subsistence harvesting of whales.
F403-8	Effects of an oil spill to plankton, the primary food source of bowheads, would likely include reductions in production due to effects of water soluble aromatic hydrocarbons, and would cause changes in species composition, reduce growth, or cause mortality (Section 6.3.2.2). However, effects vary depending on which species are present, life-cycle, and type of oil. These changes are typically temporary as the oil will eventually disperse and repopulation of the affected area by plankton from adjacent noncontaminated areas would occur within 9 to 12 hours. Therefore, it is unlikely that the food source of bowheads would be drastically affected. However, exposure of bowheads themselves to oil could cause a major threat to individual whales because of their anatomy. It is assumed that bowhead whales would be adversely affected by an oil spill during feeding and migration if they came into contact with the oil. See Section 8.7.2.1 for impacts of an oil spill to plankton and marine invertebrates.
F403-9	If bowheads were adversely affected by an oil spill and there were population level effects, it is likely that the IWC would reduce the quota. However, the probability of an oil spill occurring and affecting a large population of the whales is low. The impacts to bowhead whales from an oil spill are discussed in Section 8.7.2.3 and assume a worst case scenario. It is likely that spill cleanup measures would further decrease the chances that oil would affect bowhead whales. Refer to response to comment F403-26 and changes to Section 7.2.
F403-10	The OCS Policy Committee formally accepted the recommendations in the Report from the Coastal Assistance Working Group in May 1988 and made a recommendation to the Secretary of the Interior to

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	work with Congress on impact assistance legislation. On July 17, 1998, a bipartisan group of Congressmen announced their efforts to draft legislation which would dedicate 27% of all bonuses, rents, and royalties from federal offshore oil and gas leases to impact assistance. The draft act is titled the "Conservation and Reinvestment Act" and is modeled after the Report. The draft is available for review and comment at http:\\www.house.gov/resources/ocs. A definite time line has not been determined for introduction of the bill. The plan is to introduce it this year to stimulate discussion and debate among members of Congress and with the various constituencies. The draft bill is offered as a starting point for constructive discussion.
F403-11	Traditional Knowledge and concerns of local residents are important, and every effort has been made to incorporate this information throughout the EIS. The DEIS may have given a misleading impression by implying that the initial Traditional Knowledge effort by the cooperating agencies would continue beyond the production of this FEIS. Rather it is thought that the more comprehensive approach to gathering and incorporation of Traditional Knowledge employed here would be an initial step in an ongoing effort by all agencies to treat Traditional Knowledge in a more meaningful way. It is also expected that the Traditional Knowledge database generated for this EIS will be transferred for maintenance and periodic updating to a North Slope entity, which will make it available for use by the agencies and public as needed.
F403-12	We acknowledge your opposition to offshore oil exploration and development.
F403-13	We acknowledge the importance of subsistence to Native people.
F403-14	We disagree with your opinion that there has not been an appropriate assessment of the potential risk to subsistence resources and lifestyle. See response to comment F404-54 for a discussion of the incorporation of ODPCP information in the EIS. We have reviewed and rewritten Chapter 10 in order to provide a more thorough and accurate assessment of cumulative risks. Chapter 11 has been revised to include a list of proposed mitigation measures that will be considered by the agency decision makers. See Section 11.10.
F403-15	Traditional Knowledge has not been discounted or ignored in the conclusions reached in the EIS. Traditional Knowledge was an important factor in determining that effects of project construction-related noise on subsistence whaling could be significant. It should be noted that while the analysis has concluded that potential effects on subsistence harvest of bowhead whales are significant, such effects could be mitigated through season restrictions on various activities during the fall bowhead migration and subsistence hunt. The cooperating agencies, as well as the state, will consider Traditional Knowledge and the conclusions reached in the EIS in their final decision-making on the Northstar Project.
F403-16	Different levels of detail are presented in Chapter 7, Chapter 9, and the Biological Assessment. To some extent this is appropriate. However, see Section 9.2.3 for revisions to text. Also see response to comment F34-1.
F403-17	We disagree with the statement that no mention is made in the EIS regarding the IWC quota regime and agree that the EIS needs to include an expanded discussion of possible adverse impacts of industrial activities in the IWC bowhead whale subsistence hunt quota. The IWC quota is mentioned in the DEIS in two places. Section 2.6 describes: the 1997 IWC ban on subsistence bowhead whaling in Alaska, the formation of the AEWC, the implementation of an IWC subsistence bowhead quota for the 1978 Alaska whaling season (with both landed and struck components), how local whalers and elders disagreed with the low bowhead population estimates, how the NSB took responsibility for conducting bowhead whale census, the gradual increase in the bowhead quota for Alaska Eskimos based on bowhead census data and Alaska Eskimo cultural and subsistence needs for bowhead whales, and the current (1998) bowhead quota. Section 7.3.1.2 contains a discussion under the heading "Why are there whaling quotas?" which briefly describes: the conditions that led to the bowhead quota, the Eskimo whalers' response by forming the AEWC, the first bowhead quota, the cooperative agreement between the AEWC and NOAA, the improved bowhead population counts, and the IWC quota, landed, struck-but-lost, and total strikes for the years 1978-1991.

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	With regard to the second part of the comment, we have revised Section 7.3 of the EIS to include this point.
F403-18	We acknowledge your concern about oil spill effects. As indicated in Section 8.7.3.1, oil spill impacts on subsistence harvests would be significant for offshore spills. Minor direct impacts would be expected for onshore spills because hunting is not permitted within the project area. However, significant indirect impacts are noted for both onshore and offshore spills due to concerns about contamination of resources. See changes to Section 8.7.3.1 made in response to comment F404-187 for clarification of contamination concerns. See changes made to Section 8.5 for a discussion on oil spill probability calculations. Note that impacts presented in Section 8.7 assume that a large spill occurs and no oil spill response is initiated.
F403-18 (Cont.)	BPXA's June 1998 "Oil Discharge Prevention and Contingency Plan" and September 1998 "Addendum" for Northstar are now available and are being reviewed under state jurisdiction. These documents are not part of the EIS, but can be reviewed separately, along with the S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)." These documents have been reviewed and do not lead to any changes in the conclusions presented in Chapter 8. Information on oil spill cleanup limitations from these documents has been incorporated in the new Table 8-8 in the EIS.
F403-19	The EIS presents a comprehensive and factual assessment, based on available scientific and Traditional Knowledge, of the risks to the bowhead whale population associated with the Northstar Project. Mitigation measures were incorporated as part of the BPXA's proposed project in order to avoid or minimize potential significant impacts. The direct effect to subsistence was considered potentially significant, and it was felt that the affected communities should have a role in establishing effective mitigation measures based on their experience with oil and gas development. A list of potential mitigation measures identified by the agencies as warranting consideration is provided in Section 11.10 in the EIS, with a statement as to their purpose.
F403-20	We have seriously considered your comments and those of others on the DEIS and have revised both the oil spill and noise chapters (Chapter 8 and 9, respectively). With reference to your comment concerning your right to comment on this EIS, note that the public has a 30-day comment period following publication of this FEIS. See response to comment S2-1. See response to comment F404-54 for a discussion of incorporation of ODPCP information into the EIS.
F403-21	Section 9.9 states that the bowhead whale may experience some degree of behavioral reactions and avoidance of Seal Island during migration due to noise, but the impact is considered minor. This is the impact to the whales, not to the hunters. The text continues to explain that if such behavioral reactions were to result in changes in bowhead migration patterns (over the life of the project and beyond), impacts to subsistence hunting would be significant. This was concluded based on what is known about the expected types and levels of sounds produced by island drilling activities and sound propagation from islands into shallow water under local ambient noise conditions. Under extreme conditions (loudest drilling level, best propagation, and lowest ambient noise), island drilling noise is estimated to be audible out to a range of 6.2 miles (10 km) (Richardson et al., 1995:127). Island drilling noises from Seal Island are not expected to result in a major impact to bowhead whales, given the expected low noise levels and the low proportion of the migration that occurs within a few miles of Seal Island. Results of the Richardson et al. (1998) study have also been incorporated into Section 9.5.1.1 of the EIS. Also see changes to Section 9.8.2.2.
F403-22	No seismic activities are proposed by BPXA for the Northstar Project or included in the Project Description (Appendix A) which was submitted by the applicant. Therefore, impacts of seismic activities were not evaluated specifically for this project. To provide the reader with background information, a description of seismic activities was included in this EIS, as the majority of studies that have been conducted on the reactions of bowhead whales to noise have included reactions to seismic noise. Seismic information was also included as these activities may be required for reasonably foreseeable future projects and developments that are described in Chapter 10, Cumulative Effects. The Biological Assessment (Appendix B) provides a detailed explanation of noise studies in the Beaufort Sea and can be referenced for more information.

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F403-23	Section 9.9 states that if such behavioral reactions and disturbance as a result of noise were to result in long-term changes in bowhead migration patterns (over the life of the project and beyond), impacts to subsistence harvesting activities would be considered significant even though impacts to the whales are minor (we have corrected the text in Section 7.3.3 to make it consistent with Section 9.9).
F403-24	The Biological Assessment is a technical document that was prepared for the USFWS and NMFS, each of which will write a Biological Opinion for this project. While not required to be published with the DEIS, the Biological Assessment was included in the DEIS to provide the reader with a more detailed technical description of the effects of oil and noise on threatened and endangered species, including the bowhead whale. As a result of several comments received during the public review period, oil spill and noise information from the Biological Assessment were incorporated into several sections of the EIS. See revisions to Sections 8.7.2.7 and 9.8.2.1 and Chapter 10.
F403-25	See response to comment F403-27 and Table 1.3 in Chapter 1 for information on how Traditional Knowledge was incorporated into the EIS.
F403-26	We agree that a discussion of the IWC quota system is needed in the EIS. See changes to Section 7.3.
F403-27	If the whales cannot hear noises from Seal Island, they are not expected to be skittish and, therefore, be displaced from their normal migratory route. However, expected noise levels from a drilling island (Johnson et al., 1986:49) and the observed sensitivity of bowheads to low frequency noises (Ahmaogak, 1985:27-31) suggest that under quiet ambient conditions, bowheads could hear industrial noises at distances of at least 6.2 miles (10 km). A few animals are expected to pass within approximately 6.2 miles (10 km) of the island and, therefore, might hear the noise generated by certain operational activities. The overall effect could be that the few bowhead whales that swim near Seal Island would tend to avoid swimming within 6.2 miles (10 km) of the site. Currently, the MMS is conducting a 5-year study as a means for identifying critical data gaps which must be addressed. The current plan covers research through the year 2002.
F403-28	We acknowledge your concern about potential project impacts on the IWC quota. See revisions to Section 7.3 and response to comment F403-16.
F403-29	Section 7.2 of the EIS has been revised and contains more detail on the issue of possible noise impacts disrupting traditional subsistence bowhead hunts.
F403-30	No insult to the Eskimo subsistence community was intended. Far more of the EIS addresses the issues mentioned than the few pages noted in the comment. Components of the discussion on oil spill impacts on subsistence are found throughout the EIS. The effects of oil on bowhead whales are described in Section 6.9 and provided in detail in Appendix B. Subsistence activities on the North Slope, including bowhead whale harvest, are presented in Section 7.3. The extensive data given in these other areas of the EIS were not repeated in Chapter 8. Rather, Section 8.7.2.7 focuses on the impacts of an oil spill and oil spill response on bowhead whales and Section 8.7.3.1 specifically addresses impacts on subsistence. The impact analyses presented in Chapter 8 rely on background information given in other parts of the EIS.
F403-31	Section 8.5.2 describes the different factors that should be considered when evaluating the estimated probability of an oil spill. This includes the fact that the estimated oil spill probability for Northstar was calculated from historic MMS OCS and CONCAWE spill data, not considering the lower spill numbers from historic North Slope operating data. Section 8.4.3 presents the likelihood that an oil spill, if it occurred, would contact marine areas. As noted in the comment, the EIS indicates that significant impacts to subsistence would be expected if all events occurred at the same time. In this way, the impacts of an oil spill on resources can be judged to be quite large, even though the probability of oil spill occurrence is low.
F403-32	An ODPCP was developed for this project by BPXA and submitted for public review to the state in September 1998. As the ODPCP was submitted to the state after the release of the DEIS on June 1, 1998, it was not incorporated into the DEIS. During the preparation of the FEIS, the ODPCP was reviewed and there are now references to it in this FEIS. See changes to Sections 8.6.2 and 8.6.3. Meetings were held with whaling captains in Barrow on August 27 and 28, 1996, and in Nuiqsut on

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	August 14, 1996, specifically to record Traditional Knowledge for the Northstar Project on bowhead whale behavior, ice conditions, and other specific environmental characteristics of the Arctic. This EIS was written to satisfy the obligations of the NMFS to the MMPA. Impacts to subsistence hunting are discussed in Section 7.3. Potential mitigation measures are presented in Section 11.10.
F403-33	Individual agencies may impose mitigating measures in connection with their issuance of permits and other authorizations related to Northstar development. A range of possible mitigating measures among which agencies may choose, as appropriate, to reduce potential impacts is presented in Section 11.10. Section 8.7.3.1 addresses potential adverse effects on subsistence hunting by fouling boats and gear, and interference from oil spill cleanup activities. We have expanded this section to more fully address this issue. See changes to Section 8.7.3.1.
F403-34	See response to comments F403-5, F403-16, and F404-129 for information on impacts to subsistence.
F404-1	We acknowledge your concern that the Northstar Project may set a precedent for further offshore development. We agree this project will likely encourage more offshore development, assuming the geologic and economic factors are favorable. See Chapter 10 for a discussion of future development.
F404-2	The comment notes that the topic of greenhouse gases due to the Northstar Project and their subsequent contribution to global warming was not included in the DEIS. The comment also states that potential development of the Beaufort Sea will exponentially increase oil availability with contribution to greenhouse gas emissions. The comment finishes by noting that the development of Beaufort Sea diverts resources away from development and commercialization of alternative sustainable energy sources. In response to this comment, text has been added to Section 10.4.2.3 of the EIS addressing the issue of the Northstar Project's contribution to global climate change. In addition, the impact of Northstar on global climate through the emission of greenhouse gases is addressed in response to comment F404-21. Response to comment F404-21 also addresses this comment's statement on the exponential increase in the amount of oil available that could subsequently contribute to greenhouse gas emissions.
F404-3	The comment describes project related discharges as presented in the Project Description (Appendix A of the DEIS) as provided by BPXA. However, since the publication of the DEIS, BPXA has eliminated all surface drainage discharges and the seawater treatment plant for waterflooding (see BPXA letter of August 27, 1998, F357). As a consequence, there will be no discharges of either surface drainage or filter backwash into marine waters. Surface drainage will be disposed of through the UIC well. Appropriate changes to text have been made throughout the EIS. See response to comment F399-1.
F404-4	We acknowledge your concern about the adequacy of alternatives analysis, but disagree that the alternative analyses in the DEIS were inadequate. See response to comments F404-12, F404-34, and F404-43 for further information. A number of additional alternatives were considered, but eliminated from detailed analysis (see Section 3.4.2 of the EIS). The installation and use of double-walled pipe for subsea burial is discussed in Sections 3.4.2.7, 4.2.5, and 4.3.
F404-5	We acknowledge your concerns about oil spill probability, limitations of oil spill cleanup, and assessment of potential spill impacts. These concerns are addressed separately through a number of responses to comments, including F404-32, F404-42, F404-43, F404-44, F404-58, and F404-66. See response to comment F404-54 for a discussion of the review and incorporation of ODPCP information into the EIS. To the extent possible, the EIS has included the limited amount of available Traditional Knowledge that relates to oil spills (Sections 8.2 and 8.6.2).
F404-6	For a more detailed response, see response to comments F404-114 and F404-119. Comprehensive discussions of noise, oil spills, and other environmental impacts are found in Chapters 6, 8, and 9 of the DEIS. Additional discussion on this issue has been added to Section 9.8.2 in the FEIS.
F404-7	We acknowledge your comment that Traditional Knowledge, subsistence impacts, and concerns of Native peoples have not been adequately considered. Traditional Knowledge and concerns of local residents are important, and every effort has been made to incorporate this information throughout the EIS. See response to comments F404-129, F404-130, and F404-132 for more information.

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F404-8	We acknowledge your opinion that the DEIS does not adequately address cumulative effects of increased industrialization and climate change. For further information on climate change see response to comment F404-21 and Section 10.4.2.3.
F404-9	We disagree that the scope of this EIS is misleading. A discussion of the scoping process and the key issues identified to be addressed in the EIS are presented in Section 1.5. See response to comments F404-162, F404-163, and F404-171 for more information on the scope of the EIS.
F404-10	We acknowledge your concerns about the public process. See response to comments F404-181 and F404-182 for more information on the public process.
F404-11	We concur that the Drake oil field buried gas pipeline differed from the proposed Northstar buried pipelines, which includes oil and gas pipelines, and that it was in service for a very brief testing period. The Drake oil field gas pipeline was cited in the DEIS as the only buried subsea pipeline project located in the Arctic, of a type similar to the Northstar proposal, and its relevance is limited in that it showed no apparent damage due to ice or other forces at the time of abandonment (approximately 18 years).
F404-12	We acknowledge your concern about the safety of a subsea pipeline used between the production island and the shoreline transition zone, but we disagree that the proposed pipeline is unsafe. The risks caused by progressive subsidence in the shore crossing backfill are anticipated to be minimal. This design has been extensively modeled and the results verify that the pipe can withstand movement and strain. Moreover, coastal erosion is considered a minimal risk situation since the shorefall will be inspected each year and any eroded gravel would be replaced. For more information regarding strudel scour, refer to response to comment F404-43. In reference to the issue of pipeline failure and oil spill probabilities, the only distinguishing factor between the shorefalls proposed for Alternatives 2, 3, and 4 versus the offshore landfall on the West Dock causeway (Alternative 5) is the non-frost susceptible gradation of the man-placed causeway material. Thus Alternative 5 is anticipated to have negligible subsidence and spill risk at the shorefall compared to the other action alternatives. Please refer to Section 11.4 for information concerning the pipeline landfall issue.
F404-12 (Cont.)	Last, from a review conducted by the U.S. Army Cold Regions Research and Engineering Laboratories (CRREL) (P. Sellmann and E. Chamberlain, 1998), options to reduce thermal contact of pipeline to permafrost (if present) in the trench environment are limited. Based on limited geotechnical data, CRREL recommended additional data be collected to ensure that possible pipeline strains are acceptable for the pipeline route eventually selected (if any). These strains would be the result of thaw settlement. Further details may be found in Appendix P.
F404-13	We acknowledge your concern regarding the lack of review of the adequacy of the spill plan in the EIS. See response to comment F404-54 for a discussion of the review and incorporation of ODPCP information in the EIS.
F404-14	An ODPCP is not a permit similar to the UIC or NPDES permit. The ODPCP is a response planning document and does not authorize or approve any activity. The DEIS includes a full discussion of the necessary permits and approvals which can result in approved activities, including the NPDES, UIC, and OCS DPP. The MMS allows that, for facilities located on state lands, applicants may submit a response plan developed under state oil response requirements, pursuant to 30 CFR 254.53. The Northstar development project is located on state lands and BPXA has submitted an ODPCP to ADEC. This plan is undergoing separate public review. The public has received several notices of the state's public review process for the proposed Northstar development project for state permits and consistency with the ACMP. The state's public notice soliciting comments on the ODPCP and other use permits was published simultaneously with the Corps' and other federal agencies' notice on the DEIS. DGC twice extended the public comment deadline for the ACMP comments, first to August 31, 1998, and then to September 30, 1998. We disagree with the statement that the DEIS fails to consider the related federal action of authorization

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	for small incidental takes of marine mammals under the MMPA. Chapter 1 of the DEIS identifies this authorization as one of the various approvals required for project development, and states the DEIS provides baseline and impact information on marine mammals for use by the USFWS and NMFS. We have clarified this point. See changes to Chapter 1 in the FEIS. See changes made to Section 8.6.3.3 in response to comment F237-16 to clarify that hazing of marine mammals would require authorization under Section 109h1A or 112c of the MMPA.
F404-15	It is true that there will likely be encounters with polar bears at the Northstar production facility. Given the level of contact with polar bears cited in the comment, and the fact that no bears have been killed in the last 25 years of oil field operation, with only one bear killed during exploration activity (S. Amstrup, pers. comm.), the probability is extremely low that a polar bear would be killed in connection with Northstar operations. It is also true that the International Agreement on the Conservation of Polar Bears requires signatories to protect ecosystems of which polar bears are a part. Mechanisms are in place to avoid or minimize impacts of this project to polar bears and their habitat, including the Letter of Authorization process described in the comment, and polar bear interaction plans which may be required by agencies as a permit condition.
F404-16	We disagree that noise disturbance to bowhead whales from island construction and operations was inadequately addressed in this EIS. Refer to Sections 9.2, 9.5.1, and 9.8.2.2 for a thorough discussion of this issue.
F404-17	See response to comment F404-54 for an explanation of why the ODPCP was reviewed, but not included as part of the EIS. The Northstar DEIS provides a discussion of oil spill response capabilities, including limitations and restrictions. More importantly, the DEIS provides a comprehensive review of the potential effects associated with oil spills that may result from the proposed action, independent of the capability to cleanup the oil. This analysis will be taken into consideration by the individual agencies in decisions on whether to proceed with approval and developing their RODs for individual permit responsibilities. See response to comments F404-181 and F404-182 for a discussion of the parallel regulatory process. It is not necessary for the EIS to include the ODPCP or incidental take/harassment authorizations. An ODPCP has been submitted pursuant to state regulations and has undergone public review (see response to comment F404-14). The incidental take and harassment authorizations are issued by the NMFS and USFWS, respectively, are not required permits, and are independent to MMS action on the DPP. See changes made to Section 8.6.3.3 in response to comment F237-16 for clarification of authorization requirements for hazing of marine mammals. The MMS will comply with all applicable statutes and regulations during their approval process for the DPP. However, the MMS is not required to wait on its decision regarding the DPP until the applicant demonstrates that the project is in compliance with all applicable laws.
F404-18	Rather than implying, as the comment does, that the Northstar Development would necessarily have "major negative consequences on the environment," it is more accurate to say that the EIS recognizes that, in certain limited circumstances, there may be significant impacts to certain species or subsistence activities. The EIS further recognizes that a number of these impacts could be reduced by mitigation measures which are identified in Section 11.10. Section 8.7 and Tables 8-8, 8-9, and 8-10, which summarize impacts of potential oil spills and spill responses, do describe limited circumstances, such as those cited in the comment, under which a large oil spill, contacting 200 miles (320 km) of shoreline, could produce adverse impacts. Note that changes were made where additional information was obtained during the public review period. For example, in Section 6.5 the "negligible" impact to polar bears from gravel mining disturbance was changed to "minor" and in Section 8.7.2.3 the "minor" impact to polar bears from oil spills was changed to "significant."
F404-19	We disagree that the EIS does not adequately address the full range of environmental impacts and that further analysis is needed. Refer to response to comments F404-82 through F404-95 for additional information on the analysis of impacts presented in the EIS. The intention of the EIS has been to include all available relevant Traditional Knowledge and scientific

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	information. Consistent with this objective, the FEIS includes the addition of information that has just become available.
F404-20	We acknowledge that the scientific literature for the North Slope is comprised of numerous studies and investigations. Some studies support the contention of serious environmental degradation, while others suggest no adverse impacts. At present, the debate on the magnitude of environmental effects of North Slope oil development continues and the issue remains the subject of extensive research. We disagree with the comment that direct, indirect, and cumulative impacts have not been thoroughly evaluated in this EIS. On the contrary, we are of the opinion that this EIS is the most thorough ever done for a North Slope project. Refer to Chapters 5 through 11 for a discussion of these impacts.
F404-21	We disagree that the effect of the Northstar Development Project, serving as a precedent, was ignored. The purpose of Chapter 3 was to provide a broad overview of North Slope oil development and the effect the Northstar Project will have on future development. Section 10.3.3 of the EIS reviews future actions, including foreseeable future onshore and offshore developments, and recent and planned lease sales. As noted in Table 10-2 (Foreseeable Future Actions, Northstar Cumulative Development Area), foreseeable future activities offshore include the development of the Liberty Unit. Potential future offshore developments include Gwydyr Bay, and the Hammerhead, Kuvlum, and Camden Bay Units. Presently, no further explorations are proposed for the Gwydyr Bay and Hammerhead Units; development has not been formally proposed to any agency for the Kuvlum Unit; and the ARCO Warthog Well in the Camden Bay Unit is considered a dry hole. Only two subsea pipelines are proposed for the foreseeable future: for Northstar and Liberty. Both Northstar and Liberty are being developed in roughly the same time frames; hence, the role of Northstar "as a precedent" is not valid for foreseeable future offshore developments. However, these two developments may be viewed as precedent setting in the long-term. This comment states that the Northstar Development Project would lead to an exponential increase in the oil reserves base. As noted in the EIS (Section 10.3.1), "Since the first production well was drilled in the Prudhoe Bay Unit, North Slope oil reservoirs have produced a cumulative total of 11.57 billion barrels of oil through the end of 1996." Section 10.3.3 of the EIS states that "Total production from currently operating and identified fields which are expected to be developed is estimated to be 6.13 billion barrels from 1996 to 2015" (Source: USDOI, MMS, 1997). By year 2015, the TAPS projected throughput is 0.384 million barrels/day, representing a substantial reduction in throughput compared to current TAPS throughputs of 1.4 to 1.5 million barrels/day (Sections 10.3.2 and 10.3.3 of the EIS). Hence, we disagree with this comment's assertion that the Northstar Project would lead to an exponential increase in the oil reserves base; the validity of this assertion would require an order of magnitude increase in expected reserves and projected TAPS throughput which is the opposite of that currently projected. With respect to impacts related to global climate change, a number of specific gases have been identified as greenhouse gases postulated to contribute to "global warming." By far the most prominent of these for oil and gas industry facilities are methane (CH_4) and carbon dioxide (CO_2). For the Northstar Project, methane emissions will occur primarily as fugitive leaks from facility components and evaporation from storage vessels, while the dominant mechanism for carbon dioxide production will be combustion of fossil fuels by fired equipment. Carbon dioxide will be generated in much larger quantities than methane on a mass emission basis. Assuming the postulated connection between emissions of greenhouse gases and global warming is valid, then the proposed project activities will contribute incrementally to this effect. The direct emissions of carbon dioxide and methane due to project construction and operation will be modest, consisting mostly of temporary fuel firing by construction equipment and ongoing fuel combustion by boilers, heaters, turbines, and mobile equipment (e.g., vehicles) at the project site. The project design includes reinjection of produced gas, rather than flaring. In terms of cumulative impacts in combination with all North Slope activities, it should be noted that overall oil production in the region is declining and is projected to decline further, with or without the addition of the Northstar Project. This means that production decreases at other operating units and their corresponding emission of greenhouse gases will offset the incremental effect of the project's emissions. Thus, in a regional sense, there will be a net

