Alaska Outer Continental Shelf

OCS EIS/EA
BOEM 2018-050

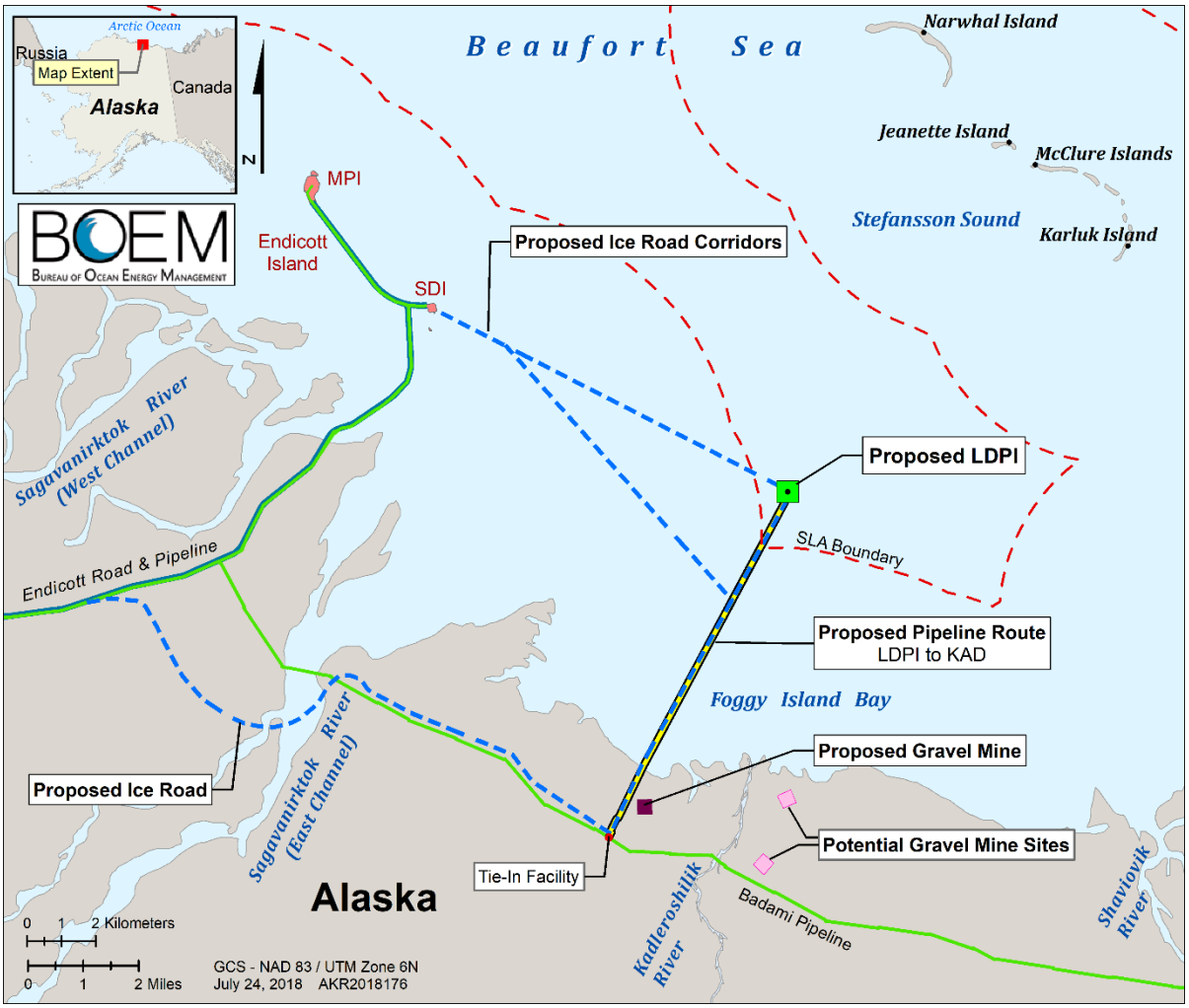
Liberty Development and Production Plan

Beaufort Sea, Alaska

Estimated Lead Agency Total Costs Associated with Developing and Producing this EIS:
$1,634,000

Final Environmental Impact Statement

Volume 2. Chapter 7 and Appendices A through C



BOEM Bureau of Ocean Energy Management

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

August 2018

Liberty Development and Production Plan

Beaufort Sea, Alaska

Final Environmental Impact Statement

Volume 2. Chapter 7 and Appendices A through C

Prepared by
Bureau of Ocean Energy Management, Alaska OCS Region

Cooperating Agencies
U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement

U.S. Department of Commerce, National Oceanographic and Atmospheric Administration, National Marine Fisheries Service

Environmental Protection Agency

U.S. Department of Defense, U.S. Army Corps of Engineers

State of Alaska, Department of Natural Resources

U.S. Department of the Interior
Bureau of Ocean Energy Management
Alaska OCS Region

August 2018

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- Air Quality Analysis Methodology
- Baseline Human Health Summary
- Wetlands Delineation Report
- Lease Stipulations
- Marine Mammal Emergency Response Standards
- Archaeology Resources

Acronyms and Abbreviations

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Acronyms and Abbreviations

µg.....micrograms
µg/cm^3 .....micrograms per cubic centimeter
µg/m^3 .....micrograms per cubic meter
µg/g .....micrograms per gram
µg/L.....micrograms per liter
µm .....micrometer
µPa.....micropascal
AAAQS .....Alaska Ambient Air Quality Standards
ACMP.....Alaska Coastal Management Program
ACP .....Arctic Coastal Plain / Area Contingency Plan
ADEC .....Alaska Department of Environmental Conservation
ADF&G .....Alaska Department of Fish and Game
ADNR.....Alaska Department of Natural Resources
ADOLWD .....Alaska Department of Labor and Workforce Development
AES .....ASRC [Arctic Slope Regional Corporation] Energy Services, Alaska, Inc.
AEWC .....Alaska Eskimo Whaling Commission
AFMP .....Arctic Fishery Management Plan
AFN.....Alaska Federation of Natives
AGDC.....Alaska Gasline Development Corporation
AGL.....above ground level
AHRS .....Alaska Heritage Resources Survey
AI/AN.....American Indian and Alaskan Native populations
AK LNG.....Alaska Liquefied Natural Gas Pipeline Project
AKNHP .....Alaska Natural Heritage Program
AKPDES .....Alaska Pollutant Discharge Elimination System
AMAP .....Arctic Monitoring and Assessment Programme
AMNWR .....Alaska Maritime National Wildlife Refuge
ANC .....Alaska Nanuuq Commission
ANCSA .....Alaska Native Claims Settlement Act
ANILCA.....Alaska National Interest Land Conservation Act
ANIMIDA .....Arctic Nearshore Impact Monitoring in the Development Area
ANS.....Alaska North Slope
ANWR.....Arctic National Wildlife Refuge
AO .....Arctic Oscillation
AOCSR.....Alaska OCS Region
APDES .....Alaska Pollutant Discharge Elimination System
API .....American Petroleum Institute
APD.....Application for Permit to Drill
APPS .....Act to Prevent Pollution from Ships
AQRP .....Air Quality Regulatory Program
AQRV.....air quality related values
AQCR.....air quality control regions
ARBO.....Arctic Region biological opinion
ARCWEST.....Arctic Whale Ecology Study
ARRT .....Alaska Regional Response Team
ASA.....aquatic site assessment
ASAMM.....Aerial Surveys of Arctic Marine Mammals
ASAP.....Alaska Stand Alone Gas Pipeline
ASL .....above sea level
ASRC .....Arctic Slope Regional Corporation
ASWG .....Alaska Shorebird Working Group
atm.....atmosphere (of Air Pressure)
AWC.....Anadromous Waters Catalog of Alaska

AWI ..... Wainwright Airport
B.P. ..... before present
BACT ..... best available control technology
Bbbl ..... billion barrels of oil
bbl ..... barrel = 42 U.S. gallons
bbls/d or BOPD ..... barrels of oil per day
BC ..... black carbon
BCB ..... Bering-Chukchi-Beaufort Seas Stock of Bowhead Whales
Bcf ..... billion cubic feet
Bcfg ..... billion cubic feet of gas
BE ..... biological evaluation
BGEPA ..... Bald and Golden Eagle Protection Act
BIA ..... Biologically Important Areas
BLM ..... Bureau of Land Management
BMPs ..... best management practices
BO ..... biological opinion
BOD ..... biological oxygen demand
BOEM ..... Bureau of Ocean Energy Management
BOEMRE ..... Bureau of Ocean Energy Management, Regulation, and Enforcement
BOP ..... blowout preventer (system)
BOPD or bbls/d ..... barrels of oil per day
BOWFEST ..... Bowhead Whale Feeding Ecology Study
BP ..... British Petroleum
BPXA ..... British Petroleum Exploration (Alaska), Inc.
BS ..... boundary segment(s) or Beaufort Sea
BSEE ..... Bureau of Safety and Environmental Enforcement
BSMP ..... Beaufort Sea Monitoring Program
BWASP ..... Bowhead Whale Aerial Survey Project
C/N ..... carbon/nitrogen ratio
CAA ..... Conflict Avoidance Agreement
CAAA ..... Clean Air Act Amendments (1990)
CAB ..... chemical and benthos
CAH ..... Central Arctic (Caribou) Herd
cANIMIDA ..... Continuation of the Arctic Nearshore Impact Monitoring in the Development Area Project
CAVM ..... Circumpolar Arctic vegetation map
CAVMT ..... Circumpolar Arctic Vegetation Mapping Team
CBD ..... Center for Biological Diversity
CBH ..... Cape Bathurst Caribou Herd
CBMP ..... Circumpolar Biodiversity Monitoring Program (Arctic Council's)
CBS ..... Chukchi-Bering Seas stock of Polar Bears
CDC ..... Centers for Disease Control
CEQ ..... Council on Environmental Quality
CER ..... categorical exclusion review
CFCs ..... chlorofluorocarbons
CFR ..... Code of Federal Regulations
CHAOZ ..... Chukchi Acoustic Oceanography and Zooplankton (program)
CHARS ..... Canadian High Arctic Research Station
CI ..... confidence interval
CIAP ..... Coastal Impact Assistance Program
CIP ..... Capital Improvement Program
CITES ..... Convention on International Trade in Endangered Species of Wild Fauna and Flora
COMIDA ..... Chukchi Sea offshore monitoring in drilling area
COMIDA-CAB ..... Chukchi Sea offshore monitoring in drilling area, chemical and benthos
Court of Appeals ..... U.S. Court of Appeals for the Ninth Circuit
cp ..... centipoise (measure of viscosity)

CPAI.....Conoco-Phillips Alaska Incorporated [2x in 5]
CPF.....Central Processing Facility
CTD.....conductivity, temperature, and depth
CTS.....compound threshold shift
CWA.....Clean Water Act
cy.....cubic yards
CZARA .....Coastal Zone Act Reauthorization Amendments of 1990
CZM .....coastal zone management
dB .....decibels
dB_{RMS}.....decibels, root mean square
DBO .....Distributed Biological Observatory
DEIS .....Draft Environmental Impact Statement
DEW.....distant early warning (system)
DO .....dissolved oxygen
DOC/USDOC.....Department of Commerce
DOI/USDOI.....Department of the Interior
DOT/USDOT .....Department of Transportation
DPP.....Development and Production Plan
DPS.....distinct population segment
Draft SEIS .....Draft Supplemental Environmental Impact Statement
DWH .....Deepwater Horizon
EA.....Environmental Assessment
ECS.....Eastern Chukchi Sea
EEZ.....Exclusive Economic Zone
EFH .....essential fish habitat
EIA .....environmental impact analysis
EIS.....Environmental Impact Statement
EJ.....environmental justice
ENP .....Eastern Northern Pacific
EO.....Executive Order
EOFL.....end of field life
EOR.....enhanced oil recovery
EP .....Exploration Plan
EPA .....U.S. Environmental Protection Agency
EPS.....Eastern Pacific Stock
ERA.....environmental resource area
ESA .....Endangered Species Act
ESI.....Environmental Sensitivity Index
ESP.....Environmental Studies Program
EVOS .....Exxon Valdez Oil Spill
EWC.....Eskimo Walrus Commission
FDA/USFDA.....Food and Drug Administration
FEIS.....Final Environmental Impact Statement
FERC.....Federal Energy Regulatory Commission
FHWG .....Fisheries Hydroacoustic Working Group
FM .....frequency modulated
FMP.....Fishery Management Plan
FONSI .....Finding of No Significant Impact
FOSC.....Federal On-Scene Coordinator
FR.....Federal Register
FSB.....Federal Subsistence Board
FSE.....full-scale exercises with response equipment deployment.
FWPCA .....Federal Water Pollution Control Act
FWS/USFWS .....U.S. Fish and Wildlife Service
G&G.....geological and geophysical
g/m^3 .....grams per cubic meter

g/min..... grams per minute
GBS ..... gravity-based structure
GHG ..... greenhouse gases
GHGRP..... Greenhouse Gas Reporting Program
GIUE ..... government initiated unannounced exercises
GLS ..... grouped land segments
GMT-1..... Greater Mooses Tooth-1 Project
GMT-2..... Greater Mooses Tooth-2 Project
GOM..... Gulf of Mexico
GP..... General Permit
gpd..... gallons per day
GPS..... global positioning system
H_2S..... hydrogen sulfide
ha ..... hectares
HAB..... harmful algae blooms
HACCP..... Hazard Analysis and Critical Control Point Plan
HAK ..... Hilcorp Alaska, LLC
HAP ..... hazardous air pollutants
HCs..... hydrocarbons
HCC..... high conservation concern
HDD ..... horizontal directional drilling
HR ..... high resolution
HRZ..... Highly Radioactive Zone
HSWUA ..... Hanna Shoal Walrus Use Area
IAP..... Integrated Activity Plan
IARPC ..... Interagency Arctic Research Policy Committee
IBA ..... important bird area
ICAS..... Inupiat Community of the Arctic Slope
IHA..... Incidental Harassment Authorization
IMO ..... International Maritime Organization
IMT..... incident management team
INC ..... incident of non-compliance
IPCC ..... Intergovernmental Panel on Climate Change
IPF ..... impact-producing factor
ISC..... Ice Seal Committee
ISER ..... Institute for Social and Economic Research
ITA ..... Incidental Take Authorization
ITL..... information to lessees (clauses)
ITR..... incidental take regulation
IUCN ..... International Union for Conservation of Nature
IWC ..... International Whaling Commission
LA..... launch area
LBCHU..... Ledyard Bay Critical Habitat Unit
LDPI ..... Liberty Development and Production Island
LGM ..... last glacial maximum
LIDAR..... light detection and ranging
LNG..... liquefied natural gas
LOA..... letter of authorization
LOSC..... Local On-Scene Coordinator
LOWC ..... loss of well control
LPG ..... liquid petroleum gas
LS ..... land segment
m/s ..... meters per second
m^3/s..... cubic meters per second
MAIs..... maximum allowable increases
MARPOL ..... International Convention for the Prevention of Pollution from Ships

Mbbl .....thousand barrels
MBR .....membrane bioreactor
MBTA .....Migratory Bird Treaty Act
MC.....mesoscale cyclones
Mcf .....thousand cubic feet
Mcf/d .....thousand cubic feet per day
Mcfg .....thousand cubic feet of gas
md.....millidarcy (measure of permeability)
MGD.....million gallons per day
MLLW.....mean lower low water
MMbbl.....million barrels
MMBO .....million barrels of oil
MMC .....Marine Mammal Commission
MMcf.....million cubic feet
MMcfg.....million cubic feet of gas
MML .....Marine Mammal Laboratory (Alaska Fisheries Science Center)
MMPA.....Marine Mammal Protection Act
MMS.....Minerals Management Service
MMscfd .....million standard cubic feet per day
MMT .....million metric tons
MOA.....memorandum of agreement
MODU.....mobile offshore drilling unit
MOR.....moderate oil residue
MOU.....Memorandum of Understanding
MOVES .....motor vehicle emissions simulator
MPI.....Main Production Island
MSD .....marine sanitation devices
MSFCMA.....Magnuson-Stevens Fishery Conservation and Management Act
MTR .....marine transit route
MWCS.....marine well containment system
NAAQS .....National Ambient Air Quality Standards
NABC.....Northwest Arctic Borough Code
NAE.....National Academy of Engineering
NAO .....North Atlantic Oscillation
NASA .....National Aeronautics and Space Administration
NCP .....National Contingency Plan
NEPA .....National Environmental Policy Act
NFF.....National Forest Foundation
NFS.....National Forest System
NGL.....natural gas liquids
NGO .....non-governmental organization
NHPA .....National Historic Preservation Act
NRHP .....National Register of Historic Places
NISA.....National Invasive Species Act of 1996
NMFS .....National Marine Fisheries Service
NOAA .....National Oceanic and Atmospheric Administration
NOI.....notice of intent
NO_x.....nitrogen oxides
NPDES .....National Pollutant Discharge Elimination System
NPFMC .....North Pacific Fisheries Management Council
NPR-A .....National Petroleum Reserve-Alaska
NPREP .....National Preparedness Response Exercise Program
NPS.....National Park Service
NRC.....National Research Council or National Response Center
NRDA.....natural resource damage assessment
NSB .....North Slope Borough

NSBSAC..... North Slope Borough Science Advisory Committee
NSIDC ..... National Snow and Ice Data Center
NSPS ..... new source performance standards
NTACs..... nondiscretionary terms and conditions
NTL ..... notice to lessees
NWAB..... Northwest Arctic Borough
O_3..... ozone
OCRM ..... ocean and coastal resource management
OCS ..... Outer Continental Shelf
OCSLA..... Outer Continental Shelf Lands Act
ODCE ..... Ocean Discharge Criteria Evaluation
OFC ..... Ocean and Fisheries Canada
OGP ..... International Association of Oil and Gas Producers
OMB..... Office of Management and Budget
ONRR..... Office of Natural Resource Revenue
OPA/OPA-90..... Oil Pollution Act of 1990
ORE..... (BOEM) Office of Resource Evaluation
OSC ..... on-scene coordinator
OSFR..... oil spill financial responsibility
OSHA ..... Occupational Safety and Health Administration
OSPD..... Oil Spill Preparedness Division
OSR ..... oil spill response
OSRA ..... Oil Spill Risk Analysis
OSRB..... oil spill response barge
OSRO ..... Oil Spill Removal Organization
OSRP ..... Oil Spill Response Plan
OSRV ..... oil spill response vessel
OWM..... oil weathering model
PAC ..... Pacific Outer Continental Shelf (OCS) Region
PACs..... poly aromatic compounds
PAH ..... polycyclic aromatic hydrocarbons
PAME..... Protection of the Arctic Marine Environment
PAR ..... photosynthetically active radiation
PBR ..... potential biological removal
PCB ..... polychlorinated biphenyl
PCH ..... Porcupine Caribou Herd
PDO ..... Pacific Decadal Oscillation
PEA ..... Programmatic Environmental Assessment
PEIS..... Programmatic Environmental Impact Statement
PEL..... permissible exposure limit
PHMSA ..... Pipeline and Hazardous Materials Safety Administration
PINC..... National Office Potential Incident of Noncompliance
PIP ..... pipe-in-pipe
PL ..... proposed pipeline
PM ..... particulate matter
PM_{10}..... coarse particulate matter with an aerodynamic diameter of 10 micrometers or less
$PM_{2.5}$..... fine particulate matter with an aerodynamic diameter of 2.5 micrometers or less
PMC..... Polar Mesoscale Cyclone
PO_4..... phosphate ion
ppb..... parts per billion
ppbv..... parts per billion by volume
ppm..... parts per million
ppmv..... parts per million by volume
ppt..... parts per trillion
PSD..... prevention of significant deterioration
psi ..... pounds per square inch

psig .....pounds per square inch gauge pressure
PSO.....protected species observer
psu .....practical salinity unit
PTS.....permanent threshold shift
RCRA .....Resource Conservation and Recovery Act
RD .....regional director
RE.....Resource Evaluation
RFFA.....reasonably foreseeable future actions
RHA .....Rivers and Harbors Act
RMS .....root mean squared
ROD .....Record of Decision
ROI.....record of increase
ROMS.....Regional Ocean Modeling System
ROW.....right-of-way
RP .....responsible party or recommended practice
RPMs.....reasonably prudent measures
RS/FO.....regional supervisor/field operations
SAR .....search and rescue or Stock Assessment Reports
SBS.....Southern Beaufort Sea Stock of Polar Bears
SCC .....social cost of carbon
SCR .....selective catalytic reduction
SD.....standard deviation
SDH.....social determinants of health
SDI .....satellite drilling island
Secretary.....Secretary of the Interior or Commerce
SEIS.....Supplemental Environmental Impact Statement
SEL.....sound exposure level
SEMS .....Safety and Environmental Management System
SFF .....summer fall feeding
SHPO.....State Historic Preservation Officer
SIL.....significant impact level
SIP .....state implementation plan
SL .....significance level (in air quality standards)
SLA .....Submerged Lands Act
SLIE .....seaward landfast ice edge
SLS.....spring lead system
SOA.....State of Alaska
SOP.....suspension of production
SPCC .....Spill Prevention Control and Countermeasure (Plan)
SSO.....sub-surface oil
SSOR.....sub-surface oil residue
stb .....stock-tank or standard barrel
STP.....seawater treatment plant
SUA.....subsistence use area
Sv.....Sverdrups
TAH.....total aromatic hydrocarbons
TAPS .....Trans-Alaska Pipeline System
TAqH.....total aqueous hydrocarbons
Tcf .....trillion cubic feet
Tcfg .....trillion cubic feet of gas
TCH.....Teshekpuk Lake Caribou Herd
TEK .....traditional ecological knowledge
TLV .....threshold limit values
TOC.....total organic carbon
TPH .....Tuktoyaktuk Peninsula (Caribou) Herd
TSLA .....Teshakpuk Lake Special Management Area

TSP ..... total suspended particles
TSS ..... total suspended solids
TTS ..... temporary threshold shift
UAF ..... University of Alaska, Fairbanks
UC ..... Unified Command
UIC ..... underground injection control
uERD ..... ultra extended-reach drilling
UERR ..... undiscovered economically recoverable resources
ULSD ..... Ultra-Low Sulfur Diesel Fuel
UME ..... unusual mortality event
UNFCC ..... United Nations Framework Convention on Climate Change
Unified Plan ..... Unified Plan for Preparedness to Oil Discharges and Hazardous Substance Release
USACE ..... U.S. Army Corps of Engineers
USC ..... United States Code
USCG ..... U.S. Coast Guard
USDOC/DOC ..... U.S. Department of Commerce
USDOI/DOI ..... U.S. Department of the Interior
USDOT/DOT ..... U.S. Department of Transportation
USEPA/EPA ..... U.S. Environmental Protection Agency
USFDA/FDA ..... U.S. Food and Drug Administration
USFS ..... U.S. Forest Service
USFWS/FWS ..... U.S. Fish and Wildlife Service
USGCRP ..... U.S. Global Change Research Program
USGS ..... U.S. Geological Survey
UTRR ..... undiscovered technically recoverable resources
UV ..... ultraviolet
VGP ..... Vessel General Permit
VLOS ..... very large oil spill
VOC ..... volatile organic compounds
VSM ..... vertical support member (supports above-ground oil and gas pipelines)
WAH ..... Western Arctic (Caribou) Herd
WCD ..... worst-case discharge
WHO ..... World Health Organization
WNP ..... Western Northern Pacific
WOUS ..... waters of the United States
WPS ..... Western Pacific Stock
WQS ..... Alaska State Water Quality Standards
WRO ..... Water Resources Office (Alaska Dept. of Natural Resources)
XSS ..... excess suspended sediment

Chapter 7

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Appendix A

Accidental Oil Spills and Gas Releases;

Information, Models, and Estimates;

and Supporting Figures, Tables, and Maps

Posted at: https://www.boem.gov/Liberty/

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Appendix B

Response to Comments

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APPENDIX B RESPONSE TO COMMENTS

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INTRODUCTION

On August 18, 2017 the Department of Interior (DOI) Bureau of Ocean Energy Management (BOEM) issued a notice of availability of a Draft Environment Impact Statement (DEIS) for the Liberty Development and Production Plan (DPP) in the Beaufort Sea Planning Area. Comments on the Draft EIS were initially accepted through November 16, 2018. The comment period was extended through December 8, 2017.