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	decrease in greenhouse gas emissions relative to current and recent levels. The total downstream emissions budget for the Northstar Project, including emissions related to crude oil production, tanker shipments, refinement, product transportation, product utilization, etc., has not been precisely computed, in part because the eventual end products (e.g., plastics, gasoline, paving materials, etc.) are not known. However, if one assumed the entire carbon content of Northstar-derived crude oil, as produced at the peak production rate, were to be completely converted to atmospheric emissions in the
F404-21 (Cont.)	form of carbon greenhouse gases (notably, methane and carbon dioxide), the ratio of these Northstar-derived carbon emissions to the estimated annual global carbon emissions due to the burning of fossil fuels would be on the order of 0.037%. Averaged over the 15-year project life of the Northstar Project, this ratio is reduced further by roughly a factor of two. The calculations offered above overestimate the actual budget for carbon emissions from the consumption of possible end products of Northstar crude oil (e.g., gasolines burned in automobiles, etc.). However, these calculations do not include emission contributions from the production and shipping of crude oil, refining, end product transportation, and so forth. A recent study required by the World Bank computed the total downstream carbon emissions budget related to an oil development in Chad. This study (Esso, 1998) included such items noted above and may be used to estimate the total carbon emissions due to the Northstar Project. The carbon emissions budget for the Chad oil field development consisted of: oilfield operations including flaring, the use of a long overland pipeline with pump stations, tanker loading, marine shipping of crude oil from Africa to other continents, product refining, transportation of end products to bulk terminals and thereafter to marketing facilities and, finally, the combustion of these end products by consumers. Linear scaling of the peak 225,000 barrels/day (Chad) production rate to that of the Northstar Project (65,000 barrels/day - peak) provides an estimate of peak annual emissions, due to all activities ranging from Northstar production to end product consumption. This estimate is only 0.045% of the annual carbon greenhouse gas emissions due to the worldwide production and use of fossil fuels. From these estimates, it is clear that the incremental contribution of the Northstar Project to the annual global production to carbon greenhouse gases derived from fossil fuel production and consumption is almost immeasurable. The end-user consumption of the Northstar Project's fuel products on the world energy market will produce the bulk of the greenhouse gas emissions related to the project. However, these impacts are not within the control of the project proponent. It is certain that energy production and usage will be market driven, and that demand for oil and other fuels will be satisfied, whether by products from this project or elsewhere.
F404-22	We disagree that the scope of this EIS is misleading. A discussion of the scoping process and the key issues identified to be addressed in the EIS is presented in Section 1.5. See response to comments F404-162, F404-163, and F404-171 for more information on the scope of this EIS.
F404-23	Under NEPA, the term "Environmentally Preferred Alternative" refers to that alternative that is environmentally preferred as assessed by the lead and cooperating agencies. For additional details, see Section 11.9.2 of the FEIS. See response to comments F404-25 and F404-26 for more information on Alternative 1 - No Action.
F404-24	We acknowledge your support of Alternative 1 - No Action.
F404-25	We disagree that the analysis of Alternative 1 - No Action does not satisfy the requirements of NEPA. Alternative 1- No Action is discussed briefly in Section 4.4 because this section describes the components of alternatives selected for evaluation in the EIS. Impacts of Alternative 1- No Action also are described for the physical, biological, and human environments (Chapters 5, 6, and 7). Please refer to response to comment F404-26 for additional information.
F404-26	The DEIS makes clear that all impacts associated with the proposed project would not occur if the project is not built (Alternative 1 - No Action). The Executive Summary states: "The No Action Alternative would not produce any of the project-specific impacts which result from the action

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	alternatives." Table ES-14 also presents Alternative 1- No Action in comparison to all other alternatives and provides a detailed summary of impacts or lack of impacts for all resource categories. Maintaining the current level of oil exploration and productions on the North Slope without the Northstar Project, including associated impacts, would not be considered "beneficial" but would more accurately be characterized as "No Impact (i.e., maintaining the status quo)."
F404-27	The diversion of investment resources toward the development of sustainable energy supplies, as noted in the comment, implies that the selection of Alternative 1- No Action will direct BPXA funds from Northstar to the development of these other energy sources. While it is true that BP does pursue a substantial program of research and development in the area of alternative energy sources, the disapproval of Northstar does not imply such a redirection of resources. BP may, as a multinational corporation, use its monetary and professional resources on the pursuit of other oil development projects; it is also free to pursue the development of alternate energy resources. Such decisions remain with BP and its stockholders alone.
F404-28	We acknowledge your support of Alternative 1- No Action.
F404-29	We disagree that this EIS ignores important environmental issues and is deficient. The examples raised in the comment concerning permafrost thawing and strudel scour are discussed in detail in Sections 5.3.2.2 and 5.6.1.4, respectively. In addition, see response to comment F34-16 for additional discussion on strudel scour risks.
F404-30	The specific design circumstances for the soils present at the shorefall proposed for Alternatives 2 and 3 have been thermally modeled in a formal design study (Point Storkersen Shore Approach, TN 460, Revision 3, INTEC, May 1998) and the resultant soil movement and pipe strains are accommodated by the pipeline thicknesses, metallurgy, and pipe diameter selected for installation. The thaw settlement expected for the Point McIntyre shorefall would be generally comparable to that evaluated at Point Storkersen. The shorefall for Alternative 5 at the West Dock causeway would be expected to experience much less subsidence, perhaps none, from thaw settlement, since the seabed soils adjacent to West Dock at the depth of trench installation are not ice-bonded permafrost. Less information is available for definitive statements regarding Alternatives 4 and 5 because data (borings) have not been collected at these particular sites. Such data collection would be necessary to evaluate the shoreline crossing if an alternative site is chosen. The lagoon trench thaw settlement study for Alternatives 2 and 3 is presented in "Lagoon Permafrost Mitigation, TN 450, Revision 3" (INTEC, May 1998). Again, the anticipated maximum thaw strain has been analyzed to be much less than the allowable operational strain. The alignments for Alternatives 4 and 5 are not expected to result in substantially higher subsidence values, or resulting greater pipe strains. The coastal erosion rates for the shorefall locations are described in Section 5.3.1.6, and shown in Figure 5.3-7. Each of the alternatives are viewed as minimal risk situations, given that the shorefall condition is to be periodically inspected. As for pipeline failure and oil spill probabilities, the only distinguishing factor between the shorefalls proposed for Alternatives 2, 3, and 4 and the offshore landfall on the West Dock causeway (Alternative 5) is the non-frost susceptible gradation of the man-placed causeway material. Thus, Alternative 5 is anticipated to have negligible subsidence and minimal oil/gas spill risk at the shorefall compared to the other action alternatives. Calculating risk of pipeline failure at the shoreline crossing could be a meaningless exercise since no data is available. Thus, the engineering approach cited above was determined the best scientific evaluation method.
F404-31	There is no evidence that the seabed soils will present "Serious risks to the subsea oil pipeline . . ." Some subsidence, differential settlement, and upheaval are expected at unknown locations along the pipeline trenches. The pipes' wall thicknesses have been analyzed with regard to the resultant structural strains and the pipe should have no difficulty withstanding the loads imposed without buckling or deforming, much less failing. It is correct to note that site-specific subsea soil conditions are not known for each of the action alternative alignments as well as they are for Alternative 2. Area-wide data has been used, and it is

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	consistent with site-specific boring data collected by BPXA for Alternative 2. The nearshore boring collected from cross-section A-A' in Figure 5.3-5 of the DEIS is consistent with the expected shoreline of Alternative 2. Selection of an alternative route would require BPXA to collect soils data for the chosen route. There is no reason to suspect or believe that subsea soil data gathered in the 1970s and 1980s is now inadequate or inaccurate just because a decade or more has passed since it was collected. To a large degree, the studies referenced by the comment in Section 5.3.2.2 provide the information which is alleged to be un-analyzed as part of the EIS.
F404-32	The evaluation of Alternative 5's shorefall and pipeline trenching as being "the safest of the action options" is discussed in Section 5.3.2.2 and summarized in the Executive Summary (Comparison of Project Alternatives). The thaw-susceptible shorefalls of the other action alternatives are discussed in the same section and are shown to carry unavoidable impacts of thaw subsidence. Any such discernable differences between alternatives that could cause structural strain of the pipelines and, therefore, subsequent spill/leak risk consequences, were viewed as important (P. Sellmann and E. Chamberlain, CRREL, Comments on the Draft EIS for the Northstar Development Project with Emphasis on Permafrost at the Sea/Land Transition, 1998 - Personal Communication). For details, see Appendix P. Engineering studies and/or thermal modeling of the alternative shorefalls for Alternatives 4 and 5 have not been completed because boring data does not exist for the sites. Such data would have to be collected if Alternative 4 or 5 is chosen.
F404-33	The DEIS did not evaluate every possible or technologically imaginable installation scenario. NEPA requires only that a reasonable range of alternatives be considered [40 CFR 1502.14 and 1505.1(e)]. Improbable alternatives, such as separating the gas and oil pipelines into different trenches, were avoided because the environmental disturbance and time to complete such a scenario would be at least double that of the one common trench burial approach. The double-walled pipeline concept is discussed in Section 3.4.2.7. Although the apparent benefits seem advantageous upon first glance, its constraints make it less workable as an option compared to the dual, single-walled pipe approach.
F404-34	For each alternative, placing the pipeline at greater depths would not provide greater protection than that afforded by the design depth (6 to 9 ft [1.8 to 2.7 m]). This pipeline burial depth has been determined through review of known and predicted strudel scour and ice gouge depths in the project area (refer to EIS Sections 5.5 and 5.6). Based on the analysis, pipeline depths of 6 to 9 ft (1.8 to 2.7 m) represents approximately twice that of known scour and gouge depths which have been determined to be sufficient to ensure pipeline protection. Increased depth would require longer installation times, and result in greater disturbance to the seafloor.
F404-35	Seasonal restrictions, such as those suggested, will be considered by the cooperating agencies as a potential mitigation measure. See the new Section 11.10, which lists the agencies proposed mitigation alternatives.
F404-36	We acknowledge your concern about industry's ability to detect a pipeline leak during winter conditions. Your recommendation to consider production restrictions during winter will be considered as part of the agencies decision-making process. For additional information on pipeline leak detection, refer to response to comment F303-4.
F404-37	The DEIS does consider directional drilling from the mainland. As noted in Section 4.2.2.2, there are no mainland locations from which directional drilling can reach a large part of the productive portion of the Northstar reservoir. This is due to limits in directional drilling technology (Section 3.4.2.3) and the offshore distance of the Northstar reservoir. Because directional drilling is not a viable option, there is no requirement to address any negative terrestrial impacts which might accompany its use.
F404-38	We agree that pipeline integrity is a primary concern of those individuals associated with the project. Development of project alternatives was described in Chapters 3 and 4 of the EIS. Risks posed to the pipeline from the physical environment are presented in Chapter 5. The detailed engineering analysis of pipeline design, operations, and maintenance was performed by the State Pipeline Office and their contractors. Appendix E of the EIS lists the technical documents available for public review at 411 West

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	Fourth Avenue, Suite 2C, Anchorage, Alaska. The highly detailed and technical nature of the documents makes their inclusion in the text of the EIS undesirable. An evaluation of double-walled pipe design was added to Section 3.4.2.7.
F404-39	The primary elements of the adequacy of the island and pipeline design are described in the EIS, and more thoroughly explained in the 23 design studies, reported as Technical/Computational Notes as cited in Appendix E. These design studies were performed under contract to BPXA, but this does not invalidate the conclusion of the studies. It is the responsibility of BPXA to identify and explain their proposal in order to have it evaluated. The State Pipeline Office is responsible for reviewing and approving project design elements (see response to comment F404-38 for additional details). Some aspects of their review may result in subsequent inclusion of technical stipulations and restrictions in the state and federal governments' permitting documents.
F404-40	The pipelines proposed by BPXA must meet the design standards developed by USDOI, MMS, and others, and any federal permits issued will require adherence to applicable standards and procedures.
F404-41	Although the statement cited from the DEIS says "a corrosion allowance has not been included . . .", the wall thickness of the pipelines has been proposed at a value approximately three times thicker than was calculated to be structurally necessary in order to ensure pipeline placement in the subsea trench. This additional wall thickness will aid in resisting any potential failures due to corrosion. In addition, periodic "smart" pigging analyses will evaluate the metallurgic response of the steel in the buried pipelines to corrosive effects.
F404-42	It is important to avoid/prevent any such pipeline failure and subsequent spill occurrence under the Beaufort Sea. The sea bottom ocean currents at Seal Island, and along each of the subsea pipeline alternative alignments, are relatively mild, which would minimize scour by current forces (see Section 5.5.1.3; or the referenced studies by Aagaard and Woodward-Clyde Consultants). Storm events can sometimes cause dramatic shore erosion, and might also disturb or remove some of the trench backfill in shallower waters during open water conditions. This disturbance is not expected to affect pipeline integrity. Strudel scour erosion is thought to be the primary mechanism for seafloor scour. The engineering study results addressing scour are described in response to comment F404-43. The pipeline trench will be periodically inspected to assure the retention of each segment of trench backfill.
F404-42 (Cont.)	Duly qualified welding procedures for the Northstar offshore pipelines will result in the welds having adequate strength and ductility for the predicted loading conditions. The design conditions, welding specifications and testing requirements have been independently reviewed by the State Pipeline Office. Welding procedure qualification and testing are presently in progress and this work is also being reviewed. The qualified weld procedure will be adhered to during production welding and all welds will be non-destructively examined to ensure that they meet the quality criteria. The proposed Northstar subsea pipeline design incorporates several features that provide a high degree of assurance against weld failure. For example, the Northstar subsea pipeline has no flanges, which was the source of the Santa Barbara failure cited by Greenpeace ("Update on The Torch Oil Spill", November 25, 1997). Also, the Northstar steel chemistry is substantially different from that which led to hardening and fracture of the weld heat affected zone on the Santa Barbara pipeline. That pipeline had many contributing factors that resulted in the failure, including: an "S" configuration of the pipe, weld defects, and substantial internal pipe wall corrosion. These apparently all occurred at the same location in which the pipe had developed a large, unsupported span. It is also important to note that the Santa Barbara pipeline had been pressure de-rated several times during its operational life. The condition of the Northstar oil pipelines will be periodically internally inspected to determine their integrity for continued operation.
F404-43	The Leidersdorf and Gadd study referenced in the DEIS was accurately cited, although you are correct that the Harding Lawson Associates field survey in 1985 did find a strudel scour 5.7 ft (1.7 m) deep and 89 ft (27.1 m) wide at the seabed. This data is specifically noted on page 5 of the design study used in the DEIS to evaluate the risks of strudel scour (Strudel Scour Evaluation, TN 415, Revision 3, INTEC, May 1998), so the DEIS did review this site-specific data. Section 5.6.1.4 on strudel scour has been

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	revised to include this earlier survey in the FEIS. The USGS, Reimnitz and Kempema, and Coastal Frontiers data mentioned in the comment is drawn from studies at Egg and Resolution Islands. The largest scour, 300 ft (91.4 m) in diameter at the seabed surface, was 6.5 ft (2 m) deep, the deepest scour was 39 ft (11.9 m) in diameter, and 14.1 ft (4.3 m) deep. As the design study notes, the deepest scours were not the largest. Contrary to the comment, the TN 415 evaluation clearly reviewed the ramifications of all of the field data cited. The probabilistic analyses performed define the extreme horizontal scour dimension (for 100-year Average Return Period) at the pipe bundle depth to be 90 ft (27.4 m) wide. At the seabed surface (mudline) this hypothetical scour was approximately 112 ft (34.1 m) wide. The forecast depth for this extreme event was 21 ft (6.4 m) below the seabed surface. The Northstar subsea pipelines are designed to withstand this extreme scour, even if it were to occur directly atop the trench. The EIS does not discuss tidal cracks, which are essentially elongated strudel scours caused by surface ice cracks which result in linear zones of seabed scour, but the depths observed for these scour features is less than that for isolated strudel scours; therefore, they are not an additional or separate issue of concern.
F404-44	We disagree that "Many risks . . . were not well evaluated" including thaw subsidence, shore erosion, etc. See response to comments F404-31, F404-32, and F404-47. Selection of Alternative 5 as the Environmentally Preferred Alternative was not solely due to the differential impacts associated with these important technical issues, although they did contribute to that decision.
F404-44 (Cont.)	Regarding the comment on the predicted maximum (100-year event) ice pileup height of 56 ft (17 m), versus the sheet pile wall height of 27 ft (8.2 m) MLLW, see Section 5.6.2.2 (Operational Impacts). The extreme pileup would likely occur at the waterline or the knee of the bench slope (+4 ft [1.2 m] MSL). The 75-ft (22.9 m) wide bench outside the sheet pile wall would cause the ice to form a 56-ft (17 m) tall pile of ice rubble that would climb to a height of +12 ft (3.7 m) MSL, which is about 6 ft (1.8 m) up the wall. The ice would still be 15 ft (4.6 m) below the top of the wall. The 56-ft (17 m) elevation is above sea level, but the rubble pile builds with a back slope down toward the protective wall. The relevant design study was a report entitled "The Potential for Ice Encroachment at Northstar Production Island", by Coastal Frontiers Corporation, November 21, 1996, with portions excerpted from Design Ice Criteria for the Northstar Development, Dr. Ken Vaudrey, April 1996.
F404-45	The pipeline burial depths proposed by BPXA and reviewed in the EIS are drawn directly from the applicable engineering studies developed to evaluate the proper depths of pipeline burial. The lagoon portion of the buried pipeline trenching, inside Gwydyr Bay, is required to provide 6 ft (1.8 m) of soil cover (this value is not controlled by ice gouging) and the farther offshore portions of the trenching from the shoal area up to 34 ft (10.4 m) water depths, is required to provide 7 ft (2.1 m) of soil cover. The 34 to 39 ft (10.4 to 11.9 m) water depth trenching requires 9 ft (2.7 m) of soil cover (Ice Keel Protection, TN 410, Revision 3, INTEC, 1998:5; an errata sheet in an earlier version of TN 410 indicates a computational/design modification). The strudel scour design study by INTEC cited by the comment does indicate that the pipelines would withstand the strains imposed by scours such as the one mentioned, and clearly notes that strudel scours quickly diminish with depth. See also Figure 5.6-7, Strudel Scour Diagram, of the EIS. To avoid confusion, the EIS sentence in Section 5.6.2.2, which ends in the phrase "minimum burial depth of 7 ft (2.1 m)" is amended to read "minimum burial depth of 7 ft (2.1 m) (north of the Barrier Islands, the pipeline will be buried at depths between 8 to 10 ft [2.4 to 3 m])." Confusion may arise between "burial depth" and "depth of cover." For example, a 7-ft (1.8 m) deep trench is required to bury a 1-ft (0.3 m) diameter pipeline with a 6-ft (1.8 m) depth of cover.
F404-46	The geotechnical input report developed by Nixon Geotech Ltd. which was referenced in the comment is a background document to the INTEC analysis, "Ice Keel Protection", TN 410, Revision 2, May 1998. The geotechnical report evaluates the site's soil properties, probable ice keel dimensions, and sub-scour

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	soil displacements applicable to the Northstar pipelines as proposed by BPXA. The report develops input for pipe-soil interaction analyses and soil load-displacement functions for correctly modeling the load transfer to the pipelines. These modeling results were then used by INTEC to prepare their engineering study that found that the 100-year ice gouge event would result in a gouge with dimensions of 3.5 ft (1.1 m) deep and 35 ft (10.7 m) wide. Both 10 and 12-inch (25.4 and 30.4 cm) pipelines were modeled, at burial depths of 7 and 9 ft (2.1 and 2.7 m), and in all cases, the maximum strains induced in the pipelines due to ice gouging did not exceed the allowable strain value. Any trench with the product pipelines buried at least 7 ft (2.1 m) below the seabed surface, and buried at least 9 ft (2.7 m) for the 34 to 39-ft (10.4 to 11.9 m) water depths (the last 3,000 ft [914.4 m] to the Seal Island shore crossing), should withstand the effects of such ice gouges. The deeper 9-ft (2.7 m) trench would decrease the strains imposed on the pipelines by the 100-year ice gouge event (TN 410, INTEC, 1998:14). The environmental impacts of this added excavation appear to make deeper trenching unnecessary.
F404-47	The information requested regarding the shorefall transition zone design is provided in the EIS on Figures 4-24 and 4-25 (Section 4.4.2.2). These figures indicate the 110-ft (33.5 m) distance is from the edge of the bluff and the 150-ft (45.7 m) distance is from the waterline (low tide). An important point is that unacceptably high erosion rates due to severe, high impact storms would be mitigated by shoreline repair before the next storm season begins. This is discussed in the last three sentences of the paragraph responding to the question, "Will coastal erosion affect pipeline integrity?" (Section 5.3.2.2), where the text mentions that the pipeline would be inspected, and appropriate gravel backfill (re)placed. For example, the backfill over the buried pipelines would be replaced, if required. Erosion of the shoreline does not expose/affect the pipelines which would remain below the seabed surface. Erosion to this degree is not expected, but should it occur it can be ameliorated without risk to the pipelines' integrity. The design of the shorefall does take into account the impacts of a maximum event, such as the removal of 35 ft (10.7 m) or more of coastline in a single storm. The 110-ft (33.5 m) setback could accommodate three such storms during the life of the pipelines, without reaching the toe of the valve pad berm. The forces of coastal erosion are not anticipated to dig down to the pipelines, which are buried 6 ft (1.8 m) below the level of the seafloor at the shorefall. Shoreline maintenance and the addition of fill/cover would be added if necessary.
F404-48	The design of the shorefall takes into account the impacts of a 35-ft (10.7 m) erosion event. The gravel backfill in such an event anchors the trench, as the gravel is much harder to erode than the native soil. Any gravel above the seabed level would mound over as the side support is removed. The gravel would also have some affect on freeze-thaw behavior, as gravel is thaw stable. The forces of coastal erosion are not anticipated to reach the pipeline, which is buried 6 ft (1.8 m) below the level of the seafloor at the shorefall (see Figure 4-25 of EIS Section 4.4.2.2). The setback (110 ft [33.5 m] from the bluff edge and 150 ft [45.7 m] from the waterline [low tide]) is more than sufficient to accommodate a maximum storm event with a removal of 35 ft (10.7 m) of coastline. If unacceptable erosion occurs (e.g., during a severe storm), remedial action would be required.
F404-49	We acknowledge your concerns regarding pipeline integrity and coastal erosion. See response to comment F404-47.
F404-50	As indicated in Sections 8.5.1 and 8.5.2 of the EIS, a gas pipeline leak is not considered to be a potential source of an oil spill. The scenario of a gas line rupture would likely be caused by the same event (e.g., an extremely deep ice keel) that would rupture the oil pipeline. A gas pipeline leak jetting into the oil pipeline would not be of a sufficient strength or duration to affect the integrity of the oil pipeline, which is over-designed with a wall thickness almost three times greater than conventional pipelines. The gas pipeline would be shut down immediately once a leak was detected (pressure drop) by the SCADA monitoring system. As indicated in pages 1-25 through 1-97 of the Northstar ODPCP, prevention or

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	controlling fire hazards (i.e., removal of all ignition sources) is one of the first priorities of spill response. This may entail waiting for gas to dissipate. No increase in oil pipeline maintenance requirements would be expected from the bundled pipeline configuration. Gas explosions causing an offshore oil spill are not likely due to a lack of oxygen available underwater for ignition and combustion.
F404-51	By the impact level definitions applied in this EIS (Section 1.8), direct impacts of ice on pipeline operations and maintenance would be minor because additional avoidance or minimization is not necessary. For example, deeper burial of the pipelines offers no increased protection from ice gouging or strudel scour.
F404-52	We acknowledge your support of Alternative 1 - No Action.
F404-53	We acknowledge your opinion that the Drake oil field pipeline did not have encouraging results. See response to comment F404-11 for more information.
F404-54	We disagree that a review of the adequacy of the spill plan is required in the EIS. This would duplicate ongoing reviews by state and federal regulatory agencies. The most current information from the spill plan process was reviewed and used in development of Chapter 8 of the EIS. Chapter 8 of the EIS was intended to provide information for discussions of the effects of oil spills on the physical, biological, and human environments. Impacts from a large oil spill were evaluated in Section 8.7 with the assumption that no oil spill response occurs. A new table has been added to Chapter 8 of the EIS that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP, the ACS Technical Manual, and conditions which reduce oil recovery efficiency. See Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled, "Summary of Oil Spill Cleanup Limitations" for discussions of major limitations of cleanup methods.
F404-55	The Traditional Knowledge excerpts referred to in the comment represent some of the main concerns facing spill response planners. See changes to Section 5.2.3.2 for clarification of Traditional Knowledge of offshore currents. Offshore currents are cited in Section 8.6.2 of the EIS as one of the factors that would delay or prevent oil spill response. Response strategies outlined on pages 1-24 through 1-97 of the Northstar ODPCP describe actions that would be taken in the event of a spill, which inherently includes weather and sea conditions. Tactic L-7 of the ACS Technical Manual includes high water flows and storm surges as two conditions that could reduce effectiveness of oil spill response. The EIS statement "under-ice water generally is calm" appears in Section 5.3.2.2 in the discussion of the effect of pipeline construction on sediment quality, and should not be confused with oil spill response information presented in Chapter 8 for different ice conditions. Pipeline construction activities would occur in winter under solid ice conditions, when ocean waters would not be exposed to wind action. Strong ocean currents and storm surges would be concerns for spill response operations during the open water or broken ice seasons, not during solid ice conditions. The statement that "under-ice water generally is calm" is based on meteorological records and data, which conclude that under-ice currents are driven by coastal storm surges and regional circulation patterns (Section 5.5.1.3). As indicated in Section 5.5.1.3 of the EIS, average under-ice currents range from 0.7 to 3.6 inches (1.8 to 9.1 cm) per second (WCC, 1997:2-2), while open water current speeds have been measured ranging from zero to 27 inches (68.6 cm) per second. Traditional Knowledge of currents is also presented in Section 5.5.1.3 with the western science information.
F404-56	We disagree that Traditional Knowledge on weather conditions and other hazards to spill response was disregarded in the EIS. In order to avoid duplication, Traditional Knowledge about the physical environment is mainly presented in Chapter 5. However,"statements" related to spill response limitations as seen by local residents familiar with harsh weather conditions and difficulties observed during spill response drills is included in Section 8.6.2. Economic, social, and psychological impacts to native communities in Prince William Sound from the *Exxon Valdez* oil spill and oil spill cleanup are discussed in Section 8.7.3.4.