A total of 56,141 public comment submissions were received in Docket BOEM-2015-0068, including 34 public comments received through public meetings. Of the total 56,141 total public submissions, 142 have been identified as unique, 55,999 were part of a form letter campaign, and none were found to be non-germane or duplicates. This appendix reflects unique submissions received containing substantive content organized by commenter type.

Issue 1. General Comments on the Proposed Development Production Plan

Summary of Comments

A number of commenters provided general comments regarding the Draft Environmental Impact Statement (EIS) for the Liberty Development and Production Plan (DPP) in the Beaufort Sea Planning Area. Commenters in support of the Proposed Action in the Draft EIS made general statements regarding the safety of the project and potential economic benefits afforded to the State of Alaska and local residents. Specifically, commenters provided the following statements in support of the Draft EIS:

- The Project would utilize the same technology that has been safely used to produce millions of barrels of oil over the past decades on the North Slope and in the Beaufort Sea.
- The Project plan is environmentally responsible.
- The Project will generate hundreds of needed jobs, tax revenue, and oil and gas royalty income at the local, state, and federal level.
- The Project will create additional indirect employment and business activity locally.
- Historically, the oil and gas industry stabilizes employment and state and federal revenue in Alaska.
- Hilcorp Alaska LLC (Hilcorp) is committed to engaging with whalers to protect subsistence activities.

One commenter in opposition to the project argued that because the estimated volume of barrels to be extracted over 22 years of the project does not significantly contribute to the overall oil consumption in the U.S., the risks to the environment from development are not justified. Another commenter in opposition stated that the project in its current form would not result in any long-term benefits significant enough make the perceived risk of the project tolerable or acceptable.

Source of Comments

- Individual/General Public
- Industry Groups

Response to Comments

Comments that express general opinions about oil and gas development or recommend specific decisions to be made by the Secretary of the Interior will be incorporated into the administrative record and available to the decision-maker during the deliberative process for the Liberty DPP. BOEM does not provide specific responses to such comments in this Final EIS.

A number of issues were listed as a basis for comments in support of and opposition to the Proposed Action without specific comments on the issue itself. Additional information and analysis of these issues can be found in the Final EIS. Details regarding the Liberty Development Production Island, including construction, operations, and decommissioning can be found in Section 2.1 of the Final EIS. Opportunities for technologies and practices to prevent, intervene, and respond to spills are described in Appendix A of the Final EIS. Potential impacts of the Proposed Action on environmental, social, cultural, and economic resources are analyzed in Chapter 4 of the Final EIS.

Issue 2. Science-Informed Decision-Making

Summary of Comments

A few commenters discussed the scientific evaluation and information identified in BOEM's Liberty National Environmental Policy Act (NEPA) analysis. A commenter stated that although the Liberty Draft EIS acknowledges some substantive data gaps, not all have been identified. The commenter provided a list of what they found to be significant data gaps, involving marine mammals, birds, fish, and the general Arctic Ocean ecosystem. The commenter concluded BOEM must address the missing data and the effects of oil and gas activities in these areas before an informed decision regarding the project can be made. Another commenter expressed concern that the best available science concerning impacts from Northstar Development Island on bowhead whales was not used. The commenter provided relevant references for BOEM's consideration. Another commenter requested BOEM keep data on blowouts up to date and conduct peer reviews of other data collected.

One commenter noted that the Draft EIS provides a vast array of scientific evaluations as part of the project's record.

Source of Comments

- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

BOEM is very serious about its commitment to science-informed decision-making. In fulfilling its NEPA obligations through this EIS, BOEM carefully analyzed each potentially affected environmental resource in and around the Proposed Action Area, with due consideration for biological resources and the Arctic ecosystem. BOEM has prepared this Final EIS to inform the public and the decision-maker about the environmental impacts that could occur if the Liberty DPP is approved. The Final EIS is based on comprehensive review of existing literature, with appropriate emphasis on peer-reviewed scientific studies. A list of studies, reports, and other materials utilized in developing the Final EIS is provided in Chapter 7 of the Final EIS. BOEM's team of analysts includes experts in relevant disciplines including oceanography, marine biology, cultural anthropology, geology, and economics. These analysts provide focused technical analyses of all reasonably foreseeable environmental impacts associated with the Proposed Action and alternatives. BOEM has determined that existing data concerning environmental resources in and around the Proposed Action Area and the potential effects of the DPP are sufficient to inform the effects analysis and facilitate a reasoned choice among alternatives. Responses to comments regarding specific data gaps perceived to occur in the EIS are provided under other issue categories in this appendix.

Issue 3. Public Outreach

Summary of Comments

A few commenters discussed BOEM's public outreach efforts related to the project.

There were a couple of requests to extend the comment deadline beyond the 90 days from publication of the notice of availability in the *Federal Register* to provide more time for stakeholder input and evaluation. Commenters stated that comprehensive comments cannot be developed in the amount of time provided due to the number of other oil industry projects and issues demanding industry and stakeholder attention. Commenters expressed frustration with BOEM's response time to the requests for extension. One commenter noted that although they plan to collaborate with BOEM, a consultation would not replace what can be provided in a written public comment letter.

One commenter expressed appreciation for an extension of the comment period. Another commenter suggested BOEM consider adding more public hearings to the schedule to allow more local residents to provide comments.

A few commenters stated that local community and cooperating agencies have not been sufficiently engaged. Commenters stated that appropriate documentation about project plans and related impacts was not provided in preparation for or during public meetings. Commenters requested BOEM schedule additional meetings once this information is shared.

Commenters generally expressed frustration regarding the exclusion of community concerns expressed by native elders and other community members in formal documents related to this and other projects in the lease areas. Similarly, commenters suggested local organizations have historically not been informed about planned explorations. Another commenter stated Hilcorp has not conducted meaningful outreach in the community prior to developing and submitting its drilling plan, as suggested in the Draft EIS.

Source of Comments

- Individual/General Public
- Industry Groups

Response to Comments

Information regarding BOEM's extensive public outreach efforts during the EIS process is provided in Chapter 6 of the Final EIS. Additional responses are provided below.

Availability and Efforts to Notify. BOEM took deliberate steps to announce the availability of the Draft EIS, to disseminate the Draft EIS, to meet with interested parties, and to publicize the series of meetings scheduled specifically for this process. These efforts included the following:

- Publishing a Notice of Availability of a Draft EIS on August 18, 2017 (82 *FR* 39453).
- Having BOEM's Tribal and Community Liaison personally call the specific communities that would be potentially affected by this project.
- Releasing the Liberty DPP Draft EIS to the public on August 18, 2017, through a press release and posting on BOEM's website at https://www.boem.gov/liberty/.
- Mailing digital copies and hard copies of the Draft EIS to interested parties on August 18, 2017.

- Scheduling public hearings in three potentially affected villages—Nuiqsut, Kaktovik, and Utqiaġvik (Barrow)—as well as in Fairbanks and Anchorage.
- Using social media, such as BOEM's Facebook page, to inform the public of the agency's efforts.
- Publishing announcements in the Alaska Dispatch News, the Arctic Sounder, the Nome Nugget and the Fairbanks Daily Miner.

BOEM also produces transcripts of public hearings held for environmental reviews. The public hearing transcripts on the Draft EIS are included within an appendix to the Final EIS. BOEM posts public hearing transcripts on its Alaska Region website at http://www.boem.gov/AK-Liaison.

Requests to Extend the Time to Comment. Council on Environmental Quality (CEQ) regulations require BOEM to provide a minimum 45-day public comment period on the Draft EIS. In the Notice of Availability of the Draft EIS, published on August 18, 2017 (82 *FR* 39453), BOEM requested that all comments be provided by the end of a 90-day comment period, or on November 16, 2017. In response to a request from stakeholders, BOEM extended the period for accepting public comment on the Draft EIS to December 8, 2017, resulting in a 112-day comment period.

The Draft EIS comment period provided a meaningful and ample period of time to comment on the document. In addition to accepting written comment, BOEM accepted comment at five public meetings held around Alaska, including major population centers and communities near the Proposed Action Area. BOEM communicated key concepts to the public at the public meetings using PowerPoint presentations.

BOEM considered each individual request for an extension to the comment period and extended the original 90-day comment period to 112 days so that Alaska Native tribal governments and Alaska Native Claims Settlement Act corporations would have more time to review the document and provide detailed comments to BOEM. The requesters who asked for an extension of time did submit comments on the Draft EIS.

Community Calendars. BOEM strives to work with community and tribal leaders when setting up meetings in Alaska communities. Specifically, BOEM Alaska Outer Continental Shelf (OCS) Region's Tribal and Community Liaison worked closely with the Alaska communities on the timing of these meetings. BOEM recognizes that many communities engage in a subsistence way of life and that the government must be flexible when subsistence activities are ongoing in the community. BOEM also recognizes additional considerations to include holidays, elections, and cultural, community, and family activities, and works hard to avoid scheduling conflicts with these important events.

Feedback Regarding the Decision. The Assistant Secretary of Lands and Minerals is expected to make his decision in late 2018. BOEM staff will contact key community and tribal leaders to discuss their interest in BOEM returning to the communities for meetings.

Issue 4. Alternatives

Summary of Comments

Several comments received on the Draft EIS expressed a preference regarding which of the alternatives analyzed in the Draft EIS should be selected by BOEM. A number of different reasons for the commenter's preference were provided. This included preferences based on the alternative's distance from the Boulder Patch, water depth, seafloor footprint, gravel requirement, pipeline length, oil flow rate, impacts on Tribal communities and subsistence use, impacts on other environmental resources, and revenue generation for the North Slope Borough (NSB). One commenter indicated their preference for the proposed action partially based on their belief that it would also be determined to be the least environmentally damaging practicable alternative.

Another commenter asked about the criteria used to arrive at the preferred alternative and suggested that the expansion of the Duck Island mine site should be eliminated from consideration in Alternative 5C.

A number of commenters specifically opposed one or more alternatives or requested that they should be rejected. A number of reasons to support these requests were provided with varying levels of detail. Reasons provided by commenters included the superiority of the location and design of the proposed action, and the technical complexity, cost, feasibility, or reasonableness of the other alternatives. One commenter opposed Alternative 4A because it was evaluated and dismissed as a feasible alternative in the 2002 Liberty Final EIS.

A number of commenters identified perceived missing or conflicting information in the description of the alternatives in the Draft EIS. This included questions about the total pipe length versus the offshore pipe length, the type of the pipeline (e.g., three-phase), economic feasibility, the gravel volumes required, assumptions for processing reservoir fluids, the location of the onshore facilities and the seawater treatment plant, consistency of production operations between the alternatives, and the safety of alternatives.

A commenter recommended that the separation between discussions of Alternatives 3A and 3B in Section 2.2.4.4 be made clearer and suggested that the figure for Alternative 4B should show the location of the facility pad and the description should note the need for a bridge to span the east channel of the Sagavanirktok River and note the length of gravel roads needed. The commenter also recommended that the elevation of the site associated with Alternative 5B should be provided to demonstrate that it would avoid seawater inundation.

A commenter stated that there are no processing facilities on the Satellite Drilling Island and that alternatives limiting the Liberty Drilling Production Island (LDPI) to drilling should evaluate the transportation of production from Liberty Island to the Main Production Island.

One commenter recommended that BOEM consider another alternative in the Final EIS for limiting the LDPI to drilling and reinjection only. Under this alternative, tri-phase oil would be exported to the Satellite Drilling Island through a subsea pipeline avoiding the Boulder Patch, and would then be piped to the Main Production Island along the Endicott Causeway for processing in the existing facility. The commenter also recommended that BOEM include an alternative for another existing mine site with the potential to meet the gravel needs of this project. Specifically, they suggested that options for Alternative 5C include the evaluation of the Duck Island Mine Site or Put 23 Pit (Oxbow Pit).

Other commenters suggested that alternatives to abandonment in place should be discussed and the Final EIS consider an alternative approximately half the distance to shore from the proposed LDPI.

One commenter expressed concern that the level of analysis was not consistent across alternatives, specifically with regards to the air quality analysis and the mining and gravel requirements of the different alternative designs. The comment on the methods for the air quality analysis is summarized in greater detail under Issue 10. Another commenter requested that additional analysis of the safety of Alternative 3B be conducted.

One commenter expressed concern that the Draft EIS failed to analyze a reasonable range of alternatives under NEPA. Specifically, the commenter stated that the Draft EIS should have included alternatives that would limit the oil and gas production activities of the project. The commenter also suggested the Draft EIS should have included an alternative that would stay the decision to approve the project until more information on global climate change is considered.

One commenter suggested drilling from Endicott Satellite Drilling Island should have been an alternative and questioned why this alternative was not considered.

Source of Comments

- Local and Regional Governments
- Federal Agencies
- State Agencies
- Industry Groups
- Individual/General Public
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Opinions and Recommendations. Comments that express general opinions or recommend specific decisions to be made by the Secretary of the Interior will be incorporated into the administrative record and available to the decision-maker during the deliberative process for the Liberty DPP. BOEM does not provide specific responses to such comments.

Agency's Preferred Alternative. Under NEPA, an agency's preferred alternative frequently takes into account factors beyond the environmental effects analysis contained within the document itself. Departmental regulations at 43 Code of Federal Regulations (CFR) 46.420(d), which implement CEQ regulations at 40 CFR 1502.14(e), describe the agency's preferred alternative as "the alternative which the agency believes would fulfill its statutory mission and responsibilities, giving consideration to economic, environmental, technical, and other factors." BOEM has determined that Alternative 1, the Proposed Action, best fulfills its statutory mission and responsibilities, given all relevant economic, environmental, and technical factors. Section 2.2.2 of the Final EIS identifies BOEM's preferred alternative.

Alternatives Selection Criteria and Process. The alternatives selection process used to develop and analyze alternatives is described in Section 2.2.1 of the Final EIS, which indicates that BOEM considered, through the Purpose and Need of the project: public scoping comments, input from Cooperating Agencies and tribal consultations, previous NEPA evaluations of Liberty exploration and development plans done by BOEM, and current conditions in North Slope oil and gas development. Alternatives to the 2002 Liberty Development and Production Plan Final EIS were developed by

considering the same sources as described above. The alternatives covered the full range of reasonable development scenarios while addressing specific concerns associated with components of the proposed Liberty DPP. Also considered in the alternatives development for this Final EIS are the changes to existing infrastructure and operations on the North Slope since the 2002 MMS Liberty EIS was completed. Land status, oil field practice, technology, and regulatory controls have changed and evolved. New information has been collected, including biological studies, oil and gas resource updates, and subsistence surveys. Each potential alternative suggested during this process—whether analyzed in the 2002 EIS, suggested by commenters during scoping, suggested by Cooperating Agencies, or identified internally by BOEM analysts—was subjected to a screening process that considered technical feasibility, economic feasibility, and ability to meet the Purpose and Need.

Reasonable Range of Alternatives. The Final EIS analyzes a reasonable range of alternatives comprising a No Action alternative, a Proposed Action alternative, and three additional "action" alternatives, each of which features two sub-alternatives. The alternatives for the NEPA analysis are largely shaped by the purpose and need for the Proposed Action. Any alternative that does not meet the purpose and need is not part of a reasonable range of alternatives and does not need to be considered in the NEPA analysis. As described in Section 1.3 of the Final EIS, the purpose of the Proposed Action is to recover and process oil from the Liberty oil field and transport sales-quality oil to market. The need for this action is established by the Department of Interior (DOI) responsibility under the Outer Continental Shelf Lands Act (OCSLA) to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs. Alternatives restricting the volume of oil and gas produced may not meet the purpose and need of the project or may not be economically feasible and therefore would be outside of a reasonable range of alternatives. The impacts of an alternative to forego approval of the Proposed Action until further information on climate change is available is captured under the No-Action Alternative.

The Duck Island Mine site was considered as Alternative 5C in the Draft EIS but has been dismissed from analysis in the Final EIS because it is no longer considered technically feasible due to insufficient quantities of usable material. The location is currently flooded and would take up to 1 year to de-water (it has an ephemeral connection to Duck Island Creek, and contains fish). Given the volume of water in the site and the lack of usable material, this location is not a feasible alternative.

New Alternatives. BOEM received a number of comments suggesting that alternatives to discrete components of the LDPI be evaluated, such as locating the LDPI 3 miles offshore, or to a location as far southwest as possible; moving power generation onshore/ changing how it is generated on the LDPI; and/or limiting activities at the production island or alternative locations. Alternative locations for the LDPI, processing, and power generation are already analyzed under existing Action Alternatives in the DEIS and FEIS.

Alternate LDPI locations are examined in Alternatives 3A and 3B. Alternative 3B in particular analyzes an alternative LDPI location that is as close to shore as is feasible, given operational constraints. Overall, alternate LDPI locations would place the island in potentially unstable sediments, could expose the island and pipeline to overflooding and strudel scour events, increase borehole lengths (which amplifies drilling risks or may result in technically infeasible drilling distances), and reduce the volume of ultimately recoverable hydrocarbons over the life of the field as compared to the Proposed Action.

Alternatives 4A and 4B consider the impacts of processing and power generation at the existing Endicott Main Production Island or at a new onshore production facility. Similar to alternate island locations, these alternatives had to consider (with regards to the pipeline right-of-way), potentially

unstable sediments, overflooding and strudel scour events so that pipeline could reasonably be operable for the life of the project.

Section 4.2.1 of the FEIS provides more detail about the technical and safety issues associated with Alternate LDPI, processing, and power generation locations. Because each of these concepts is already proposed and analyzed within existing EIS alternatives, no additional alternative combining all of these components was added to the Final EIS. The decision-maker already has discretion to select all three of this components based on the analysis provided under the existing suite of alternatives.

Additional Detail and Information. BOEM received several comments requesting that additional detail be disclosed in the descriptions of the alternatives. Where appropriate, Chapter 2 has been revised in the Final EIS based on comments received. The level of detail describing each of the alternatives in the Final EIS allows for a rigorous exploration and objective comparison of all alternatives, including the proposed action, in compliance with NEPA requirements. Further detail on each alternative beyond that provided in the Final EIS is not necessary to provide a clear basis for a choice between alternatives, as required by NEPA.

The Final EIS has been revised to clarify the gravel mining requirements for each alternative analyzed to provide for a meaningful basis of comparison of potential impacts under each alternative including the Proposed Action. Ten sites were proposed during scoping and considered by BOEM to see which were feasible for inclusion in the DEIS. Comments specific to the level of analysis of air quality impacts between alternatives are addressed in Issue 10.

Issue 5. Mitigation

Summary of Comments

Several comments proposed new mitigation measures. In some cases, suggested mitigation measures are addressed in other Issue Categories. Comments suggesting mitigation measures are as follows:

- Sediment transport monitoring should be conducted during the construction of the LDPI and subsea pipeline to compare actual sediment transport rates with sediment transport models.
- Real-time monitoring should be used to optimize construction procedures, to limit operations to periods when currents will be less likely to transport sediment to the Boulder Patch, and to examine options to minimize turbidity as a part of developing the island and pipeline construction practices.
- Real-time monitoring should be made available to onshore experts and the Bureau of Safety and Environmental Enforcement (BSEE) to make offshore drilling data immediately available.
- A mechanism to use the LDPI's infrastructure to transport oil spilled around the island to shore using the subsea pipelines should be required.
- Blow Out Preventers (BOP) should include a set of blind-shear rams installed in the BOP stack.
- An annual Mechanical Integrity Assessment Report should be completed by a BSEE-approved verification organization.
- BOPs should be completely broken down and inspected at least once every 5 years.
- All well-capping equipment should be located either on the LDPI or onshore to ensure equipment is available for immediate well control without the potential for any logistics delay and a logistics plan for any well capping equipment staged onshore should be required.
- A relief well plan should be submitted that includes the selection of a relief well rig and a logistics plan. The technical and logistical improvements in the relief well plan to tighten the relief well time to 45 day or less should be examined. The written Relief Well Drilling Plan should include the technical and operating specifications of the equipment, standard operating procedures and schedules for testing, operation, inspection, maintenance and repair, and plans for storage, transportation to the well, and deployment.
- The pipeline setback and/or mitigation measure should account for the possibility of an ivu (ice shove) event where several meters of sea ice can ride up onshore with extreme force and destructive power.
- Additional site-specific ice gouging surveys should be conducted along the proposed pipeline route and area prior to construction.
- An ecosystem impact monitoring study of the Boulder Patch area should be periodically required through the life of the LDPI.
- Process studies should be conducted on the Boulder Patch to monitor and mitigate impacts.
- Specific measures should be developed to mitigate impacts on the Boulder Patch should alternative 1 or 4 be selected.
- A nearshore fish community impact monitoring study should be required throughout the life of the LDPI in order to detect possible disruption in the spawning and migration of subsistence fish species and other ecologically important species.

- Measurements and monitoring should be conducted in areas outside of the project area including:

  -acoustic measurements and monitoring of sounds produced by project-related activities outside the project area and inside and outside the barrier islands; and

  -satellite tagging and monitoring of bowhead migration beyond the project area.

- The applicant should be required to enter into a Conflict Avoidance Agreement (CAA) as a permit condition.
- Measures that the NSB typically applies to all North Slope Projects should be included in BOEM's Record of Decision. These include measures to mitigate impacts on subsistence activities, caribou, whale migration, and noise-sensitive species.
- Vessels should avoid groups of whales. When groups of 5 or more whales are encountered by a vessel, the vessel should stop until the whales move out of the area.
- Standard operating procedures and staff training should be implemented to reduce sediment transport and minimize the impact of sediment deposition on the Boulder Patch during construction operations.
- BOEM should stipulate that summer construction at the production island must cease by July 25, to reduce impacts on fall whaling.
- Drilling through the hydrocarbon zone should be limited to November 1 to April 15 and a relief well should be completed within a 45-day period. If the relief well will take longer than 45 days to construct, the drilling through the hydrocarbon zone should be restricted to November 1 to March 1.
- A quiet period for some portion of the year should be considered, or seasonal shutdowns should be mandatory, rather than continuous drilling.
- A mechanism for sharing revenue from projects in the Arctic OCS with the State of Alaska and local governments in affected areas should be developed.
- Borough residents should be provided with the opportunity to be trained for jobs related to regional oil and gas exploration and development.
- Approval of the project should be conditioned upon the applicant's good faith effort to reach an Oil Spill Contingency Mitigation Agreement between itself, the NSB, and the Alaska Eskimo Whaling Commission.
- The applicant should commit to a "good neighbor policy" by funding an account with $20 to $30 million to be drawn upon only in the event of a major discharge event.
- The applicant should create an endowment fund for Nuiqsut and Kaktovik whalers to mitigate adverse impacts on whaling from the project.
- The applicant should sponsor a Central Beaufort Science Initiative to fund scientific studies in the Foggy Island Bay area and around Cross Island under the Collaborative Alaska Arctic Studies Program.
- At lease termination, the lease site should be returned to the pre-development condition and the pipeline should be removed and the trench backfilled.
- A minimum setback distance of 1 mile from walruses and polar bears should be required for all non-emergency helicopter flight paths.
- Blast-resistance design criteria should be required for employee living quarters on the LDPI.

- Vegetation and wetlands restoration and rehabilitation plans should be described in the Final EIS and all common best management practices should be considered.
- Compliance with State of Alaska spill prevention and response statutes and regulations should be required.
- Hilcorp should be required to engage in the Camden Bay Initiative as development gets underway.
- A winter construction schedule should be required.
- Discharge streams from the LDPI should be injected or hauled rather than discharged into the marine environment, with the exception of seawater treatment.
- Hilcorp should collaborate with the Alaska Eskimo Whaling Commission on vessel traffic patterns and frequency.
- Hilcorp should develop a plan to provide long-term habitat enhancement through gravel mine site reclamation.
- Mitigation measures related to Cross Island Whaling should be developed through a partnership with the Nuiqsut whalers and the agencies.
- The applicant should commit to providing financial and logistical support for Nuiqsut whalers for the life of the project.
- Operational and support vessels should be staffed with dedicated Protected Species Observers to alert crews to the presence of marine mammals and initiate adaptive mitigation responses.
- Impacts to the Boulder Patch must be monitored carefully due to the "moderate" to "heavy" sediment exposure expected throughout the project.
- High quality, cleaned gravel must be used to reduce the total suspended solids placed into the marine environment in the Boulder Patch area.
- The island should be relocated as far southwest as possible.
- Processing should be relocated to a new onshore facility.
- The pipeline should be buried deeper.
- Seasonal restrictions should be instituted on drilling, pile driving, shipping, and other activities during whaling season.
- Liberty Island should be removed when it is decommissioned.
- Mandatory seasonal shutdowns should be required to limit the interference with whale migration and hunting season.
- The Final EIS should include the mitigation measures developed by Hilcorp as part of the lease stipulations and the mitigation and monitoring requirements and guidance set forth in the Marine Mammal Protection Act authorizations.

One commenter requested that the language included in the mitigation measures be changed to "shall" in order to make the measures more enforceable.

Another commenter identified a discrepancy in the aircraft avoidance distances included as Draft EIS mitigation.

A number of commenters requested that some of the mitigation measures in the Draft EIS be removed in the Final EIS. In general, commenters requested that mitigation for unlikely impacts be removed. Specific mitigation proposed for removal includes the following:

- Seasonal drilling restrictions.
- Reforestation of 9,000 acres of public lands to meet carbon offset goals.
- The design of the flaring boom height must consider—along with other relevant design criteria—the mean flight altitude of low-flying at-risk species, such as has been suggested to be beneficial in the case of the flaring boom at Northstar Island (Day et al. 2015).

A number of commenters expressed support or gratitude for the mitigation measures included in the Draft EIS.

Source of Comments

- Local and Regional Governments
- State Agencies
- Federal Agencies
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

In developing the EIS, BOEM identified various ways that potential impacts could be reduced. These potential mitigation measures are identified and analyzed in the Final EIS. BOEM also considered all relevant and reasonable mitigation measures identified in public comments on the EIS. Decisions on whether to adopt specific mitigation measures will be made in the Record of Decision.

The Final EIS identifies a number of lease sale stipulations, design features, and best management practices committed to by the operator, and other mitigation measures. These mitigation measures include typical mitigation measures incorporated into Marine Mammal Protection Act take authorizations and typical mitigation measures incorporated into Biological Opinions issued pursuant to Section 7 of the Endangered Species Act. In analyzing potential impacts from the Proposed Action and other Action Alternatives, BOEM assumes implementation of, and compliance with, the mitigation measures described in sections of Appendix C in the Final EIS.

Appendix C also contains proposed mitigation measures that were developed as a result of scoping comments and comments on the Draft EIS or through impacts analysis. As described in Appendix C, the effects analysis in the Final EIS assumes that Hilcorp will comply with all lease stipulations, will implement their committed design features and best management practices, and will follow applicable measures of other federal, state, and local laws and policies. In addition, BOEM analysts identified mitigation measures in Appendix C which, if implemented may further reduce potential impacts.

Mitigation measures identified by BOEM that would further reduce environmental impacts are also identified in Appendix C and described in Chapter 4 under the resource categories to which they apply. Furthermore, BOEM describes a potential project-specific mitigation measure that would

restrict drilling into hydrocarbon-bearing zones to periods of solid ice conditions in Section 2.4 of the Final EIS.

The following responses to specific comments/issues are provided to the extent practicable:

Boulder Patch. Recommendations to mitigate impacts to the Boulder Patch included developing measures to minimize sedimentation, using high quality gravel, and implementing various studies and monitoring efforts. Currently, winter construction of the LDPI and the pipeline is the primary method used to minimize sedimentation. In addition, BOEM analyzed the use of silt curtains as a mitigation measure and determined that they were not capable of working in ice conditions. The proposed gravel mine site was selected in part because of its high quality gravel, exhibiting a mean fines content of four percent (Section 2.2). Over the life of the project, some Boulder Patch habitat may become established on the lower portions of the island's concrete slope/armor. If so, the concrete armoring would be retained during decommissioning. Also, if appropriate, some armor removed from the LDPI may be purposefully placed and used to enhance hard bottom habitat. In regard to studies and monitoring, HAK would monitor various physical features of the Liberty Development including ice conditions, bathymetry, and trench conditions. Monitoring to ensure sediment discharge does not exceed specific levels is associated with permits issued by the State of Alaska under the authority of Section 401 of the Clean Water Act (i.e., ADEC issues a Certificate of Reasonable Assurance in conjunction with the permit issued under Section 404 of the Clean Water Act to ensure that discharges comply with the Alaska Water Quality Standards). In addition, BOEM is developing a new study to examine long-term drivers of community variability in the Boulder Patch during Liberty development activities. The study would also examine possible mitigation measures using common industry materials to "reseed" or replace habitat lost due to the construction of the LDPI.

Oil spill prevention; oil spill response. Comments recommending specific oil spill prevention methods and oil spill response techniques have been provided to BSEE. Issues related to oil spill preventions, response, and clean up are administered and regulated by BSEE pursuant to its review of APDs. These issues are also addressed in separate Issue Categories.

Monitoring. Commenters recommended monitoring and/or studies of various living and physical resources such as subsistence fish species, marine mammals (including recommendations to conduct acoustic monitoring and tagging migrating bowhead whales), whalers at Cross Island, ice movement, and ice gouging. Commenters also requested that HAK be required to engage in or fund the Camden Bay initiative and the Central Beaufort Science Initiative. The efforts of HAK, BOEM, and others include a number of on-going and proposed baseline and/or monitoring studies in the Beaufort Sea. These efforts provide for an extensive monitoring regime and encompass many of these suggestions. For example, HAK is funding a four-year sea ice prediction study to analyze existing data, collect real time measurements at the Liberty site, and integrate these data to allow for targeted forecasting of ice conditions in the project area. While previous studies of ice gouging in Foggy Island Bay have found that ice gouging is less prevalent inside barrier islands with much shallower incision depths, HAK also plans to complete annual surveys over the pipeline corridor and/or along the island perimeter to assess trends associated with strudel scour impacts, ice events, or erosion. HAK is also continuing to fund the annual study of Cross Island subsistence whalers. BOEM is continuing several monitoring efforts in the Beaufort Sea, such as surveys of fish and lower trophic communities, studying migration trends of eiders and loons, and others (see http://www.boem.gov/akstudies/ for additional information on BOEM studies). In addition, lease stipulations (see Appendix F), BOEM operating regulations at 30 CFR 550, and monitoring requirements contained within Incidental Harassment Authorizations and Letters of Authorization issued by NMFS and USFWS, respectively, in accordance with the MMPA, requires operators to undertake extensive monitoring and reporting programs.

Subsistence/Arctic People. Recommendations requesting that BOEM require Hilcorp to enter into specific agreements with Alaska Native peoples are beyond BOEM's authority. These include recommendations that BOEM require Hilcorp to enter into a CAA, hire local residents, enter into an Oil Spill Contingency Mitigation Agreement with the NSB and AEWC, put funds into a "good neighbor policy" account, and/or create various types of mechanisms to provide funds to support whalers and whaling communities. However, recommendations requesting that BOEM require certain mitigation measures to avoid and/or minimize adverse effects to subsistence users/Arctic people is within BOEM's authority. Mitigation measures in Appendix C (Section C-4) require that pile-/pipe-driving shall not be allowed during subsistence whaling, and that marine vessel traffic shall not be allowed seaward of the barrier island during whaling. Because of the minimal noise level and limited extent drilling noise travel of on-island drilling, BOEM does not consider a seasonal drilling shut-down warranted. Additional issues related to subsistence/Arctic people are also addressed in a separate Issue Category.

Marine Mammals. NMFS and USFWS require a variety of marine mammal mitigation measures in every incidental harassment or letter of authorization that they issue. As explained in Appendix C and analyzed in Chapter 4, BOEM assumes that NMFS and USFWS will apply these typical/standard measures. Such measures include: PSOs shall be required (when appropriate); vessels shall avoid groups of whales, reduce speed, and/or changing direction as appropriate; aircraft shall following horizontal and vertical setbacks from individual or groups of animals; acoustic monitoring of sounds produced by project-related activities shall be conducted; and other measures as deemed necessary by NMFS/USFWS.

Revenue Sharing. Mechanisms for revenue sharing could only be established through an act of Congress. No mandates are established through an EIS, which is an informational document.

Compliance with other federal, state, or local agency regulations and/or incorporation of other agency mitigation measures. Some commenters recommended that the stipulations of other federal, state or local permitting agencies be required as part of BOEM's authorization. Examples include the suggestion that BOEM require a vegetation and wetland restoration plan for the gravel mine (an activity regulated by ADNR and USACE), adherence to the North Slope Borough's typically applied mitigation measures, compliance with the State of Alaska's spill prevention and response statutes and regulations, and requiring reinjection or off-site disposal of discharge streams (discharges regulated by the EPA and/or the State of Alaska). BOEM does not see a need to duplicate stipulations. As stated in Appendix C, BOEM assumes implementation of, and compliance with, the requirements of federal, state, or local agencies. Furthermore, BOEM's authorization does not override, supercede, or negate the authority of any other agency.

Decommissioning. Recommendations for decommissioning include: the area should be returned to pre-development condition, the pipeline be removed and the trench backfilled, and the LDPI be removed. Decommissioning is described in Section 2.2.8. At the end of the project life, decommissioning of the pipeline would be subject to both State of Alaska and DOT PHMSA regulations. As currently proposed, the pipeline would be cleaned and abandoned in place. The gravel island would be abandoned in a process similar to that used for other exploration gravel islands in the vicinity, which has had no discernible impact to resources. All surface facilities would be cleaned and removed, including armoring and sheet piles, and the island would be allowed to erode naturally.

Alternate locations and project designs as mitigation measures. Recommendations that suggest different island locations and/or processing locations are addressed in a separate Issue Category. The suggestion that blast-resistant design criteria should be required for employee living quarters would

not serve to mitigate impacts identified in this EIS; the codes and standards required by BSEE for the island facilities do not include requirements for blast resistance or hardening.

Pipeline setback should account for the possibility that ice can ride up on shore several meters, and that the pipeline should be buried deeper. This is addressed in the design criteria proposed by Hilcorp. The current proposed pipeline setback is 350 feet, and the pipeline will be buried seven to nine feet below seafloor, which is over twice as deep as the maximum strudel scour depth (3.5 feet) recorded in one nautical mile of the proposed pipeline. Furthermore, as mentioned above in the discussion of monitoring, HAK is funding a sea ice prediction study to allow for targeted forecasting of ice conditions in the project area, and also conducting annual surveys over the pipeline corridor and/or along the island perimeter to assess trends associated with strudel scour impacts, ice events, or erosion.

Issue 6. Compliance with Laws, Acts, Policies

Summary of Comments

A number of commenters identified stipulations or conditions that would be required as part of OCS Lease Sale 144 and stated that BOEM would be required to ensure the applicant's compliance. Stipulation 4, Industry Site Specific Bowhead Whale Monitoring Program, and Stipulation 5, Subsistence Whaling and Other Subsistence Activities, were mentioned specifically.

Comments were provided regarding BOEM's jurisdiction, authority, and obligations under the OCSLA. One commenter asserted that BOEM does not have legal authority to reject the proposed action for reasons not specified in the OCSLA and suggested that many of the comments requesting the project be denied were based on policy reasons unrelated to the merits of the project or the approval criteria set forth in the OCSLA. Several commenters expressed concerns that the applicant has a history of violations of state laws and rules related to spills, accidents, and other safety violations. Commenters suggested that BOEM's EIS must disclose the applicant's history under NEPA. One commenter indicated that the OCSLA requires that oil production be balanced with protection of human, marine, and coastal environments and recommended that BOEM reject the project for failure to comply with the OCSLA on this basis.

One commenter requested that the Final EIS include a new section describing the planning authority of the NSB in general and the NSB's requirements for the applicant to submit a reclamation plan. Another comment requested that the NSB be added to the list of agencies that will use the environmental analysis to inform their regulatory review of various activities described in the DPP.

Several comments were submitted regarding the application of a number of Executive Orders, federal laws, and authorities to the Proposed Action and BOEM's review. One commenter recommended that BOEM ensure that the applicant has complied with all federal laws concerning Native Allotments. Another commenter expressed concern that the Section 106 process under the National Historic Preservation Act would be completed after BOEM issues a Record of Decision, and requested that the 106 process be concluded before the Record of Decision is issued.

The State of Alaska expressed concern that the Draft EIS included little to no discussion of where the workforce would be housed and if there would be any resulting permitting implications.

A number of comments were submitted suggesting that the Draft EIS did not adequately evaluate how the proposed action would affect the ability of the United States to meet goals and targets included in climate change policies such as the Paris Agreement and stated that such an analysis is required by NEPA and supported by case law and guidance issued by the CEQ. One commenter described the CEQ regulations explaining an agency's obligations when preparing an EIS where information for the analysis is incomplete or unavailable. A commenter discussed the history of the use of social cost of carbon in NEPA analyses and stated that Executive Order 13783 assumes federal agencies will monetize the value of changes in greenhouse gas (GHG) emissions and instructs agencies to ensure such estimates are "consistent with the guidance contained in OMB Circular A-4." The commenter also cited two federal district court cases which purportedly found the failure to use the social cost of carbon in NEPA analyses to be arbitrary and capricious.

Commenters also expressed support for compliance with a number of laws and policies that were identified in the Draft EIS.

Source of Comments

- Local and Regional Governments
- State Agencies
- Federal Agencies
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

BOEM's jurisdiction, authority, and obligations under the OCSLA. Section 1.4.1.1 of the Draft EIS outlines BOEM's role and authority under the OCSLA. DOI's responsibility under OCSLA is to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs. The DOI has delegated its OCSLA authority to several bureaus, including BOEM. Statutory requirements for the submittal and review of proposed DPPs are provided in Section 25 of OCSLA (43 U.S. Code [USC] 1351). BOEM's implementing regulations pertaining to review of proposed DPPs are codified at 30 CFR Part 550. There, BOEM establishes the requirements for submitting DPPs, the process by which BOEM reviews DPPs, and performance standards that the DPP must meet in order to be approved. Pursuant to 43 USC 1351 and 30 CFR 550.270-.271, BOEM would approve the DPP only if it complies with all applicable requirements. BOEM would require modification of the DPP if it fails to make adequate provisions for safety, environmental protection, or conservation of natural resources, or otherwise does not comply with the lease, OCSLA, the regulations prescribed under OCSLA, or other federal laws. BOEM would disapprove the DPP if the operator failed to demonstrate that it can comply with applicable requirements, or if any of several other specified circumstances apply.

BOEM's decision will be documented in the Record of Decision for the Liberty DPP. If Hilcorp were authorized to conduct development and production activities, BSEE would help ensure compliance with federal laws and regulations, applicable lease stipulations, and any conditions of approval.

As described in the Draft EIS, Appendix C, the effects analysis in the EIS assumes that Hilcorp will comply with all lease stipulations, which include stipulations of Lease Sales 124 and 144.

Additional Laws and Authorities. The regulatory and administrative authorities for federal agencies that intend to adopt the EIS to meet their permitting needs are described in Section 1.4 of the Draft EIS. BOEM recognizes the permitting authorities and processes of the State of Alaska and the NSB. Further elaboration on these authorities and processes in the EIS is not necessary, nor is a list of every Executive Order for which compliance was evaluated by BOEM.

National Historic Act Section 106 Compliance. On June 2, 2017, BOEM requested, concurrence from the Alaska State Historic Preservation Officer with the determination that the ground disturbance on land and sea associated with the proposed project will have no effect on historic properties. BOEM received written concurrence from the Alaska State Historic Preservation Officer in a letter dated July 6, 2017, indicating that a finding of no historic property affected is an appropriate finding.

Permitting Requirements for Workforce Housing. Non-resident workers would be housed in Liberty Development facilities away from local village communities in the area as described in

Section 4.4.2.1 of the Draft EIS. As stated in Section 4.2.2, there would be no discharges of sanitary and domestic wastewater during construction; sanitary and domestic wastewater generated by the construction workforce would be hauled offsite to an onshore disposal facility.

Policies and Goals Regarding Climate Change and Greenhouse Gas Emissions. BOEM disagrees with the notion that producing oil from the Liberty prospect would preclude the world from meeting GHG reduction goals and would "lock in" specific negative effects associated with climate change. There is a finite amount of oil in the Liberty prospect and it is not enough to demonstrably influence climate change (in the action area or anywhere else) on its own.

Monetizing Impacts from GHG Emissions. Section 4.4.2.1 of the Final EIS presents an updated analysis of monetized impacts from GHG emissions associated with the action and No Action alternatives. These updates, which include additional estimates based on methods consistent with the Office of Management and Budget (OMB) Circular A-4, represent BOEM's response to comments criticizing the use of the recently-rescinded Social Cost of Carbon protocol as a tool for monetizing GHG impacts in the Draft EIS. BOEM does not see any compelling reason to deviate from the methodologies and assumptions underpinning OMB Circular A-4, which has been peer reviewed and has been widely accepted for more than a decade as embodying the best practices for conducting this type of analysis. Adopting other methodologies and assumptions may compromise analytical rigor and would render BOEM's analysis inconsistent with those being produced by other Federal agencies.

Issue 7. Scope, Purpose and Need

Summary of Comments

A few commenters discussed the Purpose and Need of the Proposed Action and the Impacts Scale the agency used to categorize and describe environmental effects in the Draft EIS.

A commenter questioned why several sections of the Draft EIS (e.g., impacts on environment, air quality, fish, birds, marine mammals, and terrestrial mammals) discussing the impacts from planned activities are combined with impacts from unplanned activities, namely accidental oil spills. The commenter recommended separating these impacts so remote and speculative impacts were addressed separately.

A commenter stated that BOEM's Purpose and Need statement in the Draft EIS appropriately recognizes the purpose of the proposed action (the recovery of oil from the Liberty Unit) and that the need for action stems from BOEM's regulatory authority. Another commenter, however, argued BOEM's Purpose and Need statement is inadequate and fails to comply with NEPA. The commenter suggested the Purpose and Need statement should focus on BOEM's statutory duties under the OCSLA, which according to the commenter, charges BOEM with ensuring that environmental safeguards are in place for offshore oil development and ensuring the balance of orderly energy resources development with protection of the human, marine, and coastal environments.. The commenter argued BOEM violates NEPA because it did not define its Purpose and Need in a way that would allow analysis on whether the project should occur, and instead decided that it would approve the project from the outset.

Source of Comments

- State Agencies
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Likelihood of Potential Impacts. As discussed in Section 4.1.1 of the Draft EIS, accidental oil spills have a varying potential to occur. Accidental oil spills or gas releases may potentially affect resources during all phases of the Proposed Action, depending on the spill type, source, and size (volume). Small spills, although accidental, occur during oil and gas activities with generally routine frequency and are considered likely to occur from development, production, or decommissioning activities associated with the Proposed Action. These are therefore considered by resource area. Section 4.1.1 of the Final EIS also acknowledges that a large oil spill is a statistically unlikely event, with a 99.33% chance of no large spills occurring over the life of the Proposed Action. However, because large spills are an important concern, and no one can foresee the future, BOEM assumes a large spill could occur during the Proposed Action and includes a large oil spill analysis for the development and production activities. This "what if" or conservative analysis addresses any potential serious environmental harm and informs the decision-maker of potential impacts should a large spill occur. Assuming one large spill occurs instead of zero allows BOEM to more fully estimate and describe potential environmental effects.

Purpose and Need Statement. The purpose of and need for the Proposed Action is described in Section 1.3 of the Final EIS, which indicates that the need for this action is established by DOI's

responsibility under the OCSLA to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs. OCSLA also specifies the submittal and review processes for proposed DPPs, and establishes the circumstances under which proposed DPPs are to be approved, modified, or disapproved. Section 1.4 outlines BOEM's role and authority under OCSLA. BOEM regulations pertaining to review of proposed DPPs are codified at 30 CFR Part 550, where BOEM establishes requirements for the submittal of the DPP, the DPP review process, and performance standards that the DPP must meet in order to be approved.