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F404-57	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and spill statistics used in the calculations. Additional discussion of project design features that would aid the prevention and/or limit the volume of a spill has been added to Section 8.5.3. While we agree that darkness, white out conditions, winds, and fog would hinder oil spill response, these factors would not increase the chance of oil spill occurrence. Pipeline design has incorporated analysis of ice gouge and strudel scour depths (Section 8.5.3 and Appendix E of the EIS). Section 8.6.2 summarizes weather and ice conditions that could delay or prevent oil spill response. It should be noted that although darkness would hinder response activities, generators and lights are included in the ACS inventory and would be available for use in the event of a winter spill response. A new Table 8-8 has been added to Chapter 8 of the EIS to summarize oil spill cleanup limitations.
F404-58	Table 5.6-2 summarizes the impacts of the project (including an unplanned oil spill) on sea ice, not the effect of sea ice on oil spill response. Possible limitations of oil spill response due to broken ice conditions are described in Sections 8.6.1, 8.6.2, and 8.6.3. A new Table 8-8 has been added to the EIS, which summarizes weather/environmental conditions (including ice conditions) which could reduce oil recovery efficiency.
F404-59	Section 8.5.2 of the EIS has been revised to clarify the presentation of estimated oil spill probabilities and statistics used in the calculations. Additional discussion of project design features that would aid the prevention and/or limit the volume of a spill has been added to Section 8.5.3. Evaluation of oil spill impacts assumed that no spill response occurred and did not include how likely it was for an oil spill to occur. These issues were addressed separately in Chapter 8. While reading Section 8.7, it is important for the reader to keep in mind that the impacts presented would only occur if: 1) there was a large (greater than 1,000 barrels) oil spill, 2) there was no oil spill response, and 3) the spill occurred at the specific location or time of year that coincided with use of the area by sensitive resources. The impacts were characterized in this way to clearly divide the discussions of likelihood of an oil spill from the consequences. Project design and typical operating procedures help to minimize the probability of an oil spill, but do not change the potential impacts if a spill does occur. See the response to comment F34-73 for a discussion of tundra impacts from cleanup equipment. See response to comment F355-31 for an explanation of cumulative probabilities. Section 10.7 of the EIS specifies that the cumulative probability of an oil spill is high and the effect is considered significant. The contribution from the Northstar Project is considered to be minor. It is unclear from the comment what justification exists for increasing the impact level from minor to significant.
F404-60	Section 10.7 was rewritten to specifically consider the contribution of the Northstar Unit Development. As described in Section 10.7, the cumulative probability of a large oil spill occurring during the life of the Northstar Development Project is 95.2%. Northstar's contribution to the cumulative oil spill probability is less than 2%. We agree that the probability of a large oil spill occurring during the proposed life of Northstar somewhere on the North Slope is high.
F404-61	The topic of tanker spills has been incorporated into Section 10.3.4 of the FEIS.
F404-62	With the use of blowout prevention technology, the probability of a blowout releasing crude oil to the environment is extremely low. There has never been a crude oil blowout from the North Slope oil fields (Section 8.5.2). From 1979 through 1996, there have only been five oil well blowouts worldwide greater than 10 million barrels (Section 8.5.2). Although 15,000 barrels of oil per day is the assumed rate for response planning, a rapid decline in the bottom hole pressures would be expected during a blowout and the rate of oil spill would diminish as well. Physical characteristics of the reservoir make it virtually impossible for a spill of 113 million gallons (428 million liters) to occur.
F404-63	The cited reference is consistent with information presented in Section 8.5.2 of the EIS. Both sources indicate that no blowouts on the North Slope have ever occurred that spilled liquid hydrocarbons, i.e. crude oil. ADEC's definition of a blowout includes release of gases, which would be much less damaging than a crude oil spill. The probability of crude oil blowouts was conservatively estimated in the EIS from world-wide data for crude oil well blowouts and other platform spills, which includes spills in countries not governed by the same strict standards for safety procedures, equipment, and training as

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	in the United States.
F404-64	We agree that the potential for a blowout, although estimated to be low, exists. Even if the estimated probability for a spill was a fraction of a percent, the potential impacts must be evaluated. One of the functions of the EIS is to present the probable impacts of this unplanned event and to specify the likelihood of occurrence for the public and decision makers. A distinction should be noted between the total rate of blowouts and the rate of blowouts resulting in the spill of crude oil. Most blowouts do not spill crude oil and bridge themselves naturally. Public feedback received during public hearings in Barrow, Kaktovik, Nuiqsut, Anchorage, and Fairbanks indicates differing priorities and tolerance for risk. For some, the probability of a large oil spill that may or may not happen sometime during the life of the Northstar Project is far outweighed by the more immediate concerns about employment and personal finances. For others, the socioeconomic benefits of the project are greatly surpassed by the potential risks to the biological resources and the local resident's subsistence culture. This is not to say that construction workers are unconcerned about environmental protection or that North Slope residents oppose all oil and gas production. Rather, public testimony during the hearings and comments received on the EIS (and the project in general) illustrate that individuals have different attitudes about risk.
F404-65	See response to comment F404-54 for an explanation of the ODPCP's inclusion in the EIS.
F404-66	The DEIS discussion of spill impacts and impacts of spill response was based on draft documents available prior to DEIS publication. More current documents were reviewed to identify changes that could affect the analyses in Chapter 8. The inclusion of scenario-specific ACS Technical Manual tactics in the new Table 8-8 is an example of updated information now included in the FEIS. The evaluation of oil spill impacts assumes that no response occurs (i.e., worst case impacts). While Chapter 8 does not contain detailed spill response information, likely cleanup operations are presented and evaluated as additional sources of impacts that would be expected to occur as a result of spill response activities.
F404-67	Although we have no control over the state's information requirements or public comment periods, we will use the most current information available prior to publication of the FEIS in our analyses of oil spill and response impacts. Changes to the ODPCP (such as the through ice sampling period change from 60
F404-67 (Cont.)	days to 30 days) reviewed thus far have been incorporated into EIS as applicable (Table 8-5 and new Table 8-8), but have made little difference in the impact analyses presented in Chapter 8. This is primarily because the impact analyses in Section 8.7 of the EIS assumes no oil spill cleanup occurs. Also, the planned response methods have not changed from those initially proposed and identified in Chapter 8.
F404-68	We disagree that equipment operating limitations are not discussed in the ODPCP and ACS Technical Manual. The ODPCP indicates a time frame during which the response equipment will be deployed from various locations. The estimated response time from the discovery of the spill to the time of deployment of the equipment varies depending on the location, pre-planning, and logistical support. Table 1-3 of the ODPCP summarizes the seasonal response options available. Section 1.5.1 of the ODPCP lists the estimated response times for Northstar and Tactic L-3 of the ACS Technical Manual Volume 1 (June 1998) indicates the anticipated travel times for each type of equipment. Realistic maximum response operating limitations are described in Section 3.4. Reduction of effectiveness of oil response are presented in Tactic L-7 and in Attachment A of the September 1998 Northstar ODPCP Addendum.
F404-69	Noise produced from an ice-breaking barge pushed by a tug is discussed in Section 9.7.1 of the EIS. See changes made to Section 9.8.2.1 to include discussion of noise impacts of ice-breaking barges used in spill response on marine mammals, birds, and subsistence. If an ice-breaking barge is used during the response to an oil spill, minor impacts may occur to bowhead whales and significant impacts would be possible to the fall subsistence harvest of bowheads if such disturbance caused a change in their normal migratory route. See changes to Sections 8.7.2.7 and 8.7.3.1 for this clarification.
F404-70	It is not appropriate for the EIS to duplicate the ongoing ODPCP review by the state. ADEC will determine if the Northstar ODPCP is in compliance with 18 AAC 75, Oil and Hazardous Substances Pollution Control Regulations. Article 4 of these regulations covers specific ODPCP requirements. State

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	response planning standards are set out in 18 AAC 75.430 through 18 AAC 75.442. 18 AAC 75.430 specifically states "the plan must demonstrate the general procedures to cleanup a discharge of any size, including the greatest possible discharge that could occur, subject to the provisions of AS 46.04.020 and AS 46.09.020." Section 8.6 of the EIS acknowledges the ongoing review of the ODPCP by the state and federal agencies. It also discusses the possible limitations to oil spill response (Section 8.6.2). Since little data is available demonstrating the oil industry's response record during broken ice conditions, Section 8.7 presents an evaluation of impacts assuming no response. Any cleanup measures implemented would serve to lessen these impacts. Table 8-5 presents worst case spill volumes for project specific spill scenarios. The new Table 8-8 summarizes weather/environmental conditions, spill response techniques, and conditions which would reduce oil recovery efficiency. The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" was reviewed and found to be consistent for the approach used and the conclusions reached in the EIS.
F404-71	Section 8.6.1 identifies available response methods and cites major limitations on the specified techniques. For example, in the discussion on chemical dispersants, the EIS states that application of this method on the North Slope is unlikely, due to its minimal effectiveness in cold temperatures and concerns about biological toxicity. The comment does not provide a reference for a spill recovery efficiency of 15%. However, the best oil spill recovery estimates found in literature specific to North Slope conditions and response methods likely to be used for Northstar are presented in the new Table 8-8 of the EIS. The S.L. Ross et al. report (June 1998) indicated that oil recovery efficiency for a blowout in broken ice conditions could be quite low.
F404-72	We acknowledge your concern about relying on in situ burning for spill response in broken ice conditions. The points made by the comment are mentioned in the EIS (Sections 8.6.1, 8.6.3, and 8.6.3.4). As shown on the new Table 8-8, in situ burning has been proposed as an oil spill response method for solid ice, broken ice, and open water conditions. In situ burning, used in conjunction with mechanical recovery techniques, would likely result in higher oil recovery. As stated in the "In Situ Burning" subsection of 8.6.1, burning remains a viable response even after 24 hours in the case of a continuous spill (blowout) or under ice spill (pipeline leak or rupture). These spill scenarios are situations where ignition of the oil is still possible after 24 hours either because fresh oil continues to be discharged or weathering/evaporation rates of the oil are slowed dramatically. More important than the 24-hour time window for implementation of in situ burning, oil characteristics and slick thickness are of primary concern in determining burnability. See changes to Section 8.6.1 and 8.6.3.4 for clarification of timing to initiate in situ burning.
F404-73	The difficulties, such as the comment identifies, expected in dealing with oil in broken ice conditions and the variability in potential oil recovery efficiencies (see new Table 8-8), are the major reasons for the approach to impact assessment used in Chapter 8 of the EIS. Oil spill impacts are evaluated assuming no response occurs.
F404-74	See response to comment F404-70 for an explanation of why this report was reviewed for consistency with Chapter 8, but was not included as part of the EIS. The S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" presents recovery effectiveness for different blowout oil spill scenarios. On page 4 of the Executive Summary in this report, it is shown that in some broken ice conditions, in situ burning may be a more efficient method than existing countermeasures. The Northstar ODPCP, ACS Technical Manuals, and above-referenced S.L. Ross et al. report are separate documents from the EIS which address oil spill response. These documents were reviewed and found to be consistent with the EIS. Chapter 8 of the EIS was intended to be a focal point for

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	discussions of the effects of oil spills on the physical, biological, and human environments. Section 8.6 addresses oil spill response activities and the available containment and cleanup methods in ice and broken ice conditions. Impacts from a large oil spill were evaluated in Section 8.7 with the assumption that no oil spill response occurs. A new table has been added to Chapter 8 of the EIS that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP and ACS Technical Manual, and conditions which reduce oil recovery efficiency. See Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled "Summary of Oil Spill Cleanup Limitations" for discussions of major limitations of cleanup methods.
F404-75	See response to comment F404-50 for a discussion on the effects of the bundled gas and oil pipelines on oil spill response. We do not agree that the EIS should describe a response to both pipelines rupturing at once. Should such a scenario be considered realistic, the state, as part of its ODPCP review process, would address adequacy of response capabilities. The EIS would then assess impacts of the planned response.
F404-76	See response to comment F404-72 for a discussion of in situ burning. We agree that visual leak detection of small chronic leaks during solid ice conditions by drilling holes through the ice could result in large volumes of oil being spilled. Table 8-5 has been revised to incorporate the shorter sampling period (30 days) specified in the ODPCP Addendum (September 1998) and total discharge of the pipeline volume. These chronic pipeline leak volumes represent worst case spills, although they are unlikely due to the limiting effects of seawater intrusion on total discharge volume and the probable operational response of pigging the pipeline once a leak is detected. See changes to Section 8.5.1 made in response to comment F302-7 for discussion of the visual pipeline inspection methods.
F404-77	We agree that fog and blowing snow could slow the rate of oil spill response. This statement has been included as a footnote in the new Table 8-8 added to the EIS as an operating limitation potentially present during any part of the year.
F404-78	Conditions limiting the use of in situ burning are summarized on the new Table 8-8. See changes to Section 8.6.2 for clarification of the sea and wind conditions under which in situ could be used. ADEC must assess the situation described in the comment in relation to state standards during the review process for the ODPCP. As indicated by DGC in response to comment F422-16, the state has the responsibility of resolving outstanding oil spill prevention and response issues before approving the Northstar ODPCP. It is inaccurate to conclude that in situ burning is the state's least preferred response option. It is also inaccurate to conclude that in situ burning is the only possible response available in broken ice conditions. Pages 8-44, 8-45, and 8-48 of the DEIS specify that in situ burning may be more effective in some broken ice conditions (this is substantiated by the summary table on page 4 of the Executive Summary in the S.L. Ross et al. June 1998 report). Mechanical containment and recovery methods would most likely be used in conjunction with in situ burning to maximize oil recovery.
F404-79	We disagree that the practicality and efficacy of in situ burning were ignored. Limitations to when this response method can be used are discussed in Sections 8.6.1, 8.6.2, and 8.6.3. Predicted burn efficiencies are discussed in Section 8.6.1 and are shown in the new Table 8-8. Impacts to air quality as a result of in situ burning are discussed in Section 8.7.1.2. The EIS states that this response technique would produce the greatest amount of air emissions of all potential response activities.
F404-80	Although darkness would hinder response activities, the ACS inventory includes generators and lights which would be available for use in the event of a winter spill response. Tactic L-7 of the ACS Technical Manual (June 1998) and Attachment A of the ODPCP Addendum (September 1998) present the reduction of effectiveness of oil spill response due to these factors. See changes to Section 8.6.2 for discussion of spill response in darkness. Section 8.7.3.6 of the EIS specifically addresses oil spill effects on the visual

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	and aesthetic resources. By definition, lower impacts to visual resources from an oil spill would be expected during the dark months of winter. Viewer sensitivity would be higher in the summer when more people are participating in subsistence or recreational activities.
F404-81	See response to comment F404-56 for a discussion on Traditional Knowledge applied in Chapter 8, and response to comment F404-57 for information on the appropriateness of statistical spill data used to estimate Northstar spill probabilities.
F404-82	The use of 1,000 barrels or greater as the volume for large spills was for consistency with spill size classifications of the MMS OCS spill statistics used to calculate Northstar oil spill probabilities. This spill size includes large blowout spills. The amount of environmental damage caused by an oil spill is not necessarily correlated with the volume of the spill. More important considerations are the timing and location of the spill, thus separate analyses of specific volumes or spill sources (blowout vs. pipeline) does not add value. Impacts from large oil spill were evaluated in Section 8.7 of the DEIS for the spill volumes associated with the more likely spill source, a pipeline leak or rupture. Impacts to migratory birds (sea ducks), invertebrates, coastal vegetation, and threatened and endangered species, polar bears, and bowhead whales from a large oil spill would be significant. The response planning standard volume of 177,900 barrels for a well blowout presented in the Northstar ODPCP (and Chapter 8 of the EIS) assumes that a 15,000 barrel of oil per day well continues to discharge oil for 15 days. This scenario was agreed upon by BPXA and ADEC for evaluation of oil spill cleanup capabilities in broken ice conditions. Worst case discharges are selected for scenario development in the ODPCP because Federal (OPA 1990) and State (18 AAC 75) regulations require an operator to demonstrate response capabilities to such incidents in prescribed time frames. MMS regulations (30 CFR 254.26, Oil Spill Response Plans for Outer Continental Shelf Facilities) cited in the comment specify that spill scenarios must show "how you will cope with the initial spill volume upon arrival at the scene and then support operations for a blowout lasting 30 days." 30 CFR 254.47, Determining the Volume of Oil of Your Worst Case Discharge Scenario, defines the worst case discharge volume as "the daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility." While response capabilities must be shown for 30 days, worst case discharge is a daily volume. It should also be noted that 30 CFR 254.53 allows for submission of a response plan developed under state requirements.
F404-83	Information on the effects of oil on polar bears and bowhead whales is described in Sections 6.5 and 6.9, respectively. See response to comment F404-96. We acknowledge the opinion that many spill impacts would not be minor. According to the definitions used in the EIS (Section 1.8), we believe the impact levels are assessed fairly. Additional analysis during preparation of the FEIS led to changes in impact level assessments for the Steller's eider, spectacled eider, and polar bears. See changes to Sections 6.5.2 and 6.9.2. As described in Chapter 1 of the EIS, Chapter 6 is where the physiological and behavioral effects of oil on biological resources is presented. Chapter 8 describes the population level impacts of a spill based on information presented in Chapter 6. Additionally, a more detailed discussion of the effects of oil on whales and marine mammals is presented in the Biological Assessment, Appendix B. This information was not repeated in its entirety in Chapters 6 and 8 to avoid redundancy. However, we have added additional cross-referencing to Appendix B to ensure the reader can find this information. See changes to Sections 6.9.1 and 8.7.2.7. Scientific information gained from studies of the *Exxon Valdez* oil spill is cited throughout Chapters 6 and 8 of the EIS. Sections 6.5.2.2 and 6.9.2.2 both discuss the effects of oil on marine mammals and reference several studies that were presented in the 1994 book by Dr. Tom Loughlin, "Marine Mammals and the *Exxon Valdez*."
F404-84	We disagree that the impacts to bowhead whales from an oil spill are inadequately evaluated in the EIS. Sections 6.9, 8.7.2.7, and Appendix B describe toxicity and physiological effects of oil on bowhead whales, as well as population level impacts. See response to comment F404-83 for discussion of the EIS

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	presentation of oil spill impacts on bowhead whales.
F404-84 (Cont.)	Note that Section 8.7.2.7 concludes that an oil spill could result in significant impacts to bowhead whales. See changes made to Section 8.7.2.7 to clarify that oil spill impacts on bowhead whales would be significant.
F404-85	It is incorrect to state that no pre-project sediment sampling was done, or that there is no available knowledge regarding the existing concentrations of metals and hydrocarbons of the project area's seafloor sediments. As is described in the DEIS, Table 5.3-2, Test Trench Marine Sediment Chemistry in the Project Area, and Figure 5.3-6, Surface Sediment Sample Locations, a number of borings were made by Woodward-Clyde in 1995, and samples collected to establish baseline values for these constituents. In addition, sediment sampling was also performed in 1996 by Montgomery Watson while the Pilot Offshore Trenching program was being conducted. This sediment sampling program yielded analytical results for the presence of Total Organic Carbon, various metals and Diesel Range Organics from samples taken at Trench Site A (in the Gwydyr Bay Lagoon) and Trench Site C (1 mile [1.6 km] offshore of Stump Island). See reference to study and data report in Section 5.3.4. As indicated in Section III of the NPDES Permit (Appendix O), sediment monitoring is required to address questions of toxicity, concentration, and/or persistence of contaminants discharged by the Northstar facilities.
F404-86	The DEIS does provide sediment chemistry for samples taken in and around the project area. These are summarized in Table 5.3-2 of the DEIS (sampling locations are provided on Figure 5.3-6). From Table 5.3-2, it is clear that the metals in sediment levels are very low (often non-detectable). As noted in Section 5.3.1.5, hydrocarbons found in Alaskan Beaufort Sea sediments are primarily naturally occurring compounds resulting from riverine and other onshore sources rather than from human activities. In particular, hydrocarbons found in nearshore and offshore sediments show little evidence of anthropogenic petroleum inputs. No drilling muds or cuttings would be discharged from the Northstar Project (these will be disposed of through the UIC well). Moreover, surface drainage will also be discharged down this well, further eliminating the possibility of discharging deck drainage that might have come in contact with such muds or cuttings. In addition, sediment monitoring for the NPDES Permit will be required. Such monitoring will involve tests for both hydrocarbons and metals often associated with oil and gas developments.
F404-87	We believe that the EIS appropriately recognizes these potential effects of oil on Steller's eiders. We see no reason to subject an endangered species to a study in order to verify that oil will effect them in a similar manner as other waterfowl.
F404-88	Our analysis of impacts on plankton and marine invertebrates is correct based on the impact level definitions (Section 1.8) used for this EIS. Death of organisms alone does not imply that impacts are significant.
F404-89	See changes made to Section 8.7.2.2 for discussion of sublethal impacts of oil to larval stages of fish.
F404-90	Effects to individuals are measurable but considered minor. Mortality of hundreds of individuals can be considered significant depending on the size of the population (i.e., spectacled eiders) (Sections 6.9.2.2 and 8.7.2.7).
F404-90 (Cont.)	See changes made to Section 8.7.2.2 as a result of response to comment F404-89 regarding genetic damage to fish. At present, there is considerable debate within the scientific community on whether the *Exxon Valdez* oil spill resulted in genetic mutations. Changes have been made to the FEIS text to incorporate the most current available data. See changes made in response to comments F302-5 and F302-116 to Section 8.7.2.3, where oil spill impacts to polar bears have been increased to "significant," and to Section 8.7.2.5, where unpublished USFWS seaduck population data has been incorporated.
F404-91	We believe that available literature on the *Exxon Valdez* oil spill was thoroughly reviewed and

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	incorporated as appropriate in the EIS. Where published data was found to be conflicting with other information, either the most scientifically conclusive data available was used in our evaluation of impacts for this EIS, or both views were presented for comparable studies.
F404-92	Section 8.7.2.7 of the EIS indicates that significant impacts to bowhead whales would occur if all of the low probability events occurred concurrently. This would require occurrence of a large oil spill, no oil spill response action, and transport of spilled oil to the Chukchi lead system (less than 1% chance of contact within 90 days; Figures 8-5a and 8-5b) during the limited number of days (23) each year whales are migrating through the lead system. See changes to Section 8.7.3.1 for clarification of oil spill impacts to subsistence harvesting of bowhead whales.
F404-93	Section 8.7.2.7 specifies that the impact of an oil spill on spectacled eiders would be significant. The oil spill impact analyses presented in Section 8.7 assume that an oil spill has occurred and no oil spill response is performed. The probability of an oil spill is discussed separately in Section 8.5.2. The impact analyses are presented separately from the oil spill probability estimates to avoid possible interpretation that an oil spill impact level should be reduced because the likelihood of the event was small. Unlike project related impacts from (planned) activities presented in Chapters 5, 6, and 7, oil spill impacts would result only if such an unplanned event occurred.
F404-94	We acknowledge your opinion that the potential impacts of a spill are too great.
F404-95	We believe we have used the best scientific information available, including Traditional Knowledge, in preparing assessments in both the EIS and the Biological Assessment. We agree that improvements can be made and have done so. For example, the new Table 8-8 provides information on oil spill cleanup limitations in offshore water and ice conditions. Revealing and assessing potential impacts in the EIS does not imply "a willingness to countenance these effects" by the federal agencies; it is simply what is required by NEPA. The EIS is not a decision document and discussion of its potential impacts does not mean an agency will approve the project, as proposed or with mitigation. See response to comment F404-54 for information on evaluation of spill response capabilities and the ODPCP.
F404-96	We disagree that impacts to the biological environment are inadequately evaluated in the EIS. Oil spill impacts on bowhead whales, polar bears, ringed and bearded seals, fish, marine invertebrates and plankton, birds, and terrestrial mammals are described in Chapter 6. In particular, Sections 6.5.2.2 and 6.9.2.2 present information from "Marine Mammals and the *Exxon Valdez*" by T.R. Loughlin. See response to comment F404-83.
F404-97	See response to comment F404-83 for discussion of the EIS presentation of oil spill impacts on whales and marine mammals.
F404-98	We disagree that the major scientific papers on toxic and thermoregulation impacts of oil on polar bears have not been cited. Potential effects of oil on polar bear thermoregulation are discussed in Section 6.5.2.2, with citations to scientific literature.
F404-99	The EIS presents more than just one paragraph on oil impacts to seals. The effects of oil on ringed seals are discussed in Section 6.5.2.2, and impacts of an oil spill to ringed seals are discussed in Section 8.7.2.3. The effects of oil on harbor seals in Prince William Sound as a result of the *Exxon Valdez* oil spill are discussed in Section 6.5.2.2, which cites authors "Frost et al., 1994 and Frost and Lowry, 1994."
F404-100	The potential attraction of polar bears to activity at Seal Island is discussed in Sections 6.5.2.2 and 9.8.2.2. Polar bears can either be attracted to or displaced by construction or other human activities at Seal Island in response to smells and/or noise from activities.
F404-101	We acknowledge your concern that warm-water discharges could result in open water areas that would attract polar bears and seals. Although discharges from Outfall 001 will be slightly warmer than ambient water, the flow rates and temperatures of these discharges are low enough to prevent the creation of open water areas near the outfall port during the ice season. Hence, discharges from the reconstructed Seal

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	Island should not generate conditions "that can attract polar bears to seals" (per comment). For additional data refer to Table 4 and Appendix B (Technical Computations) of the NPDES Permit Fact Sheet (Appendix G of the DEIS).
F404-102	It is true that there will likely be encounters with polar bears at the Northstar production facility. Given the level of contact with polar bears cited in the comment, and the fact that no bears have been killed in the last 25 years of oil field operation, with only one bear killed during exploration activity, the probability is extremely low that a polar bear would be killed in connection with Northstar operations. It is also true that the International Agreement on the Conservation of Polar Bears requires signatories to protect ecosystems of which polar bears are a part. Mechanisms are in place to avoid or minimize impacts of this project to polar bears and their habitat, including the Letter of Authorization process described in the comment, and polar bear interaction plans which may be required by agencies as a permit condition.
F404-103	We disagree that the number of polar bears impacted by development is underestimated. The reference to tens of bears potentially affected by an oil spill has been changed to "up to 30 bears". Because polar bears can travel great distances, a larger number of bears can be affected as they pass through an oil spill area over a period of time, even though their densities remain relatively low. Polar bears can concentrate in areas at certain times of the year, during which higher numbers would be susceptible to oil spill effects. New text has been added to indicate that 28 bears have been documented on Cross Island near a bowhead whale carcass in 1996. See Chapter 8, Section 8.7.2.3 for text changes.
F404-104	We agree that a climate change could have a negative effect on polar bears. However, the contribution of the Northstar Development Project to this potential effect would be extremely low. See response to comment F404-21.
F404-105	The criteria for significance was based on NEPA as stated in Section 1.8, and relates to both context and intensity and is not solely based on effects at the population level for the entire Beaufort Sea. Cumulative effects are discussed separately in Chapter 10.
F404-106	We acknowledge your comment regarding the biological definitions of negligible, minor, and significant for the various levels of impacts. The decision makers are presented with this information to assist in identifying the intensity of the impacts. By definition, the negligible criteria is an impact which is not measurable. While it acknowledges that there is a potential impact, the effect cannot be defined in terms of frequency, duration, scope, size, or intensity. With reference to the second point in the comment, the referenced statement in Section 1.8 specifies that significance criteria is identified for each individual analysis in resource Chapters 5 through 7.
F404-107	We disagree that the impact on the Central Arctic Herd has not been acknowledged in the DEIS. In Section 6.8.1.1, the shift in the calving area from the construction of the Milne Point Road is discussed, as is avoidance of oil field structures and areas within the oil field by the cow/calf segment of the herd. Avoidance of oil field structures can also interfere with access to insect relief and foraging areas. Blockage to free movement of caribou throughout portions of the oil fields due to congested facilities and low-elevation pipelines is discussed in Section 6.8.2.2. These are the main issues of the papers cited in the comment.
F404-108	We acknowledge your concern about impact to caribou from construction of pipelines in currently undeveloped tundra areas. However, habitat along Alternative 2 between E Pad and Point Storkersen or Alternative 3 from Point Storkersen to Point McIntyre, is not generally considered the "best" or "prime" summer range habitat for caribou, since it is within the cooler coastal fringe of their summer range. Caribou typically only use this area during mid-summer for short periods of time when they move to the coast to avoid insects. When the weather inland cools and insect intensity declines, caribou leave the coast to move back inland. The presence of an elevated pipeline along either the Alternative 2 or Alternative 3 route would not be expected to adversely affect caribou, as discussed in Section 6.8.2.2. Weekly helicopter pipeline inspection overflights along Alternatives 2 or 3 would be expected to cause temporary disturbance to any caribou in the area.
F404-109	This EIS applies the NEPA definition of "human environment." The topics listed in Section 7.1 (subsistence harvesting, cultural/archeological resources, land and water uses, socioeconomics, transportation, aesthetics, and recreation) identify the contents of the chapter, which covers a portion of

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	the human environment as defined by NEPA, which also includes all aspects of the natural environment.
F404-110	We disagree that the DEIS fails to address the issues of unavoidable adverse effects, short-term gain vs. long-term productivity, and irretrievable and irreversible impacts as required by NEPA. These subjects are addressed within each individual chapter under each topic section of the DEIS, and are highlighted in the summary sections. To make this more apparent to the reader, a brief recap of these subjects has been added to the summary information in Section 11.8.12. See changes to the text made as a result of response to comment F34-34.
F404-111	We acknowledge your comment about the level of impacts to caribou. See response to comment F404-108.
F404-112	The statement from Section 7.5.1.1 refers to impacts from planned project activities. An oil spill is an unplanned event and is, therefore, treated differently when identifying project impacts. As shown in the inset tables on Figures 8-4a and b, modeling predicts a less than 1% probability that an oil spill would contact NPRA or ANWR lands within 30 to 60 days. We do not consider this to be a "likely" event.
F404-113	We disagree that there is no evidence showing that at least some bowheads will tolerate noise. Taken in context, the statement made in Section 9.5.1.1 is the author's conclusion based on scientific literature reviewed, such as LGL and Greeneridge (1987). The cumulative effects of noise on bowheads whales is described in Section 10.5.7 of the EIS. This analysis is limited due to the absence of data to evaluate cumulative impacts. As the Biological Assessment was written as a document to be used by USFWS and NMFS for the drafting of their Biological Opinions, no changes were made to this document for the FEIS. All comments have been forwarded to these agencies for their consideration in drafting their Biological Opinions, which are included as Appendix M.
F404-114	Should the scheduled sea lift of modules be delayed and coincide with the fall migration of bowhead whales, the impacts to bowhead whales is expected to be minor because data suggests that few whales migrate close (within 10 miles [16 km]) to Seal Island. Such a delay in the sea lift would not change the impacts analysis already presented in the DEIS and Biological Assessment. Section 9.8.2.1 describes the expected bowhead responses to barge activity at Seal Island. The same would be true for vessel and barge activity associated with a spill cleanup during the fall bowhead migration. Few bowheads would be expected to be present close (within 10 miles [16 km]) to the island. This does not include icebreaking barge activity, which may or may not be used in a spill response.
F404-115	We agree with your concern regarding pile driving. Pile driving and hammering, as part of the island construction, do produce high levels of sound, with the sound generally characterized as short duration, rapid onset, and high peak pressure level. See Section 9.7.3 for revisions to the text. There is a possibility of schedule changes and, if the schedule slips to when bowheads are present, a greater degree of displacement will occur. The cooperating agencies are considering placing a restriction on these types of activities during the fall whale migration. See Section 11.10, Mitigation Measures.
F404-116	Given everything that is known about the expected types and levels of sounds produced by island drilling activities, sound propagation from islands into shallow water under local ambient noise conditions is expected to be detectable out to ranges of less than of a few miles. Under extreme conditions (loudest drilling level, best propagation, and lowest ambient noise), island drilling noise is estimated to be audible out to a range of 6.2 miles (10 km) (Richardson et al., 1995:127). Island drilling noises from Seal Island are not expected to result in a major impact to bowhead whales, given the expected low noise levels and the low proportion of the migration that occurs within a few miles of Seal Island. The distance of 11 miles referred to in the Biological Assessment is a misprint and should be 11 km (6.8 miles). With reference to the question on whether the agencies considered measuring drilling sound off Endicott Island, the answer is no because such data would not be very applicable to Northstar due to differences in sites and project design.

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	Changes were made to the text in Sections 9.5.1.1 and 9.8.2.2.
F404-117	We acknowledge your point on field measurements, the text has been revised in Section 9.5.1.1 to take into account the data from the Richardson et al. 1997 and 1998 reports. Also, the comment that further monitoring and measurement work needs to be done is a good one. Given that much of any prediction on noise levels as a function of range are site-specific, data must be collected relative to the Seal Island operations. These data would also be extremely valuable for future estimates of potential impacts.
F404-117 (Cont.)	There are several statements in this comment that are erroneous. First, the only evidence on the range of acoustic communication comes from the acoustic studies during the spring migration off Point Barrow, and these show only that countercalling occurs at ranges of 3 to 6 miles (4.8 to 9.6 km). Acoustic communication may, and probably does, occur at greater ranges, but there are no data to support this hypothesis. The data on bowhead hearing ability comes from a few bowhead and right whale histological samples as analyzed by Ketten (1993). These clearly indicate that right whales are adapted for low-frequency hearing, but do not provide any indication of low-frequency sensitivity. Second, most field measurements of noise have, in fact, been taken at ranges beyond 0.6 miles (1 km), not just within 0.6 miles (1 km). See Section 9.5.1.1 for changes to the text.
F404-118	It is true that under certain circumstances seismic impulse sounds have been detected at ranges of 100 miles (161 km), but these are extremely rare cases. Greene did collect data at ranges of 41 miles (66 km). Under these long range circumstances, the seismic pulse is no longer a pulse, but is dramatically dispersed in time and frequency so that it lasts 1 to 2 seconds and has a distinctive downward frequency sweep. The sound would arrive at a receiver from along multiple paths, making it essentially impossible to determine either the range or direction of the source. Empirical measurements at various distances from the noise activities as part of a mitigation program are discussed in Section 11.10.
F404-119	Section 9.8.2.1 describes construction noise impacts to bowheads whales, migratory birds, and subsistence. We agree that the number of helicopter trips for module installation during construction could result in a significant impact to common eiders and oldsquaws (See Chapters 6 and 9).
F404-120	It is unclear what the comment is agreeing with since we have not evaluated seismic exploration and exploratory drilling impacts in the EIS. There are no such activities planned at this point for the Northstar Project, thus an evaluation of the impacts cannot be done. We do believe it is appropriate to consider such activities under cumulative impacts, if they are likely or foreseeable.
F404-121	We acknowledge your concern about oil spill impacts on threatened and endangered species. The four species (bowhead whale, spectacled eider, Steller's eider, and delisted Arctic Peregrine falcon) evaluated in the EIS are the only threatened and endangered species that occur in the project area. Effects on threatened and endangered species found along tanker routes wll be fully considered in the Biological Opnion for this project (see Appendix M).
F404-122	Section 10.5.7 addresses the cumulative effects to the bowhead whale, spectacled eider, and Steller's eider. In this section we state that cumulative offshore activity associated with current and reasonably foreseeable future projects could represent a substantial increase in activity above current levels.
F404-123	We acknowledge your concerns about the western stock of the Steller sea lion and the Pacific coast salmonid species recently listed. Comments on the Biological Assessment have been forwarded to the USFWS and NMFS for consideration in drafting their Biological Opinions.
F404-124	We acknowledge your concern about potential tanker transportation impacts and oil spills on endangered species. Comments on the Biological Assessment have been forwarded to USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions. Clarifications were made to the text of the Executive Summary and Section 4.4.2.4 for consistency with the Biological Assessment.
F404-125	We acknowledge your concern about the baseline impact of tanker traffic to the west coast and Asia. Comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions.
F404-126	We acknowledge your concern about the shipment of oil and its potential impact on the southern sea otter. Because of the southern sea otter's small distribution and the low probability of a large spill from a tanker, the chance of an oil spill occurring where it would affect this species is low and can be

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	discounted. Therefore, it was concluded that the project is unlikely to adversely affect this species. Comments on the Biological Assessment have been forwarded to USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions.
F404-127	We disagree that the EIS downplays the significance of oil spills. The use of 1,000 barrels or greater as the volume for large spills was for consistency with spill size classifications of the MMS OCS spill statistics used to calculate Northstar oil spill probabilities. This spill size includes large spills such as those cited in the comment. We agree that smaller spills can also, in certain circumstances, result in substantial biological impacts.
F404-128	We disagree that North Slope production projections are not presented in this EIS. The purpose and need for the proposed action is described in Section 1.2. Section 3.3.2 describes the current rate of oil flow. Oil production (based on projected TAPS throughput volumes) is provided in Section 7.7.1.5 for the 15-year life of the project. These projections indicate a steady decline in production.
F404-129	The DEIS has incorporated Traditional Knowledge of the people of the North Slope throughout the document. Where available, Traditional Knowledge has been used to evaluate project alternatives, and it is incorporated into discussions of environmental consequences and referenced in Chapters 5 through 9 of the DEIS. Its presence in the EIS indicates that we have "listened to and used" Traditional Knowledge in our assessment. The conclusion that significant negative impacts on subsistence whaling activities are expected due to the Northstar Project is an example of seriously considering Traditional Knowledge in our assessments.
F404-130	Traditional Knowledge was used to evaluate the significance of potential, project-related impacts on bowhead whales, and was used to modify some project design features related to the offshore island. The EIS is not a decision document, but rather a compilation of information and analysis that addresses the environmental issues identified in scoping. The ROD documents will present each agency's decision on the Northstar Project and will describe the information it used to come to those decisions. Traditional Knowledge will almost certainly be an important component of that decision-making rationale.
F404-131	While the approach to Traditional Knowledge was focused on the Northstar Project and project area, it is a very comprehensive effort to incorporate Traditional Knowledge into preparation of the EIS. Chapter 2.0 provides details on the development, peer review, and execution of the methodology. Regarding the community of Kaktovik, a Traditional Knowledge collection trip was made to Kaktovik in June 1996; however, city leaders requested that we not talk to Whaling Captains and other knowledgeable individuals until terms could be reached for Kaktovik's participation. The city's proposal was not something that the cooperating agencies could authorize, and data was not collected in the community. The agencies requested that BPXA be briefed on the EIS Traditional Knowledge effort and, in the spirit of better understanding the potential operating environment, BPXA contributed a few questions. All questions and data collection categories were approved by the agencies, and there was no bias whatsoever. The agencies directed that BPXA be briefed on the Traditional Knowledge collected, again for the purpose of better understanding the projected impacts on the environment.
F404-132	We disagree with your comment that environmental concerns raised within the context of Traditional Knowledge were ignored. Traditional Knowledge was used extensively by the applicant in their design of the project and we have presented Traditional Knowledge throughout this EIS, including in the environmental consequences sections of Chapters 5 through 10. See text changes in Section 1.4.7 and new Table 1-3 that shows where Traditional Knowledge was specifically used in this EIS.
F404-133	We disagree that the EIS fails to address concerns about North Slope sources of air pollution. Existing characteristics and environmental consequences related to air quality can be found in Sections 5.4.1.3, 7.8.1.2, and 10.4.2. See response to comment F356-35.
F404-134	See response to comment F404-132.
F404-135	We agree that the EIS has indicated that should certain types of activities occur during the fall whale migration that cause an alteration, or result in behavioral changes that make hunting more difficult, there could be a significant impact on subsistence whaling. See Table 8-10.
F404-136	Chapter 10, Cumulative Impacts, has been rewritten in response to comments. For a discussion on global climate change, see response to comment F404-21 and Section 10.4.2.

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F404-137	We disagree that the cumulative impacts of oil development on bowhead whales are downplayed. The statement cited is referring to the potential bowhead avoidance response, and is related to subsistence hunting practices and not lethal effects to whales. Potential impacts to bowheads from oil spills are discussed separately from the discussion of cumulative impacts in Section 8.7.2.7 and in the Biological Assessment (Appendix B of the DEIS).
F404-138	We acknowledge your concern for the impacts to the bowhead migration from industrial noise. The statement cited in the DEIS is referring to the bowhead avoidance response as a result of industrial noise. This avoidance of the area around Seal Island is not expected to have any lethal effects to the bowheads. However, the avoidance would have an effect on the subsistence whale hunting practices because whales would be farther offshore and hunters would be less likely to be successful. As far as the impact of multiple deflections, Kuvlum and Hammerhead are within the migratory route of the bowhead whale on their fall migration, but these potential developments are farther offshore and in deeper water than Northstar. These prospects are also 75 miles (121 km) east of Northstar. The potential for deflection from these potential projects or the direction they would be deflected cannot easily be compared to the Northstar Project, which is in shallower water closer to shore. The distance between these potential developments and Northstar would also make any impact from multiple displacement less likely. However, the cumulative effect of regional increases in offshore oil and gas activity has been identified for bowhead whales. Seismic surveys have been identified as activities being more likely to cause deflections as a result of multiple disturbances than noise associated with operations.
F404-139	The contribution of the Northstar Project to the cumulative effects of oil development in the Beaufort Sea is relatively small. Seismic surveys associated with leases issued in recent and currently planned federal lease sales are considered potentially significant. However, seismic surveys are not part of the Northstar Project; therefore, the contribution from the Northstar Project to cumulative impacts on bowheads would be from noise from construction, drilling, operations, and vessel and aircraft activity.
F404-139 (Cont.)	It is possible for most individual project impacts to be considered minor. The intent of analyzing cumulative effects under NEPA is to consider impacts of individual projects which may be categorized as minor, but when added to other minor impacts (past, existing, and reasonably foreseeable future actions) could potentially be significant. This is what was done and reported in Chapter 10 of the EIS.
F404-140	We agree that further delineation of the Northstar reservoir could reveal more reserves, but these would likely be developed from Seal Island. The development of satellite fields would require separate NEPA documents. At this point, only known prospects can be evaluated. See Section 10.3 for the latest information available.
F404-141	BPXA submitted plans to the state to drill three wells in Pete's Wicked Reservoir-Gwydyr Bay after the release of the Northstar Project DEIS. However, this development is not associated with BPXA's proposed Northstar Project. This development was listed in Table 10-2 as a foreseeable future action (see Section 10.3). We have rewritten Chapter 10 and revised the tables in response to comments. Table 10-2 lists foreseeable future projects in the Northstar Project Cumulative Impact Area, and is no longer broken into onshore and offshore components. Gwydyr Bay and Pete's Wicked are listed in this table (Table 10-2).
F404-142	This technique is not proposed for the Northstar Project.
F404-143	The project the comment cites, Pete's Wicked Reservoir-Gwydyr Bay, is not associated with the Northstar Project, but is considered in the cumulative impacts analysis as a reasonably foreseeable future action. See Table 10-2. Also see response to comment F404-141 and F404-144.
F404-144	Three production wells have been proposed for Pete's Wicked Reservoir-Gwydyr Bay. This application was made after the Northstar DEIS was released. This project is not being permitted in association with the Northstar Project. See response to comment F404-141.
F404-145	The category of Reasonably Foreseeable Future Actions was further divided into five sub categories, as defined in Section 10.3.3. Future actions were classified and put into the most appropriate categories.

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F404-146	We agree that the Kuvlum and Hammerhead Units have been combined and some seismic activity is proposed for the near future; however, the combination of these units does not make a substantive change in the potential development of either prospect. We have revised the tables in Chapter 10. Table 10-2 lists foreseeable future projects in the Northstar Project Cumulative Impact Area. We no longer break out this category into onshore and offshore components. We have updated the Sandpiper Project to include that three delineation wells are planned for the year 2000 and a DPP has been submitted to MMS for processing.
F404-147	We agree, and ANWR has been deleted from our revised Table 10-2. Note that Chapter 10 has been rewritten in response to comments.
F404-148	We have rewritten Chapter 10 in response to comments, including the summary tables. We have expanded our discussion in Chapter 10 to include TAPS cumulative effects.
F404-149	Total freshwater use over the life of the project is not as useful a measure as "annual" freshwater use for analyzing impacts. Freshwater supplies would be renewed each year. The EIS does state that one likely freshwater choice is the lake at the Kuparuk Deadarm Mine site (Section 4.4.2.2), but does not infer that it is the only one that will be used. The Kuparuk Deadarm mine site is within 3 miles (4.8 km) of BPXA's proposed Northstar gravel mine location in the Kuparuk River Delta, and could be accessed by an ice road on the Kuparuk River. This lake is a deep source that is currently permitted by the State of Alaska for removal of up to 100 million gallons (378.5 million liters) of water per year. This source is replenished each year during breakup. The volume of freshwater required for ice roads is approximately 15% of the annual amount permitted for removal from this lake. In addition, several other permitted sources are available in the project area and may be used to minimize haul distances to desired locations. To limit lake drawdown to 6 inches (15.2 cm), a lake surface of 80 to 90 acres (32.4 to 36.4 hectares) is required. Withdrawals from multiple sources would result in a drop in lake levels on the order of a few inches.
F404-150	Table 5.4-7 provides actual emissions data based on stack measurements and/or actual throughputs, fuel use, etc. This information will be added to the table as a footnote in the FEIS.
F404-151	Figure ES-4 presents currently operating facilities. Liberty and Alpine are not yet operating. The facilities outside the Project Area are not essential to an overview of current facilities in the Project Area. Other nonproduction facilities (roads and pads) are also not essential for the purpose of this figure because the contribution of the Northstar Project to the overall oil field infrastructure is not a major issue.
F404-152	In response to comments, Chapter 10 has been revised.
F404-153	The text on cumulative effects in Table ES-14 has been misinterpreted. The statement referenced in Table ES-14, Human Environment/Land and Water Use Cumulative Impacts/Alternatives 4 and 5, is referring to the cumulative impact of access to subsistence hunting areas. The Prudhoe Bay oil fields are closed to hunting; therefore, the Northstar alternatives, which are adjacent to existing facilities, will not contribute to cumulative impacts to onshore subsistence hunting access and game availability. See Section 10.6.1, for discussion on cumulative impacts to subsistence.
F404-154	We acknowledge your concern that the Northstar Project will set a precedent for further offshore development. We agree this project will likely encourage more offshore development, assuming the geologic and economic factors are favorable. See Chapter 10 for a discussion of future development.
F404-155	The cumulative impacts discussion focuses on the incremental contribution of the Northstar Project and whether there is a potential for significant cumulative impacts. The contribution of the Northstar Project to onshore impacts is measurable, but very minor.
F404-156	See response to comment F404-21 and Section 10.4.2 for information on Northstar's impact to global warming.
F404-157	We acknowledge Greenpeace's concern about increased greenhouse gas emissions. For a discussion on greenhouse gases and climate change see response to comment F404-21 and Section 10.4.2. The

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	possibility, as speculated by Brooks et al., of CO_2 released from depressurized produced water will depend on the properties and processing of this water. However, this CO_2 will not be subsequently released to the atmosphere, but is rather reinjected. In particular, gas separators employed on the North Slope for processing produced water do not vent to the atmosphere.
F404-158	The question of climate change in the western Arctic is still a matter of scientific investigation, although data does suggest the Arctic is warming at a faster rate than other parts of the globe. However, the respective contributions of natural and human-generated causes remain unknown; natural climate variability, on the century-scale, appears to be an important contributor. Most global warming models currently in use require long time scales to generate impacts. In particular, the time scales required to project significant climate changes exceed the 15-year life of BPXA's proposed Northstar Project. Given the long time scales required for climate models to induce climate change, compared to the life of the proposed project, climate change is not anticipated to be problematic with respect to oil spills and leaks.
F404-159	The question of climate change in the western Arctic is still a matter of scientific investigation. There is some evidence that the Arctic is warming but the impacts to the area remain unknown. As noted in a recent paper by Overpeck et al. ("Arctic Environmental Changes of the Last Four Centuries"; Science, [276]:1251-1256, 14 Nov. 1997), century-scale Arctic climate variability is the norm with the primary implication being that today's Arctic cryosphere (glaciers and permafrost) are not at steady state. Moreover, the reconstruction of past environmental change in the Arctic suggests that natural variability is large in this region. The authors continue by stating "The complexity of natural and anthropogenic forcing highlights the probability that assumptions of climate stability, or efforts to simply extrapolate past patterns of change into the future, will ultimately fail to anticipate future Arctic climate change and its impact." The rate of glacier, permafrost, and ice cap shrinkage remains a topic of scientific investigation. It appears that many of the glaciers in the northern latitudes are receding. Century old records also suggest a reduction in the volume of permafrost. The respective contributions of natural and human generated causes remain unknown; as noted above, natural variability, on the century-scale, is large in the Arctic. To model such climate changes, climatologists employ global warming models. Most models in use require long time scales to generate impacts. In particular, the time scales required to project significant climate changes far exceed the 15-year life of the proposed Northstar Project. The comment questions the integrity of the island itself, the subsea pipeline, and the pipeline shore crossing (transition from subsea to above ground). All of these components are designed with significant safety factors. For example, the ability of the island itself to withstand storms on the magnitude of a 100-year event is due to the use of subsea berms, transition benches, and above-sea seawalls. The pipeline itself is buried well below the expected strudel scour depths (in addition, the pipeline is designed to withstand exposure due to strudel scour); the effects of any global warming on sea temperature over the project's life cannot impact subsea permafrost (such effects require very long time scales). The pipeline shore crossing design included extreme storm erosion events and subsidence (e.g., pipeline pigging for subsidence). Of equal importance, the infrastructure would be inspected on a routine basis and after extreme events. Hence, over the 15-year life of this project, global warming is not expected to impact the project's infrastructure.
F404-160	The comment mentions strudel scour to be of particular concern as related to the "to the melting of frozen water from rivers and therefore could be expected to occur with increasing intensity in the warming Arctic". While it is true that strudel scour is the product of river melt overflowing the sheet ice, the rivers that contribute to such scouring melt quickly. This river melting process lends to ice sheet breakup, which effectively ends strudel scouring. Hence, the effect of a warming Arctic, i.e. increased air and soil temperatures, on strudel scour is debatable, particularly given the relatively short life of the proposed project when compared to predictions of time required to warm the Arctic.
F404-161	The desire of the United States to reduce its reliance on foreign oil resources has long been stated, and implies both the development of domestic oil resources and sustainable alternate forms of energy, in addition to continued advancements in energy conservation measures. With the decline of most United

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	States oil fields (including the Alaskan North Slope), the development of Northstar is consistent with developing domestic oil resources for domestic use. As noted in Section 10.2.3 of the DEIS, the 1995 oil production rate of 1.45 million barrels/day from existing North Slope development is projected to decline to 0.944 million barrels/day by 2005, and to 0.292 million barrels/day by 2020. This decline will result in substantial available capacity in the TAPS as long as the system remains operational. The USDOI has suggested that TAPS would require extensive modification to continue operations past 2015 at the projected throughput of 0.384 million barrels/day. Unsatisfied capacity of TAPS translates into lost revenues for state, federal, and local governments. The gross state revenues, including revenues to the NSB, are projected to be $520 million over the 15-year life of the Northstar Project. Northstar is also projected to generate almost 3 million man-hours of employment, with a wage equivalent of approximately $70 million. The oil and gas industry is the largest contributor to Alaska's economy, with over half of each state dollar generated by taxes and royalties on North Slope crude oil. North Slope production has been in decline since 1991, resulting in a continued decline in oil revenues to the state and various local governments. This has had an important impact on the state economy, given that 50% of the State's General Fund (FY 1996) came from such revenues. Hence, Northstar would satisfy (in part) the continued economic viability of TAPS, generate additional employment in the state, and reduce the current rate of decline in state, local, and federal revenues associated with North Slope oil production. As noted in the Section 11.8.6 of the DEIS, none of these revenue and employment benefits would result from Alternative 1 - No Action. The comment states that "the domestic energy needs could be better served by BPXA investment in its solar business." This implies that the selection of Alternative 1 - No Action will direct BPXA funds from Northstar to the development of these other energy sources. While it is true that BP does pursue a substantial program of research and development in the area of alternative energy sources, the disapproval of Northstar does not imply such a redirection of resources. BP may, as a multinational corporation, use its monetary and professional resources on the pursuit of other oil development projects; it is also free to pursue the development of alternate energy resources. Such decisions remain with BP and its stockholders alone. For additional information on greenhouse gas emissions, see response to comment F404-21 and Section 10.4.2.
F404-162	This EIS is not a programmatic EIS. Agencies may decide to reference future Environmental Assessments/EISs where appropriate to the Northstar EIS depending on the proposed project and what similarities, if any, exist with Northstar. While it was a goal of the cooperating agencies to prepare an EIS that contained information applicable to future oil and gas projects, its principal focus was centered on the Northstar Development Project and not the Beaufort Sea as a whole. Options in Chapter 3 were never intended to be assessed for impacts. Chapter 3 only describes development options for the selection of appropriate project alternatives for specific sites (in this case, the Northstar Unit) which can then by analyzed for environmental impacts. For a discussion of the scope of this EIS, refer to Chapter 1.
F404-163	We disagree that the Corps and the cooperating agencies have failed in achieving this goal. It is one of several that the EIS has accomplished. The comment is correct that technologies new to the Alaskan Arctic are presented in this EIS. However, they are proven technologies that have been used elsewhere in the world or are clearly identified as "conceptual".
F404-164	The flow chart in Figures ES-5 and 4-5 was developed to illustrate the range of oil and gas development and production technologies that were evaluated to assess the applicability for use in the Alaska Beaufort Sea. For more specific information refer to Section 4.2.2.2 of the DEIS.
F404-165	See response to comment F404-164. This EIS examined alternate Northstar landfall locations and their

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	impacts in Section 3.4 of the Executive Summary and Sections 4.2.5 and 4.3 of the EIS.
F404-166	We disagree that the actual discussions held between the cooperating agencies and the applicant need to be included in the EIS. Section 4.4 summarizes the discussions which led to the identification of the five project alternatives. This same section also identifies the technological options considered by the applicant. The pace of exploration and development on the North Slope had no bearing on the process illustrated in Figure 4-5.
F404-167	Various bottom-founded structures, including CIDS, were evaluated for the Northstar Project as discussed in Chapter 4. The technical evaluation was performed by BPXA and reviewed by the cooperating agencies. The cooperating agencies performed the environmental evaluation. It was determined that gravel islands incorporate technology proven to withstand the forces of the arctic environment and this technology has been used in the Alaskan Beaufort Sea since the mid-1970s. The risks and impacts of other structures and/or project locations would be evaluated in terms of the site-specific factors.
F404-168	A comprehensive scientific literature review was conducted for this EIS. Specific references to the Endicott monitoring programs are included in Section 6.4 of the EIS.
F404-169	A causeway proposed for an area where water and fish movements are a concern would be unacceptable unless it has adequate breaching, particularly near the coastline, to allow water and fish movements. This concern would be evaluated on a site specific basis. This was the case in determining the alternatives available to transport oil and gas products from the Alaskan Beaufort Sea. As a result, it was determined that for both cost and environmental reasons burial beneath the seafloor was the best option.
F404-170	There are no plans to construct new dock facilities for this project due to the proximity of West Dock. Marine shipments of equipment and supplies will utilize existing facilities.
F404-171	We disagree that this EIS fails to take into account site-specific factors in determining potential environmental impacts for the proposed Northstar Project. We believe that the information contained in this EIS and the level of analysis undertaken for each alternative is thorough. See response to comment F404-162 for more information.
F404-172	At this time, we are not aware of any offshore reservoirs being considered for future oil production other than Northstar and Liberty. BPXA is planning to drill to Pete's Wicked reservoir below Gwydyr Bay; however, well locations will be onshore.
F404-173	This information is not relevant to this EIS. Section 3.2.1 - Oil and Gas Leasing Programs in the Alaskan Beaufort Sea, summarizes the state and federal lease programs. It would not be appropriate to show the lease blocks that received the highest bids on each sale as lease sales are highly speculative.
F404-174	We acknowledge your opinion that the EIS did not adequately address technological risks and environmental impacts. See response to comment F404-162 for a discussion of Northstar-specific development options.
F404-175	Rainfall data statistics for the Northstar Development's Seal Island are not available. Such statistics, if available, would be useful for estimating the rainfall the island would receive in a year, as requested by the comment. However, such an estimate is of little value when designing the deck and surface drainage components of the reconstructed island. The design of these components is driven by the magnitude and duration of severe storms, which can generate large amounts of deck and surface drainage over a short period that must then be disposed of by some means other than a marine discharge. There are no meteorological or hydrologic records for the island; this basic information was derived during the development of the DEIS using standard hydrologic techniques. This involved four stages of data manipulation and modeling, including determining the appropriate precipitation records to use, converting that data into a series for determining the magnitude of different storm recurrence intervals, determining the stormshed's hydrologic characteristics, and calculating the peak and total flow rates. A conservative approach was used throughout the process to arrive at a “worst case” storm. Admittedly, such an approach cannot precisely characterize Seal Island's meteorology, but it does provide a method for estimating storm strength above that expected to occur at Seal Island.