BOEM and BSEE employ environmental safeguards as part of statutory requirements under OCSLA. Among other things, this places responsibility on the Secretary of the Interior to ensure a number of safeguards including, but not limited to, the following.

- A limitation that geological and geophysical exploration for mineral resources not be "unduly harmful to aquatic life ..."
- Regulations providing for the suspension or temporary prohibition of activity under a lease "if there is a threat of serious, irreparable, or immediate harm or damage to life (including fish and other aquatic life) ... or to the marine, coastal, or human environment ..."
- Regulations providing for the cancellation of any lease or permit if the Secretary of the Interior determines after a hearing that continued activity would "probably cause serious harm or damage to life (including fish and other aquatic life) ... or to the marine, coastal, or human environment" and also determines that the "threat of harm or damage will not disappear or decrease to an acceptable extent within a reasonable period of time" and that the "advantages of cancellation outweigh the advantages of continuing such lease or permit in force ..."
- A requirement to disapprove oil and gas exploration plans if the Secretary of the Interior determines that any proposed activity under a plan "would probably cause serious harm or damage to life (including fish and other aquatic life) ... or to the marine, coastal, or human environment" and "cannot be modified to avoid such condition."

BOEM reviews all proposed DPPs under its existing regulations at 30 CFR Part 550 Subpart B, and only approves those plans which demonstrate compliance with the performance standards at 30 CFR Part 550.202. The Purpose and Need defined in the Final EIS does not preclude analysis of whether or not the project should be authorized. The Final EIS considers a No-Action Alternative (Alternative 2), under which the Proposed Action would not be approved and the actions described in the Liberty DPP would not take place.

Issue 8. Development and Production Plan

Summary of Comments

A number of comments were provided on the DPP which provided the basis of the Proposed Action analyzed in the Draft EIS. Two comments expressed concern that the Draft EIS did not provide more description of the Northstar Island project as a reference for the DPP because of the similarities in the construction techniques and environmental conditions for both projects. These comments suggested that the project team behind the DPP could benefit from the construction history and remediation measures used in the Northstar Island project.

Several comments on the DPP stated that the Proposed Action as described and analyzed in the Draft EIS is a safe and prudent approach to allow the project to proceed. These commenters expressed confidence in the safety of the technology that would be used in the DPP, the history of the safe operation of artificial gravel islands for oil and gas production, and the environmental requirements that would be placed on the project by multiple permits and authorizations. One commenter also stated that the environmental considerations for the project had been repeatedly and thoroughly examined over two decades of studies and evaluations of oil and gas development in the area.

Multiple commenters suggested that information or details regarding the design or operation of the project were missing in the Draft EIS. Many commenters requested that the Final EIS should supplement, elaborate upon, or correct project information, while others commented on specific components of the DPP without specifically recommending revisions to the Final EIS. These comments included the following statements, questions, and requests:

- Further explanation should be provided regarding why subsea pipes and the gravel island would be abandoned in place.
- The definition of “trips” in the context of surface vehicle transportation estimates should be clarified.
- All the chemicals that would be stored at the LDPI should be listed.
- Proposed restoration activities should be verified and described.
- State closure plans would require consideration by the State of Alaska in the future and descriptions of the fate of infrastructure should be described accordingly.
- Information should be added under “Facilities & Systems” in Table 2.2.7-2 for Alternative 4B.
- The start of ice road construction is dependent on several factors including snow condition, weather, wind score, and the ability to bring in additional snow or ice chips.
- Criteria to begin ice road construction includes -5.0º C at 30 centimeters of soil depth and at least 6 inches of snow.
- Ice roads may be slotted at their entrance to prevent access.
- Will offshore ice roads be capped with fresh water?
- Where will gravel come from during the life of the project?
- If land farming of gravel is needed, how and where would it be accomplished?
- It is overly optimistic to state that ice roads may last into early June.

- More realistic mine site cross sections should be provided in the Final EIS and should depict the actual mined slopes and benches. Typical Cross Section Sheet 7 of 7 from the U.S. Army Corps of Engineers (USACE) Individual Permit Application should be used.
- Rehabilitation of the gravel mine site would not include a connection to a stream channel.
- Where will the construction workforce be housed for the alternatives?
- The mine site would not result in draining and capturing of an adjacent pond into the excavation area, as described in Section 4.3.6.1 of the Draft EIS.
- Total gravel needs for the DPP would be 1,337,000 cubic yards for the Proposed Action and 929,000 for the LDPI itself. The Badami ice road crossing pad would require 1,500 cubic yards of gravel.
- Typical Cross Section Sheet 14 of 15 from the USACE Individual Permit Application should be used for mine site figures in the Final EIS.
- Wells would be drilled and completed by the end of 2Q Execute Year 5.
- A more detailed description of the volume of materials to be backfilled, including the intended disposal plan for any excess materials not fitting inside the trench excavation, should be provided.
- An offshore island using a disposal well for waste discharges should be used and clarification should be provided whether all drilling waste would be injected into the disposal well and if not, how the waste will be handled.

Source of Comments

- Local and Regional Governments
- State Agencies
- Federal Agencies
- Elected Officials
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

BOEM submits that this Final EIS accurately describes the necessary elements of the Proposed Action and alternatives, to a sufficient level of detail that allows for a full evaluation of potential environmental impacts and a meaningful comparison among alternatives. Based on comments received on the Draft EIS, several improvements have been made to the document, including revised and clarified discussion of the Liberty DPP and its alternatives. BOEM has revised the description of the Proposed Action and alternatives to the Proposed Action in the Final EIS to provide additional detail and clarification as necessary to inform the analysis of reasonably foreseeable environmental impacts.

Comparison to the Northstar Island Project. The purpose of BOEM's EIS is to determine the possible impacts of the Liberty DPP (the Proposed Action) and provide for a comparison of meaningful alternatives to the Proposed Action, including a No-Action Alternative. BOEM agrees that the Northstar Island project provides relevant information due to its similarities to the Proposed

Action. This information is incorporated into the Final EIS where relevant. However, further details on the Northstar Island Project beyond what is included in the Final EIS are not necessary for the analysis of the Proposed Action and alternatives under NEPA.

Issue 9. Climate Change

Summary of Comments

Various comments referred to global climate change and the challenges surrounding a warming Arctic.

A few commenters mentioned scientific research conclusions that fossil fuels in the Arctic and globally must remain in the ground in order to meet international climate goals, or hold temperature rise to below 2 degrees Celsius. One commenter summarized findings of the 2017 U.S. Global Change Research program, Climate Science Special Report and claimed that the report highlights the urgent need to address climate change and that expanded Arctic fossil fuel development would hinder efforts to avoid the effects of climate change.

One commenter stated that the Draft EIS estimate that the project will contribute 64.5 million metric tons of CO2 equivalent of GHG pollution is too low.

One commenter stated that BOEM's analysis of the GHG emissions and associated climate change impacts of the project is flawed and does not comply with NEPA. The commenter claimed:

- The 2017–2022 OCS Oil and Gas Leasing Proposed Final Program report BOEM utilized is flawed in that it concluded lease sales will result in lower GHG emissions compared to the no-leasing "No Action" alternative. BOEM's assumption that any emission reductions gained by no action will be offset by oil and gas development elsewhere, (e.g., perfect substitution) is unsupported. The commenter provided descriptions of various analyses of oil and gas production and impacts on GHG and/or oil consumption in support of this claim. The commenter noted that BOEM's conclusion that the "No Action" alternative will lead to higher GHGs, rather than lower, contradicts its MarketSim global market model findings.

- BOEM did not account for the GHG benefits of reducing foreign oil consumption in its analysis.

- Another flawed "critical assumption" made by BOEM is that the demand for oil and gas will remain constant over the next 40 to 70 years and that oil and gas will be the primary energy source over the next 70 years.

- The commenter claimed, "It is arbitrary for the agency to quantify certain economic benefits of the Project (and allude to others) without accurately disclosing the social cost of its likely carbon emissions."

- Although BOEM acknowledges that black carbon contributes to climate change in Arctic regions, it failed to estimate black carbon emissions from the project and must address it in its Final EIS.

- The Draft EIS fails to acknowledge how the increased GHG emissions from increased oil and gas development will negatively impact polar bear recovery, intensify existing threats to whales and ice seals, and impact the Boulder Patch ecosystem.

- The commenter suggested that BOEM consider utilizing a cost-benefit analysis tool developed by the Interagency Working Group on Social Cost of Greenhouse Gases when monetizing the economic benefits of the project.

Another commenter encouraged BOEM to:

- Continue to estimate the monetized value of potential impacts from lifecycle GHG emissions;
- Derive such estimates from multiple, peer-reviewed models (with specific models recommended);
- Consider pricing carbon at higher rates;
- Share resources, information, and expertise with other Federal agencies conducting similar exercises;
- Continue to estimate monetized values on a global basis (or in the alternative, supplement any domestic-only analysis to reflect impacts that occur overseas but nevertheless affect U.S. interests);
- Utilize a 3% or lower discount rate (or in the alternative, a declining discount rate) when monetizing long-term effects;
- Treat the estimates provided in the Draft EIS as the lower bound of potential impacts; and
- Calculate the social cost of methane.

A few comments were provided on specific sections of the Draft EIS, including:

- A commenter requested clarification regarding different GHG emission figures for Alternative 3A and 3B in Table 4.2.4-1. The commenter questioned whether the change in location between the Alternatives would lead to an increase in GHG emissions or if the increase would be related to construction increases or other factors.

- A commenter requested the number of total metric tons of CO2e in Table 4.2.4-2 be reconciled and corrected. The commenter noted that BOEM's estimates for "Proposed Action and Action Alternatives" (64,570,000 total metric tons of CO2e) and "No Action" (89,940,000 total metric tons of CO2e) are incorrectly listed in Table 4.2.4-2.

- A commenter questioned the discussion of lifecycle GHG emissions and the costs to society in Section 4.2.4 of the Draft EIS. According to the commenter, this discussion is not needed in the Draft EIS per the March 28, 2017, Executive Order revoking requirements for analyzing the social cost of carbon.

Source of Comments

- Individuals/General Public
- State Agencies
- Industry Groups
- Environmental Advocacy and other Public interest Groups (NGOs)

Response to Comments

Climate change presents unique challenges to Arctic Alaska. The Final EIS addresses issues related to climate change in several ways.

Overview of how the Final EIS considers Climate Change and GHG Emissions. The Final EIS provides a multi-faceted, comprehensive analysis of relevant climate change issues. Chapter 3 of the Final EIS explains the mechanisms of climate change and describes how climate change is affecting environmental resources around the world. This discussion acknowledges the role of factors such as fossil fuel combustion in causing climate variability and describes important climate-driven processes such as sea level rise, ocean acidification, and diminishment of sea ice. The discussion goes on to describe in greater detail how climate change is affecting the Arctic Ocean and Arctic Alaska in particular, incorporating information from authoritative climate reports such as the Third National Climate Assessment (Melillo et al. 2014).

Each resource-specific subsection of Chapter 4 of the Final EIS analyzes potential impacts from the Proposed Action and other alternatives in the context of this changing environment. Section 4.2.4 of the Final EIS further analyzes the contribution of each alternative to climate change and the potential effects of that contribution. All GHG emissions that could directly or indirectly result from each alternative are quantitatively estimated to provide a proxy for assessing potential contributions to climate change. These "lifecycle GHG emissions" include not only projected "upstream" GHG emissions from the proposed development and production activities described in the proposed Liberty DPP, but also projected "downstream" GHG emissions from the refining and consumption of oil that would be produced from the Liberty prospect. Section 4.4.2 of the Final EIS then estimates impacts of these lifecycle GHG emissions in monetary terms.

Chapter 5 of the Final EIS considers climate change as it relates to potential cumulative impacts. Section 5.1.3 of the Final EIS provides additional information on climate change-related factors that are expected to affect environmental resources in their own right or influence how the Proposed Action could contribute to cumulative impacts. The ensuing subsections within Chapter 5 then analyze how the Proposed Action could contribute to cumulative impacts on specific resources or species in light on ongoing climate change.

Direct GHG Emissions. Section 4.2.4 estimates the GHG emissions that would result from the Proposed Action and the other action alternatives. The variance in GHG emissions between the Proposed Action, Alternative 3A, and Alternative 3B is attributable to the size of the drilling units that would be used under each of these alternatives. The drilling unit under Alternative 3A would be about 1.5 times larger than that under the Proposed Action and the drilling unit under Alternative 3B would be about 2.5 times larger than that under the Proposed Action, leading to a corresponding increase in projected GHG emissions. The variance in GHG emissions is not associated with the different locations of the drilling units, as the commenter surmises.

Lifecycle GHG Emissions. BOEM's estimate of lifecycle GHG emissions is based on a methodology originally developed by BOEM to better understand potential environmental impacts associated with its 2017–2022 OCS Oil and Gas Leasing Program. BOEM's model and the assumptions upon which it is based are explained in detail in a separate technical report on GHG emissions (Wolvovsky and Anderson 2016), which is incorporated by reference in the Final EIS. Using numbers generated by this model and its underlying assumptions, BOEM Alaska Region developed estimates for the GHG emissions that would result from selecting the various alternatives analyzed in the Final EIS. These estimates are provided in Section 4.2.4 of the Final EIS. The lifecycle GHG emissions estimated for the Proposed Action (which are also representative of the lifecycle GHG emissions that would result from selecting any of the other action alternatives) represent the sum of estimated GHG emissions from the development and production activities described in Hilcorp's DPP, the transportation and refining of oil produced from Liberty, and end-use consumption of this oil. The No Action Alternative accounts for GHG emissions associated with

developing, transporting, refining, and consuming other energy sources in lieu of oil from the Liberty prospect in order to meet future energy demands.

Estimated Oil Recovery. BOEM's calculation of lifecycle GHG emissions is based on a reasonable estimate of the amount of oil that would be produced under the Proposed Action (i.e., 125 million barrels [MMbbl]). The sole reference to 167 MMbbl of recovery contained within Hilcorp's DPP appears to be a typo or simple arithmetic error. Applying the estimated 55% recovery rate to the estimated 230 MMbbl present in the Liberty reservoir yields a recovery of 126.5 MMbbl, which is consistent with the other estimates contained within the DPP and with what BOEM assumed in its environmental impacts analysis.

Discrepancy in Lifecycle GHG Emissions Volumes. Public comments identified a discrepancy between the estimated lifecycle GHG emissions reported in Section 4.2.4 of the Draft EIS and those presented in Table 4.2.4-2 of the Draft EIS. This discrepancy has been corrected in the Final EIS.

Market Substitution. Market forces dictate that if oil were not produced from the Liberty prospect, energy would be procured from other sources to keep energy supplies in step with energy demand. BOEM's analysis accounts for this concept, known as market substitution. Changes in energy consumption patterns are estimated using BOEM's energy market simulation model, MarketSim (Industrial Economics Inc. 2015). MarketSim was used to evaluate substitutions in the 2017–2022 Program economic analysis. This model simulates end-use domestic consumption of oil, natural gas, coal, and electricity in four sectors; primary energy production; and the transformation of primary energy into electricity. MarketSim mostly represents U.S. energy markets, but also captures interaction with world energy markets as appropriate. To account for substitution between different sources of energy, the model calculates equilibrating prices for oil, natural gas, coal, and electricity based upon the expected increase in OCS production of oil and gas.

The estimated lifecycle GHG emissions associated with the No Action Alternative reflect the lifecycle GHG emissions associated with the other fuels (anticipated to be primarily oil imports, along with a mix of natural gas, renewables, and coal) that would be produced and consumed in lieu of oil from the Liberty prospect. Comments asserting that the Final EIS assumes "perfect" substitution are incorrect. BOEM does not assume that market substitution would occur on a 1:1 basis or entail the exact same type of energy. Instead, BOEM's MarketSim model provides a more nuanced and realistic estimate of how market substitution would work and how much lifecycle GHG emissions would likely result from substitute energy sources. BOEM's model adopts assumptions from the U.S. Energy Information Administration (EIA)—the primary federal government authority on energy statistics and analysis—and from economics literature. These assumptions help BOEM estimate where substitute sources of oil and gas would come from (i.e., oil and gas production from state submerged lands, onshore domestic production, international imports) and the other types of energy sources that would be utilized to help energy supplies keep pace with demand (i.e., coal, biofuels, nuclear, renewable energy). Estimating this mix of substitute energy sources is important because each substitute energy source entails a different capacity to produce lifecycle GHG emissions over the course of its production, transportation, refining, and/or consumption. For instance, OCS oil typically produces more lifecycle GHG emissions per unit of energy than nuclear and renewable energy, but less than coal or imported oil (which typically entails higher production and transportation emissions). BOEM's model also estimates and accounts for the marginal increase in conservation measures and the marginal reductions in energy consumption that would be expected to result from higher oil prices in the absence of new OCS oil production.

Many commenters found the results of BOEM's analysis to be counterintuitive, questioning how the No Action Alternative (i.e., not producing oil from Liberty) could result in higher GHG emissions

than the Proposed Action (i.e., producing oil from Liberty). At the risk of oversimplification, these model results reflect the fact that if oil is not obtained from the OCS, similar amounts of energy will be derived from other sources to help supply keep pace with demand, particularly in the near term, and, on balance, these substitute sources (largely imported oil) entail higher lifecycle GHG emissions than OCS sources. The marginal increase in GHG emissions associated with these substitute sources is slightly greater than the marginal decrease in GHG emissions associated with reduced consumption.

Forecasting Future Energy Demand. The Reference Case provided in the Annual Energy Outlook (AEO) prepared by the EIA provides the best available baseline for analysis of future oil and gas demand. Despite the urging of several commenters, BOEM does not see a compelling reason to depart from the federal government's own expert forecasting of these issues.

It is acknowledged that the 2016 AEO Reference Case analysis only projected energy demand through 2040, whereas BOEM's model for estimating lifecycle GHG emissions estimates impacts occurring through 2070. BOEM accounted for this discrepancy when designing its model by extrapolating EIA's Reference Case to address these later years. This approach was simple and reasonable—EIA's Reference Case already reverts to near linear assumptions (e.g., 0.5% growth in consumption annually) in the later years approaching 2040, and this assumption was easily extrapolated to cover the subsequent years. BOEM also notes that the inherent uncertainty in the makeup of energy markets between 2040 and 2070 is of limited relevance to this Final EIS, which analyzes a specific project that is expected to conclude within 25 years. For these reasons, additional information regarding energy demand in the distant future is simply not essential to a reasoned choice among alternatives in this Final EIS.

The EIA acknowledges that its 2016 AEO Reference Case projection is predicated upon existing laws, policies, and technologies, and does not speculate about how laws, policies, and technologies may change in the near or distant future. These characteristics help make the EIA forecast an appropriate baseline for the objective analysis of future impacts. The availability of alternative energy consumption projections (such as the model developed by the Stockholm Environment Institute), which assume various changes to current energy policy and/or different levels of reliance on renewable sources, is noted. However, BOEM finds no compelling reason to utilize any of these more speculative projections over the EIA's independent, expert forecast.

Modelling Limitations. BOEM acknowledges that there are limitations to its methodology for calculating lifecycle GHG emissions in this Final EIS. Some of these limitations are inherent to the model designed and utilized by BOEM. A list of key assumptions incorporated into BOEM's model, along with explanations of why those assumptions are reasonable, is provided in Section 7 of Wolvovsky and Anderson 2016. Several more specific responses to comments which criticize particular modelling assumptions are provided under separate subheadings within this issue category.

Other limitations stem from BOEM's use of a model originally designed to inform a programmatic, nationwide analysis (i.e., the National OCS Leasing Program) for the purpose of a project-specific review. While BOEM incorporated project-specific information into its analysis wherever possible (e.g., estimated GHG emissions from Hilcorp's proposed development and production activities), in some instances BOEM lacked reliable project-specific information and instead utilized nationwide or global averages as reasonable proxies (e.g., average GHG emission rates from transportation, refining, and consumption of OCS oil, and the composition of substitute energy sources).

Readers and the decision-maker should bear in mind that estimating lifecycle GHG emissions is an inherently complex endeavor requiring the consideration of many variables and the development of

many assumptions. Each of the assumptions incorporated into BOEM's model and applied in this project-specific analysis was developed by BOEM physical scientists and economists based on their best professional judgment using the best available science. Some of these assumptions may suggest a tendency to overstate the potential for GHG emissions, while others may suggest a tendency to understate the potential for GHG emissions. One hundred percent accuracy in these matters is not possible, much less anticipated by BOEM or implied in this Final EIS. However, BOEM is confident that the estimated lifecycle GHG emissions provided in the Final EIS represent a reasonable approximation of what is likely to occur under each alternative.

Marginal Changes in Foreign Consumption. Comments that BOEM's model does not account for any decrease in foreign emissions that may occur under the No Action Alternative are correct. BOEM makes this limitation clear in its summary of the model (Wolvovsky and Anderson 2016). That summary further explains why quantitatively estimating the marginal decrease in foreign emissions that may occur under the No Action Alternative is not feasible.

Context suggests that any change in foreign oil consumption resulting from the pending decision on the Liberty DPP would be relatively small. Since the amount of oil that could be produced at the Liberty DPP represents a very small fraction of the amount of oil comprising the global market, the decision on whether to proceed with the Liberty project could only have a negligible impact on worldwide oil prices and, as a result, only a negligible impact on foreign consumption and emissions levels. Even if BOEM could reliably estimate these marginal differences (which it cannot, given the lack of reliable information on foreign emissions factors and consumption patterns), such estimates would not change the end results of BOEM's analysis to a meaningful extent. Thus, BOEM finds that the lack of information concerning marginal changes to foreign emissions is not essential to a reasoned choice among the alternatives analyzed in this Final EIS.

Monetizing Impacts from GHG Emissions. Section 4.4.2.1 of the Final EIS presents an updated analysis of monetized impacts from GHG emissions associated with the action and No Action alternatives. These updates, which include additional estimates based on methods consistent with the Office of Management and Budget (OMB) Circular A-4, represent BOEM's response to comments criticizing the use of the recently rescinded Social Cost of Carbon protocol as a tool for monetizing GHG impacts in the Draft EIS.

Several commenters anticipated the use of OMB Circular A-4 in the Final EIS and recommended certain adjustments to its underlying methodologies and assumptions (e.g., different carbon prices, discount rates, and geographic scope). BOEM does not see any compelling reason to deviate from the methodologies and assumptions underpinning OMB Circular A-4, which has been peer reviewed and has been widely accepted for more than a decade as embodying the best practices for conducting this type of analysis. Adopting other methodologies and assumptions may compromise analytical rigor and would render BOEM's analysis inconsistent with those being produced by other federal agencies.

BOEM also declines to provide a separate estimate of the social cost of methane. Methane emissions are already accounted for in BOEM's analysis of lifecycle GHG emissions, and have been included in the carbon dioxide equivalent calculation to ensure an appropriate comparison. These collective estimates are a scientifically sound method to permit a reasoned choice amongst alternatives.