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	Two sets of rainfall data with sufficient time periods were available for the North Slope: from Barter Island and Barrow. The Barter Island data was determined to have greater magnitude storms and was found to be closer in rainfall amount to a limited data set from Resolution Island, located at the mouth of Prudhoe Bay, 16.9 miles (27.2 km) on the 121 degree radial (true north) from Seal Island. Barter Island data was collected for approximately 40 years, from 1949 through 1988. The Barter Island data available for analysis included the occurrence year, record storm amount, and record month's precipitation for each month of the year, as well as the monthly precipitation from 1959 through 1988. To synthesize the annual peak storm series, ratios between the record storms and record month's total rainfall were determined, then applied to each month from 1949 through 1988. This enabled an approximate determination of the peak annual storm for each year of record. It was found that, for Barter Island, there is very little difference between the greatest precipitation from snowfall, 2.25 inches (5.71 cm) and the greatest from rainfall (2.23 inches [5.66 cm]). As a result, it is justified to look at both snowfall and rainfall to conservatively determine the greatest precipitation total that the island's drainage system may be required to handle. The greatest precipitation month values for each year in the available record, the ratio that was applied, and the resulting estimated peak annual precipitation event was presented in Table B-7 of the DEIS Appendix G (National Pollutant Discharge Elimination System Fact Sheet). Using these data and a log Pearson Type III statistical distribution, the predicted storm for a 10-year reoccurrence interval is 1.336 inches (3.393 cm) of precipitation/2-hour period. The statistical parameters include a skew coefficient, G, of 0.539 derived from the data above. This data is shown in Figure B-3 of the DEIS Appendix G. From the Project Description (FEIS, Appendix A), Seal Island is divided into north and south drainages. The Soil Conservation Service's TR55 model is commonly used to analyze the hydrology for small urban watersheds. An interface for TR55 developed at the University of Central Florida was utilized (SMADA 6.0 for Windows). In TR55, the first hydrologic parameter to derive is a time of concentration for each watershed using the anticipated longest flow path and the storm magnitude being analyzed. Next, “initial abstractions” are derived, based on the surfaces and soils, in this case, gravel. An initial abstraction of 0.31 inches (0.78 cm) was assumed for the packed gravel surface of Seal Island. This means that the first
F404-175 (Cont.)	0.31 inches (0.78 cm) of the modeled rainfall would be held in storage in the void space of the gravel before runoff is generated. In addition, the TR55 method utilizes “curve numbers” to simulate the resistance and overall percentage of the rainfall that is expected to be infiltrated. Total and impervious areas are calculated from the watersheds' dimensions. The model uses this watershed and rainfall data, with extensively researched mathematical curves, to estimate the amount of runoff for the storm event and watershed. The curve number for packed gravel over a packed gravel base from the TR55 manual was used. The modeled predictions are summarized in the table below. Note that the data presented in this table is an overestimate of a severe storm event on Seal Island. **Drainage Terminal** / **Initial Abstraction (inches)** / **Peak Inflow (cfs)** / **24-hour Volume (cubic feet)** / **24-hour Volume (gallons)** / **2-hour Volume (gallons)** South: 0.31 / 0.45 / 5,331 / 39,879 / 19,800 North: 0.31 / 0.54 / 12,415 / 92,874 / 28,300 Notes: cfs = Cubic feet per second The flow rates on the table are substantial and would mandate a rather robust deck and surface drainage system to prevent a marine discharge of storm water. This is of particular concern should the island's working surface be contaminated. To reduce these computed flow rates due to a severe storm, additional data must be made available or the assumptions relaxed (e.g., increasing the estimated initial abstraction); the second approach is not recommended without additional research to support a relaxation of assumptions.
F404-176	To develop an effective monitoring program and establish effluent limitations, ambient water quality data

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	are required (as is correctly suggested by the comment). With the expected marine discharges being from Outfalls 001, 002, and 005 (see Appendix G of the DEIS), the following ambient water quality parameters are required: dissolved oxygen, total suspended solids, turbidity, pH (a measure of acidity), temperature, and salinity. In addition, oceanographic data on current direction and magnitude (average and maximum), pycnocline depth, and ice thickness must be available. Ambient concentrations of phosphate/silicate/ nitrogen/trace metal contents and hydrocarbon concentrations are also useful. Data on these parameters for the Beaufort Sea are available in sufficient detail to support the development of the discharge limitations for the above outfalls. For details on these pre-construction/production parameters and other oceanographic conditions, refer to Volume IV of the DEIS, Appendix G. The final permit does require pre-construction sediment sampling in order to further develop a sediment analysis baseline.
F404-177	The comment is correct in stating that adequate public oversight requires regular monitoring of the environment, including the water and sediment around the reconstructed Seal Island. The Final NPDES Permit (Appendix D) addresses this concern by a multicomponent process, including: 1. Effluent monitoring of Outfalls 001, 002, and 005; 2. Performance of Whole Effluent Toxicity tests; 3. Water monitoring; and 4. Sediment monitoring. The effluent monitoring component provides data collected on effluents from each of the three outfalls (001, 002, and 005). Part of this data is collected continuously, while other portions are collected periodically as grab samples. The Whole Effluent Toxicity tests assess the effects of collected effluents, in varying concentrations, on both finfish and sediment-dwelling organisms.
F404-177 (Cont.)	The water monitoring component examines water temperature, total suspended solids, total residual chlorine, biochemical oxygen demand, fecal coliform bacteria, pH, and salinity in the vicinity of the principal discharge port (Outfall 001) and at other points around the island. The above constituents were selected because they represent the possible pollutants from this outfall. In addition, ambient water temperature will also be monitored. The sediment monitoring component examines sediments near the island for ammonia, cadmium, total residual chlorine, chromium, manganese, mercury, nickel, vanadium, polynuclear aromatic hydrocarbons (PAH), and sulfides. Far-field sediment monitoring will be accomplished as a component of the Section 103 permit associated with the Northstar Development and pursuant to the Marine Protection, Research, and Sanctuaries Act of 1972 (MPRSA) for the transport of dredged materials for ocean disposal. Unlike the constituents sampled for in the water monitoring component, the above sediment constituents are not expected to be routinely discharged from Seal Island. However, they represent the type of pollutants that could be discharged by neglect or improper design from an oil production facility and could, thereafter, have an effect on sediment quality. In addition, the sediment monitoring component includes a benthic abundance and community structure study. All data collected and the subsequent analyses are reported to both the EPA and ADEC on a periodic basis. These governing agencies can require additional monitoring based on the results of any of the above monitoring components. There is no provision for “significantly large mixing zones around the island;” only one small mixing zone is needed (5 m in semiradius). The water monitoring program will collect water samples from the edge of this mixing zone to ensure water quality standards are complied with outside of this zone.
F404-178	While it is true that sedimentation from the island's reconstruction and from the dewatering outfall (005) will have negative impacts on marine life around the island, the durations of these impacts are expected to be short because these two activities are one-time events. The remaining and primary outfall (001) is not expected to generate sedimentation, nor is it expected to create open water near its discharge port during the ice season. As a result, this discharge is not expected to result in marine mammal harassment.
F404-179	During the comment period for the Draft NPDES Permit, BPXA submitted a letter to the EPA stating

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	their intention to eliminate Outfalls 003, 004 (North and South Deck Drainage Sump Effluent), and 006 (Seawater Treatment Plant Filter Backwash). Deck drainage will continue to be collected within the sump system, but the fluids will be pumped to the Class I industrial waste disposal well and not discharged through the outfalls as outlined in the NPDES Fact Sheet and Draft Permit. Outfall 006 has been eliminated altogether. Outfalls 001, 002, and 005 have not been eliminated and authorization to discharge from these outfalls, together with effluent limitations, monitoring, and other requirements, are contained in the final permit. The comment's reference to elimination of the discharge, storage, and reinjection suggest the comment was raising concern over adequate storage of fluids collected in the deck sumps. With the exception of snow removal, all requirements related to deck drainage (Outfalls 003 and 004) have been removed from the Final NPDES Permit (Appendix D), which does not authorize the discharge of deck drainage fluids under any circumstances. Fluids collected in the sump system are to be pumped to the Class I industrial waste disposal well for reinjection, with the exception of those determined to be hazardous. Any fluids not injectable, will be transported to an appropriate onshore disposal location. With regards to adequate storage of deck drainage should the Class I industrial waste disposal well be out of service, BPXA has outlined options that may be followed to contain the fluids (see August 27, 1998 letter to Mr. Robert Robichaud, EPA from Mr. Peter Hanley, BPXA, Northstar Development Project
F404-179 (Cont.)	Sump Water Storage, Disposal and Control Options). These options include: storage in the sumps; storage in the Well Clean Out Tank; storage in a vac truck; and storage in a barge or other storage available for liquids recovered from spill response activities, such as temporary tankage or bladders. The Northstar Project is required to have an approved ODPCP prior to commencement of operations. As part of that plan, the facility must demonstrate the ability to contain and recover 36,000 barrels of oil. This storage would be available for storage of liquids being routed to the 500-barrel Well Clean Out Tank via the sumps. The combined volume of the North and South sumps is 194 barrels. Should the Class I industrial waste disposal well be out of service during precipitation, the fluids collected in the sump would have to be contained for later injection, or transported off the island and disposed at another authorized facility. Except for snow removal, discharge of deck drainage to marine waters for the Northstar facility is not authorized by the NPDES Permit.
F404-180	The proposed injection will occur in permeable sandstones overlain by several impermeable shale barriers and well beneath all freshwater aquifers. This is a very favorable geologic setting for permanent wastewater disposal. It is, of course, impossible to assure absolutely that no injected material will escape the approved injection zone. The draft UIC permit, however, includes continuous pressure monitoring and periodic mechanical integrity testing which will, we believe, quickly reveal any such escapes. The proposed UIC permit also will require that injection cease immediately in any such event. It was a primary consideration in the drafting of the UIC permit to assure, insofar as we may, that no injected material will return to the surface.
F404-181	We disagree that the public process has been dramatically abbreviated due to the consolidation of the permitting process. The cooperating agencies entered into an agreement which results in managing their regulatory processes “in parallel” in order to increase administrative efficiency, avoid duplication, and increase cooperation.
F404-182	The public has had the opportunity to comment on the proposed project through scoping meetings, meetings in villages, public hearings, written testimony, and an extended public comment period (47 days longer than required by NEPA) for this DEIS. In addition, scoping reports were directly and individually sent to environmental groups following the meetings. The public has also had the opportunity to comment on the draft NPDES and UIC permits. The public will have another opportunity to comment on the FEIS (30-day public review period). Several agencies may present their respective “preferred alternatives” in the FEIS. The Corps, however, will wait until after the FEIS comment period is complete before determining its preferred alternative. See Section 11.9 of the FEIS for a discussion of the agencies' preferred alternative.

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F404-183	The public has had several opportunities to comment on the proposed project from scoping through an extended public comment review period for the DEIS. See response to comments F404-181 and F404-182 for further discussion of the public comment process and the cooperating agencies consolidated permitting process.
F404-184	The MMS carefully reviewed BPXA's proposed Northstar Final Project Description submitted for facilities in state waters for the proposed Northstar Project. The Project Description goes into considerable detail and meets the requirements under 30 CFR 250.204(a) [previously 30 CFR 250.34(a)] for an OCS DPP. The Project Description includes drilling wells into, and producing oil from, two OCS leases, and requires an approved DPP. Additional supporting information as appropriate [pursuant to 30 CFR 250.204(b)] was also provided by BPXA and incorporated directly into the Corps' DEIS for the Northstar Project. The MMS deemed the Project Description, in conjunction with the DEIS, as complete on June 1, 1998.
F404-184 (Cont.)	MMS's regulatory jurisdiction for reviewing and approving BPXA's project is limited to the drilling, completion, and operation of wells drilled on or into Federal OCS leases. Except for a few wells which will have bottom hole locations in federal acreage, all the surface facilities, including the gravel island, production and processing equipment, and pipeline are located on State of Alaska lands and are under the direct jurisdiction of the State of Alaska. The DEIS, the Project Description, and supporting information provide the information required under the DPP for the scope of activity within MMS's jurisdiction for the Northstar Project. The MMS will carefully analyze all of the information provided for the proposed Northstar Project, including the FEIS and all comments received on the DPP and FEIS in developing its ROD on the DPP. Project approval is a deliberative process, and the DEIS is one aspect of the procedural review process. No OCS action to approve, disapprove, or require modification to the DPP will be taken by the MMS until the FEIS is released. No OCS development and production activities can be conducted unless and until the DPP is approved, and the DPP (Project Description) has received coastal consistency concurrence by the State of Alaska.
F404-185	The MMS, by letter dated June 1, 1998, inserted into Appendix A and distributed with the Northstar DEIS, a request for comments on BPXA's Northstar Project Description (the DPP). Appendix A of the Northstar DEIS is BPXA's Final Project Description. Also, Volume I, page ES-14 contains a description of the EIS and Appendices, and states that Appendix A, the Project Description, also serves as the DPP for MMS's approval. The June 1, 1998, Federal Register Notice of Availability and public notice/information bulletin issued by the Corps, in conjunction with the distribution of the DEIS (which included the DPP [Project Description]) provided for sufficient and appropriate distribution and availability of the DPP (Project Description) and DEIS for state and public review pursuant to 30 CFR 250.204(g) and (j). These notices also specified that an ODPCP, as required by 30 CFR 254, was being submitted and processed pursuant to state requirements (see response to comment F404-14). The MMS will not and cannot take any action on the proposed DPP until the FEIS is published. The MMS has up to 60 days following release of the FEIS for the Northstar Project to take action on the proposed DPP pursuant to 30 CFR 250.204(l).
F404-186	We acknowledge your opinion that the Corps should not grant the Northstar permit. The Corps decision will include a public interest review.
F404-187	We agree that the EIS should include a discussion of human health risks associated with impacts from the Northstar Project on subsistence. Section 8.7.3.1 addresses impacts from perceived contamination of game and fish from an oil spill, and identifies the impact as potentially significant. Studies conducted after the *Exxon Valdez* oil spill documented both contamination of some resources and the social and psychological effects of fear of contaminated subsistence resources. See changes to Section 8.7.3 of the EIS which has now been expanded to more fully address this issue. Also see changes made to Section 1.4.7 from response to comment F421-3 regarding Environmental Justice. Additionally, Section 7.10 addressing Environmental Justice has been added.
F404-188	The scoping process for the EIS clearly identified North Slope community residents' concerns with dependence on subsistence resources and a healthy environment, and with the expansion of oil and gas

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	activities. The EIS has considered these concerns and potential impacts on subsistence activities, and economic and social characteristics. We wrote the EIS in a way so the providers of Traditional Knowledge could see how their information was used, and we provided opportunities for locals to meet and share Traditional Knowledge with the EIS team.
F404-189	Society faces psychological effects associated with change and uncertainty every day. Many of the concerns identified in the six "planning phase" categories identified in this letter were raised in the scoping process and had an influence on both the collection of Traditional Knowledge and the scope of analysis of environmental consequences. Concerns associated with subsistence related to biophysical/health systems, cultural systems, social systems, and psychological systems have been addressed in Section 7.3.3; concerns related to air quality and health have been addressed in Section 10.4.2.
F404-190	See response to comment F404-187 regarding concerns identified in the scoping process and where related environmental consequences have been addressed. The EIS does consider preproject impacts, but does not consider the lease sale impacts as part of the NEPA process. See response to comment F404-186.
F404-191	Under the OCS Land Act (OCSLA) of 1953 (67 Stat. 462), as amended (43 U.S.C. et seq. [1994]), the USDOI is required to manage the leasing, exploration, development, and production of oil and gas resources on the Federal OCS, and requires that the Secretary oversee the OCS oil and gas program and to balance orderly resource development with protection of the human, marine, and coastal environments, while simultaneously ensuring that the public receives an equitable return for these resources. The MMS is responsible for the mineral leasing of OCS lands and for the supervision of offshore operations after lease issuance. A lease gives the lessee the exclusive right and privilege to drill for, develop, and produce oil and gas resources on that lease, subject to existing laws and regulations. Once a lease is awarded, the MMS' Regional Supervisor for Field Operations is responsible for approving, supervising, and regulating operations conducted on the lease. We wish to reiterate that MMS' regulatory jurisdiction for reviewing and approving BPXA's Northstar Project is limited to the drilling, completion, and operation of wells drilled on or into Federal OCS leases. For the Northstar Project, except for a few wells which will have bottom hole locations in federal acreage, all the surface facilities, including the gravel island, production and processing equipment, and pipeline are located on state lands and subject to state jurisdiction. However, within MMS's jurisdiction, we will carefully analyze all of the information provided for Northstar, including the FEIS and comments received on the DPP and the FEIS. No OCS action to approve, disapprove, or require modification to the DPP will be taken by MMS until the FEIS is released and adopted by the MMS. The MMS will not and cannot take any action on a proposed DPP until that time. The MMS has up to 60 days following release of the FEIS and adoption for the Northstar Project to take action on the proposed DPP, pursuant to 250.204(l). No OCS development and production activities can be conducted unless and until a DPP is approved. The MMS cannot approve the DPP unless and until it has received coastal consistency concurrence by the State of Alaska.
F404-192	We acknowledge your concern about the unprecedented nature of the project's proposed use of subsea pipeline technology and the oil industry's ability to respond to an oil spill in arctic conditions. See response to comment F404-59 for a discussion of the oil spill probabilities estimated for Northstar. See response to comments F404-71 through F404-80 for information about oil spill response limitations.
F406-1	In a July 15, 1998 letter from NMFS to the Corps, NMFS acknowledged the receipt of the requested materials.
F406-2	In a July 15, 1998 letter from NMFS to the Corps, NMFS acknowledged the receipt of the requested materials.
F407-1	We acknowledge your comment on your ability to begin work on the effect of the Northstar Project on bowhead whales. We acknowledge your receipt of the requested information needed to begin formal consultation and prepare a biological opinion concerning the Northstar Project.
F408-1	We acknowledge your opposition to the project.

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F408-2	We acknowledge your opposition to the project. See response to comment F403-27 for a discussion on incorporation of Traditional Knowledge and the concern of the Inupiat people.
F408-3	We acknowledge your opposition to the project and your concern regarding the chance of an oil spill. Pipeline leak rate and spill probability are provided in EIS Sections 8.5.1 and 8.5.2, respectively.
F408-4	We acknowledge your concern about increased development on the North Slope. See response to comment F404-136.
F408-5	As is described in Chapter 3, particularly Sections 3.3.1 and 3.3.2, TAPS has been proposed for use under all development alternatives to carry any oil produced from Northstar. The EIS does not attempt to evaluate the system integrity or probable life of TAPS since its infrastructure is already fully in place.
F409-1	We acknowledge your support of the project.
F410-1	We acknowledge your support of the project.
F411-1	See revisions made to Section 8.4.1 for additional information about the long-term fate of oil spilled in the Beaufort Sea related to microbial degradation. Chemical data provided in Table 8-2 of the EIS was intended to provide general background information for those readers not familiar with crude oil properties. It should be noted that no analytes are "missing" as indicated by the comment. Rather, the toxic PAH compounds are represented by percentages listed for the appropriate carbon number. Toxicity of crude oil is a topic commonly discussed in relation to risk assessments. This complex area of study is too specific in scope to include in detail in the EIS. However, in response to the comment, additional physical and chemical characteristics for Prudhoe Bay crude oil in Table IV-3 of Jordan and Payne's (1980) "Fate and Weathering of Petroleum Spills in the Marine Environment" have been considered. This table indicates that approximately 25% by weight of Prudhoe Bay crude oil is aromatic compounds. Additional information provided by BPXA indicates a benzene percentage of 0.246% by weight of liquid Northstar crude oil (i.e., after removal of gas and water fractions). Benzene is a low molecular weight aromatic hydrocarbon that is more highly soluble in water (1,780 ppm) than most other aromatic hydrocarbons and has been discussed widely in risk assessment literature due to its classification as a carcinogen.
F411-2	Table 8-2 was not intended to be a detailed presentation of the chemical composition of Northstar crude oil. Rather, the major constituents of the produced fluids from the Northstar formation are listed in Table 8-2 to illustrate for the typical reader why 25% to 35% of the volume would be expected to volatize following a spill. The comment is correct in stating that processing of the produced fluids will change the percentage composition of the compounds listed. As described on page 3.3-2 of Appendix A, methane, ethane, and propane will be removed from the oil and butane and pentane are added to the crude
F411-2 (Cont.)	as part of the sales oil conditioning. However, the chemical characterization given in Table 8-2 is an approximation valid for a well blowout scenario, where oil, water, gas, and solids would be released into the environment prior to processing. It is not possible to provide a precise chemical characterization (including compounds representing less than 1% by volume) of the oil that would be flowing from Seal Island to TAPS, since this composition would vary over time according to wellhead crude oil compositions and process conditions.
F411-3	The table for response to comment F411-3 (page L - 139) provides more specific gas chromatographic analysis data for Northstar crude oil than that given in Table 8-2 of the EIS. The data was taken from a BPXA memo in response to NMFS request for full analytical description of Northstar crude oil. Solubility data of a variety of petroleum hydrocarbons is presented on page 41 of Jordan and Payne's (1980) "Fate and Weathering of Petroleum Spills in the Marine Environment." This table provides the following solubility data for low molecular weight hydrocarbons in distilled water: 1780 ppm Benzene, 515 ppm Toluene, 175 ppm o-Xylene, 152 ppm Ethylbenzene, 57 ppm 1,2,4-Trimethylbenzene, 50 ppm iso-Propylbenzene, and 31.3 ppm Naphthalene. The solubility of Naphthalene in seawater is given as 22 ppm. Heavier molecular weight hydrocarbons are decreasingly soluble in water. It should be noted that the more soluble benzene, toluene, ethylbenzen, and xylene compounds are also the more volatile,

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	meaning portions of these compounds would be lost to evaporation within a few hours or days of a surface spill. Subsea pipeline spills would have a lower evaporation rate, since toxic, light aromatic hydrocarbons do not evaporate when bound onto sediment particles (Horowitz et al., 1978:190).
F411-4	See revisions made to Section 8.4.1 for additional information about the long-term fate of oil spilled in the Beaufort Sea in terms of microbial degradation. See revisions made to Section 8.6.1 for additional information about natural/passive recovery of oil spills (i.e., biodegradation). See revisions described in response to comment F411-1.
F411-5	We acknowledge your comment regarding the importance of microbial activity in the long-term fate of oil following an oil spill from the Northstar Project. See response to comment F411-1.
F411-6	See revisions to Sections 8.4.1 and 8.6.1 made as a result of response to comments F411-1 and F411-4. Section 8.7.2.4 of the EIS specifies that impacts to invertebrates from an oil spill would be significant.
F411-7	See revisions to Sections 8.4.1 and 8.6.1 made as a result of response to comments F411-1 and F411-4. Microbe populations and the effect of low temperatures were discussed in these text additions. The suggestion made in the comment that the Beaufort Sea is analogous to the Antarctic environment in terms of lack of hydrocarbon exposure is refuted by the existence of naturally occurring oil seeps on the North Slope, as reported by NOAA (Becker and Manen, 1988: 21).
F411-8	See revisions to Section 8.7.2.1.
F411-9	Text has been added to Sections 4.4.2.4, 8.5.1, and 8.5.3 of the EIS to clarify proposed visual inspection methods for subsea pipeline leak detection in solid ice conditions. We agree that an offshore subsea pipeline leak would lead to contamination of marine sediments. See revisions to text in Chapter 8 indicating that toxic aromatic hydrocarbons would likely bind onto seafloor sediments, thus remaining in the water/sediment environment longer than in the blowout scenario where many of these hydrocarbons would be expected to evaporate. However, the statement made in Section
F411-9 (Cont.)	8.7.1.1 of the EIS about winter spills having a lower impact on sediments than summer spills was based on the areal extent of sediments contacted. Ice cover and subsequent slower currents in the winter would prevent spilled oil from being transported far from the release point. Discussion of the double-walled pipe option has been added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS.
F411-10	We acknowledge your opposition to the project.
F411-11	Under the terms of the lease with the state, BPXA would have a period of one year to remove equipment and facilities, and restore the site as directed by the state, unless an extension in time is granted. The cost of abandonment would depend on what was required at the time by the state and the Corps. The analysis for this project has shown that reuse of previously abandoned oil and gas facilities is a practical option. Therefore, it makes no sense to calculate abandonment costs at this time. In addition, see response to comment F356-44.
F411-12	We acknowledge your comment regarding ingestion of hydrocarbons by zooplankton. This would represent a very small fraction of the total amount of oil spilled into the environment.
F411-13	We acknowledge your comment regarding the effects of petroleum products on the productivity of phytoplankton.
F411-14	The likelihood of ice gouging and strudel scour having structural affects on the buried pipeline has been studied for the project area, and is not anticipated to result in pipeline failures during the life of the Northstar Project (see also response to comments F34-61 and F303-3). There has not been any comparable long-term experience with subsea pipelines in the Alaskan Beaufort Sea, though there are a wide variety of these installations throughout the world at other latitudes, both buried and lying upon the seafloor. A number of the challenges faced by pipelines operating under these warmer circumstances will be more difficult in the Arctic. The Northstar pipeline design has been based on conservative criteria and the application of all available data on the issues has been evaluated.

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F411-15	We acknowledge your comment regarding controversy in the scientific literature and the need to address this issue. Where debate exists within the scientific community, all available information has been reviewed and summarized in the EIS. Additional information has been included in the FEIS. For example, Section 8.4.1 presents information on the various scientific studies of microbial degradation rates of spilled oil and Section 8.7.2.2 indicates that data in literature pertaining to genetic damage to larval fish from oil spills is inconclusive.
F411-16	We acknowledge your opposition of the project and your support of Alternative 1 - No Action.
F412-1	We acknowledge your support of the project.
F413-1	The EIS does not extensively describe specific "standards" for the proposed offshore pipeline engineering and construction work because they have not been set by the State of Alaska, nor has the world had much experience to date with arctic subsea pipelines. Instead, the minimization of spills or leaks from the pipelines have been held as the paramount goal. The design studies prepared, under contract to BPXA, identified what structures and assemblies would be required to perform and survive under the extreme conditions faced in the Arctic. These studies were reviewed and approved by the State Pipeline Office.
F413-1 (Cont.)	The various studies have been cited in various portions of the EIS (in particular see Appendix E) and are available at several locations in Alaska for review by the general public, if desired. It would expand the EIS to an unmanageable size to restate the assumptions, parameters, and results of these engineering studies (see response to comments F34-61, F303-3, and F411-14).
F413-2	The suggestion made regarding reviewing the use of a double-walled pipe (pipe-in-pipe) for Northstar's proposed pipelines has been considered and is not as positive as the comment author has implied. See the new discussion on the double-walled pipe option in Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS. After some deliberation, it does not appear preferable, for this set of circumstances, to use double-walled pipe instead of implementing the proposed single thick-walled pipeline. The Colville River application being arranged for the Alpine Development project is different in technological and practical terms than the much longer, offshore Northstar pipeline application.
F413-3	We acknowledge your comment, although it is unclear what aspects of the risks from environmental effects were supposedly excluded from the project alternative evaluations. The conclusions of the engineering studies performed were stated simply and directly. Permafrost and subsidence are discussed in Section 5.3, in addition to shoreline erosion. The various sea ice questions are treated in Section 5.6. The ice gouging study referenced in the EIS (Ice Keel Protection, TN 410, Revision 3, INTEC, May 1998) does address the pressures on and structural response of the pipelines due to ice keel gouging. As is mentioned in response to comment F413-1, the EIS would become unwieldy and very difficult to review if each of the engineering and other scholarly documents used to develop it were fully included in the textual discussions. Shoreline design is addressed in response to comments F359-18 to F359-24.
F413-4	We acknowledge your concern regarding offshore drilling and development. Pages 21 and 22 of ADEC's August 5, 1998 "Preliminary Analysis of Oil Spill Response Capability in Broken Ice (to Support Request for Additional Information for Northstar Oil Spill Contingency Plan)" discusses drilling restrictions during broken ice conditions. Possible limitations of oil spill response due to broken ice conditions are described in Sections 8.6.1, 8.6.2, and 8.6.3 of the EIS. A new Table 8-8 has been added to the EIS, which summarizes weather/environmental conditions (including ice conditions) which could reduce oil recovery efficiency.
F413-5	Possible limitations of oil spill response due to broken ice conditions are described in Sections 8.6.1, 8.6.2, and 8.6.3. A new Table 8-8 has been added to the EIS, which summarizes weather/environmental conditions (including ice conditions) which could reduce oil recovery efficiency. See response to comment F404-72 for the discussion of timing to initiate in situ burning. The Northstar ODPCP, ACS Technical Manuals, and the S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" are separate documents from the EIS that address oil spill response. These documents were reviewed and found to be consistent with the EIS. Chapter 8 of the EIS was intended to be a focal point

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	for discussions of the effects of oil spills on the physical, biological, and human environments. Section 8.6 addresses oil spill response activities and available containment and cleanup methods in broken ice and ice conditions. Impacts from a large oil spill were evaluated in Section 8.7 with the assumption that no oil spill response occurs.
F413-6	As indicated by the DGC in comment F422-16, the State of Alaska has the responsibility of resolving outstanding oil spill prevention and response issues before approving the Northstar ODPCP. It is inaccurate to conclude that in situ burning is the state's least preferred response option. It is also inaccurate to conclude that in situ burning is the only possible response available in broken ice conditions. Sections 8.6.1, 8.6.2, and 8.6.3 of the EIS specify that in situ burning may be more effective than mechanical recovery in some broken ice conditions (this is substantiated by the summary table on page 4 of the Executive Summary in the S.L. Ross et al. report). Mechanical containment and recovery methods would most likely be used in conjunction with in situ burning to maximize oil recovery. See response to comment F404-72 for further discussion of in situ burning.
F413-7	Section 8.5.2 of the EIS has been revised to clarify why MMS OCS and CONCAWE spill statistics were used to calculate oil spill probabilities for Northstar. Extreme weather conditions cited in the comment are presented in Section 8.6 and the new Table 8.8 as factors that would limit oil spill cleanup efficiency, but have no effect on oil spill probability. Project design features that would aid in the prevention of an offshore pipeline oil spill, such as pipeline burial depth to avoid damage from ice gouges and strudel scour, are discussed in Section 8.5.3. See response to comment F302-100 for discussion of the oil spill trajectory model information used for Northstar
F413-8	NEPA does not require the inclusion of permits within the EIS. The UIC and NPDES Permits were included in this EIS for the purpose of allowing the permitting process for these documents to run parallel with the EIS process. The Northstar ODPCP and the S.L. Ross et al. report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)" have been reviewed and found to be consistent with Chapter 8 of the EIS. The most current information from the ODPCP was reviewed and used in development of Chapter 8 of the EIS. Chapter 8 of the EIS was intended to provide information for discussions of the effects of oil spills on the physical, biological, and human environments. Impacts from a large oil spill were evaluated in Section 8.7 with the assumption that no oil spill response occurs. A new table has been added to Chapter 8 of the EIS that summarizes weather/environmental conditions on the North Slope, spill response techniques presented in the Northstar ODPCP and ACS Technical Manual, and conditions which reduce oil recovery efficiency. See Sections 8.6.2 and 8.6.3 and the new Table 8-8 titled, "Summary of Oil Spill Cleanup Limitations" for discussions of major limitations of cleanup methods.
F413-9	We disagree with the claim that the direct, indirect, and cumulative impacts of action alternatives have not been identified, or that other significant impacts have not been adequately analyzed. All of the environmental issues identified through public scoping have been analyzed to the fullest extent possible. Oil spill dangers are addressed in Chapter 8; air pollution impacts are addressed in Section 5.4; discharges to the Beaufort Sea are addressed in Section 5.5, the NPDES Permit and Fact Sheet (Appendix O of the EIS; Appendix G of the DEIS), and the Ocean Discharge Criteria Evaluation (Appendix H); impacts to wildlife are addressed in Chapter 6; impacts to subsistence activities are addressed in Section 7.3; and cumulative impacts are addressed in Chapter 10.
F413-10	Chapter 10, Cumulative Impacts, has been rewritten in response to comments. A cumulative impact is the impact on the environment which results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions. We recognize that considerable oil development has occurred since 1968. However, conducting a cumulative impact analysis of all development since 1968 is outside the scope of this EIS.
F413-11	We acknowledge your comment regarding the use of Traditional Knowledge in the EIS. We have incorporated Traditional Knowledge throughout the EIS. See response to comment F413-12, text changes to Section 1.4.7, and Table 1.3.

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F413-12	Throughout this EIS process, we have made a considerable attempt to solicit and utilize Traditional Knowledge in evaluating the environmental effects of the Northstar Development Project. We recognized that under NEPA and Executive Order 12898, BPXA's proposed project will occur in an area where there exists a rather unique indigenous population with a subsistence culture closely tied to the environment. For these and other reasons, the cooperating agencies have held scoping meetings; conducted workshops; held public hearings; and conducted special meetings with whaling captains, village elders, and government leaders for the purpose of soliciting their views and to collect and integrate Traditional Knowledge into this EIS. Oral and written comments also have been presented to the agencies during the public comment period on the DEIS, which was extended 30 days beyond the original comment period. As a result, we are of the opinion that this EIS has set a new standard for incorporating Traditional Knowledge into NEPA analyses for the North Slope. See Table 1.3 for a listing of where Traditional Knowledge is integrated into this EIS.
F413-13	We acknowledge your concern about noise and bowhead whales. The effects of oil and noise on bowhead whales are described in Sections 8.7.2.7, 9.5.1.1, and 9.8.2.2 of the EIS. Given everything that is known about the expected types and levels of sounds produced by island drilling activities, sound propagation from islands into shallow water under local ambient noise conditions is expected to be detectable out to ranges of less than of a few miles. Under extreme conditions (loudest drilling level, best propagation, and lowest ambient noise), island drilling noise is estimated to be audible out to a range of 6.2 miles (10 km) (Richardson et al., 1995:127). Drilling noises from Seal Island are not expected to result in a major impact to bowhead whales, given the expected low noise levels and the low proportion of the migration that occurs within a few miles of Seal Island.
F413-14	The question of climate change in the western Arctic is still a matter of scientific investigation. Should it be shown that a global warming phenomena is/will create a "hot spot" in the Arctic, the impacts to the area remain unknown. As noted in a recent paper by Overpeck et. al. ("Arctic Environmental Changes of the Last Four Centuries", Science. (276):1251-1256, 14 Nov., 1997), century-scale arctic climate variability is the norm, with the primary implication being that today's arctic cryosphere (glaciers and permafrost) are not at steady state. Moreover, the reconstruction of past environmental change in the Arctic suggests that natural variability is large in this region. The authors continue by stating "The complexity of natural and anthropogenic forcing highlights the probability that assumptions of climate stability, or efforts to simply extrapolate past patterns of change into the future, will ultimately fail to anticipate future Arctic climate change and its impact". The rate of glacier, permafrost, and ice cap shrinkage remains under scientific investigation. It appears that many of the glaciers in the northern latitudes are receding. Century old records also suggest a reduction in the volume of permafrost. The respective contributions of natural and human generated causes remain unknown; as noted above, natural variability, on the century-scale, is large in the Arctic. The comment requests that "the Corps should analyze the potential contribution of greenhouse gas emissions from the anticipated oil development"; refer to response to comment F404-21 and Section 10.4.2.
F413-14 (Cont.)	The request that the Corps should consider the economic and environmental benefits that would result from the development of climate-friendly alternatives such as wind and solar power, although commendatory, is outside the scope of the EIS. Moreover, as noted in response to comment F404-161, the selection of Alternative 1 - No Action does not imply a redirection of BP resources from the proposed Northstar Project into the development of other alternative energy sources. In addition, it is certain that energy production and usage will be market driven, and that demand for oil and other fuels will be satisfied, whether by products from this project or elsewhere.
F413-15	As discussed in response to comment F413-14, the question of climate change in the western Arctic is still a matter of scientific investigation. In particular, the respective contributions of natural and human generated causes remain unknown; natural climate variability, on the century-scale, appears to be a important contributor. Most global warming models currently under investigation require long time scales to generate impacts. In particular, the time scales required to project discernable climate changes far exceed the 15-year life of the proposed Northstar Project.

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	The infrastructure referred to in the comment is assumed to be the island itself, the subsea pipeline, and the pipeline shore crossing (transition from subsea to aboveground). All of these components are designed with considerable safety factors. For example, the ability of the island itself to withstand storms on the magnitude of a 100-year event is due to the use of subsea berms, transition benches, and above-sea seawalls. The pipeline itself is buried well below the expected strudel scour depths (in addition, the pipeline is designed to withstand exposure due to strudel scour); the effects of any global warming on sea temperature over the project's life cannot impact subsea permafrost (such effects require very long time scales). The pipeline shore crossing design included extreme storm erosion events and subsidence (e.g., pipeline pigging for subsidence). Of equal importance, the infrastructure would be inspected on a routine basis and after extreme events. Hence, over the 15-year life of this project, global warming is not expected to impact the project's infrastructure.
F413-16	As discussed in response to comment F413-14, the question of climate change in the western Arctic is still a matter of scientific investigation. In particular, the respective contributions of natural and human generated causes remain unknown; natural climate variability, on the century-scale, appears to be a important contributor. Most global warming models currently in use require long time scales to generate impacts. In particular, the time scales required to project discernable climate changes far exceed the 15-year life of the proposed Northstar Project. Given the long time scales required for climate models to induce climate change compared to the life of the proposed project, climate change is not anticipated to be problematic with respect to oil spills and leaks. Refer to response to comment F413-15 for remarks on regional storms and project infrastructure. Impacts, if any, of global warming on the movement of sea ice are considered nondetrimental to the project because of reduced ice loads on structures.
F413-17	We acknowledge your opposition to Alternative 2 and that you agree with the cooperating agencies that Alternative 5 is "environmentally preferred." You are incorrect, however, that state regulations require pipe-in-pipe design for leak detection.
F413-18	The state will be addressing this standard in its consistency analysis.
F413-19	We disagree that we have not addressed the limitations of oil spill response. Refer to Section 8.6.2, Spill Response Limitations, for a discussion of limitations regarding open water, solid ice, and broken ice conditions. Also, a new Table 8-8 has been added to the EIS to summarize major limitations of oil cleanup methods. The suggested project operation restriction of shutting down the pipeline as a measure to reduce the probability of spills when cleanup would be difficult is a potential mitigation measure under active consideration by the cooperating agencies (Section 11.10.2).
F413-20	We acknowledge your support of Alternative 1 - No Action. See Section 8.5 of the EIS for a discussion of the oil spill probability calculations for Northstar and Section 8.7 for a description of potential impacts should an oil spill occur.
F414-1	We acknowledge your support of the project.
F415-1	We acknowledge your support of the project.
F416-1	We acknowledge your opposition to offshore drilling.
F416-2	We acknowledge your concern about oil spills and noise. We have analyzed both of these impacts extensively in the EIS. See Chapters 8 and 9.
F416-3	Section 8.6 outlines available methods for oil spill response, including containment and cleanup methods, spill response limitations, and response activities for environmental settings. Specific information, such as equipment and procedures on oil spill cleanup are presented in BPXA's (June 1998) document, "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska."
F417-1	We acknowledge your support of the project.

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F418-1	We acknowledge your support of the project.
F419-1	We acknowledge your support of the project.
F420-1	We acknowledge the historic NSB opposition to offshore oil and gas development, and that the NSB's greatest concerns are, and always have been, noise and oil spill impacts. The EIS has been structured, in part, in acknowledgment of those primary concerns, with separate oil spill and noise chapters (Chapters 8 and 9, respectively).
F420-2	Chapters 7 and 8 of the EIS present a good faith attempt to fully describe the potential effects of an oil spill on the Inupiat subsistence lifestyle.
F420-3	We acknowledge your request for additional time to review the Northstar ODPCP. After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F420-4	We acknowledge the NSB's disagreement with the DEIS choice of Alternative 5 as environmentally preferable. Please refer to Chapter 4 for revised text describing the assumptions and analyses which support selection of environmentally and agency preferred alternatives. Also, see revised text in Chapter 4 describing the erection of new VSMs to support placement of pipelines associated with Alternative 5.
F420-5	The Northstar Project will use a slope protection system consisting of a combination of concrete matting and an underlying layer of geotextile fabric, sheetpile, and a subsea gravel berm. The system has been designed to withstand predicted 100-year ice, wave, storm, and other environmental forces.
F420-6	See response to comments F356-44 and F411-11 for more information. BPXA will be required to develop a Northstar Abandonment Plan when the reservoir is depleted. Such a requirement is stated as a federal lease sale stipulation (see Appendix D). The Abandonment Plan will require approval by the Corps, MMS, and ADNR before implementation. The plan will include an assessment of the abandonment activities and there will be opportunities for public review and comment. It is difficult at this time to estimate costs or determine the technology to be used, since research on these options is still underway. Abandonment options are presented in Section 4.4.2.7.
F420-7	See revisions to Section 7.5.
F420-8	See response to comment F404-54.
F420-9	Recommendations such as these will be considered by the Corps, other cooperating federal agencies, the State of Alaska, and the NSB as stipulations in their permitting of the project. Your recommendations for mitigation will be considered by the cooperating agencies. See Chapter 11 for the new section on mitigation measures (Section 11.10).
F420-10	Oil impacts to polar bears were presented in DEIS Section 6.5.2.2, page 6.5-15, last paragraph. Oritsland et al. (1981), Hurst et al. (1982) and Derocher and Stirling (1991) are cited as sources. The impacts of oil on harbor seals from the *Exxon Valdez* oil spill are discussed in DEIS Section 6.5.2.2, page 6.5-15, second paragraph and the studies cited include Frost et al. (1994) and Frost and Lowry (1994), both papers from Loughlin (1994). Sea otters do not occur within the area considered for the Northstar EIS. However, sea otter data was presented in the Biological Assessment of potential Northstar Project impacts on marine mammals (Appendix B, DEIS). Detail on the potential effects of oil on bowhead whales was also presented in DEIS Appendix B, Section 6.2.1.1, page 6-7. It will be made clear in the text of the EIS (Section 1.7) that in many cases where data on marine mammal species and/or oil spill impact data on marine mammal species is lacking, we have extrapolated available knowledge on related species to our analysis in an attempt to develop reasonable conclusions on potential oil spill effects in the project area.
F420-11	This sentence referenced in the Executive Summary is a general summary of some of the major adverse effects of an offshore oil spill and the ingestion of oiled prey was considered a major effect for polar bears. More details on the effects of oil on polar bears, including ingestion through grooming are

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	presented in Section 6.5.2.2. Oritsland et al. (1981), Engelhardt (1981), Hurst et al. (1982), Lentfer (1990) and Derocher and Stirling (1991) are cited as sources in this section. Also see the new section on polar bears in Chapter 6. It was not appropriate to cite these sources in Section 8.7.2.3, given the context of the discussion.
F420-12	It was not the intent of the EIS to imply that the Traditional Knowledge gathering effort associated with the project was an "initial" undertaking that would be continued as a project by the cooperating agencies. Rather, it is hoped that the expanded effort made here in this EIS will serve as a precedent for the cooperating agencies, and all other agencies, to continue to improve Traditional Knowledge efforts on future projects. It is further hoped that the Northstar Project Traditional Knowledge Database will ultimately be transferred to some appropriate North Slope entity for maintenance and expansion as additional relevant hearing transcripts and other materials become available. To date, the database has been made available to the Barrow Arctic Science Consortium under a contract with the MMS.
F420-13	The sources of Traditional Knowledge referenced in Chapter 2 and Table 2-1 were those available, through libraries, MMS, and the NSB, to the EIS team at the time that chapters for the PDEIS were being prepared. Since preparation of those chapters, additional testimony containing Traditional Knowledge, such as that provided during Lease Sale 170 hearings, became available. Where additional information relevant to the Northstar Project EIS was obtained from public hearings, this information was incorporated into the EIS. Also see Table 1-3 which details usage of Traditional Knowledge in the EIS.
F420-14	In DEIS Section 6.4.1, the second paragraph states that fish resources have been previously reviewed in other documents and these studies have been included by reference. All the literature was reviewed, though only the most appropriate references for the points being made in the text were cited. There is no need to reference all studies conducted in the area.
F420-15	We agree that the lagoon habitat is important to juvenile and adult fish and that the warmer waters are important to their invertebrate prey species. The reference gives an example of the "typical" warmer temperatures in the lagoons and is not meant to infer that higher temperatures do not occur. Text has been added to Section 6.4.1 for clarification.
F420-16	We acknowledge your comment about the citation. The Gallaway and Britch (1983) citation is the original work conducted for the Endicott Development in summer of 1982 under contract with SOHIO Alaska Petroleum Company.
F420-17	We acknowledge your comment regarding species expected to benefit from the flooded mine sites. We have added these species to the text. See revised Section 6.4.2.2
F420-18	We acknowledge your comment regarding the similarities between trenching and natural ice gouging. See Section 6.4.2.2 for new text.
F420-19	We agree that this section should be expanded to include king eider information. See Section 6.7.1.3 for new text. Also see response to comments F302-42 and F302-116 for additional information.
F420-20	While the black guillemot colony is outside the Northstar Project area (about 100 miles [161 km] west), a major oil spill could reach this area and adversely affect these birds. We have revised Section 6.7.2.2 to indicate this possibility.
F420-21	Section 8.7.2 was intended to present a general overview of oil spill impacts on the biological environment. A more detailed examination of oil spill effects is presented in Chapter 6 for each species category. Refer to the Environmental Consequences Sections 6.2.6.2, 6.3.2.2, 6.4.2.2, 6.5.2.2, 6.6.2.2, 6.7.2.2, 6.8.2.2, and 6.9.2.2 for the requested information.
F420-22	We agree that this section was confusing. We have revised Section 8.7.2.1 for clarity.
F420-23	We agree that clarification on plankton impacts is needed. See Section 8.7.2.1 for revised text.
F420-24	We agree that this paragraph is confusing and we have revised the last sentence for clarity. See Section 8.7.2.1 for the revised text.
F420-25	We agree that such an implication is inappropriate and it was not our intent. The referenced study was on adult pink salmon. The sentence was edited for clarity. See Section 8.7.2.2 for revised text.

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F420-26	The impact to fish from oil spills was determined to be minor as defined in Section 1.8. While individual members of a species may be adversely affected, overall impacts to the population will likely be minor. The data collected on migrating salmon in the Martin (1990) study showed that adult pink salmon could detect extremely low concentrations of oil and they found an alternate route. However, juveniles may be unable to avoid oil. In some scenarios, oil may be so widespread that all fish have difficulty avoiding it. In such scenarios, high mortality of individual fish could result, but due to the population structure of most species (where sexually mature fish produce many eggs to ensure that the adults are replaced), oil spill impacts will remain minor. To clarify this point, we have revised Section 8.7.2.2 accordingly.
F420-27	We agree that one or more year classes could be eliminated by a large spill if oil entered Simpson Lagoon. Oil impact to the fish species in and around the Colville Delta at various times of year is discussed in Section 8.7.2.2.
F420-28	We acknowledge your concern over possible contamination of subsistence foods from oil spills. We have highlighted this issue in Section 8.7.3.1 and have listed the fear of contamination as a significant indirect impact in Table 8-9.
F420-29	The *Exxon Valdez* studies on effects on marine mammals were not ignored. Individual papers in the book edited by Loughlin were cited rather than the entire book. The studies on harbor seals cited in Chapter 6.5 (Frost et al., 1994, and Frost and Lowry, 1994) have conclusively demonstrated the toxic effects of oil.
F420-30	The suggested alternative citation is for a "summary and conclusion" chapter in a book that focused on marine mammal impacts resulting from the *Exxon Valdez* oil spill. We are of the opinion that Geraci and Smith (1977:402) is a better reference, since it specifically addresses inhalation of petroleum vapors and ringed seals.
F420-31	This conclusion is a finding of the MMS through analysis of the data and professional judgement and is from a published FEIS. This is a valid conclusion but the citation is incorrect. See revisions to Section 8.7.2.3. The EIS in question was prepared by the MMS for Lease Sale 170. The authors of that statement cited a number of papers which provided pertinent data on the probability of oil spill occurrence and contact to the lead system during the spring (May - June) period when beluga whales are expected to be in the area. The MMS authors drew their conclusions on potential oil spill effects on beluga whales based on their synthesis of available information. We have similarly reviewed these data and agree with the MMS that oil would not have long lasting sublethal effects. Also, we did not intend to downplay impacts. Rather than cite Loughlin (1994), we chose instead to cite the papers included in the book when appropriate in this EIS.
F420-32	We chose not to cite the Dahlheim and Matkin (1994) study because its results are inconclusive. See response to comment F32-4 for a discussion of killer whale mortality.
F420-33	We agree that there have been some observations relating to the avoidance of oil by cetacean species; however, none of the species cited occur in the project area on a regular basis. This reference was cited in the Biological Assessment (Appendix B) in regard to the bowhead whale. It is stated in Section 8.7.2.3 that beluga whales could be contacted by an oil spill into ice leads during the whales' spring migration. Beluga whales would be restricted to the open ice leads and would have no choice but to swim through oil contaminated waters. It is believed that they will avoid oil, if possible, but may have few options during the spring migration period. The reference to this paper was added to Section 6.5.2.2 in regard to the beluga whale.
F420-34	The sea otter does not inhabit the project area and, therefore, was not discussed. Oil impacts to the southern sea otter are presented in the Biological Assessment, Appendix B. We agree that, in the event of limited species-specific data or regional data, it is appropriate to utilize other marine mammal data which may provide some indication as to potential oil spill impacts. We have added a new paragraph at the end of Section 8.7.2.3 to address this issue.
F420-35	The effects of an oil spill and oil on seals are described in Section 6.5.2.2. We agree that additional

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	discussion would improve this section. See Section 6.5.2.2 for the new text.
F420-36	Impacts of oil on seals are discussed in Section 6.5.2.2. The section is a summary of the literature. Refer to the cited sources for additional details.
F420-37	The discussion referred to on page 8-59 of the DEIS is about plankton and marine invertebrates (marine environment), whereas the text on page 8-63 of the DEIS pertains to coastal (terrestrial) invertebrates.
F420-38	A discussion of the effect of oil on birds can be found in Section 6.7.2.2. Table 6.7-3 analyzes the potential impacts of the four project action alternatives. For additional discussion of the potential population level oil spill impacts to birds see Section 8.7.2.5.
F420-39	The reference is to birds residing in the marine waters during the summer months in contrast to birds flying over the area. The text has been edited for clarification. See revisions to Section 8.7.2.5 and Table 8-1.
F420-40	A reference for the data presented in the second sentence of the second paragraph on page 8-64 in the DEIS is Divoky, 1984:431. The text reference was not to Table 8-4b, but to Figure 8-4b. We have made revisions to the text in Section 8.7.2.5.
F420-41	The text is not referring to individuals (see Section 6.7.7.2) and correctly states that the impact on birds at the population level from an onshore oil spill would be minor, as defined in Section 1.8.
F420-42	We agree that the discussion of impacts to birds from oil spill response activities should be modified. See revisions to Section 8.7.2.5.
F420-43	The degree to which Arctic fox and grizzly bears are oiled does have an effect on their thermoregulation. Text in Section 8.7.2.6 has been revised to incorporate this important point.
F420-44	See revisions to Section 8.7.2.6 for clarification of minor impacts to foxes.
F420-45	See response to comment F302-119 and changes to Section 8.7.2.6.
F420-46	We agree that such a statement is inappropriate and we have deleted it from Section 8.7.2.6. Also, please note that this chapter discusses the likely impacts of an oil spill on biological resources at the population level. At this level, even if individual grizzly bears experience some mortality, the impact on the population as a whole on the North Slope will be negligible.
F420-47	The sentence in question was deleted in Section 8.7.2.6. See response to comment F400-7.
F420-48	We agree that this paragraph was misleading. We have clarified this paragraph by revising and deleting text. See revisions to Section 8.7.2.6.
F420-49	The discussion on bowheads and oil does not need to be repeated in both the EIS and the Biological Assessment (Appendix B). It is intended to be cross-referenced. The Northstar DEIS used the excellent discussions regarding toxicity of spilled oil in the book "Marine Mammal and the *Exxon Valdez* oil spill" (Loughlin, 1994) by citing several of the individual papers in both the EIS and the Biological Assessment. Also, see Section 6.9.2.2 for discussion of the impacts of oil on individual bowhead whales.
F420-50	The effect of oil on bowhead whales is described in Section 6.9 and references the work by Harvey and Dahlheim (1994). It acknowledges that serious impacts to bowhead whales could occur as a result of an oil spill (also refer to Appendix B of the DEIS).
F420-51	See Section 9.4 for revised text incorporating more recent seismic noise data. The report "Marine Mammal and Acoustical Monitoring of BPXA's Seismic Program in the Alaskan Beaufort Sea, 1997" was edited by John Richardson. The individual chapters in this report were cited separately in the EIS.
F420-52	We agree that this data should be added to the text. See revised Section 9.4.
F420-53	The report "Marine Mammal and Acoustical Monitoring of BPXA's Seismic Program in the Alaskan Beaufort Sea, 1997" was edited by John Richardson. The individual chapters in this report are cited separately in the EIS. See Section 9.5.1.1 for changes to the text.
F420-54	We use data from the 1997 seismic monitoring program. See response to comment F420-53.

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F420-55	We agree that this sentence in the DEIS had conflicting conclusions. It has been rewritten to address this issue. See Section 9.5.1.1 for changes to text.
F420-56	We have clarified this sentence and mentioned that whales will avoid moving through noisy areas. See Section 9.5.1.1 for revised text.
F420-57	We agree that the second paragraph on page 9-13 of the DEIS could be misleading. See Section 9.5.1.1 for new text.
F420-58	See Section 9.5.1.1 for revised text.
F420-59	We agree that adding text referencing the 1997 open water seismic program would be useful. See Section 9.5.1.1 for changes to the text.
F420-60	See Section 9.5.1.1 for changes to the text.
F420-61	The new text added to Section 9.5.1.1 replaces text on page 9-16 of the DEIS and clarifies and updates information that was presented in the 1998 report, "Marine Mammal and Acoustical Monitoring of BPXA's Seismic Program in the Alaskan Beaufort Sea, 1997." See Section 9.5.1.1 for changes to the text.
F420-62	See Section 9.8.2.1 for revisions to the text.
F420-63	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The edits suggested by the comment have been incorporated into Section 9.5.1.1 of the EIS.
F420-64	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The edits suggested by the comment have been incorporated into Section 9.5.1.1 of the EIS.
F420-65	Comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies as they draft their Biological Opinions (Appendix M). The text referred to in this comment does not appear in Section 9.5.1.1 of the EIS in the same detail as in the Biological Assessment of the DEIS. Although changes were made to Section 9.5.1.1 of the EIS, this discussion does not require the level of detail that the comment suggested. The Biological Assessment is a more technical document than the EIS, and it is not appropriate to include all the information presented in the Biological Assessment within the EIS.
F420-66	Comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies as they draft their Biological Opinions (Appendix M). The text referred to by the comment is not included in the EIS. However, the Richardson et al. (1998) report was reviewed and is referenced by changes made in Section 9.5.1.1 of the EIS. While the suggestions that the comment offered are points well taken, it is important to note that the Biological Assessment is intended to be a more technical document. Therefore, it is not appropriate to include all of the information presented in the Biological Assessment in the EIS.
F420-67	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). Information from the Richardson (1998) study was incorporated into Section 9.5.1.1. See revisions to this section of the EIS.
F420-68	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The text referred to by the comment is not included in the EIS; however, the results of the Richardson et al. (1998) report were incorporated into Section 9.5.1.1 of the EIS.
F420-69	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The text referred to by the comment is not included in the EIS; however, the results of the Richardson et al. (1998) report were incorporated into Section 9.5.1.1 of the EIS.
F420-70	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The text referred to by

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	the comment is not included in the EIS; however, the Richardson et al. (1998) report was reviewed and is referenced by changes made in Section 9.5.1.1 of the EIS.
F420-71	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The text in question was clarified in the EIS. See changes to Section 9.5.1.1 of the EIS.
F420-72	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The reference to Henk and Mullan (1996) was incorporated into Section 6.9.3 of the EIS.
F420-73	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The citations by Dubielzig and Aguirre (1981), Haldiman et al. (1982), and Haldiman (1986) were incorporated into Sections 6.9.2.2 and 6.9.3 of the EIS. See changes to these sections.
F420-74	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The citations for Zhu (1997) and (1998) were incorporated into Sections 6.9.2.2 and 6.9.3 of the EIS.
F420-75	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). See response to comment F420-32.
F420-76	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The text in question by the comment does not appear in the EIS. Therefore, no changes were made to that document. However, it should be noted that this same discussion in Section 8.7.2.1 correctly references the Lease Sale 170 FEIS.
—	Note: Comments on the DEIS were provided by the Inupiat Community of the Arctic Slope (ICAS); responses to these comments are given below in F420-77 through F420-85.
F420-77	We recognize that the subsistence culture is more important than money. It would not be possible or appropriate to estimate costs, in dollar value, of potential impacts to subsistence activities and associated social and cultural impacts. These impacts are addressed in Section 7.3.
F420-78	Oil spill cleanup -- Oil spill cleanup during times when the ice pack is in would be similar to cleanup during broken ice, which is discussed in Section 8.6.2. Broken ice constrains the use of containment and recovery response techniques and limits the use of mechanical equipment. However, in situ burning is one of the alternatives for dealing with oil spills under these conditions. Evaporation -- The only conditions in which there would be no evaporation would be for an oil spill under the ice. In these conditions, the viscosity of the oil would be higher which, in turn, would affect the rate of spreading (Section 8.4). The toxicity of the oil would also be greater because the lighter fractions are generally more harmful. Spill migration -- The mean under-ice water circulation is discussed in Section 5.5.1.3. Currents have been found to be very low during the period of ice cover and spill migration under the ice is not expected to extend far from the leak. Oil would still float to the under surface of the ice and become encapsulated. In open water conditions, higher current speeds are expected during surges or extreme tidal events, which would be expected to increase the spread of the oil.
F420-78 (Cont.)	Oil spill depth and plume configuration -- See Section 8.4.3 which presents data from the Oil Spill Risk Analysis. Terminology -- The comment is not specific as to which definitions and terminology are inaccurate. A glossary is included in the EIS. Allocation of restoration costs -- Allocation of restoration costs for an oil spill is out of scope for the Northstar EIS, primarily because this would be determined based on the actual damages, circumstances

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	of the spill, and whether the damages from a spill could be restored. Impact of location of pack ice on wells -- All of the wells on Seal Island will be engineered to withstand actions of the pack ice, such as ice override. During an extreme event, there is potential of damage to well heads but this is remote (Section 5.6.2.2). Shear zone -- The shear zone is much farther offshore than Seal Island and no pipeline segment would be located in the shear zone. Seal Island lies within the landfast zone. Ice ride up -- This issue is addressed in Section 5.6.2.2. Ice override has been considered in the engineering of the pipeline landfalls and the facilities have been set back 110 ft (33.5 m) to account for this potential on Alternatives 2, 3, and 4 and it is unlikely that ice override would ever extend beyond this distance. Landfall for Alternative 5, on West Dock Causeway, does not have a 110 ft (33.5 m) setback, but the presence of the causeway would act to prevent large ice movements. There is a potential during extreme ice event that ice could ride up and cause substantial damage to this installation. Potential impacts to Arctic Ocean ecology -- This issue is outside the scope of this EIS and project area. The geographic scope of this EIS is much smaller. Section 8.7.2 presents the impacts to the biological environment, which is understood to include the primary ecological components found in the project area, as well as some of those in the Arctic Ocean.
F420-79	Spill response limitations are discussed in Section 8.6.2 of the EIS. The S.L. Ross report "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice" is also available. It has been reviewed, along with the Northstar ODPCP, and found to be consistent with Chapter 8 of the EIS.
F420-80	Impacts to the subsistence and Inupiat culture are addressed in Sections 7.2 and 7.3 of the EIS. The scoping process for the EIS determined that the North Slope communities potentially directly affected by the proposed project are Nuiqsut, Barrow, and Kaktovik. These communities were consulted as part of the scoping process. Additionally, community offices, officials, and several residents of coastal Chukchi Sea communities received notices and newsletters regarding the Northstar Project during the EIS scoping and development process. Regarding effects on migrating resources, see response to comment F403-9.
F420-81	See response to comment F420-77.
F420-82	See response to comment F420-77.
F420-83	See response to comment F420-77. Potential mitigation measures were identified by the agencies for inclusion in the FEIS (Section 11.10). Each agency will determine what mitigation measures to include in their final decision on the project as well as on the permit stipulations. It is likely that project impacts on subsistence resources, among other issues, will be considered by the agencies in the decision-making process.
F420-84	As part of the approvals required for the Northstar Project, BPXA will be required to 1) have an ODPCP approved by ADEC, 2) have a Spill Prevention and Containment Plan approved by the EPA, and 3) have a finding of consistency with the provisions of the ACMP and the NSB Coastal Management Program.
F420-85	We acknowledge that the Inupiat Community of the Arctic Slope will not support offshore development until a thorough study is conducted on under ice oil containment and removal.
F421-1	At first glance, a jacketed, bundled pipeline appears to offer environmental advantages over a single, thick-walled pipeline design. On closer examination, however, these perceived advantages are outweighed by the structural design compromises, increased corrosion potential, and the increased complexity of installation and repair. New text on double-walled buried pipelines has been added in Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS.
F421-2	We disagree that elements of the Northstar ODPCP should be identified and evaluated in the EIS. The cooperating agencies have agreed that a review of the applicant's spill plan in the EIS was not appropriate because of the independent review conducted by the state and federal agencies. A review in the EIS is also not possible because the ODPCP is still a draft document. Spill prevention and response