Linking GHG Emissions to Specific Climate-Change Related Impacts. Climate change is a global phenomenon. While GHG emissions from all over the world contribute to climate change, there exists no scientific basis for attributing specific or localized climate change-related impacts (e.g., impacts on polar bears, whales, seals, or the Boulder Patch) to any specific source of GHG emissions. The Final EIS acknowledges that the Proposed Action would contribute to climate change, and estimates direct

and indirect GHG emissions associated with the Proposed Action as a reasonable proxy for the degree of that contribution. However, BOEM declines to engage in baseless speculation about which climate change-related impacts would be attributable to GHG associated with the Liberty project.

Conformity with Various Policy Objectives. BOEM disagrees with the notion that producing oil from the Liberty prospect would preclude the world from meeting GHG reduction goals and would "lock in" specific negative effects associated with climate change. There is a finite amount of oil in the Liberty prospect and it is not enough to demonstrably influence the adverse effects associated with climate change (in the action area or anywhere else) on its own.

Several public comments categorize oil source in binary terms (e.g., Arctic versus non-Arctic, offshore versus onshore, discovered versus undiscovered) and argue that producing oil of a certain type is incompatible with meeting various global GHG emissions goals. Such labels are of limited importance when analyzing potential climate change impacts from any specific project because they do not speak to the resource's capacity to emit GHGs if produced and consumed. There is no valid scientific reason to categorically distinguish between Arctic and non-Arctic resources, for instance, when analyzing potential lifecycle GHG emissions and the resulting contribution to climate change in an EIS. While foregoing development of a certain category of oil could be one strategy of limiting global emissions and thereby curbing additional climate change impacts, it is not the only strategy. In fact, developing that oil could actually have a net benefit to climate policy objectives in the near term if such production displaces consumption of other resources such as coal or imported oil that entail relatively higher GHG emissions. Any objective analysis of a potential resource's contribution to global GHG emissions must account for this market substitution effect.

Ocean Acidification. The concept of ocean acidification is explained in Chapter 3 of the Final EIS and incorporated into the effects analyses for relevant environmental resources in Chapters 4 and 5 of the Final EIS.

Black Carbon. Black carbon emissions are a subset of PM2.5 and PM10, which are estimated in Section 4.2.4. It is not possible to precisely delineate the percentage of PM2.5 and PM10 emissions that would take the form of black carbon. However, the Final EIS responds to public comments by providing additional, qualitative analysis of the potential for project-related black carbon to impact the local environment.

Issue 10. Impacts on Air Quality

Summary of Comments

Several comments address the potential impacts on air quality from emissions of particulate matter and GHGs. In addition to general comments addressing language clarifications, commenters expressed concerns about the modeling approach taken and assumptions included in the Draft EIS.

Several comments recommended general clarifications to language and definitions used in the Draft EIS to reflect either a more accurate description of air quality impacts or provide further explanation for a non-technical audience. These comments included:

- Refine the language describing air quality degradation allowed in Class I and Class II areas and clarify the discussion of how BOEM defines "ambient air" in the analysis.
- Expand the discussion of air quality impacts during construction and production and the discussion on how the two periods of impact interact to produce overall cumulative impacts in the project area.
- Provide additional data summary tables, further narrative discussion of results associated with data tables, and references to air quality outcomes from similar projects (e.g., Greater Moose's Tooth-2) to clarify the conclusions for non-technical audiences.
- Revise terms used to describe the combustion of sulfur dioxide compounds during fuel production and the natural emission of air pollutants from biogenic and non-biogenic sources.
- Clarify that the geographic range (e.g., either onshore or offshore) for which specific air quality impacts were calculated only represents the modeled domain, and clearly indicate the geographic range selected in the narrative discussion of results.
- Explain clearly that air quality impacts resulting from the conservative assumptions included in the analysis indicate that the actual realized air emissions will fall within the allowable standards for air quality.

Other comments offered specific critiques of the methods and analytical approach supporting the analysis of potential air quality impacts in the Draft EIS. Commenters offered several revisions to assumptions regarding the project's operations and the applicable permits taken into account during modeling. Commenters stated that the EIS should:

- Characterize in more detail the mobile source emissions and include an inventory of all reasonably foreseeable oil and gas developments on the North Slope to fully understand future cumulative impacts that could result in violations of the National Ambient Air Quality Standards.
- Include a discussion of particulate matter emissions during in situ fuel burning.
- Provide rationale for using a threshold of 25% of the National Ambient Air Quality Standards as an indication of meaningful air quality impacts.
- Commenters suggested that a number of conclusions in the Draft EIS are based on faulty assumptions and approaches to the assessment that conflict with air quality analyses included in the Air Quality Impact Analysis in the Liberty DPP. Recommended revisions to assumptions included in the model included the following:
- Existing background air pollutant concentrations and geographic location chosen for comparison of existing conditions.

- Increases in ambient air background concentrations resulting from differences between emissions increases between alternatives.
- Rate of emission increases resulting from construction activities among proposed Alternatives.
- Proportional increases in maximum pollutant impacts resulting from differences in size of drill rigs used in various Alternatives.
- Distance of maximum impacts of the Proposed Action in Alternative 3A, 3B, 4A, and 4B.
- Increases in air quality impacts resulting from an increase in Drill Unit rating in Alternatives 3A and 3B.
- Commenters also identified other perceived inconsistencies in emissions estimates in the Draft EIS including the following:
  - One commenter requested the following sentence in Section 3.1.5.3 be revised: “There are relatively few offshore and onshore sources on and near the Alaska North Slope.” The commenter suggested the sentence is inconsistent with information provided in Table 3.5-1 that shows emission of thousands of tons of criteria pollutants, GHG, and hazardous air pollutants in existing Alaska North Slope sources.
  - A commenter requested a correction to the existing onshore annual emission rate for hydrogen sulfide on Table 3.1.5-1 of the Draft EIS to 16.4 tons per year. The request aligns the rate with total annual hydrogen sulfide emission rate and the referenced data source, Simms et al, 2014, in the table.

Source of Comments

- Federal Government
- State and Local Governments
- Energy and Non-Energy Industry and Other Associations

Response to Comments

- **Explanation and Clarification Requests.** Responses to comments requesting additional explanation or clarification of language used in the air quality analysis in the Draft EIS include the following:
- Section 3.1.5 of the Final EIS has been revised to refer to air quality-related values as "resources sensitive to air quality impacts" instead of "highly prized" as they are described in the Draft EIS. Furthermore, the analysis in the Final EIS has been revised to reflect that air quality degradation up to the level of the Prevention of Significant Deterioration is allowed in a Class I area and the classification is based on the level of air quality degradation from a baseline pollutant concentration allowed in an area.
- The interaction of air quality impacts during the construction and operation are evaluated in the Draft EIS. Specifically, the first paragraph of cumulative effects analysis for air quality in Section 5.2.2 notes “The duration of the effects, if any, are temporary, as pollutants are assumed to remain within the main exhaust plume only until impact with the ground—they are not additive, meaning the overall impact is less than the sum of the parts.”
- Additional summary tables showing impacts of all aspects of the Proposed Action and Alternatives are available in Appendix B of the Final EIS. Text has been clarified as needed for the lay audience. No additional text comparing air quality impacts of Liberty to those from

Moose's Tooth or other projects has been added as this would not change the impacts analysis nor help to inform the decision-maker.

- The Final EIS has been revised to reflect that the sulfur oxides are formed when sulfur is burned. The definition of biogenic sources used in the air quality analysis in the Draft EIS includes natural sources such as volcanic eruptions or forest fires, which is consistent with established inventories of air pollution sources.
- Text has been added to Section 4.2.3.3.2 of the Final EIS describing the geographic range of the impacts modeled starting from the 546-yard Safety Boundary to the shoreline. The Final EIS revisions detail that all maximum impacts described in the subsequent discussions would result at the 546-yard Safety Boundary.
- There is no inherent inconsistency between Table 3.1.5-1 and the text in Section 3.1.5.3 of the Draft EIS. The volume of emissions measured in tons per year is not dependent on the number of offshore and onshore emissions sources.
- Table 3.1.5-1 has been revised in the Final EIS.
- **Critiques of Methods.** Responses to comments that offered specific critiques of methods used in the Draft EIS include the following:
- The cumulative effects analysis of potential air quality impacts is adequate and meets NEPA requirements. Reasonably foreseeable activities have been included as necessary.
- Text has been added to discuss particulate matter emissions during in situ fuel burning.
- Text had been added to explain that if the impact of the proposed action and the alternatives when combined with the background concentrations are below 25% there is no potential to violate the National Ambient Air Quality Standards.
- **Critiques of Assumptions.** Responses to comments that offered specific critiques of assumptions used in the Draft EIS include the following:
- As described in Section 3.1.5 of the Draft EIS, “air quality” is referred to in the context of the environmental review under NEPA and is not intended to describe air as defined in EPA’s federal regulations. The description of the term “ambient air” has been clarified in the Final EIS to reflect the definition from 40 CFR Part 50.1(e).
- As described in Section 3.1.5 of the Draft EIS, Alaskan Ambient Air Quality Standards valid at the time the document was prepared were described in the Liberty EIS and incorporated by reference in the Draft EIS.
- The impact conclusions in the Draft EIS regarding increased emissions impacts for Alternatives 3 and 4 were incorrect because they were based on the assumptions that the 2,100-horsepower drilling unit described in the DPP was used for the Air Quality Impact Assessment model, and that the impacts would be at the shoreline. In actuality, the Air Quality Impact Assessment modeled a drilling unit of over 12,000 horsepower, and it modeled impacts at the 500-meter safety boundary. The text in the Final EIS has been revised to address these issues.

Issue 11. Water Quality – NPDES

Summary of Comments

Several comments address issues related to the adherence to and obtainment of a National Pollutant Discharge Elimination System (NPDES) permit under the Clean Water Act (CWA).

BOEM received a few comments suggesting specific revisions and corrections to the discussion of the NPDES permitting requirements. Requested edits include:

- Consider any necessary state wastewater discharge permits, including the Alaskan Pollutant Discharge Elimination System (APDES) permit, and the impact of applicable state water quality standards for all Alternatives.
- Discuss the construction workforce housing locations, and the associated wastewater treatment and discharge implications for permitting for those facilities.

A commenter recommended an intermittent monitoring and modeling exercise be conducted on discharge of the brine plume at various distances from the seawater treatment plant.

The commenter also requested an explanation of what will occur to the discharge streams during disposal well maintenance.

Source of Comments

- Federal Agencies
- State Agencies
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy and Non-Energy Industry and Other Associations

Response to Comments

Water Quality Permitting Requirements. Under each alternative, Hilcorp would be required to obtain CWA permits for all discharges from its facilities to surface waters during construction and operations, including Section 402 (NPDES) permits issued through the Alaska Department of Environmental Conservation's APDES Program. By obtaining the APDES permits and adhering to the permit conditions, it is not anticipated that construction and operations of any of the build alternatives would violate state water quality standards.

As stated in Section 4.2.2 of the Draft EIS, there would be no discharges of sanitary and domestic wastewater during construction; sanitary and domestic wastewater generated by the construction workforce would be hauled offsite to an onshore disposal facility.

Discharge Streams Including Brine Discharge. As noted by the commenter and described in Section 2.1.9 of the Draft EIS, brine discharge would occur as a result of the operation of the seawater treatment plant on the LDPI. The potential impacts of wastewater discharges on water quality during the production phase of the Proposed Action are described in Section 4.2.2.1. BOEM's analysis indicates that the primary source of water quality impacts from NPDES discharges during production is from total suspended solids, which would result in a negligible to minor impact on water quality. Any effluent monitoring of this discharge would be at the discretion of EPA and if deemed necessary, would be included within the NPDES permit for the facility.

As described in Section 2.1.9 of the Draft EIS, sanitary and domestic wastewater would be hauled offsite during construction and injected into a disposal well during normal operations. Potable water treatment reject wastes would also be discharged into a disposal well. For both types of wastewater, Hilcorp has requested a contingency discharge for times when the well is not operational due to maintenance or other issues. When necessary, these types of wastewater would be discharged from the LDPI directly into Stefanson Sound in the Beaufort Sea.

Issue 12. Lower Trophic Level Organisms

Summary of Comments

A few comments submitted addressed potential impacts on marine organisms living in lower trophic levels. Commenters stressed the importance of lower trophic organisms to the overall food chain and the marine environment. General comments are as follows:

- Recommendation for an expanded discussion of the seasonality and intensity of primary production, abundance, and distribution of plankton in the Arctic Ocean by reviewing other source materials to better understand the impact of the LDPI.
- Recommendation that further analysis of the potential impacts of chronic small spills, construction activities, and increased turbidity on the resiliency and long-term viability of the Boulder Patch flora and fauna is needed, including consideration of suspended sediment flowing both to the east and to the west, the pipeline backfill mound, and the effects of the loss of prey species on higher level organisms.
- A statement that the Draft EIS fails to address impacts on the Boulder Patch in light of other threats to this unique ecosystem, including ocean acidification.

Source of Comments

- Local and Regional Governments
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Potential Impacts on Plankton. Section 3.2.1.1 of the Draft EIS discloses the variability of timing and extent of seasonal plankton blooms in arctic waters, which is dependent on the combination of cold temperature, sea ice, and seasonal fluctuations in light regimes. As stated in the Draft EIS, phytoplankton blooms (including concurrent zooplankton organisms) tend to occur in two separate events of early and late summer, generally from July to August. The Draft EIS goes on to state that the density and duration of the blooms are dependent upon weather conditions and nutrient fluxes. The Draft EIS acknowledges the variability in the annual plankton bloom events and that they are dependent on many variables; they could occur earlier in the year and last longer. The impact analysis on plankton is presented in the context of plankton being present during the construction activity or operations, so additional information added to the Final EIS on plankton presence (and timing) would not ultimately change the impact analysis or conclusions presented in the Draft EIS.

BOEM submits that this Final EIS adequately analyzes the potential environmental effects on plankton associated with the Proposed Action and alternatives. There is sufficient analysis upon which to base associated determinations of effect. In conducting its analysis, BOEM has considered the best available information.

Oil Spills and Other Impacts on the Boulder Patch. Potential impacts of small (including chronic) and large oil spills on lower trophic level organisms, including those organisms that inhabit the Boulder Patch, are addressed in Section 4.3.1.1 of the Draft EIS. As stated in the Draft EIS, a multitude of factors determine an oil spill's degree of damage on plankton and benthic communities, including the size and duration of the spill, geographic location, season, weather, and the particular species exposed. However, the Draft EIS discloses the potential range of impact possibilities from an

oil spill (up to and including mortality of individual organisms), as well as short- and long-term impacts, based on well-sourced scientific literature.

As described in Section 4.2.2.1 of the Draft EIS, water quality impacts from the proposed LDPI and pipeline construction are expected to increase sediment load in the water column and excess suspended sediment may affect the Boulder Patch. Only the west-flowing currents were included in the modeled turbidity plume used in the analysis. This is because west-flowing currents occur on average 60 to 70% of the time. Furthermore, the vast majority of the area comprising the Boulder Patch is located to the west of the proposed LDPI and pipeline location. Therefore, east-flowing sediment would have no effect on the Boulder Patch and the analysis of excess suspended sedimentation is considered conservative and worst case. The potential impacts of the modeled turbidity plume on Boulder Patch habitat were described in detail in Section 4.3.1.1, which includes a description of potential impacts on primary productivity and biota that rely on the Boulder Patch for habitat and feeding.

Section 3.2.1.3 of the Draft EIS describes the potential impacts of climate change, including ocean acidification, on lower trophic organisms such as those that inhabit the Boulder Patch. Section 4.3.1.1 describes the potential impacts of the Proposed Action on lower trophic organisms and states that the impact-producing factors and impacts described for the Proposed Action are not expected to differ as a result of those climate change processes.

Issue 13. Fish and Shellfish

Summary of Comments

Several comments submitted addressed potential impacts to fish populations within the project area, including the impacts to Pacific salmon, whitefish, and Arctic cod populations. BOEM also received comments requesting additional citations for information included in this section. General comments are as follows:

- The impacts of road and pipeline construction, and associated bridges, barges, and other infrastructure on fish populations needs to be addressed in this section.
- The analysis of cumulative impacts section discusses the potential implications of retreating sea ice on the increase in commercial fishing, despite the practice being prohibited in the U.S. Arctic. This analysis should include impacts on subsistence fisheries.
- This section does not accurately reflect the importance of certain fish species, specifically whitefish, for subsistence fishing in the region.

Source of Comments

- Local and Regional Governments
- State Agencies
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

Section 4.3.2 of the Draft EIS discusses impacts on fish populations in detail, including the potential impacts on fish from the development, production, and decommissioning of the Proposed Action. Issues such as habitat alteration, noise impacts, ice road and pipeline construction impacts, and vessel traffic are analyzed and discussed in detail in Section 4.3.2.1.

Section 4.3.2.1 describes habitat alteration and increase in water turbidity as impacts from pipeline trenching and gravel deposition that could have a negative effect on fish populations. BOEM also analyzes the impacts of noise on fish during the development, production, and decommissioning phases in Section 4.3.2.1. Noise impacts, including those from vessel traffic, on spawning fish are also included in Section 4.3.2.1, which describes the risk of spawning delays or disruptions on acoustically sensitive migratory species and describes how noise and seismic activities may cause fish to exhibit displacement and avoidance behaviors.

BOEM addresses the effects of climate change on subsistence fisheries in the Section 5.2.11.3 of the Draft EIS. This section discusses the potential effect of climate change on the habitat, behavior, abundance, diversity, and distribution of populations of subsistence species, thereby indirectly affecting subsistence harvest patterns.

In Section 3.3.3.2 of the Draft EIS, BOEM acknowledges the importance of fish for subsistence harvests, stating “Fishing is a major component of the annual subsistence rounds of Nuiqsut, Kaktovik, and Utqiaġvik.” Section 3.3.3.2 also contains detailed information on the importance of subsistence activities and harvest patterns including the whitefish, noting that “Broad whitefish are an important resource that contributes highly to Nuiqsut’s annual subsistence harvests (SRB&A 2010).”

The statement “Utqiaġvik residents commonly harvest broad whitefish, which provides a substantial amount of their annual harvests in comparison to other fish,” has been revised in the Final EIS to indicate that whitefish are specifically targeted for subsistence harvest.

Issue 14. Marine Mammals

Summary of Comments

Many comments expressed concern about the project's adverse impacts on the bowhead whale, a critical species for Nuiqsut subsistence harvests in the region, and their habitat. Specifically, these comments discussed the deflection of bowhead whale migratory paths due to acoustic disturbances from project activities including noise produced from drilling, vessels/barges, and production on the artificial island. Some comments stressed that the Draft EIS failed to accurately consider the impacts of noise pollution on whales and noted that the study improperly limited the impacts on whales to inland of the barrier islands, with one comment stressing the importance that "whale deflection—inside and outside the barrier islands—is THE single most important issue that needs to be considered in the Final EIS." One commenter argued the Draft EIS' conclusion that whales would not be physically injured by sound waves completely missed the point and that the Draft EIS should have focused its analysis on whale deflection, not whether whales are injured by drilling noise.

Commenters expressed concern that a deferral line restricting oil and gas activities in subsistence whaling areas has not been provided and requested that a deferral line be provided before BOEM and other cooperating agencies make a decision.

A comment on the Draft EIS noise impact analysis stated that although the Draft EIS mentions some restrictions on activities during whaling season, it also suggests a lack of concern regarding routine impacts (such as pile driving) on whale migration and hunting seasons.

Another commenter offered an alternative that would put the project's island in state waters in order for the project to be closer to shore, lessening the impact on whale migration.

Several commenters pointed out specific areas where they believed the Draft EIS was inadequate when evaluating impacts on marine mammals. These included the Draft EIS referencing outdated marine mammal Stock Assessment Reports (SARs), not providing clear analysis for the reader, and containing number of issues or errors in the analysis. Some of these commenters also provided suggested edits or ideas on how to improve the analysis. Specific insufficiencies, as indicated by commenters, include the following:

- "DEIS references 2014-2015 Stock Assessment Reports on cetaceans, but more recent SARs for 2016 are available, and should be used to finalize the EIS Information used in the analysis is not comparable to this project as the data does not reflect production (or production combined with drilling) from an artificial island in the Beaufort Sea."
- "The DEIS states that the minimum population estimate for the Western Arctic stock of bowhead whales is 13,796 based on ice-based counts (Allen and Angliss, 2015). However, the most recent Nmin population estimate is 16,091 from Muto et al. (2016)."
- "The BOEM EIS states that "Because of the widely varying population estimates over the years, a reliable minimum population of the Beringia DPS of bearded seals has not been established (Allen and Angliss, 2015)." However, Muto et al. (2016) states that "An Nmin for the entire stock cannot presently be determined because current reliable estimates of abundance are not available for the Chukchi and Beaufort seas. Using the 2012 Bering Sea abundance estimate by Conn et al. (2014), however, provides an Nmin of 273,676 bearded seals in the U.S. sector of the Bering Sea."
- "The discussion of conditional probabilities and combined probabilities on these pages *(4-187 and 4-188)* are not well explained for the public (non-technical reader)."

- "In this figure *(3.2.4-15)* concerning polar bear maternal den sites and denning habitat, the native allotment near the Liberty subsea pipeline transition is identified as a potential material site. The use of this native allotment as a material site has not been identified elsewhere in this document."
- "The last paragraph on page 3-88 of the DEIS states that ringed seals are listed as threatened under the Endangered Species Act (ESA), however this listing was recently vacated due to litigation."
- "Figure 4.3.4-4 (NMFS Level A and B Harassment Thresholds and Modeled Threshold Shifts) of the DEIS is very difficult to read.
- "Figure 4.3.4-6 shows SEL and RMS thresholds vs source levels and whale audiograms. This is confusing and difficult to interpret - it is not possible to directly compare the source level with the SEL threshold without duration of exposure information, and the received level at the animal will depend on the distance from the source. The significance of this depiction is difficult to determine."
- "Table 4.3.4-6 - the vessel noise extents are reproduced from SLR 2017 but not referenced. Also, the table includes activity durations which are not relevant to the identified noise extents to the behavioral thresholds and should be deleted (these durations were used for the PTS assessment, but could be misleading in the context of this table)."
- (Section 4.4-129*)* "Discusses dredging being a continuous noise source audible for distances >25km. No dredging is proposed, and as such, suggested to remove this from the EIS."
- "Figure 4.3.4-7 figure references SLR 2017, but it relates to geohazard survey noise which were not covered in the SLR noise impact assessment. The paragraph under this talks about the audible bandwidth of beluga whales, but this is not shown on the figure."
- (Section 4.4-152*)* "The second to last paragraph states that a spill response can "cause disturbance" and "harm marine mammals or their prey." A release of oil may do that, but the response itself includes the involvement of local, state, and federal regulators (Unified Command). In a large release of oil, response tactics are approved by Unified Command. It is highly unlikely that the response would worsen the incident. The last paragraph states that spill response equipment is only cached at Deadhorse and Utqiaġvik (Barrow). That is incorrect. Spill response equipment is at dozens of coastal production facilities (e.g. MPU, Endicott, Northstar, etc.)."
- ("The reference for Table 4.3.4-5 says that it is from NMFS (2013b). Many of the numbers in this table however appear to be taken from the Liberty acoustic modelling report. There are some additional activities shown that will not take place for Liberty - eg dredging. Also, ditch witch is listed in an open water context, and would not be used in open water conditions. If these numbers are indeed from SLR's report, the table title is not strictly correct - the results reproduced from our report are the maximum distances, not the median, and are not related to background noise levels. Also the paragraph above the table says it is based on propagation in the strongest 1/3 octave band which is again not correct if these numbers are from SLR and not from NMFS (2013b) as referenced - there is no NMFS 2013b in the reference list."
- (Sections 4.3.4.3, 4.3.4.4, and 4.3.4.5) "The DEIS states that sheet pile driving could exceed the injury (Level A) threshold for pinnipeds, extending out to 330 m (0.33 km) and 240 m (0.24 km) for sheet pile and pipe driving respectively. Table 6-13 of Hilcorp's LOA application reports the Level A threshold distance to vibratory sheet piling (2.5 hr) as 0.02 km, impact sheet piling (40 mins) as 0.52 km, and impact pipe driving as 0.24 km (2 hrs). BOEM is encouraged to compare these results for consistency in the Final EIS."

- (Section 3.2.4.1. Cetaceans page 3-54) The estimated population for eastern Chukchi Sea whales in the DEIS needs to be updated to approximately 20,000 based on 2012 surveys from Lowry et al., 2017.
- (Section 3.2.4.1. Cetaceans page 3-54) The reference about stocks being separated during winter is Citta et al. (2016), not Suydam.
- (Section 3.2.4.1. Cetaceans page 3-63) This section includes information about both Odonotocetes and Mysticetes. To avoid confusion between this section and the previous Odonotocetes section, and following Mysticetes section, move this section to the end of the Marine Mammal chapter.
- (Section 3.2.4.4 Polar Bear, page 3-107) The data range is across years 2001 to 2010, not 2001 to 2006. It should be noted that the surveys do not cover the entire range of the Southern Beaufort Sea polar bears and, therefore, the population estimate is minimal.
- (Section 3.2.4.4 Polar Bear, page 3-107) Additional data has been collected but not yet been analyzed. BOEM has not informed the public that the population of polar bears may have increased since 2010.
- (Section 4.3.4. Marine Mammals, page 4-109 Figure 4.3.4-4) The font size for this figure is too small and unusable to the public.
- (Section 4.3.4.1.1. Whales, The Proposed Action, page 4-136 Transportation) Sentence "The number of vessel trips would increase during this period, which would result in greater potential for disturbance and displacement of whales out to distances of 2.2 km (Table 4.3.4-7)" references Table 4.3.4-7 but the table does not provide information about the level of sounds produced by vessels.
- (Section 4.3.4.1.1. Whales, The Proposed Action, page 4-136 Transportation) Sentence "Noise associated with support vessels is expected during drilling and would likely have a negligible physiological level of effects on beluga whales within 0.2 mi (0.32 km) of vessels (Table 4.3.4-5), but could elict behavioral effects out to 2.2 km (Table 4.3.4-7)" should clarify what information is used to support this conclusion.
- (Section 4.3.4.1.1. Whales, The Proposed Action, page 4-136 Transportation) BOEM should conduct additional analysis of impacts to belugas or clarify that sea-going ships/barges are not going to be used and that all modules, drill rigs, pipes, and other material are going to be transported via land and not sea.
- (Section 4.3.4.1.1. Whales, The Proposed Action, page 4-137 Production Operations) Caveats must be provided about the substantial differences between the two stocks of belugas.
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-138) Edit the following sentence to state that the 160dB zone is 880 and 1260m from the source: "Slope shaping and armament installation would create potential zones of behavioral disturbance between 880 and 1260 m from the source, and zones of PTS risk < 10 m from the noise source (SLR 2017)."
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-138) Revise the following sentence to indicate that because the lead for bowhead spring migration has been closer to the northern coast of Alaska in the past 10 years, bowheads could migrate much closer to Liberty Island and be exposed to sounds from sheet/pile/pipe driving: "The beginning of the slope armor installation would overlap temporally with the bowhead whale spring migrations into the Canadian Beaufort Sea (in mid-May through mid-June, Section 3.2.4.1); however, the spring migration occurs over the continental shelf break, well offshore of the Proposed Action Area."

- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-138) The paragraph on fall migration is misleading because many whales could be exposed to sounds from sheet/pile/pipe driving if it were to occur in August. Very large numbers of bowheads were in Beaufort Sea in the last two week of August 2016 and 2017.
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-139) The paragraph discussing Canadian Beaufort Sea where bowheads were seen close to artificial islands is not directly comparable with the Alaskan Beaufort Sea coast and should not suggest that bowhead behavior off the Alaska coast will be the same as in the Canadian Beaufort Sea. This paragraph should be modified to provide the context of bowhead behavior and how it might influence whale's tolerance to industrial sounds or activities.
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-140) Clarify and justify the assertions that small numbers of bowheads were impacted from industrial sounds at Northstar Development Island.
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-140) Data should be referenced to support conclusions that deflection of bowheads by a few kilometers would not have a biologically significant impact.
- (Section 4.3.4.1.1. Bowhead Whales, Proposed LDPI Construction, page 4-140) Any possible impacts from ships or barges that might be transiting to Liberty Island from off-slope should be accounted for and indicated in this section.

Several commenters pointed out other areas where they believed the Draft EIS failed to adequately consider impacts including the lack of a full analysis of all direct, indirect, and cumulative impacts of the project on whales and ice seals, and failed to evaluate effects on marine mammals and their habitat due to climate change and threats from increased human-bear interactions from further oil and gas development. Additionally, one commenter indicated that, due to significant data gaps or missing information on the marine mammals, birds, fish of the project area, the Draft EIS could not reasonably assess the true effects of the project, and stated that "more research is also necessary to accurately assess marine mammal reactions to different types of noise and that more work is needed to characterize the seasonal and spatial levels of ambient noise in the Beaufort Sea."

A few commenters exhibited support of the Draft EIS analysis and project design. One commenter commended the project on looking for ways to lower project impacts as much as possible and stated they felt the Draft EIS did a "solid job" of evaluating impacts on marine mammals and that it could "drive the decision-making process." Other commenters expressed confidence in the project's collaboration with local agencies to develop appropriate monitoring programs and local whalers on addressing their concerns.

Source of Comments

- State Agencies
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

Adequacy of the Analysis. BOEM submits that this Final EIS adequately analyzes the potential environmental effects associated with the Proposed Action and alternatives. There is sufficient analyses upon which to base the evaluation and associated determinations of effect. In conducting its analysis, BOEM has considered the best available information.

Bowhead Whales. The effects of noise from the proposed LDPI construction and operations on marine mammals, and their migrations, were analyzed and may be found in Draft EIS Section 4.3.4. As described in this section, noise impacts on whales would be mostly localized. For sheet/pile/pipe-driving activities, the Draft EIS states that "[t]he beginning of slope armor installations would overlap temporarily with the bowhead whale spring migrations into the Canadian Beaufort Sea (in mid-May through mid-June, Section 3.2.4.1); however, the spring migration occurs over the continental shelf break, well offshore of the Proposed Action Area. In a recent Biological Opinion for maintenance construction at Northstar, the National Marine Fisheries Service (NMFS) determined noise from construction and operational activities (including pile-driving) would not likely be detectable far enough offshore to be heard by spring-migrating whales, and if any noises were audible to whales at that distance, they would be weak and unlikely to elicit behavioral reactions (National Marine Fisheries Service 2012a)."

Section 4.3.4.1.1 of the Draft EIS includes statements that bowhead whales could be affected by construction activities if they are present in August. Specifically, under Proposed LDPI Construction (page 4-138): "[i]nstallation of slope protection around the LDPI would occur between May and August during the first summer of the Proposed Action, and this has the potential to impact bowhead whales should they occur in the vicinity." Under Sheet/Pile/and Pipe Driving (page 4-138): "Bowhead whales do not typically start their westward fall migration until late August when the LDPI slope protection installation would be completed. It is possible that a few bowhead whales leaving early on their westward migration could be impacted by the noise associated with this activity."

BOEM believes the Draft EIS acknowledges the potential presence of bowhead whales in the Beaufort Sea in August and notes the commenter's observations of bowheads in the Beaufort Sea in the last two weeks of August 2016 and 2017.

For migrating bowhead whales to be affected, the lead system would have to occur inside of the barrier islands, which it never does. In addition, noise from the LDPI construction would not propagate under shorefast sea ice (Foggy Island Bay from late October into July) as easily as it does under open water conditions. Consequently, the bay will be covered with sea ice when whales migrate into the Beaufort Sea in spring, and the noise from construction should not extend beyond Foggy Island Bay.

Section 4.3.4 of the Draft EIS discloses all potential direct and indirect construction and operations impacts on marine mammals, which includes bowhead whales. The impact discussion specific to bowhead whales under Section 4.3.4.1 provides some additional species-specific information on potential effects of the Proposed Action. The inclusion of information on bowhead whales in the Canadian Beaufort Sea in the species-specific section is simply to provide some additional information (i.e., known similar project examples) on bowheads in addition to the full range of potential marine mammal impacts already described in detail in the preceding Draft EIS sections. The Canadian Beaufort Sea bowhead whale information does not supplant the Proposed Action's detailed impact analysis in the preceding Draft EIS sections.

The statement in Section 4.3.4.1.1 of the Draft EIS that small numbers of bowheads were affected by industrial noise output by facility activities at Northstar Development Island is based on the acoustic studies conducted at Northstar and information in the NMFS Endangered Species Act Biological Opinion and Marine Mammal Protection Act Letters of Authorization (LOA) to BP Exploration Inc. for take of marine mammals incidental to operations of offshore oil and gas facilities in the Beaufort Sea. These documents are referenced at the end of the commenter's cited sentence in the Draft EIS with full citation provided in Chapter 7 of the Draft EIS.

The Draft EIS' conclusion that deflecting the paths of migrating bowhead whales offshore by no more than a few kilometers would not, in most cases, incur biologically significant effects, is valid. As described in the Draft EIS, a deflection by a few kilometers is well within the range of normal variability, which is based on the citations at the end of the conclusion statement in the EIS, which specifically includes NMFS' Biological Opinion and Marine Mammal Protection Act LOA to BP Exploration Inc. for take of marine mammals incidental to operations of offshore oil and gas facilities in the Beaufort Sea. The full citation is provided in Chapter 7 of the Draft EIS.

Deferral Line. Leases comprising the Liberty unit have already been issued by BOEM during the lease stage of the OCSLA process and cannot be deferred at this time. This project-specific NEPA process does not consider deferral areas.

Pile Driving Impacts. As identified in Section 2.1 of the Draft EIS, pile driving would occur during construction of the LDPI. Potential impacts on marine mammals as a result of pile driving activities are described in Section 4.3.4 of the Draft EIS. BOEM relied on the SLR report (2017) for analyses of potential impacts from sheetpile-/pipe-driving. Should the Applicant need to repair or replace pilings during the life of the project, they would need to apply for a USACE CWA Section 404 permit and Rivers and Harbors Act Section 10 permit, both of which are federal actions subject to NEPA review and, if necessary, consultation under Section 7 of the ESA.

Relocating the Production Island to State Waters. Alternative 3B evaluates an LDPI location 1.5 miles closer to shore and entirely within state waters. Impacts on marine mammals, including whales (and potential migration impacts), are described in Section 4.3.4 of the Draft EIS and impacts specific to Alternative 3B are described in Section 4.3.4.1.3.

Stock Assessment Reports. BOEM has reviewed the most recent SARs and has included new information in the Final EIS. This new population information does not change the impact types, mechanisms, or conclusions that are disclosed for cetaceans in the EIS. For example, BOEM agrees that the latest SAR for bowhead whale estimates the current population to be 16,091, and that the population growth of this species has been increasing every year based on the SAR population trend analysis. BOEM does not believe this increased population changes the impact types, mechanisms, or ultimate conclusions that are disclosed for this species in the FEIS.

Bearded Seal Population Estimates. BOEM acknowledges that bearded seal population estimates are unavailable from the latest SAR by Muto et al. (2016). However, Section 3.2.4.2 of the Draft EIS cites multiple studies that have estimated bearded seal population, including Conn et al.'s (2014) estimate of 245,476 to 360,544 bearded seals in the Bering Sea. These other studies are sufficient to inform BOEM's analysis of reasonably foreseeable impacts on bearded seals.

Conditional Probabilities. The methodology for the probabilities analyses is described on page 4-186 of the Draft EIS, and is further supported by information in Appendix A of the Draft EIS. Without further information from the commenter on what specifically is not well explained in the probabilities description, BOEM cannot provide further clarifications on the discussion.

Final EIS Updates and Revisions. In response to comments, a number of revisions and edits were made to the evaluation of marine mammals in the Final EIS, including the following:

- Figure 3.2.4-15 has been revised to remove the native allotment that is incorrectly identified as a material site.
- The last paragraph on page 3-88 of the Draft EIS has been revised in the Final EIS to state the Arctic ringed seal is no longer listed as threatened under the Endangered Species Act due to the U.S. District Court for the District of Alaska's 2016 decision to vacate NOAA Fisheries' 2012 listing of the species as threatened.
- Figure 4.3.4-4 has be revised for clarity in the Final EIS. The charts within the figure have been enlarged to the size of a full, separate page.
- Figure 4.3.4-6 has be revised for clarity in the Final EIS.
- All references to dredging associated with the Proposed Action have been removed from the marine mammal section of the Final EIS; dredging is mentioned in the context of noise from other comparable projects.
- Figure references have been corrected in the Final EIS where necessary.
- The statements in the Draft EIS that equipment is only cached at Deadhorse and Utqiaġvik have been deleted from the Final EIS. The Final EIS will not be revised to list spill response equipment locations as they are subject to change.
- Table 4.3.4-5 has been revised to remove the dredging entry, the reference to NMFS 2013b, and the statement that the table was based on propagation in the strongest 1/3 octave band. The table is intended to display the noise propagation of general construction activities and not meant to describe the specific activities associated with the Proposed Action. The table title has been changed to clarify that it displays the median distance to behavioral thresholds. It was also revised in the Final EIS to better reflect that the results of SLR's report are the maximum distances and are not related to background levels.
- The Final EIS has been revised for consistency with Hilcorp's Letter of Authorization application for take of marine mammals incidental to operations of offshore oil and gas facilities.
- The Lowry et al. 2017 reference cited in Section 3.2.4.1 of the Draft EIS estimates around 20,000 beluga whales in the Eastern Chukchi Stock; this information is included in the Final EIS. BOEM does not believe this increased population changes the impact types, mechanisms, or ultimate conclusions that are disclosed for this species in the Draft EIS.
- The citation in Section 3.2.4.1 of the Final EIS regarding separation of beluga whale stocks during winter has been changed to Citta et al. 2016. The References chapter of the Final EIS has also been revised accordingly.
- Polar bear range data has been revised in the Final EIS where possible. Some of the data cited by commenters is not yet available.
- Figure 4.3.4-4 has been revised in the Final EIS for clarity.
- Discrepancies in the table and figure numbering systems in the marine mammals sections of the Draft EIS have been corrected in the Final EIS. References have also been added to the tables and figures, where needed.
- BOEM has revised the Final EIS to include the noise level for the zone of potential behavioral disturbance that would extend between 880 and 1260 meters from the noise source. Please note

that slope shaping and armament installation are considered as continuous noises, not impulse noise. For this reason, the zone of disturbance is 120 dB instead of 160 dB.

Impacts of Spill Response Activities. As described in Section 4.3 of the Draft EIS, there are instances where marine mammals were adversely affected by the presence of clean-up crews, vessels, and aircraft during even well-coordinated spill responses. BOEM submits that this Final EIS adequately analyzes the potential environmental effects associated with spill response activities.

Vessel Transport. As stated in Section 2.2.1 of the Draft EIS, Hilcorp would use barges, hovercraft, and vessels to transport equipment, personnel, and construction materials to the LDPI. Vessel traffic from outside the project area (or off-slope) is addressed in the Draft EIS. Figure 2.1.1-3 shows the general route from Dutch Harbor to the project area. Vessels on this route would transport supplies and materials for project construction and operations. The potential impacts of vessels on marine mammals, including vessels from Dutch Harbor, are described in Section 4.3.4 of the Draft EIS. Revisions were also made to the Final EIS text regarding potential injury and behavioral disruption impacts resulting from support vessels.

Beluga Whale Stocks. BOEM acknowledges that Cook Inlet beluga whales live in a different environment than beluga whales in the project area (i.e., Beaufort Sea), and that ambient underwater noise levels may be different. However, BOEM does address potential impacts on beluga whales in the project area and has also reviewed NMFS impact assessments (i.e., Biological Opinion, Environmental Assessment) of beluga whales related to the nearby Northstar production facility for comparative purposes to the potential impacts of the proposed project. BOEM was simply including additional information on assessments of beluga whales in other waters in Alaska.

Issue 15. Birds

Summary of Comments

Several comments addressed potential impacts on marine and coastal birds and recommended specific revisions to the Draft EIS. Some of these comments focused on the vulnerability of birds to collisions with vessels and infrastructure and to contact with spilled crude oil. General comments include:

- The impacts on bird populations from air traffic (helicopters), vehicular traffic, and other road construction are more significant than characterized in the Draft EIS. Further avoidance or mitigation measures to protect critical habitat should be specified, given the more significant impact of the Proposed Action.
- Additional mitigation measures for construction and gravel extraction for the road construction would occur in the winter when migratory birds are not present at the site.
- The oil spill impact analysis should include the Beaufort Sea Nearshore Important Bird Area as it spans the project area and would be impacted in the event of an oil spill. Additionally, the cumulative impacts of adjacent or nearby oil and gas development projects should be assessed when considering impacts on bird populations from the Liberty Project.
- Although predator abundance is expected to increase as a result of potential nesting, perching, and denning sites, the location of the LDPI offshore and the applicant's strict food waste controls will avoid attracting predators and the impacts of increase levels of predators would be minor rather than moderate.
- Birds in the project area will be subjected to artificial light pollution from energy platforms, tankers, and other lighted structures. The impacts of artificial light on injury, flight and migratory patterns, mortality, and communication patterns should be included.

Source of Comments

- State Agencies
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Energy and Non-Energy Industry and Other Associations
- Individual/General Public

Response to Comments

Road Construction, Vehicle Traffic, and Air Traffic. One comment requesting a more accurate analysis of impacts on birds from air and vehicle traffic and road construction did not specify in what way BOEM analysis was inaccurate or what specific impacts should be avoided and mitigated other than to indicate that impacts on snow geese should be upgraded to serious—an impact classification that is not in use in the Draft EIS. BOEM addresses the impacts of vessel, air, and vehicle traffic as well as habitat loss and alteration in Section 4.3.3.1 of the Draft EIS. This section discusses the different impacts of each vessel/vehicle type and the potential effect those impacts have on bird populations. Impacts discussed in this section include the disturbance, displacement, and mortality of birds during important life history stages, including breeding, nesting, pre-migration staging, and molt. Increased use of existing roads is expected, and is analyzed in Section 4.3.3.1 under "Vehicle Traffic," for both non-listed and ESA species. All impacts on nesting birds, including disturbance, collision with chicks and hens, and interference with natural movement patterns that may lead to exposure and increased predation were considered. Potential impacts on birds resulting from the

alternatives to the Proposed Action have been updated in Section 4.3.3 of the Final EIS to clarify details regarding potential impacts from road construction.

Winter Mitigation Measures. The discussion of measures to minimize lethal take by deterring birds from nesting in areas planned for gravel extraction is appropriate. As noted on page 4-82 of the Draft EIS, the disturbance impacts from construction are primarily confined to the non-breeding season and would largely occur in areas unsuitable for nesting. However, there is still a possibility that impacts could occur in the winter and the mitigation is intended to minimize the possibility of impacts. Furthermore, the mitigation measure in question is one of the "Additional Potential Mitigation Measures" that "is speculative" and "*may be* expected to further reduce numbers of birds affected."

Beaufort Sea Nearshore Important Bird Area. Beaufort Sea Nearshore Important Bird Area, though not specifically called out, is addressed in Section 4.3.3.1 of the Draft EIS. As stated in this section, the area in the Beaufort Sea and the surrounding region are represented in the Oil-Spill Risk Analysis (OSRA) model by Environmental Resource Areas (ERAs), Land Segments (LSs), and Grouped Land Segments (GLSs) as listed in Appendix A, Table A.1-9 and A.1-10 of the Draft EIS. The cumulative effects of past, present, and reasonably foreseeable future actions on bird populations was analyzed and described in Section 5.2.5. The analysis of cumulative impacts has been updated in the Final EIS to more clearly reflect the cumulative impact of adjacent oil and gas development projects.

Predator Abundance and Attractants. BOEM addressed predator abundance in Section 4.3.3.1 of the Draft EIS, which concluded that "the Proposed Action would have a minor to moderate level of impact on local populations of nesting shorebirds, waterfowl, loons, and passerines." The text in the Final EIS has been revised to more clearly explain the potential sources of predator attractants such as infrastructure providing new raven nest structures.

Artificial Light Impacts. BOEM addressed the effects of night lighting on birds in Section 4.3.3.1 of the Draft EIS. This section stated that some birds may be more prone to collisions with structures and vessels than others because of their typical flight pattern or attraction to artificial light. BOEM acknowledges species, such as eiders, which typically fly low over water and have greater potential to collide with offshore structures and ships, especially under conditions of poor visibility such as fog, precipitation, and darkness. Section 4.3.3.1 of the Draft EIS also addressed passerines, which are typically nocturnal migrants, stating that they have demonstrated high relative rates of light attraction and strikes in Alaskan waters and elsewhere.

Issue 16. Terrestrial Mammals

Summary of Comments

Some comments addressed potential impacts on caribou, Arctic foxes, and other terrestrial mammals. Several of these comments requested additional analysis or clarification on the estimated impacts, or suggested reductions in the estimation of impacts based on revised operating assumptions. General comments are as follows:

- Add a citation and accompanying reference list for Appendix C to show where the avoidance criteria for muskoxen was developed.
- Revise life history information (mating periods and cubs) used for arctic foxes.
- Revise impact outcomes for caribou populations based on low-level aircraft not overlapping with calving locations of caribou and year-round access road use to transport personnel. Clarify caribou presence in the project area during use of ice roads.
- Gravel mining and pipe construction would be well established before fox denning would occur, reducing mortality from construction equipment.