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	in the EIS (Chapter 8) includes: (1) identification of likely and proposed prevention, leak detection, and response techniques; (2) discussion and prediction of how design techniques can decrease the probability of spills; (3) discussion of how proposed leak detection would limit the volume of the spill; (4) identification of impacts from response and cleanup activities; and (5) identification of impacts from a maximum volume spill to which no response is made due to weather or other conditions. Much of this discussion is based on the most current information available coming out of spill plan discussions between the applicant and the state. The expectation is that changes to the ODPCP will be within the scope of options discussed in this EIS, and will improve prevention and leak detection, thus decreasing environmental impacts.
F421-3	The DEIS did not fully summarize the extent of the agencies' attempts to include North Slope residents in various phases of this project. In response to this comment, we have expanded Section 1.4.7 to more fully summarize these discussions and describe the steps taken by the agencies to comply with Executive Order 12898. We have also made revisions to Chapter 2 (Traditional Knowledge) and have highlighted Environmental Justice issues when responding to public comments (Appendix L). During the public comment period, the lead agency provided additional time for public review of the DEIS in response to requests for an extension. Public hearings and other meetings were also held in all native communities likely to be affected by this project. Twice, public meetings (one public scoping and one public hearing) were rescheduled in respect of the village's wishes and to ensure full community participation.
F421-4	A new discussion on the double-wall pipe option has been added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS.
F421-5	The comment's recommendation to evaluate procedural restrictions for project operations is acknowledged and is being considered as part of the agencies' decision-making and permitting processes. The suggested approach of shutting down the pipeline during broken ice conditions as a measure to reduce the probability of spills when spill response would be difficult is a potential mitigation measure under active consideration by the cooperating agencies (Section 11.10.2).
F421-6	Methodology for obtaining Traditional Knowledge from the Inupiat has been presented in Chapter 2 of the EIS. Traditional Knowledge has been incorporated into the affected environment sections of Chapters 5 through 9. Native issues and concerns related to oil and gas development and informed views related
F421-6 (Cont.)	to the potential impacts of the proposed project were incorporated into discussions of environmental consequences. Observations regarding project design, construction, and operation characteristics also were incorporated into the environmental consequences sections in each chapter. Traditional Knowledge was extensively used by the applicant in project design. Native observations on the physical environment, such as current movement, ice flow, ice gouging depths, ice pile-up, and island over-ride, were used by the applicant's engineers when designing the island and subsea pipeline. Native concerns over visual impacts and broken sandbags resulted in the applicant's decision to use neutral colors on production structures and concrete armor plating to protect the island from ice, storm surges, and erosion. Traditional Knowledge on movement of fish, marine mammals, birds, and other wildlife was used to better understand the potential impacts of construction, production, and maintenance activities on these species. Local observations concerning noise on whale and seal behavior was extensively used to more fully understand the potential impacts on these animals and subsequent implications on subsistence hunting. Traditional Knowledge continues to be used in decisions related to environmental assessment and project design. During the public comment period, information provided by Inupiats reinforced earlier observations and, in some cases, provided new information. For example, during the Nuiqsut hearing the agencies learned that, in some circumstances, open water exists under the ice in the Colville River Delta, suggesting that an oil spill at Seal Island during winter could infiltrate this nearshore area. Traditional Knowledge, as well as western science, will be used by the agencies when they make their final decision on their preferred alternative. Should the Northstar Development Project be approved by the respective agencies, Traditional Knowledge will influence any mitigation measures required by the agencies.

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	As a result of this and other comments, we have expanded the explanation of how Traditional Knowledge was incorporated into the EIS. See Section 1.4.7, Table 1.3, and Section 2.7 for changes to text.
F421-7	The ball mill will be operated intermittently, as needed, to crush drill cuttings prior to disposal into the injection well. The schedule for operations is not known at this time. The noise associated with the ball mill was considered as part of the multi-source, industrial noise associated with drilling activities on Seal Island. Drill waste disposal has been added to the list of noise sources from Seal Island. See revisions to Section 9.7.4. Also see Section 11.10, Mitigation Measures.
F421-8	It is correct that there are likely additive effects from noise generated by several activities taking place simultaneously. In Section 9.3, we mention that most environmental noise includes a conglomeration of noise from distant sources that create a relatively steady background noise. Section 9.4 also discusses the role ambient noise has on determining the effect of a project-specific noise. For the North Slope, ambient noise includes manmade industrial noise produced by the Prudhoe Bay industrial complex. Our analysis then focuses the reader on specific types of project noise and the effects on the environment, since it is with these noise types that environmental data exist. Given the availability of data, we believe our presentation of noise effects is acceptable in Chapter 9. Please note that the cumulative and additive effects of project noise are described in Section 10.8. Similarly, cumulative noise impacts to the bowhead whale also are addressed in Section 10.5.7. Section 11.10 presents potential mitigation measures, including a noise monitoring program to collect noise data. Such data could be used in the future to determine this project's noise signature and to further alleviate noise impacts of this project.
F421-9	We agree that this EIS is structured a little differently than other EISs; however, we are of the opinion that it fully meets the intent of NEPA and CEQ regulations. All agencies have some latitude on how to organize an EIS. In this case, the agencies chose a format that accomplished several objectives: (1) Present Traditional Knowledge and western science in an objective manner, without drawing conclusions as to which information is better; the reader and the decision-maker are able to draw their own conclusions. (2) As a result of scoping, the chapters were organized to focus the reader's attention to the big issues (oil spills and noise). (3) We relied heavily on appendices (Project Description, Biological Assessment, Draft NPDES Permit) that were prepared for the Northstar Project. Such information, when coupled with the EIS, provides the reader with much more information than would otherwise be included in the EIS. (4) Recognizing that the proposed project incorporates new ideas to oil development on the North Slope, considerably more information and analyses were purposely incorporated than usual in an EIS. (5) To minimize redundancy, chapters and appendices have been cross-referenced whenever possible. (6) The EIS was organized in a manner to make it more responsive to local requests. Section 1.4.7 provides a description of agency efforts to include North Slope residents in preparation of the EIS, steps taken to comply with Executive Order 12989 on Environmental Justice, and use of Traditional Knowledge in the EIS. Table 1.3 provides a "road map" of where Environmental Justice and Traditional Knowledge have been addressed in the EIS.
F421-10	The referenced sections in Chapters 5 through 11 have been re-examined to eliminate inconsistencies. New text has been added in Sections 5.1, 6.1, and 7.1 that discusses the criteria used to determine whether an impact is significant for a particular resource.
F422-1	We acknowledge your support of Alternative 2.
F422-2	We acknowledge your support of Alternative 2 as the Environmentally Preferred Alternative because of the belief that it reduces the probability of oil spills.

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F422-3	We acknowledge your disagreement with the selection of Alternative 5 as the Environmentally Preferred Alternative.
F422-4	For regulatory permit actions, the Corps takes an independent position whether to issue or deny a particular application until the full public review is complete. The EIS is not a decision document and the filing of the FEIS is not to be considered a decision on a permit application. The decision on the permit by the Corps cannot occur until after the 30-day public comment period on the FEIS is complete (see Section 11.9.1.1). The Corps' determination of its preferred alternative will be presented in the ROD.
F422-5	We acknowledge your support of Alternative 2 and your recommendation that the cooperating agencies select this alternative as the Agency Preferred Alternative.
F422-6	We acknowledge your comment that the State Pipeline Office is conducting a thorough engineering review of the pipeline design for Alternative 2 to ensure it will withstand arctic conditions.
F422-7	We acknowledge your preference of Alternative 2 over Alternative 5 for the reason that Alternative 2 has 33% less buried pipeline in the seafloor.
F422-8	The EIS recognizes the fact that the pipe racks running from West Dock cannot accommodate another pipeline. Section 4.4.5.1 and Table 4-25 describe how new VSMs would have to be placed along the existing pipeline structures running south from West Dock.
F422-9	We acknowledge your comment that although the onshore portion of Alternative 2 would traverse a relatively undisturbed area, the area is surrounded by existing oil and gas development and infrastructure.
F422-10	We acknowledge your preference of Alternative 2 because it involves the shortest subsea pipeline. We also acknowledge your opinion that the marine portion of the pipeline should be kept to the shortest length possible to minimize the probability of an oil spill.
F422-11	The BPXA pipeline shorefall design (for Alternatives 2 and 3) seems adequate to withstand anticipated shore erosion for the life of the Northstar oil field (see page 5.3-45 of the DEIS). Periodic maintenance should assure that the shorefall zone remains in satisfactory condition, without undue erosion. It is incorrect to state that the shorefall trench backfill will be native material. As is shown in Figure ES-17 of the DEIS, the pipeline trench will be backfilled with select (non-frost susceptible) granular soil material to at least 3 ft (0.9 m) below the bottom of the pipelines. The exposed portion of the trench, above the normal waterline, will be covered with native materials and seeded to encourage the growth of common tundra grasses and an appearance much like the adjacent, undisturbed shore area. It is correct to assume that the shorefall area will be monitored, and any localized erosion replaced in order to stabilize the crossing location. Increased efforts would be made if erosion reduces the distance from shore to the pipelines' vertical risers to as little as 50 ft (15.2 m).
F422-12	Site-specific boring data has been collected to evaluate the soils likely to be exposed by the subsea trenching proposed for the offshore portions of Alternatives 2 and 3 (pages 5.3-42 and 43 of the DEIS). Similar information has been applied to the alignments for Alternatives 4 and 5 from nearby seabed soils data. The thaw settlement predicted for each of these alignments has been accommodated as part of the formal engineering studies of the pipelines' structural design. As is mentioned in the comment, periodic longitudinal pigging inspections will help to assess the pipeline's vertical movements and resultant subsidence or uplift imposed strains. This should confirm whether or not the pipelines are performing as designed.
F422-13	We disagree that the EIS fails to consider recent relevant data, or that it ignores the value of the competent and substantial engineering design efforts made to date. The pipeline burial design is properly conservative, and does not vary the burial depths unnecessarily. Using the design parameters and procedures established in the BPXA project description (Appendix A) proves that Alternative 5's risk due to ice gouging is not elevated compared with Alternatives 2 or 3,

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	because of the depth and alignment of the additional trenching proposed for those alternatives. See response to comment F402-11.
F422-14	As mentioned in the comment, all of the offshore pipeline route alternatives are subject to the potential for strudel scours. Figure 5.6-8 has been amended in the FEIS to better depict the location of the various proposed build-alternative alignments with relation to the density of strudel scours per mile of track line. This has led us to alter the DEIS's conclusion that Alternatives 4 and 5 would have lesser impacts due to the relative risks of strudel scour. See response to comment F34-16.
F422-15	The reuse of gravel materials from existing airstrips, pads, and roads is generally workable, although these materials are at times unsuitable due to either excessive fines (which makes them frost-susceptible and structurally unstable) or an accumulation of hydrocarbon staining and contamination. Where feasible, previously mined gravel should be re-used, such as the potential for demolition and use of the gravel currently incorporated into the Kuparuk River State No. 1 exploration site's airstrip and pad (see response to comment F302-17). The relative cost for these retrieved cubic yards of gravel materials would be higher than for pit-run, newly mined gravels; but the total cost of both development/cleanup efforts, and the total environmental impacts attributable to such gravel use would be less than the likely results from not accomplishing this reuse by diverting the gravels to this nearby new project.
F422-16	We agree that ADEC's analysis and the state's responsibility for final approval of the Northstar ODPCP should be referenced in the EIS. See changes made in Section 8.6 of the EIS.
F422-17	We acknowledge your comment that the state is investigating methods of detection that could provide faster detection, better resolution, and accurate location of leaks.
F422-18	See changes to Table ES-2.
F422-19	See Section 3.2 for changes to text.
F422-20	There is presently a North Slope wide (principally ARCO and BPXA) waste management guidance document nearing completion. This document will address waste disposal and reuse options on the North Slope. The procedures for waste management at Northstar will be consistent with this document. This document was not available for review prior to completion of this FEIS.
F422-21	See Section 1.4.8 for changes.
F422-22	See Section 4.4.2.4 for changes to text.
F422-23	See Sections 7.5.2.2 and 7.5.1.1 for changes to text.
F423-1	We acknowledge your opposition to the project.
F423-2	We acknowledge your concern about global warming. See response to comment F404-21 and Section 10.4.2 for a discussion of impacts related to global warming and climate change.
F423-3	The technology being proposed for this project has been extensively tested by BPXA and the State Pipeline Office and has been used in other projects around the world. The comment is correct that the undersea oil pipeline will be the first in the Arctic; however, effects of permafrost on the pipeline are considered minor (Section 5.3.2.2).
F423-3 (Cont.)	Section 8.6 of the DEIS describes oil spill containment/cleanup methods and discusses limitations to spill response. Also, in June 1998, BPXA completed the "Oil Discharge Prevention and Contingency Plan, Northstar Operations, North Slope, Alaska" which provides detailed information pertaining to spill response planning. Cleanup of the worst case spill scenario, a drilling blowout during broken ice conditions, has been analyzed by S.L. Ross et al. in "Evaluation of Cleanup Capabilities for Large Blowout Spills in the Alaskan Beaufort Sea During Periods of Broken Ice (June 1998)."
F423-4	After careful consideration of requests from the public for an extension of the public comment period of the DEIS, the Corps District Engineer, with support of the cooperating agencies, extended the public comment period to August 31, 1998. The decision to extend the public comment period to this date was reached as a balance between requests for extensions and a significant number of requests for no extension.
F424-1	We acknowledge your concern about consistency in assessing the impacts in such areas as cumulative

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	effects, effects of noise, and oil spill probability. We have reanalyzed all the impacts to marine mammals, terrestrial mammals, birds, and threatened or endangered species and have made several changes in impact levels based on our review. Cumulative effects of noise and oil spill probabilities have also been reviewed and this chapter (Chapter 10) has undergone revision based on public comments.
F424-2	The word "example" has been inserted into the sentence. See Section 2.6 for changes to text.
F424-3	The word "vastly" has been deleted from this sentence. See Section 2.6 for changes to text.
F424-4	See Section 3.2.1 for changes to text.
F424-5	See changes to Table 3-1.
F424-6	See Section 3.3.2 for revised text.
F424-7	See Section 3.4.1.1 for revised text.
F424-8	See Section 3.4.1.2 for revised text.
F424-9	Three phase fluids (oil, water, and gas) require pressurization to retain the gas components. Oil tankers and barges are generally not designed to pressurize their cargos. Hence, they cannot transport three phase liquids. As a consequence, oil tankers and barges cannot be employed to transport three phase liquids (e.g., wellhead produced product) from the Northstar production island.
F424-10	The reference to "onshore pipeline length" in the sentence is incorrect. We have altered it to "offshore pipeline length" in the FEIS.
F424-11	Use of the proposed Kuparuk River Delta site would be the same from an environmental impact standpoint when compared with the other named, active mine sites. The same amount of gravel would be used no matter where it was drawn from, and the active source would just be depleted earlier and future gravel for other projects drawn from some other site, which has yet to be identified or permitted. It is likely that the length of ice roads required would be greater if any of the existing sources were used for the Northstar Project. Selection of the preferred Northstar gravel source will probably be decided based on a combination of environmental and economic parameters.
F424-12	Most of the excess spoils are due to the volume of the pipeline itself. If these excess spoils were returned to the trench, the "mound" in the trench is estimated to increase in height by no more than a few inches (engineering estimates less than 6 inches [15.2 cm]).
F424-13	There is no increase in temperature as a result of the discharge. The construction dewatering discharge (Outfall 005) results from seawater infiltrating the gravel island. The resulting dewatering discharge temperature is expected to be very close to that of ambient seawater.
F424-14	We acknowledge your comment that the area quoted on page 6.3-11 of the DEIS does not agree with the area on page 6.4-22 of the DEIS. The totals in both sections have been changed to 150 acres (60.7 hectares) (for Zones 1 and 2) for consistency. See changes to Sections 6.3.2.2 and 6.4.2.2.
F424-15	The second full paragraph of page 6.3-11 of the DEIS (Section 6.3.2.2) states "As discussed above, it is not expected that the silt plume would cause a measurable reduction in abundance of common species beyond the range of natural variability or have adverse effects on the benthic biota. Bottom disturbances such as ice gouging and strudel scour, common in the offshore zone, may mask some construction effects on benthic invertebrates as a result of mounding, deposition, and alteration of sediments during the pipe-laying process. Naturally occurring hyposaline and highly turbid conditions occurring during spring breakup could also mask construction impacts. The overall impact from pipeline trenching and backfilling on plankton and marine invertebrates would be minor and disturbed areas are expected to be recolonized after installation of the pipeline." Although the sediment plume after the ice melts may decrease the occupied habitat for a short period, it is not expected, as a primary impact, to result in a decrease in available habitat. Moreover, as noted above, disturbed areas are expected to be recolonized after installation of the pipeline.
F424-16	Text has been added to provide additional references as you have suggested. See Section 6.4.2.2.
F424-17	See Section 6.4.2.2 for revised text.

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F424-18	We disagree that there is an inconsistency between the cited sections because they are referring to different areas for the total. See response to comment F424-14. The third sentence of the second full paragraph on page 6.4-22 of the DEIS states that no more than 1 inch (2.5 cm) of residual dirt will be left on the ice next to the pipeline ice slot, while the first paragraph of page 6.3-11 refers to the effects of trenched sediment resettling on seabed (no mention of thickness is made). The comment refers to Section 6.3-11; we assume this is page 6.3-11.
F424-19	Ringed seals are expected to be attracted to Seal Island due to the presence of fish around the island. Impacts to ringed seals are expected to be minor and are discussed in Section 6.5.2.2.
F424-20	Modeling provided in Appendix G (NPDES Fact Sheet) demonstrates that marine discharges from Outfall 001 are quickly diluted in a 16.4-ft (5 m) radius mixing zone. In particular, the plume of this discharge satisfies state water quality standards (WQS) for thermal discharge well within this 16.4 ft (5 m) mixing zone. As noted in the comment's citation, no detectable effects on fish from the discharge (thermal or otherwise) are anticipated.
F424-21	See Section 6.4.3 for a new summary statement.
F424-22	Snow removal, truck activities, and road maintenance are examples of other industrial activities that occur periodically during winter months. See Section 6.5.2.2 for revisions to text.
F424-23	BPXA has eliminated all thermal discharges to marine waters which could create impacts to ice patterns and open leads. The only marine discharges now included in the proposed project are Outfalls 001 (continuous flush water, potable water system brine, wastewater effluent), 002 (fire suppression test water), and 005 (construction dewatering).
F424-24	Text was edited to include number of helicopter and barge trips during construction. See Section 6.9.2.2 for this information.
F424-25	This section is a summary and, therefore, it is not necessary to restate in great detail how sound effects bowhead whales in this part of the document. Refer to Section 9.8.2.1, which describes why the impact to bowheads from helicopter overflights and barge trips is considered minor. Mitigation measures are discussed in Section 11.10.
F424-26	We acknowledge your comment regarding inaccurate citations in Section 7.3.2.2. See Section 7.3.2.2 for revised text.
F424-27	Section 8.7.2.7 addresses the impacts of oil on bowhead whales. The effects of oil on bowhead whales are addressed separately in Section 6.9.2.2.
F424-28	See Section 8.7.2.7 for the revised text.
F424-29	Real and perceived tainting of subsistence resources was a significant problem during and after the *Exxon Valdez* oil spill. Research by the Alaska Department of Fish and Game indicated that, in some affected communities, subsistence harvests shifted significantly from marine to terrestrial resources, specifically caribou, where the harvest doubled in some communities (Fall and Field, 1996). While caribou could not provide a cultural or acceptable substitute for the bowhead whale hunt, it is not unreasonable to assume that in the case of an oil spill and real or perceived tainting of subsistence resources, harvest activities would shift from marine to terrestrial resources, particularly caribou, because of a need to make up the quantity of any marine subsistence resources that might not be available.
F424-30	See Section 8.7.3.1 for the new text added to clarify contamination risks to subsistence resources.
F424-31	We acknowledge your opinion that emphasis should be placed on the discussion of noise and its effects from artificial drilling islands rather than marine seismic geophysical surveys.
F424-32	The sentence has been revised to reflect the inconclusiveness of the study. See Section 9.5.1.1 for changes to the text as a result of comment F420-52.
F424-33	See changes made to Section 9.5.1.1. Your point that responses of bowheads to offshore drilling operations needs to be properly placed in context relative to the Northstar Project's proposed island drilling operation is well taken.

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F424-34	The type of drilling rig used for drilling operations at Corona and Hammerhead has been added. See changes made to Section 9.5.1.1 as a result of response to comment F424-33.
F424-35	The conclusions of LGL and Greeneridge are applicable. Conclusions from these studies, although not directly applicable to the Northstar Project drilling program, provide some general insight into the impacts of offshore drilling operations on bowhead whales. See changes to Section 9.5.1.1 of the EIS.
F424-36	See changes made to Section 9.5.1.1 of the text.
F424-37	See Section 9.5.1.1 for revisions to the text as a result of response to comment F420-57.
F424-38	This statement can be found in the last paragraph of Section 9.5.1.1 of the DEIS. However, the citation the comment is referencing has been deleted as a result of response to comment F420-60. See Section 9.5.1.1 of the EIS for changes to text.
F424-39	We acknowledge your concern regarding the scheduled completion of pile driving 2 weeks prior to the bowhead whale fall migration period. The cooperating agencies are considering restricting such activities during the fall whale migration period as a potential mitigation measure (see Section 11.10).
F424-40	See Section 9.8.2.1 for the revised text.
F424-41	See Section 9.8.2.2 for the revised text.
F424-42	See Sections 9.5.1.1 and 9.8.2.2 for the revised text.
F424-43	See Section 9.8.2.2 for the revised text.
F424-44	See Section 9.8.2.2 for the revised text.
F424-45	See Section 9.8.2.2 for the revised sentence.
F424-46	See Section 9.8.2.2 for the revised text.
F424-47	See Section 9.8.2.2 for the revised text.
F424-48	This conclusion statement has been deleted. See Section 9.8.2.2 for changes to text.
F424-49	The sentence referred to in this comment describes how routine island operations may impact subsistence activities if they coincided with the fall whale migration. The sentence at the top of page 9-47 of the DEIS describes how the bowhead whale may experience some degree of behavioral reactions and avoidance of Seal Island during migration due to noise, but the impact to the whale is considered minor. However, if such behavioral reactions were to result in long-term changes in bowhead migration patterns (over the life of the project and beyond), impacts to subsistence harvesting activities would be considered significant.
F424-50	We have revised the tables in this section. Information pertaining to Lease Sale 170 is now provided in Table 10-2.
F424-51	The EIS addresses the issues of air quality and arctic haze. See response to comment F356-35.
F424-52	We acknowledge your concern regarding possible waste stream effects on bowhead whales.
F424-53	Cumulative effects of an oil spill have been included in a revision of Chapter 10 in the FEIS.
F424-54	Section 10.7 was rewritten to specifically consider the contribution of the Northstar Unit Development. As described in Section 10.7, the cumulative probability of a large oil spill occurring during the life of the Northstar Development Project is 95.2%. Northstar's contribution to the cumulative oil spill probability is less than 2%.
F424-55	The effects of noise from operations at Seal Island will occur throughout the life of the project. This will result in a minor impact to bowhead whales, because Seal Island is on the periphery of their migratory route. Bowheads may avoid Seal Island under unusually quiet ambient conditions if they can hear noise from the island. This minor displacement would not adversely impact whales, but could have a significant effect on the subsistence hunters in the area. With reference to the second point, noise from operations is a known aspect of the Northstar Project and

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	will occur over the 15-year life of the project. Oil spills, on the other hand, would be very episodic and few in number (if any) and, therefore, direct effect of spills are considered separately from the cumulative effects analysis. While a single oil spill effect can be devastating during certain times of the year, they do not meet the criteria for significant cumulative effects.
F425-1	This comment was addressed earlier. See response to comment F302-1.
F425-2	This comment was addressed earlier. See response to comment F302-2.
F425-3	This comment was addressed earlier. See response to comment F302-3.
F425-4	This comment was addressed earlier. See response to comment F302-4.
F425-5	This comment was addressed earlier. See response to comment F302-5.
F425-6	This comment was addressed earlier. See response to comment F302-6.
F425-7	See response to comment F425-155.
F425-8	Discussions on pipeline leak detection have been ongoing throughout the summer and fall of 1998 between BPXA and ADEC, Division of Spill Prevention and Response. The Badami Best Available Technology submittal for pipeline leak detection was the basis for choosing a combination of Pressure Point Analysis and Mass Balance Line Pack Compensation for the Northstar pipeline. This system was chosen by considering system performance, response time, reliability, and overall cost-benefit (INTEC, 1998:1). BPXA's proposed leak detection system threshold of 0.15% of throughput exceeds the state requirement of 1% of throughput. BPXA has proposed to perform through ice inspection every 30 days during the winter to detect pipeline leaks smaller than the detection system's threshold of 0.15%. See revisions to Sections 8.5.1 and 8.5.3 for clarification of the winter (solid ice) inspection methodology and the probability of detecting a leak using this technique. Final approval of spill detection methodology is the responsibility of MMS and the state. See text added to Sections 3.4.2.7, 4.2.5, and 4.3 of the EIS for discussion of double-walled pipeline design versus BPXA's proposed design.
F425-9	This comment was addressed earlier. See response to comment F302-9.
F425-10	This comment was addressed earlier. See response to comment F302-10.
F425-11	This comment was addressed earlier. See response to comment F302-11.
F425-12	This comment was addressed earlier. See response to comment F302-12.
F425-13	Section 4.6.4 of the Executive Summary states that, as a result of bowhead avoidance of Seal Island due to noise and industrial activity, whalers could be required to travel further offshore in search of whales, which could represent significant effects to subsistence activities. The conclusion in Sections 9.8.2.2 and 9.9 stated that although whales may experience some degree of behavioral reactions and avoidance of Seal Island during migration. impact to the whale is considered minor. This section then notes that if such behavioral reactions were to result in long-term changes in bowhead migration patterns (over the life of the project and beyond), impacts to subsistence harvesting activities would be considered significant. Therefore, we believe the conclusion stated in Section 9.9 is consistent with the Executive Summary. See response to comment F425-201 regarding the impact of prior exploratory drilling at the Hammerhead and Harvard prospects.
F425-14	The ultimate determination as to whether a marine cultural resources survey will be required will most likely made by the State Historic Preservation Officer. However, the likelihood of encountering offshore cultural resources is considered low. We have provided additional information in Sections 7.4.4, 7.4.5, and 7.4.7. At this time, it is not known whether the state will require any surveys.
F425-15	At the direction of the cooperating agencies, the focus of the cumulative impacts analysis was on resources which had the potential for significant cumulative effects. Cumulative impacts result from the incremental effect of the Northstar Project when added to the past, existing, and reasonably foreseeable

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	future actions. Many resources in the Northstar Project area may be subject to cumulative effects, but these effects were concluded to be minor and, therefore, were not specifically addressed in this EIS. Oil spill effects are addressed separately since they are probabilistic and may not occur. The direct impact of large oil spills are nonetheless devastating when they do occur. For instance, the cumulative impacts of the Northstar Project on fish resources, when added to the past, existing, and reasonably foreseeable future actions, were not found to be significant because contributions to fish impacts from the Northstar Project are negligible and future actions are not expected to use nearshore structures that interfere with fish movement (e.g., causeways). The effects of oil spills on individual resources are discussed in Chapter 6. Oil spill impacts are presented in Chapter 8.
F425-16	We acknowledge your comment regarding the need for darker colored chapter sheets. A darker shade was selected for the FEIS.
F425-17	Webster's College Dictionary defines a backhoe as "an excavating machine with a bucket attached to a hinged boom." Crawler hydraulic excavator is a more precise and accurate term for the equipment likely to be used in this specific application, but is not as simple nor is it used as much in common layman's parlance.
F425-18	The trapezoidal area mentioned is clearly shown, in sectional view, on Figure ES-14. The slope of the sidewalls will vary at different points along the trenches.
F425-19	"Immediately" could be misconstrued, and "behind" is potentially confusing. The sentence is deemed to be adequate without any alterations.
F425-20	The equipment shown on Figure ES-12 will perform the necessary task of vertically cutting the ice so that it can be removed. The reference made is simple and unlikely to confuse either the general public or project construction personnel.
F425-21	The leak detection sensitivity of 0.15% is based on the oil flow rate through the pipeline over the past 24 hours. As indicated on page 2-19 of the Northstar ODPCP (June 1998) it would take approximately 60 minutes to detect a leak between 0.15% and 1% of the throughput. Larger leaks, 1% and 5% of the flow, would cause alarms to sound more quickly, 10 and 1 minutes respectively.
F425-22	See Executive Summary Section 3.5.3.3 for revised text. Additional discussion of the winter (solid ice) inspection methodology and the probability of detecting a leak using this technique has been included in Sections 8.5.1 and 8.5.3 of the EIS. More detailed information on response strategy for solid ice conditions is presented on pages 1-78 through 1-82 of the Northstar ODPCP (June 1998). Due to difference in density between Northstar crude oil (specific gravity of 0.806) and seawater, most oil would rapidly rise up through the sediments and water to the rough under surface of the ice. Under-ice currents would not be sufficient to spread oil beyond the initial point of contact with the ice under surface. Natural depressions in the under-ice surface and incorporation of the oil into new ice growth would limit the area contaminated by oil.
F425-23	It is true that no drilling muds and cuttings would be discharged into the marine environment. As described on pages 6.2-1 and 6.2-2 of Appendix A, all drilling mud and cuttings will be disposed of in the permitted Class I industrial waste disposal well or through annular injection. The only other alternative for disposal is transportation to existing Prudhoe Bay facilities. There are no plans for a holding pit on the island.
F425-24	The sentence in question alludes to the possibility that Seal Island's infrastructure could potentially be retained and used for any number of then-desirable alternative uses. If the pipelines were evaluated and found to be in satisfactory condition for ongoing use in pumping natural gas to the island, or other fluids, then they too could be retained and recommissioned for that use. The proper decisions can be competently made in the future once more is known and when timely alternatives are able to be fully evaluated.
F425-25	We agree that an introductory paragraph would be useful for this section. See Section 4.0 Summary and Comparison of Alternatives for the new text.
F425-26	See response to comment F425-27.