Source of Comments

- Local and Regional Governments
- State Agencies
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

Muskoxen Avoidance Criteria. The mitigation was developed using existing study data relating to the effects of aircraft operations on caribou, muskoxen, and grizzly bears on the Arctic Coastal Plain and in northern Canada. A 1,500-foot altitude above ground level requirement is cited as the minimum altitude operations should maintain to avoid impacting caribou, muskox, and grizzly bears. The avoidance of muskox groups was recommended based on the existing body of literature.

Arctic Fox Life History and Impacts. Life history information for Arctic foxes has been revised in Section 3.2.5.4 of the Final EIS. As explained in more detail in Section 4.3.5.4 of the Draft EIS, pipeline construction could have adverse effects on Arctic foxes if existing fox dens were to be disturbed or damaged. The estimated impacts on Arctic fox from gravel mining described in the Final EIS is a conservative estimate. The development and implementation of an interaction plan that prohibits feeding foxes or otherwise attracting them would further reduce the potential level of effects on Arctic foxes to negligible.

Impacts on Caribou. BOEM submits that the descriptions of impact conclusions for caribou were described accurately in Section 4.3.5.1.2 of the Draft EIS. This section includes the assumption that most caribou from the Central Arctic Herd migrate out of the area during the winter. Potential impacts on any stragglers or caribou electing not to migrate or visitors from the Teshekpuk Lake Herd would not result in population-level impacts. Other restrictions and mitigation measures identified in Section 4.3.5.1.2 of the Final EIS would reduce impacts on stragglers or caribou electing not to migrate.

Issue 17. Vegetation, Wetlands, and Substrate

Summary of Comments

Commenters discussed potential impacts of the project on vegetation, wetlands, and substrate.

Comments were provided on specific sections of the Draft EIS, including:

- Table ES-1 of the Executive Summary should indicate that the approximate 21 acres of emergent wetland lost as part of the development of the gravel mine would be converted upon mine reclamation to an open water system that could provide an ecological uplift. Because gravel mine reclamation would be completed shortly after construction, "the 21 acres of impacts relative to that project component should not be considered long-term and could be considered temporary."
- Section 3, Figure 3.2.6-1 and Table 3.2.6-1 should be referenced as the "Wetlands Delineation Study Area," not the "Proposed Action Area."
- Section 4.2.2.5 of the Draft EIS neglected to identify additional impacts on wetlands that would occur from extensive gravel hauling on the existing road, including creation of dust shadow from gravel haul trucks on Endicott Road that could affect water quality.
- Section 4.3.6.1 should indicate that, "approximately 21 acres of emergent wetland lost as part of the development of the gravel mine would be converted upon mine reclamation to open water system that could provide an ecological uplift. The uplift would be derived from the new open water habitat and shallow littoral zone offering a medium for *Arctofila Fulva* volunteers to establish." According to the commenter, "the new open water system would include waterfowl and migratory bird habitat, and provide a long term water source for ice road development. This uplift is reflected in the Aquatic Site Assessment (ASA), as open water lentic systems (lakes ponds) are rated as automatic Category I, while the wetlands lost are mainly Category II."
- Section 4.3.6.1 "over states impacts to wetlands from ice roads and pads, which are not Section 404 regulated as the construction of ice roads and pads are not considered a fill activity under Section 404." Because the use of ice roads in a project design is a measure to avoid impacts on wetlands, a commenter requested the description of ice road and pad impacts be, "stated as 'temporary vegetation' impacts, and that ice roads and pads would not result in impacts to wetlands."
- In Section 4.3.6.1, the determination that a 1.5-acre pond would be included in the mine site excavation area is incorrect and should be revised.
- In Section 4.3.6.5, the table reference for Table 4.3.7-2 listed at the top of the page is incorrect. It should be Table 4.3.6-2, not Table 4.3.7-2. The language describing Table 4.3.6-2 should state that the data, "…represents the whole Wetlands Delineation Study Area and not just the Proposed Action Area. This table presents the acres of study area, not acres of actual potential disturbance."

Comments specific to USACE issues (i.e., Section 404 of the CWA; Section 10 of Rivers and Harbors Act) include:

- The Draft EIS should include the entire statement from Hilcorp's Section 404 Individual Permit Application Mitigation Statement with respect to the Draft EIS wetlands evaluation, relative to wetlands avoidance and minimization measures.
- Section 2.1.10 should include a qualifier to the last sentence concerning CWA Section 401 certifications on CWA 404 permits by the Alaska Department of Environmental Conservation. It should also include a section on state's authority.

- Section 2.2.4.4 should include Water/WDAP 401 certification of 404 permits for Alternatives 3A and 3B with emphasis that Alternative 3B would be in state land and waters.

Source of Comments

- Individuals/General Public
- State Agencies
- Federal Agencies
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Gravel Mine Sites. BOEM has determined that wetland impacts from the gravel mine site associated with the Proposed Action are localized and long-term. Any resulting ecological uplift as a result of reclamation efforts would need to be assessed upon completion of the final and approved reclamation plan.

The potential for changes in geomorphic category and related functions of wetlands impacted at the gravel mine site were addressed in the Draft EIS. Section 4.3.6.1 of the Draft EIS indicated "gravel mine sites fill with water over time and require dewatering before further use." Section 4.3.6.1 indicated that "the topographical difference expected between the bottom of the gravel mine site and adjacent wetlands is so large there is no expectation that a vegetated wetland could be successfully established." The Draft EIS further stated that once the gravel has been removed, the overburden would be returned, but that wetland vegetation would likely be limited to a "relatively narrow fringe of wetland vegetation along all or part of the pond/lake shore," that "an emergent wetland fringe may be successfully established along the perimeter of the gravel pit," and that given the anticipated narrow emergent wetland fringe "the area would ultimately resemble an artificial lacustrine system."

Final EIS Updates and Revisions. In response to comments, a number of revisions and edits were made to the evaluation of vegetation, wetlands, and substrate in the Final EIS, including the following:

- References to Figure 3.2.6-1 and Table 3.2.6-1 in Section 3 have been updated in the Final EIS to reference them as illustrating the results of the delineation within the Wetlands Delineation Study Area.
- Section 4.3.6.1 of the Final EIS has been revised to remove the reference to the 1.5-acre pond in the mine site excavation area.
- The table reference in Section 4.3.6.5, at the top of page 4-230, has been updated in the Final EIS to be Table 4.3.6-2.
- The text describing Table 4.3.6-2 has been updated in the Final EIS with the text indicated herein in *italics* to clarify that "Table 4.3.6-2 presents the surveyed locations of the Proposed Action, Alternative 5A and Alternative 5B *gravel mine sites*, the amount of area surveyed, and the distribution of Arctophila fulva in each surveyed *alternative gravel mine* location." Contrary to the commenter's assertion, the table was not described in the Draft EIS text as presenting data for the Proposed Action Area.

- Sections 1.4.7 and 2.1.10 of the Final EIS have been updated to reflect Section 401 of the CWA and designated authority for review of actions requiring a CWA Section 404 permit to the State of Alaska.
- Section 2.2.4 of the Final EIS has been updated to reflect activities subject to Section 404 of the CWA; however, State of Alaska permitting requirements are not included. The State of Alaska is not adopting the EIS to meet any permitting needs and a recitation of their permitting authority in the Final EIS is unnecessary.

Impacts from Alternative 5C. A number of comments on the potential impacts of Alternative 5C were received. Alternative 5C has been dropped from consideration in the Final EIS due to the difficulty of de-watering the site and likely lack of available gravel. Therefore, detailed response to these comments is not necessary.

Ice Roads and Ice Pads. Section 4.3.6.1 of the Draft EIS states that the impact on wetlands from ice roads and the ice pad perimeter of the gravel mine site would be "of short duration, local, and limited in extent and is considered to be minor." Section 4.3.6.1 indicates that the ice pad around the gravel mine site "would temporarily impact existing vegetation; crushed vegetation is expected to recover within two growing seasons." The Draft EIS does describe possible mechanisms of indirect impact on vegetation and wetlands via changes to hydrology and water flow, increased erosion potential, and consequent effects on plant phenology, particularly if roads are built in the same location for multiple years. The potential for indirect effects from the introduction of invasive species is also acknowledged. No revisions have been made to the Final EIS in response to comments suggesting that the Draft EIS overstates impacts from ice roads and ice pads.

Clean Water Act Permit. No changes have been made to the Final EIS in response to comments requesting that the EIS should include the entire statement from Hilcorp's Section 404 Individual Permit Application Mitigation Statement. Specific descriptions of efforts to avoid and minimize impacts on wetlands and waters of the United States included in the 404 application are not a requirement of a NEPA evaluation and as such were not included in the Draft EIS. Developing measures to avoid and minimize impacts on wetlands is a USACE CWA Section 404 permit process requirement for appropriate sequencing of mitigation actions, as per the CWA Section 404(b)(1) guidelines developed by EPA and USACE and a related 1990 Memorandum of Agreement between EPA and USACE on mitigation.

Sections 1.4.3.1, 1.4.3.2, and 2.1.10 of the Draft EIS address the regulatory framework and components of the proposed action which would require a permit from USACE under Section 404 of the CWA due to impacts on USACE-regulated Waters of the United States (which includes wetlands) and under Section 10 of the Rivers and Harbors Act (including as extended by section 4(f) of the OCSLA, as amended). Section 1.4.7 addresses regulatory requirements under the jurisdiction of the State of Alaska.

Section 401 of the CWA provides states with the legal authority to review an application or project that requires a federal license or permit (e.g., a CWA 404 permit) that might result in a discharge into a Water of the United States located within the jurisdiction of the state. Applicants for a USACE CWA Section 404 permit for actions within the State of Alaska must apply for and obtain a Certificate of Reasonable Assurance from the Alaska Department of Environmental Conservation to conduct a regulated activity.

Section 2.1.10 acknowledges that an Individual Permit would be issued by USACE under Section 404 and Section 10 authorities, but neither Section 1.4.7 nor Section 2.1.10 specifically address CWA

Section 401 water quality certification, which has been delegated by the federal government to the State of Alaska for actions in state land and waters.

Section 2.2.4.4 of the Draft EIS specifically addresses USACE permitting and references CWA Section 404. The Draft EIS does not specifically address CWA Section 401 water quality certification as an authority delegated by the federal government to the State of Alaska for actions in state land and waters.

Issue 18. Economic Impacts

Summary of Comments

Many commenters discussed the economic impacts of the project.

Several commenters suggested the project is vital to restoring Alaska's economy. Commenters suggested the project will have a positive impact on the State of Alaska and its public sector, including high-paying and high-quality employment opportunities (in the oil and gas industry and other industries indirectly related to oil and gas), improved quality of life for residents, increased business opportunities and long-term economic activity, as well as generation of tax revenue to the NSB and royalty payments to the State of Alaska. Commenters expressed support for the project and the employment opportunities it will bring to Alaska, stating that the state has been in recession since the 1980s. One commenter stated that one third of jobs in Alaska are tied to the oil industry. Other commenters stated that the project would protect the longevity of TAPS, restoring financial stability to Alaska.

Two commenters stated Alternative 3B would result in increased property tax revenues to Alaska as a result of moving the proposed LDPI into state-managed waters and disagreed with any suggestion that the NSB would not have taxing authority over the facilities located in state waters independent of the State of Alaska, as is currently done with existing facilities located in state waters.

Similarly, a commenter questioned why Section 4.4.2.1 states that the State of Alaska is assumed not to share property taxes with the NSB for oil and gas infrastructures in state waters, and why a conflicting statement is made on page 4-293 of the Draft EIS: "BOEM anticipates minor beneficial effects to community health in the NSB due to increased revenue."

One commenter stated that the State of Alaska relies on responsible resource development industries to provide revenues that fund services to Alaskan citizens, such as public education, the University of Alaska, roads, public safety, social welfare, and more. Another commenter suggested the project will support an estimated 6,000 or more jobs, approximately $3 billion in labor income, and $1.6 billion or more in government revenue that can be used towards public services.

A commenter predicted that the project will help provide more affordable energy to families and small businesses in Alaska and the rest of the U.S., suggesting residents of Alaska, "…spend more than $7,400 on energy annually," an amount which makes up "…more than 10% of the state's medium household income, and close to 50% of the income of an Alaskan living at the poverty line."

Referencing Section 4.4.2 of the Draft EIS, which concludes that the project is expected to have a "negligible beneficial impact" on the state economy and only "a negligible to moderate beneficial impact" on the NSB economy, two commenters suggested that BOEM has underestimated the potential economic benefits to the state and NSB. One commenter provided the results of an evaluation published by the University of Alaska Anchorage Institute of Social and Economic Research (which used an economic impact modeling tool, IMPLAN) to estimate the project's impacts on employment and wages as well as the indirect and induced effects of employment and wages during the construction phase of the project (between 2017 and 2023).

One commenter expressed support for locating the project's island in state waters, thus creating a local revenue stream from the project through either local taxation or federal-state revenue sharing. This commenter stated that communities and subsistence hunters carry much of the risks of offshore development in Alaskan waters, and have difficulty securing funding to meet the regulatory

requirements placed on subsistence hunting by the government and International Whaling Commission. The commenter encouraged BOEM and Hilcorp to hire local workforce and develop ways for local communities to benefit from the development of offshore resources.

A commenter stated that although the location of Liberty in federal waters would reduce potential benefits of revenue sharing between the NSB and the State of Alaska, a safe and responsible development should be prioritized.

One commenter provided specific critiques of the Draft EIS and made the following comments:

- The commenter stated that the annual state oil and gas revenues of $7.6 billion in the Draft EIS (page 4-245) are incorrect, and suggested that the revenues in FY 2016 were $1.6 billion.
- The commenter questioned why the Draft EIS discusses the costs of social carbon in Sections 3.3.2.4, 4.4.2.1, and 4.2.4, since an Executive Order issued in March 28, 2017, withdraws or revokes requirements for analyzing the social cost of carbon.
- The commenter stated that the discussion of the impacts from the Exxon Valdez oil spill on employment, income, and revenue is incomplete without discussion of the negative economic impacts on employment and income for commercial fishers and tourism businesses.

A commenter discussed the use of a domestic-only estimate for calculating the social cost of carbon in the Draft EIS and stated the use of the estimate would be, “inaccurate, misleading, and out of step with the best available economic literature, in violation of Circular A-4’s standards for information quality.”

Source of Comments

- Alaska Native Organizations
- State Government
- Corporations

Response to Comments

Benefit and Contribution to the state and local economy. The BOEM analysis in the Draft EIS indicates that the effect of the Proposed Action on state employment and labor income (wages) would be less than 1%. BOEM has reviewed those estimates and determined that they are less than 2% and approximately 2%, respectively. The text in the Final EIS has been revised accordingly. The corresponding effect for the NSB is 2.2% and 2.6%, respectively. Because of these low percentages, BOEM concludes a negligible or minor effect and estimates revenues to the state would represent less than a 1% increase and conclude a minor effect. The NSB would receive less than 1% increment on revenues but would receive benefits in other ways resulting from the proposed action; these revenues and benefits lead BOEM to conclude that there will be a moderate effect. See Section 4.4.2.1 for analysis.

A commenter expressed concern that the Draft EIS underestimated the economic benefit of the project and referenced a report by the University of Alaska Anchorage Institute for Social and Economic Research (ISER). While the ISER report uses similar methods as those used for the Draft EIS, BOEM’s analysis differs in the way indirect and induced effects are calculated, analyzes employment on an annual basis to accurately estimate the incremental impacts of the project, and considers baseline employment and labor income to better represent the relative impact of the project. BOEM believes the ISER report data appears to further support the Draft EIS impact conclusion for

the State of Alaska and it does not provide additional information specific to the NSB analysis. The Proposed Action is expected to have negligible beneficial effects on state employment, labor income, and revenues.

The Final EIS has been revised to indicate that, on average, the State of Alaska would receive $9.8 million annually associated with its share of royalties and lease payments. BOEM estimates that the sum of the average annual TAPS-related effect, state corporate income taxes, and state property taxes (after transfer to the NSB) would be approximately $3.5 million. The total average annual revenue to the state from the Proposed Action would be approximately $13.3 million, which represents less than 2% of the $2.4 billion in 2015 total state oil and gas revenues (ADR, 2015) and also represents less than 1% of the $1.6 billion total state oil and gas revenues in 2016 and $1.7 billion in total state oil and gas revenues in 2017 (ADR, 2015; ADR, 2016). The relatively small amount of annual State of Alaska revenues associated with the Proposed Action would have little to no effect on the state economy, resulting in a negligible effect.

Lack of analysis of economic effects of an oil spill on businesses such as commercial fishers and tourism businesses. There are no commercial fisheries in the U.S. Beaufort Sea. There are some small, eco-tourism businesses in the region that could be impacted in the event of an oil spill, but employment at these businesses is too small to affect the conclusions about potential effects to the economy.

Property taxes resulting from the LDPI being located in State of Alaska waters under Alternative 3B. BOEM has revised the text in the Final EIS to acknowledge that the NSB would share the property tax increment.

Local revenue generation. The Alaska Eskimo Whaling Commission supports local revenue generation through local taxation or federal-state-local revenue sharing. Only the NSB, State of Alaska, and/or the U.S. Congress have the authority to take the action to create such taxation or revenue sharing provisions.

The Cost of Consumer Energy. The Draft EIS does not provide an analysis of changes in the availability of affordable energy in Alaska and the rest of the U.S. as a result of the Proposed Action as such an analysis is beyond the scope of the Draft EIS. BOEM's independent reservoir model and reservoir simulation studies using the Hilcorp development plan indicate that the Liberty Field reservoir would recover from 41% to 48% of the 180 million barrels of oil originally in place, with a peak production rate of approximately 58,000 barrels of oil per day within the first 2 years of production with an estimated project life of 22 years. According to the EIA (2018), average daily U.S. oil production was 8,857,000 barrels per day and Alaskan production was 490,000 barrels per day in 2016. Therefore, the effect of the increased oil supply from the Proposed Action on the price of domestic oil is likely negligible.

Exxon Valdez Oil Spill. Section 4.4.2.1 of the Draft EIS mentions the Exxon Valdez Oil Spill for the purpose of forecasting the potential impacts of a future oil spill on the economy. The Draft EIS acknowledges that the Exxon Valdez Oil Spill "had adverse effects on jobs and income associated with commercial and recreational fishing," but does not include discussion of the impacts on tourism. Tourism does not occur in appreciable levels in the immediate vicinity of the Proposed Action due to shallow waters that preclude cruise ships and industrial activity; therefore, any impact from an oil spill on the local tourism industry would likely be negligible. Furthermore, there are no commercial fishers in the U.S. Beaufort or Chukchi Seas.

Social Cost of Carbon. Section 4.4.2.1 of the Final EIS presents an updated analysis of monetized impacts from GHG emissions associated with the action and No Action alternatives. These updates, which include additional estimates based on methods consistent with the Office of Management and Budget (OMB) Circular A-4, represent BOEM's response to comments criticizing the use of the recently-rescinded Social Cost of Carbon protocol as a tool for monetizing GHG impacts in the Draft EIS.

Issue 19. Arctic People, Subsistence Use, and the Environment

Summary of Comments

Comments generally discussed the importance of protecting the local environment and potential impacts resource development may have on subsistence activities. Comments also supported continuous efforts to maintain a working relationship between industry and local whalers and stakeholders.

Subsistence Activities and Harvest Patterns. Noting the successes of similar near-shore projects, including Endicott, Northstar, Oooguruk, and Nikaitchug, and Hilcorp's history of collaborating with whalers and the local people, some commenters stated that they are willing to support the Liberty Project if similar safety and mitigation measures are taken to reduce risks to the environment and subsistence activities.

Commenters expressed concerns associated with adverse effects on Nuiqsut subsistence whaling. Commenters at public meetings requested BOEM reconsider the concerns expressed by whalers and communities who will be impacted by the project. Commenters stated that the Nuiqsut Whaling Captains' Association should be part of the cooperating agency. Some described the grave effects oil and gas activities have on whale behavior and how these impacts have created new challenges and barriers for whalers to safely and successfully hunt.

Commenters provided specific comments related to whalers that launch from the base of Cross Island, stating that this area is the primary concern associated with the Liberty Project.

- A commenter requested Figure ES-1 in the Draft EIS be revised to include Cross Island and associated text be revised to describe its distance from the project facilities. Similarly, the commenter discussed the importance of the Nuiqsut's whaling grounds around Cross Island and their close proximity to the proposed drilling site.
- One commenter stated that the key to reducing or eliminating potential effects on Cross Island whaling is carefully planned mitigation measures involving Nuiqsut whalers and the development of a meaningful partnership between whalers and agencies.
- Referencing Table 2.1.1-2 in the Draft EIS, which provides estimates of marine traffic and vessel types, a commenter concluded that the levels of vessel traffic expected from the project's construction, development, and operation would deflect bowhead whales and impact subsistence whaling. The commenter noted that if whales are deflected farther away from Cross Island, as anticipated, the safety of hunters would become a factor due to longer travel distances and higher chances of encountering inclement weather. The commenter also expressed concern that longer tow distances could lead to whale spoilage. This commenter requested a CAA restricting barging activities until whaling has concluded at Cross Island be utilized for the Liberty Project.
- A commenter provided history related to prior evaluations conducted by BP that found that offshore construction and drilling activities at Northstar impact subsistence whaling by deflecting whales farther away from the shore and from subsistence users that harvest them. The commenter expressed concern that impacts on whales would be worse at the proposed Liberty Project site because the drilling site is east of Cross Island, instead of west like at Northstar. According to the commenter, whales targeted by Nuiqsut hunters are traveling west, near or in the proposed Liberty Project area, before they get to Cross Island, not after. The commenter expressed concern that if whales are deflected from their traditional migration route while east of Cross Island, there is a great chance the whales will only pass through the outer reaches of Nuiqsut's whaling grounds. According to the commenter, potential impacts on subsistence whaling for Nuiqsut

include "possible alteration of movement patterns of some whales present inside the barrier islands; stress and worry over alteration of whale movement patterns on the part of whales; support vessel traffic; summer construction activities such as sheet pile driving; and whaler avoidance of the project Action Area."

- One commenter requested BOEM's support in encouraging Hilcorp to engage in the Camden Bay Initiative.

A commenter noted that the Draft EIS does not consider whaler avoidance of the proposed action areas as a serious problem by acknowledging that Nuiqsut whalers have been pushed out of the Northstar area and that the project will push them out of Foggy Island Bay as well (pages 4-258 and 4-259 of the Draft EIS).