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F425-27	See Executive Summary, Section 4.1, for changes to text.
F425-28	See response to comment F425-27.
F425-29	See revisions to Executive Summary, Section 4.2.
F425-30	This comment was addressed earlier. See response to comment F302-13.
F425-31	This comment was addressed earlier. See response to comment F302-14.
F425-32	See changes to Section 3.2.1.
F425-33	See changes to Table 3-1.
F425-34	See changes to Section 3.3.1.
F425-35	See Section 3.3.2 and Chapter 10. We have rewritten Chapter 10 in response to comments. We have updated this chapter with reference to the Tarn Project and prepared new tables. Table 10-1 lists existing oil and gas development in the Northstar Project Cumulative Impact Area. As per your comment, Tarn has been added to this list.
F425-36	See Section 3.3.2 for the corrected figure.
F425-37	This comment was addressed earlier. See response to comment F302-15.
F425-38	The sentence referenced has been altered in the FEIS to properly reflect the hexagonal shape of the center core working deck. See Section 3.4.2.4 for the clarification.
F425-39	"Natural blowdown" was removed from the EIS. See the Executive Summary, Chapter 3, and Chapter 4 for changes to text.
F425-40	See Section 3.4.2.5 for the corrected text.
F425-41	This comment was addressed earlier. See response to comment F302-16.
F425-42	See response to comment F425-39.
F425-43	This comment was addressed earlier. See response to comment F302-17.
F425-44	See response to comment F425-39.
F425-45	Relic offshore permafrost and the salinity of infiltrating seawater do result in referential complications. This is touched upon briefly in Section 5.3.1.3. The Northstar Project's site-specific conditions regarding ice-bonding are the key to thermal modeling and analysis when evaluating the potential for soil thawing and any resultant subsidence.
F425-46	The permafrost discussion, Section 5.3.1.3, begins with the traditional description of permafrost and goes on to elaborate on the complications of applying this definition in offshore, high saline conditions. We agree that the offshore subsea soils, such as those surrounding the pipeline trenches, are only of engineering concern with regard to issues such as subsidence when there are ice-bonded soils. The USGS paper, "Temperature and Depth of Permafrost on the Arctic Slope of Alaska," by Lachenbruch et al. (1988), does depict the range of permafrost depths across the Arctic Coastal Plain, which has enabled us to revise the Arctic Coastal Plain permafrost depth text challenged in the comment. See Section 5.3.1.3 for revised text.
F425-47	We disagree that the sediment chemistry background levels need to be presented in this paragraph of the EIS. They are fully described in the referenced document (Boehm et al., 1990) and discussed in Section 5.3.1.5.
F425-48	A berm is a "mound of dirt." The phrase "gravel berm" is used repeatedly in the BPXA Final Project Description, and serves as well as the suggested replacement terms.
F425-49	The representation of coastal erosion on Figure 5.3-7 was deemed to be more understandable than presenting the same material in narrative form. We disagree that there is a need to reiterate exactly the same information.

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F425-50	We find that the sentence referenced in the comment is satisfactory.
F425-51	See revised paragraph in Section 5.6.2.2 for oil spill effects on sea ice.
F425-52	As shown in Table 8-5, a chronic offshore pipeline leak during solid ice conditions could result in the release of up to 5,900 barrels of oil. This maximum estimate is based on a small leak below the leak detection threshold of 0.15% of the pipeline flow rate that is not discovered for 2 months.
F425-53	See Section 6.3.2.2 for the revised text.
F425-54	The sediment stored on the surface of landfast but not bottomfast ice would be a relatively small amount of material (5,000 cubic yards [3,823 m^3]) which will likely cover less than 3 acres (1.2 hectares) when spread 1 to 2 ft (0.3 to 0.6 m) thick. The dispersal of this material would occur over a large area (within 0.6 miles [1 km] of the site) as the ice breaks up and melts. The contribution of this relatively small amount of material to the turbidity and sedimentation of the offshore area in comparison to background conditions would be considered minor. Impact to fish and benthic invertebrates would also be minor since the deposition in any particular area of the bottom would be minimal.
F425-55	Beluga whales and spotted seals are included because they do occur in the Northstar Project Area and they could potentially be affected by a major spill. The Northstar Project Area extends to the Colville River Delta and belugas are common off shorefast ice near the Colville River Delta in midsummer. The only concentration of spotted seals in this region is near this delta.
F425-56	This comment was addressed earlier. See response to comment F302-18.
F425-57	The information has been updated. See Section 6.5.1.2 for a new sentence which provides this information and reference.
F425-58	This comment was addressed earlier. See response to comment F302-19.
F425-59	This comment was addressed earlier. See response to comment F302-20.
F425-60	This comment was addressed earlier. See response to comment F302-21.
F425-61	This comment was addressed earlier. See response to comment F302-22.
F425-62	This comment was addressed earlier. See response to comment F302-23.
F425-63	This comment was addressed earlier. See response to comment F302-24.
F425-64	This comment was addressed earlier. See response to comment F302-25.
F425-65	This comment was addressed earlier. See response to comment F302-26.
F425-66	This comment was addressed earlier. See response to comment F302-27.
F425-67	This comment was addressed earlier. See response to comment F302-28.
F425-68	We acknowledge that sometimes information from western science, observations of local residents, and Traditional Knowledge conflict, but we present the information in an unbiased manner without resolving all discrepancies.
F425-69	This comment was addressed earlier. See response to comment F302-29.
F425-70	This comment was addressed earlier. See response to comment F302-30.
F425-71	This comment was addressed earlier. See response to comment F302-31.
F425-72	The impact of North Slope industrial activities on polar bear habitat selection and use is outside the scope of this EIS. The emphasis in this section is the impact specific to the Northstar Project.
F425-73	A similar comment was addressed earlier. See response to comment F302-32.
F425-74	This comment was addressed earlier. See response to comment F302-33.
F425-75	See Section 6.5.3 for revised text.
F425-76	This comment was addressed earlier. See response to comment F302-34.

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F425-77	Figure 6.7-1 has been improved to better illustrate the sea duck molting area.
F425-78	This comment was addressed earlier. See response to comment F302-36.
F425-79	This comment was addressed earlier. See response to comment F302-37.
F425-80	This comment was addressed earlier. See response to comment F302-38.
F425-81	This comment was addressed earlier. See response to comment F302-39.
F425-82	This comment was addressed earlier. See response to comment F302-40.
F425-83	This comment was addressed earlier. See response to comment F302-41.
F425-84	This comment was addressed earlier. See response to comment F302-42.
F425-85	This comment was addressed earlier. See response to comment F302-43.
F425-86	This comment was addressed earlier. See response to comment F302-44.
F425-87	This comment was addressed earlier. See response to comment F302-45.
F425-88	This comment was addressed earlier. See response to comment F302-46.
F425-89	This comment was addressed earlier. See response to comment F302-47.
F425-90	This comment was addressed earlier. See response to comment F302-48.
F425-91	This comment was addressed earlier. See response to comment F302-49.
F425-92	This comment was addressed earlier. See response to comment F302-50.
F425-93	This comment was addressed earlier. See response to comment F302-51.
F425-94	This comment was addressed earlier. See response to comment F302-52.
F425-95	This comment was addressed earlier. See response to comment F302-53.
F425-96	This comment was addressed earlier. See response to comment F302-54.
F425-97	This comment was addressed earlier. See response to comment F302-55.
F425-98	This comment was addressed earlier. See response to comment F302-56.
F425-99	This comment was addressed earlier. See response to comment F302-57.
F425-100	This comment was addressed earlier. See response to comment F302-58.
F425-101	This comment was addressed earlier. See response to comments F302-58 and F302-59.
F425-102	This comment was addressed earlier. See response to comment F302-60.
F425-103	This comment was addressed earlier. See response to comment F302-61.
F425-104	This comment was addressed earlier. See response to comment F302-62.
F425-105	This comment was addressed earlier. See response to comment F302-63.
F425-106	This comment was addressed earlier. See response to comment F302-64.
F425-107	This comment was addressed earlier. See response to comment F302-65.
F425-108	This comment was addressed earlier. See response to comment F302-66.
F425-109	This comment was addressed earlier. See response to comment F302-67.
F425-110	This comment was addressed earlier. See response to comment F302-68.
F425-111	This comment was addressed earlier. See response to comment F302-69.
F425-112	This comment was addressed earlier. See response to comment F302-70.
F425-113	This comment was addressed earlier. See response to comment F302-71.
F425-114	This comment was addressed earlier. See response to comment F302-72.

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F425-115	This comment was addressed earlier. See response to comment F302-73.
F425-116	This comment was addressed earlier. See response to comment F302-74.
F425-117	This comment was addressed earlier. See response to comment F302-75.
F425-118	This comment was addressed earlier. See response to comment F302-76.
F425-119	This comment was addressed earlier. See response to comment F302-77.
F425-120	This comment was addressed earlier. See response to comment F302-77 and F302-78.
F425-121	This comment was addressed earlier. See response to comment F302-79.
F425-122	This comment was addressed earlier. See response to comment F302-80.
F425-123	See Section 6.9.3 for the revised sentence.
F425-124	This comment was addressed earlier. See response to comment F302-81.
F425-125	See response to comment F425-123.
F425-126	This comment was addressed earlier. See response to comment F302-82.
F425-127	This comment was addressed earlier. See response to comment F302-83.
F425-128	We acknowledge your comment regarding Figure 7.3-1 being out of sequence. This will be addressed in the FEIS.
F425-129	This comment was addressed earlier. See response to comment F302-84.
F425-130	This comment was addressed earlier. See response to comment F302-85.
F425-131	This comment was addressed earlier. See response to comment F302-86.
F425-132	This comment was addressed earlier. See response to comment F302-87.
F425-133	This comment was addressed earlier. See response to comment F302-88.
F425-134	This comment was addressed earlier. See response to comment F302-89.
F425-135	See changes to Section 7.4.1.
F425-136	This comment was addressed earlier. See response to comment F425-14.
F425-137	There are no known offshore cultural resources in the project area. The likelihood of encountering offshore cultural resources is considered low, with site destruction most probably already finished or ongoing as a result of ice movement and bottom scouring. See Section 7.4.4 for changes to the text.
F425-138	See Section 7.4.6 for the revised sentence.
F425-139	See changes to Section 7.6.3.
F425-140	This comment was addressed earlier. See response to comment F302-90.
F425-141	This comment was addressed earlier. See response to comment F302-91.
F425-142	This comment was addressed earlier. See response to comment F302-92.
F425-143	This comment was addressed earlier. See response to comment F302-93.
F425-144	This comment was addressed earlier. See response to comment F302-94.
F425-145	This comment was addressed earlier. See response to comment F302-95.
F425-146	This comment was addressed earlier. See response to comment F302-96.
F425-147	This comment was addressed earlier. See response to comment F302-97.
F425-148	This comment was addressed earlier. See response to comment F302-98.
F425-149	This comment was addressed earlier. See response to comment F302-99.
F425-150	This comment was addressed earlier. See response to comment F302-100.

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F425-151	This comment was addressed earlier. See response to comment F302-101.
F425-152	This comment was addressed earlier. See response to comment F302-102.
F425-153	We agree that 26% should be used throughout the document based on data in Table 8-7. See Section 8.4.3 for the corrected text.
F425-154	The sentence in Section 8.4.3 has been revised to reflect the suggestion presented in the comment.
F425-155	We agree that an additional paragraph should be added at the end of Section 8.4.3 to provide clarification of the figures within the text. Please refer to Section 8.4.3 for revised text. We disagree that further clarification on this topic is required in Section 8.7, as the impacts presented in this section are discussed in accordance with the four environmental settings likely to be contacted. The suggested text changes to Section 4.6.8 of the Executive Summary were not done. This section focuses on the likelihood of a spill as a comparison to each action alternative with varying pipeline routes. The modeling results from Lease Sale 170 exclusively represent a spill originating at Seal Island. However, text changes were included in Section 4.2 of the Executive Summary to illustrate the geographic extent of a spill. Please refer to the Executive Summary for these changes.
F425-156	This comment was addressed earlier. See response to comment F302-103.
F425-157	This comment was addressed earlier. See response to comment F302-104.
F425-158	See Figure 8-5a for corrections.
F425-159	See Figure 8-5b for corrections.
F425-160	This comment was addressed earlier. See response to comment F302-105.
F425-161	"Complete failure" refers to any scenario above and beyond a chronic leak that would constitute a complete rupture of the pipe, resulting in a total spill of the containment volume. We disagree that ice gouging would be considered a mechanical failure. Ice gouging constitutes an affect on the pipe as a result of the surrounding physical environment in comparison to mechanical failure which involves one of the components of the pipe failing.
F425-162	See Section 8.5.2 for revisions to text.
F425-163	This comment was addressed earlier. See response to comment F302-106.
F425-164	See Section 8.5.2 for revisions to text.
F425-165	Refer to the discussions on this issue in Section 8.5.1.
F425-166	This comment was addressed earlier. See response to comment F302-107.
F425-167	This comment was addressed earlier. See response to comment F302-108.
F425-168	This comment was addressed earlier. See response to comment F302-109.
F425-169	This comment was addressed earlier. See response to comment F302-110.
F425-170	This comment was addressed earlier. See response to comment F302-111.
F425-171	This comment was addressed earlier. See response to comment F302-112.
F425-172	See Section 8.7.2.2 for revised text.
F425-173	This comment was addressed earlier. See response to comment F302-113.
F425-174	This comment was addressed earlier. See response to comment F302-114.
F425-175	This comment was addressed earlier. See response to comment F302-115.
F425-176	This comment was addressed earlier. See response to comment F302-116.
F425-177	See Section 8.7.2.5 for the corrected text.
F425-178	See Section 8.7.2.5 for changes to text.

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F425-179	This comment was addressed earlier. See response to comment F302-117.
F425-180	This comment was addressed earlier. See response to comment F302-118.
F425-181	See Section 8.7.2.5 for the corrected reference.
F425-182	The statement is qualified by the word “likely” and caribou would not be a regular user of the shorefast ice in comparison to Arctic fox.
F425-183	See Section 8.7.2.6 for revised text.
F425-184	This comment was addressed earlier. See response to comment F302-119.
F425-185	See Section 8.7.2.6 for revised text.
F425-186	This comment was addressed earlier. See response to comment F302-120.
F425-187	References were checked for clarity of these statements. While the 1985 and 1989 citations for Ahmaogak refer to seismic activity, the 1995 Ahmaogak reference cited refers to offshore drilling and seismic activity. This sentence was reworded for clarity. See Section 9.5.1.1 for revised text.
F425-188	The use of the adjective “obvious” is not really the author's conclusion. It refers to the fact that the whale's response was obvious to observers as they followed it around the drill site.
F425-189	Although the interpretation of these results were confounded by heavy ice conditions, the authors concluded that floating drilling units might cause bowheads to shift their migration distribution. See changes to Section 9.5.1.1 for clarification.
F425-190	Prior comments on this matter on the Biological Assessment and Chapter 9 were received from MMS during the Preliminary DEIS Stage. The Corps approved the present text in this section in April of 1998. Animals that do not respond to seismic noise are not useful evidence of response. The section has been amended to include the Richardson et al. (1998) results.
F425-191	The information is presented to include the observations of whalers and displacement observed during whaling as a result of seismic activity. The beginning of Section 9.5.1.1 “Bowhead Whale - Responses to Noise” discusses the effects of seismic survey activity.
F425-192	The paper referred to by Cleator, Stirling, and Smith (1989) could not be located. The sentence in question was revised. See Section 9.5.1 for the revised text.
F425-193	This comment was addressed earlier. See response to comment F302-121.
F425-194	This comment was addressed earlier. See response to comment F302-122.
F425-195	This comment was addressed earlier. See response to comment F302-123.
F425-196	This comment was addressed earlier. See response to comment F302-124.
F425-197	This comment was addressed earlier. See response to comment F302-125.
F425-198	This comment was addressed earlier. See response to comment F302-126.
F425-199	This comment was addressed earlier. See response to comment F302-127.
F425-200	Text in the EIS was edited for clarity. See Section 9.8.2.2 for changes to text.
F425-201	This comment opens the debate on the subject of the whaling captains' consensus of opinion that whales are displaced and respond to noisy industrial activities that occur along their migration route. The text does not contradict the whaling captains' contention of a deflection starting at around 35 miles (56 km). It is not productive to debate whether or not the whalers' beliefs are supported by the aerial survey data or the field observations. No one can present empirical evidence for that year at those various sites relative to the activities that contradicts the notion that sound could have been above background levels.
F425-202	The present text does not make the assumption expressed in the comment. The Richardson reference is not used to support a conclusion of long-term impact. It is there to support the statement that noise from island drilling is not expected to propagate very far. Text in the EIS was edited for clarity. See Section 9.8.2.2 for revised text.

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F425-203	The text as written does not state or imply that Johnson et al. stated that bowheads could hear industrial noises at 6 miles (9.7 km). That reference is given since it provided some empirical measurements of noise from an island drilling activity. Revisions were made to Sections 9.5.1.1 and 9.8.2.2.
F425-204	The intention of this paragraph is to present Traditional Knowledge from whalers who believe that displacement of the bowhead migratory path and the whales' avoidance of Prudhoe Bay have occurred as a result of industrial activities. The paragraph also explains that the local residents beliefs and experiences have led them to the assumption that displacement will occur as a result of Seal Island operations. Section 9.8.2.2 has been revised to clarify this point. It is unlikely that a single court decision claiming the opposite will change the opinions and beliefs of the whalers.
F425-205	This comment was addressed earlier. See response to comment F302-128.
F425-206	This comment was addressed earlier. See response to comment F302-129.
F425-207	This comment was addressed earlier. See response to comment F302-130.
F425-208	This comment was addressed earlier. See response to comment F302-131.
F425-209	This comment was addressed earlier. See response to comment F302-132.
F425-210	This comment was addressed earlier. See response to comment F302-133.
F425-211	We have revised the tables in this section. Reference to federal Lease Sale 144 has been deleted since no development or exploration has been proposed.
F425-212	We have revised the tables in this section. Table 10-2 lists foreseeable future projects in the Northstar Project Cumulative Impact Area and estimated reserves for those future actions, such as the federal NPRA, when information is available.
F425-213	Chapter 10 has been rewritten in response to comments. Your comment was addressed through the revision process.
F425-214	Reference to the Warthog Prospect has been dropped from Chapter 10 since it proved to be a dry hole and ARCO reports no plans to continue exploration in the area.
F425-215	We have rewritten Chapter 10 in response to comments. Your comment was addressed in the revision process.
F425-216	See response to comment F425-215.
F425-217	See Section 10.3.3.4 for the corrected sentence.
F425-218	This comment was addressed earlier. See response to comment F302-134.
F425-219	We have rewritten Chapter 10 in response to comments. Your comment has been addressed in the revision process.
F425-220	See response to comment F425-15.
F425-221	This comment was addressed earlier. See response to comment F302-135.
F425-222	This comment was addressed earlier. See response to comment F302-136.
F425-223	We have deleted this sentence from Section 10.7.
F425-224	Text in Chapter 10 and the Executive Summary has been revised to specifically consider the contribution of the Northstar Unit Development. The cumulative probability of a large oil spill occurring during the life of the Northstar Project is 95.2%. Northstar's contribution to the cumulative oil spill probability on the North Slope is less than 2%.
F425-225	Additional language was added to indicate the two types of impacts. See Section 11.8 for new text.
F425-226	See Section 11.4 for the revised sentence.
F425-227	This comment was addressed earlier. See response to comment F302-137.
F425-228	This comment was addressed earlier. See response to comment F302-138.

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F425-229	This comment was addressed earlier. See response to comment F302-139.
F425-230	This comment was addressed earlier. See response to comment F302-140.
F425-231	This comment was addressed earlier. See response to comment F302-141.
F425-232	This comment was addressed earlier. See response to comment F302-142.
F425-233	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). This sentence was deleted in the EIS. See response to comment F425-214.
F425-234	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The sentence in question appears on page 4-81 of the DEIS. No changes were made to this section as it accurately describes VSM placement at the Putuligayuk River crossing as stated in the Project Description, Appendix A. See Figure 2.4-18 of Appendix A which shows the VSM placement in the river.
F425-235	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The sentence in question was not included in this same discussion in the EIS; therefore, no changes to the EIS are required.
F425-236	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The sentence in question was not included in this same discussion in the EIS; therefore, no changes to the EIS are required.
F425-237	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The sentence in question appears on page 4-90 of the DEIS and is information that was incorporated into the EIS from Section 3.6.4 of the Project Description, Appendix A.
F425-238	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). See revisions to Section 4.4.2.4.
F425-239	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The referenced figure is not included in the EIS; therefore, no changes to the EIS are required.
F425-240	Your comments on the Biological Assessment have been forwarded to the USFWS and NMFS to be reviewed by these agencies in drafting their Biological Opinions (Appendix M). The sentence in question was not included in the EIS; therefore, no changes to the EIS are required.
F425-241	We chose to retain TN 750 while adding TN 830 (Offshore Pipeline Route Options Evaluation).
F425-242	We recognize that this letter supersedes the earlier letter (F302). In cases where identical comments were made, we respond to comments in the earlier letter. Comments unique to this letter (F425) are addressed specifically here.
F426-1	We acknowledge your support of the project.
State Letters	
S1-1	We acknowledge your support of concurrence by DGC that the Northstar Project is consistent with the ACMP.
S1-2	We acknowledge your support of ADEC certification of the NPDES and Section 404 Permits and state certification of the UIC Permit.
S2-1	The State of Alaska extended the public comment period for ACMP consistency review and state permits to September 30, 1998. For more information regarding the concurrent review of state permits and the DEIS comment period, refer to response to comments F404-181 and F404-182.

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S3-1	The DGC received your July 27, 1998, public records request by facsimile on July 28. In response to your request, we provided a copy of the June 1, 1998, "start-up" letter for the Northstar Development Project. When an application packet appears to be sufficient for public review, DGC begins the review of a project for consistency with the ACMP (see 6 AAC 50.070[e]). The "start-up" letter notifies the applicant that the application packet appears to be sufficient for public review. We extended the routine 50-day project review schedule up front for this project to 177-days to allow more time for agency staff and the public to review project-related documents. Normally set at "Day 25" of the review, the DGC initially extended the deadline to request additional information to "Day 45" for the Northstar review. The request for additional information milestone provides state agencies and the coastal district an opportunity to identify additional information that is needed for the consistency review or to fulfill statutory responsibilities. On July 15, 1998, after receiving information requests from ADEC, the DGC extended this deadline until a time at which the information request is determined to be adequately satisfied. In addition to the June 1, 1998, start-up letter, we provided a copy of the July 15, 1998, information request for your convenience. We provided this information without charge, under the exception for requests that entail copying costs under five dollars [see AS 09.25.110(d)]. As we have explained above, we are unable to supply the exact documents you have identified because they do not exist (see AAC 96.335(a)(1)]. In the event of a denial, the law requires us to enclose the following regulatory provisions: (1) The requestor may administratively appeal the denial by complying with the procedures in 6 AAC 96.340. (2) The requestor may obtain immediate judicial review of the denial by seeking an injunction from the superior court under AS 09.25.125. (3) An election not to pursue injunctive remedies in superior court shall have no adverse effects on the rights of the requestor before the public agency. (4) An administrative appeal from a denial of a request for public records requires no appeal bond. DGC staff sent Mr. Dan Ritzman of your organization a copy of the state applications for the Northstar Project on July 24, 1998. Please contact Glenn Gray of DGC if you have any questions about the state's review of the Northstar Project. I understand Mr. Gray has offered to schedule a meeting with you and other members of the public to discuss the state's review of this important project.
S4-1	We acknowledge your support of Alternative 2.
S5-1	The State of Alaska extended the public comment period for ACMP consistency review and state permits to September 30, 1998. For more information regarding the opportunity for public involvement in the proposed project, refer to response to comment F404-182.
S5-2	DGC extended the public comment period for the Northstar Development Project to September 30, 1998, to ensure review participants time to review information related to state permits. The state requested additional information from BPXA on air pollution and oil spill contingency planning. After determining that the requested information was sufficient for state permitting purposes, it was distributed to those who expressed interest in receiving it.
S7-1	This letter is a duplicate of letter F404. See response to comments F404-1 through F404-192.
S8-1	The requested volumes were mailed on August 3, 1998.
S8-2	The request for the spill plan was sent to the DGC, who distributed copies of the Northstar ODPCP and ACS Technical Manuals as per this request.
S8-3	BPXA is currently in the process of investigating tundra restoration options for removal of gravel pads

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	and roads after depletion of reservoirs. They are actively pursuing remediation on one oil field in order to form a uniform Abandonment Plan for later use. The Northstar Project will be grouped with other fields, such as Prudhoe Bay, and be a small part of a large remediation process. The cost for abandonment is unknown at this time and is largely dependent upon current remediation results, as well as technology that would be available at the time of abandonment.
S8-4	The State of Alaska extended the public comment period for ACMP review and state permits to September 30, 1998. The Corps, with support of the cooperating agencies, extended the public comment period of the DEIS to August 31, 1998 (refer to response to comment F18-1).
S9-1	This letter is a duplicate of letter F411. See response to comments F411-1 through F411-16.
S10	See response to comments F420-77 through F420-85.

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