A commenter claimed the Memorandum of Understanding between Hilcorp and the Nuiqsut Whaling Captains' Association offers no real benefits as it can be terminated without cause with just 1 year notice. The commenter requested that Hilcorp be required to engage in good faith negotiations to reach a CAA with Alaska Eskimo Whaling Commission and commit to providing financial and logistical support for Nuiqsut whalers for the life of the project, not just until the Memorandum of Understanding with the Nuiqsut Whaling Captains' Association is terminated.

A few commenters stated that the Draft EIS underestimates the cumulative effects of the project, combined with other oil and gas development in the Arctic and climate change, and the major impacts these effects will have on subsistence users and their sociocultural and community health. Disruption to or long-term loss of subsistence harvest of bowhead whales due to deflection, interference, whaler avoidance, or summer construction could result in critical disruption to sharing patterns and cultural values, diminished nutritional status in communities, and other stressors.

A few commenters discussed Hilcorp's existing support of subsistence hunting activities around Cross Island related to the Northstar and Endicott projects, and its commitment to sign a CAA with area whaling groups to protect subsistence activities. A commenter stated that the Draft EIS has not considered Hilcorp's intent to continue working with whaling captains and the Village of Nuiqsut to ensure whaling will not be impacted by the proposed Project. Other efforts made by Hilcorp to support subsistence whaling include submitting a Plan of Cooperation to NMFS; documenting engagement activities with subsistence communities within the North Slope Region; developing project-specific subsistence mitigation measures after consulting with NSB, Alaska Eskimo Whaling Commission, and the Nuiqsut community; and formalizing a Memorandum of Understanding with the Nuiqsut Whaling Captains' Association.

One commenter concluded that mitigation efforts made by Hilcorp (such as monitoring work conducted at Northstar and Endicott, acoustic modelling performance during the 2017 open water season, and the Cross Island Bowhead Whale Subsistence Assessment) will inform further efforts to reduce acoustic impacts from the project and subsistence activities occurring nearby.

A commenter questioned why BOEM has avoided granting Nuiqsut Cross Island whalers a deferral line like other villages impacted by oil and gas developments in the area.

Some commenters provided comments on specific areas of the Draft EIS, including the following:

- Regarding Table 3.3.3-1 in Section 3.3.3.2 of the Draft EIS, a commenter requested the table include: (1) fourhorn sculpin because it is mentioned as a hearing specialist; (2) burbot; and (3) peak subsistence times of January through April and then October through December with snowmachines as the method of transportation.

- Regarding text in Section 3.3.3.3, "Subsistence fishers have noticed some broad whitefish from the Colville River and Nigliq Channel near Nuiqsut have patchy fungal-like lesions on the exterior surface; the lesions are caused by a common water mold (Saprolegnia) which is not exotic to the NSB and surrounding area." A commenter noted the phrasing relating to Saprolegnia mold as either exotic or not could also be read to mean the related infection is common, which is not the case.
- The reference in Table 4.4.3-2 to potential conflict between summer subsistence caribou hunting, fishing, and waterfowl hunting and gravel reclamation activities is incorrect as gravel reclamation activities will have ended before summer subsistence activities begin.
- There is no "applicant proposed" temporary annual suspension of non-reservoir drilling operations to avoid interference with subsistence whale hunting as indicated in the Draft EIS pages 2-62 and 4-319, and Appendix C. Impact pile driving is the only activity that is proposed to be suspended during the bowhead whale subsistence harvest period.
- The Subsistence and Public Health Sections of the Draft EIS conflate pile driving and slope protection activities. Because of the distinct timing, requirements, and different potential acoustic impacts in the marine environment, these activities should be considered separately in the Draft EIS.
- Section 4 of the Draft EIS (page 4-265) states that "noise and disturbances from slope protection could result in minor impacts to subsistence seal hunting for Nuiqsut and Kaktovik… especially… if hunters need to look for seals in the Proposed Action Area in July and August." A commenter questioned why a level of impact greater than negligible was concluded in Table ES-1 if seal hunting does not currently occur in the project area.
- To ensure consistency with language in Sections 101(a)(5)(A) and (D) of the Marine Mammal Protection Act, future documentation should replace the phrase, "will not result in unreasonable interference with subsistence harvest" with "will not result in an unmitigable adverse impact to the availability of marine mammal subsistence resources."
- In an effort to identify an approach that could mitigate potentially major impacts on Nuiqsut whalers, the Final EIS should only include an analysis of a Liberty Drilling and Production Island located closer to shore (3 miles) and analyze the amount of recoverable oil using extended reach drilling from this location.

Traditional Knowledge. One commenter stated that the Draft EIS demonstrated a lack of use and acceptance of traditional knowledge. Specifically, the commenter stated that the language in the Draft EIS is patronizing towards subsistence users compared to "scientific" studies conducted by non-subsistence users. According to the commenter, this tone suggests that Nuiqsut's knowledge is not worth as much as others whose experiences in the area are limited. For example, the Draft EIS uses language such as "whalers believe…", "whalers hold strong native attitudes towards…", "from the whaler's perspective…", and "perceived interference…" Further, statements in the Draft EIS that acoustic impacts and deflection of whales will only occur inside the barrier island is contrary to Kuukpik and other subsistence users experience and communications to BOEM.

Environmental Justice. One commenter suggested that although the Draft EIS acknowledges the project will have major impacts on environmental justice communities, including Nuiqsut, it failed to place these impacts in the context of the increasing industrialization that comes to the community from all sides, and fails to cope with the multiple and cumulative effects of increasing development around Nuiqsut.

A commenter argued that BOEM's prediction that the social-ecological system in the North Slope would adapt to shifting environmental conditions over the 25-year life of the Proposed Action goes against the concept of environmental justice and protecting those that are historically oppressed or forced to accept burdens and impacts caused by industrialization and other developments (Section 4.4.5 Environmental Justice, page 4-295).

Source of Comments

- Local and Regional Governments
- State Agencies
- Elected Officials
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

Subsistence Activities and Harvest Patterns. Many of the comments received on subsistence whaling have been addressed through revisions to the Final EIS.

The potential impacts of the Proposed Action and Alternatives on subsistence whaling are described in the Draft EIS in Section 4.4.3, which includes an analysis of the deflection of whale movements. As described in this section, Hilcorp has consulted with potentially affected subsistence communities during development of the Proposed Action to discuss potential conflicts between operations and subsistence activities and harvest patterns, and to identify measures to prevent unreasonable conflicts.

BOEM acknowledges that whaler avoidance is a serious problem and has made changes in the Final EIS to clarify the impacts of the Proposed Action and alternatives on subsistence whaling. BOEM also notes that Section 4.4.3 of the Draft EIS includes the following statement: "At times during the 25-year life of the Proposed Action, the area inside the barrier islands may be the only area where whales are available to Nuiqsut whalers. If they were deterred from using it by the presence of the proposed LDPI and non-whaling vessels, their opportunities to strike whales could be severely reduced for one or more seasons depending on ice and weather conditions, resulting in major impacts to subsistence whaling for Nuiqsut."

Mitigation measures identified by BOEM to reduce potential impacts on subsistence whaling are identified in the Draft EIS in Appendix C. These include measures to reduce potential adverse effects on Cross Island subsistence whalers from routine construction, development, production, and decommissioning of the Proposed Action. Appendix C notes a number of mechanisms intended to protect subsistence whaling and other marine mammal harvesting activities. It also identifies design features and Best Management Practices committed to by the operator that would avoid, minimize, or mitigate potential impacts on subsistence hunting. It is acknowledged that Hilcorp has committed to taking part in the CAA with the Alaska Eskimo Whaling Commission and to abide by the CAA each year that marine operations are conducted in support of the Proposed Action. Past CAAs have included various measures (e.g., minimum flight altitudes, vessel routing, other seasonal restrictions) designed to manage interactions between subsistence activities and offshore oil and gas activities.

Additional mitigation measures developed subsequent to the publication of the Draft EIS are also listed in Appendix C of the Final EIS. Commenters requested that BOEM require the applicant enter

into agreements to support or finance research and other initiatives. As a general matter, BOEM cannot compel a lessee to enter into contractual agreements with third parties.
In the Draft EIS, Figure 3.3.3-1 (Subsistence Use Areas for Utqiaġvik, Nuiqsut, and Kaktovik) and Figure 3.3.3-2 (Nuiqsut/Cross Island Location and Travel Routes with Landmarks) include the location of subsistence whaling areas in the Beaufort Sea, Cross Island, and subsistence whaling routes relative to the Proposed LDPI. Figure ES-1 provides an overview of the proposed action and is not at a scale that allows for Cross Island to be included. As described in Section 3.3.3.3 of the Draft EIS, Cross Island lies approximately 18 statute miles north to northwest of the Proposed LDPI. Potential impacts on Cross Island and subsistence whaling were evaluated and are disclosed in Section 3.3.3.3 of the Draft EIS.

Deferral Line. Questions about leasing and recommendations about lease deferral areas are not within the scope of the Final EIS, which analyzes the environmental impacts of a proposal to develop existing leases.

Final EIS Updates and Revisions. In response to comments on specific pieces of the analysis of subsistence whaling, a number of revisions and edits were made in the Final EIS, including the following.

- Comments specific to Table 3.3.3-1 on subsistence resources and peak harvest has been revised in the Final EIS based on comments provided. This table focuses on aspects of subsistence that could be affected by the Proposed Action and is not intended to be a comprehensive listing of all subsistence activities that communities engage in.
- The text describing Saprolegnia in Section 3.3.3.3 of the Final EIS has been modified to clearly state that while the mold is not exotic to the NSB, fungal-like lesions on fish from the mold are not common.
- The proposed mitigation measure referenced on pages 2-62 and 4-319 of the Draft EIS that identifies restrictions on certain drilling activities on a seasonal basis, but "allows for non-reservoir drilling and all other operations year-round (subject to the temporary annual suspension proposed in Hilcorp's DPP to avoid interference with subsistence hunting)" has been revised in the Final EIS to remove the reference to the temporary annual suspension, as no such suspension was included in Hilcorp's DPP.
- Section 2.1.3 of the Draft EIS states that the LDPI slopes would be protected from erosion in part by driven sheet piling around the LDPI perimeter. Thus, sheet piling and the associated pile driving are an integral part of the slope protection activities. For the purposes of evaluating the effect of these activities on subsistence hunting, they were grouped together as they would occur during the same time (May through August) and location (LDPI). However, the effects of sheet pile driving and other LDPI slope protection activities (i.e., grading, armament installation) were considered separately in the acoustical analysis of the impacts on sensitive subsistence fish and wildlife.
- While the area may not presently be frequented as a seal hunting area due to its position between Nuiqsut and Kaktovik, the area surrounding the LDPI was determined to be a subsistence use area based on interviews with active and knowledgeable subsistence harvesters in Utqiaġvik, Nuiqsut, and Kaktovik. As such, LDPI slope protection work is expected to have minor impacts on seal hunting for Nuiqsut and Kaktovik and negligible impacts on seal hunting for Utqiaġvik.
- Subsequent to the publication of the Draft EIS, BOEM has recommend additional mitigation measures to reduce potential impacts on environmental resources in the Final EIS; however, lease stipulations have already been established and cannot be revised by BOEM in the Final EIS.

- Potential impacts on Nuiqsut whalers from all variations of alternate LDPI locations, processing operations, and pipeline routes are considered as part of Alternatives 3 and 4 in the Final EIS. Further discussion of alternate LDPI locations is now provided in Section 2.3.2 of the Final EIS.

Traditional Knowledge. BOEM appreciates that Alaska Native Peoples possess a deep understanding of the land and sea that has made it possible for them to survive for thousands of years in one of the most challenging environments on Earth. Over the past 20 years, traditional knowledge has become increasingly integrated with social, biological, and physical scientific disciplines. Listening to indigenous perspectives and taking local knowledge into account are vital to achieving informed decision-making in ocean resource management. Although traditional and scientific knowledge may arise from different cultural traditions, they are compatible and allow for a powerful synergy when integrated appropriately. BOEM seeks to integrate traditional knowledge into the NEPA process by using input received from three primary channels: the Environmental Studies Program, Government-to-Government consultations, and public testimony.

- BOEM actively expands the collection and use of traditional knowledge through its Environmental Studies Program. The Environmental Studies Program designs, funds, and manages research efforts that are conducted through external Principle Investigators. Research strategies have evolved over the years, and different projects have involved a wide variety of data collection efforts, including life history interviews, ethnographic fieldwork, workshops, focus groups, household surveys, community expert review panels, traditional knowledge database construction, and collaborative wildlife tagging studies.
- BOEM also engages Village and Regional tribes in its relevant decision-making processes. Government-to-Government consultation, coupled with more informal discussions between BOEM management and tribal leadership, provide invaluable insight that is considered and incorporated into agency decisions. In these conversations, tribal elders and leaders become our teachers, mentors, and coaches. Chapter 6 contains additional information regarding Government-to-Government consultation on the Liberty DPP.
- BOEM also gathers traditional knowledge from local residents though testimony at public hearings in potentially affected communities. Their traditions and knowledge result from ancestors living in and around these areas for thousands of years, and are kept alive through the shared experiences, counsels, and conversations of daily living. Chapter 6 provides additional information regarding public hearings on this Final EIS.

Traditional knowledge derived through each of these channels has informed the Draft EIS and Final EIS and the decisions concerning the Liberty DPP. BOEM has revised the Final EIS where appropriate to better characterize the information provided by traditional knowledge regarding subsistence use and other resource areas. BOEM remains committed to further improving its efforts to both accumulate traditional knowledge and incorporate traditional knowledge into its decision-making. BOEM also encourages prospective operators to do likewise.

Environmental Justice. Environmental justice concerns are analyzed in Sections 4.4.5 and 5.2.13 of the Final EIS. The cumulative impact analysis relative to environmental justice in Section 5.2.13 acknowledges that Nuiqsut is located in an “expanding area of oil and gas exploration and development onshore” and that cumulative impacts are most relevant to the communities of Nuiqsut and Kaktovik because these are located nearest the Proposed Action Area. Other cumulative impacts relative to environmental justice also included climate change, oil spills, changes to the subsistence hunting environment, changes to social organization or cultural values, and the benefits from increased tax revenue.

Section 4.4.5.1 of the Final EIS considers the effects of global climate change and shifting environmental conditions on environmental justice populations over the 25-year life of the Proposed Action. The environmental justice cumulative impact analysis in Section 5.2.13 acknowledges that "the additive cumulative effects of past, present, and future projects to the subsistence way of life in the NSB over the 25-year life of the Proposed Action could become more severe. Potential impacts on human health and social organization could be major. Impacts to culture and infrastructure of subsistence-based communities in the NSB could be disproportionately high and adverse."

Issue 20. Archeological Resources

Summary of Comments

Commenters addressed cultural resources in Section 3.3.6 of the Draft EIS. Specifically, the commenters suggested:

- The introductory sections in Section 3.3 of the Draft EIS did not mention cultural and archaeological resources or explain how cultural and archaeological resources interconnect with other aspects of the sociocultural systems the Draft EIS analyzes.
- Section 3.3.6 should be renamed to encompass more than one kind of cultural resource, not those defined by the National Historic Preservation Act. Instead, the Draft EIS should follow NEPA regulations which address the "human environment" or "natural and physical environment and the relationship of people with that environment."
- The Draft EIS does not explain how buildings and structures are archaeological resources.
- Per the guidance document titled "A Guidance Document for Characterizing Tribal Cultural Landscapes" (Ball et al. 2015), the Draft EIS should include the Nuiqsut Cultural Landscape in the cultural resources analysis.
- The Draft EIS does not mention compliance with several Executive Orders and other federal laws concerning cultural resources.
- The Draft EIS should assess the impacts of ice roads on archeological and historic resources. Several reports, memos, and letters concerning cultural resource assessments for projects with ice roads can be found in the Document Repository module of the Alaska Heritage Resources Survey.
- It is unclear if the Section 106 (National Historic Preservation Act Consultation) process is complete, or will be complete before the Record of Decision is issued. A copy of the archaeological survey performed along the terrestrial pipeline route was not provided in the Document Repository of the Alaska Heritage Resources Survey.

Source of Comments

- Individual/General Public

Response to Comments

Section 3.3 of the Final EIS acknowledges that, in the context of rural Alaska, a social, cultural, or economic system is a set of interacting, interrelated, or interdependent parts that form a collective whole and that a breakdown in any part of the system can cause social disruptions, community dysfunctions, and economic hardships. Section 3.3.6 of the Final EIS addresses archeological resources specifically. Section 3.3.6.1 of the Final EIS defines Archaeological Resources as any prehistoric or historic district, site, building, structure, or object (including shipwrecks). It includes artifacts, records, and remains which are related to such a district, site, building, structure, or object. Archaeological resources described in the Final EIS are either historic or prehistoric and generally include properties that are 50 years old or older.

Section 3.3 and Section 4.3 of the Final EIS includes subsections describing the existing conditions for and potential impacts on sociocultural systems, economy, subsistence activities and harvest patterns, community health, and environmental justice in addition to archeological resources. It is

beyond the scope of the Final EIS to analyze or further explain interconnections between cultural resources and sociocultural systems unless these interconnections are relevant to the analysis of the impact of the Proposed Actions on these resources.

A number of Executive Orders and laws and acts were identified by a commenter as absent from the Draft EIS, including Executive Order 12898 on environmental justice, which was discussed in detail in Section 3.3.5 and Section 4.4.5 of the Draft EIS. In Section 1.4 of the Draft EIS, the regulatory and administrative authorities of state and federal agencies are listed including the laws and acts that provide those agencies with authority over some component of the Proposed Action. Other laws and Executive Orders that BOEM has determined to apply to the Proposed Action are identified in other sections of the Draft EIS. Other Executive Orders, laws, and acts not specifically identified in the Final EIS are not anticipated to apply to the Proposed Action.

Nuiqsut Cultural Landscape. The guidance document titled "A Guidance Document for Characterizing Tribal Cultural Landscapes" (Ball et al. 2015), which was developed in coordination with BOEM, is intended to provide a method for agencies to consult with tribes more effectively and appropriately in advance of any proposed undertaking, particularly as they relate to tribal cultural landscapes. The document defines tribal cultural landscapes as "any place in which a relationship, past or present, exists between a spatial area, resource, and an associated group of indigenous people whose cultural practices, beliefs, or identity connects them to that place." The document is not meant to serve as an official policy; rather, it is designed to outline a proactive approach for resource management agencies and indigenous communities to work together to identify areas of tribal significance that need to be considered in planning processes. The tribal cultural landscape approach outlined in the guidance document has applicability as part of an overall planning process under NEPA; however, it does not require that tribal cultural landscapes be included in a cultural resource analysis of an EIS in a specific way. Section 6.2.1 of the Final EIS describes BOEM's tribal consultation and coordination in regards to the proposed activities in the Liberty DPP.

Impacts of Ice Roads. Cultural resources in the action area may be present onshore or on the seafloor of the Beaufort Sea. Ice roads are proposed to be constructed on both sea ice and onshore. Ice roads constructed on sea ice are constructed by grading the sea ice and then thickening with water to provide a suitable surface. Ice roads constructed on sea ice would not disturb the seafloor of the Beaufort Sea; therefore, they have no potential to cause effects on archeological or historic resources. Ice roads constructed onshore on tundra are constructed by laying water down to protect the tundra after the soil is frozen and there is adequate snow cover. Onshore ice roads would be approximately 6 inches thick and would cause no ground disturbance; therefore, there is no potential to cause effects on archeological or historic resources. Onshore ice roads would only be constructed during project development and decommissioning, are only active from January through mid-April, and would not result in a permanent impact on the cultural landscape.

Consultation under Section 106 of the National Historic Preservation Act. As indicated in Section 6.2.4 of the Draft EIS, BOEM initiated Section 106 consultation with the Alaska State Historic Preservation Officer at the release of the Draft EIS. Section 6.2.4 of the Final EIS has been revised to provide an overview of the Section 106 consultation for the Liberty DPP.

Issue 21. Cumulative Impacts

Summary of Comments

Several comments expressed concern over the adequacy of the cumulative impacts analysis in the Draft EIS and provided recommendations about additional information that should be evaluated for the cumulative impacts analysis. Commenters recommended that the Final EIS more fully analyze the contribution of the DPP to cumulative effects on the Nuiqsut Tribe, the use of Native land, and subsistence activities. One commenter stated that the foreseeable cumulative impacts on the Nuiqsut Tribe was a sufficient basis for BOEM to deny the project.

- One commenter recommended that the conversion of a new lake at the mine site should be included in the cumulative analysis of wetlands.
- Another comment expressed concern that the Draft EIS did not fully evaluate cumulative impacts on birds, including migratory birds that face threats in other areas.
- One commenter recommended that the Final EIS evaluate the cumulative impacts on communities resulting from the need for the affected public to review and comment on a number of NEPA documents because the need to be engaged frequently affects the ability of the community to conduct subsistence harvest and other necessary activities.
- A number of commenters recommended that the Final EIS evaluate other projects and actions that were not considered in the Draft EIS as part of the cumulative impacts analysis. This included a number of oil and gas projects in the United States as well as projects in the MacKenzie Valley and the Russian Chukchi and Bering Sea.
- Commenters also recommended that the status of various projects that were described in the Draft EIS be updated for the Final EIS. One comment requested that the Final EIS remove reference to military bases as reasonably foreseeable future actions, claiming that there are no existing or planned bases in the area.
- One commenter also questioned why cumulative impact statements in the Draft EIS were described with the qualifier “could” and expressed concern that the Draft EIS did not explain under what circumstances the impacts may not contribute to cumulative effects.
- A number of comments stated that the cumulative impacts analysis in the Draft EIS was adequate and that the scope of the analysis was appropriate. Conversely, one commenter stated that the Draft EIS incorrectly included cumulative impacts on wetlands across the entire North Slope when only impacts inside the watersheds directly affected by the DPP should be included.
- Another commenter stated that the cumulative impacts analysis for air quality should be expanded beyond the nearest onshore area based on predominant winds and plume trajectory.
- A number of other comments on the cumulative analysis of air quality impacts requested that details in the analysis be clarified and perceived missing context be provided.
- A commenter stated the conclusion that oil and gas activities have had no residual effects on marine mammals in the Beaufort Sea is not supported by data or quantitative analyses (Section 5.2.6.2 Discussion of Other Relevant Actions page 5-29).

Source of Comments

- Local and Regional Governments
- State Agencies

- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

A number of commenters expressed concern about the adequacy of the cumulative impacts analysis and provided examples from the Executive Summary of the Draft EIS. Other relevant sections in the Draft EIS beyond the Executive Summary address the comments provided by these commenters. Section 5.2.11.3 of the Final EIS describes BOEM's analysis of cumulative impacts on subsistence harvest and evaluates potential impacts on subsistence hunters from Nuiqsut, including caribou hunters, whalers, and fishers.

Past, Present, and Reasonably Foreseeable Future Actions Considered in the Analysis. Several commenters recommended that a variety of other projects and actions be included in the cumulative impacts analysis. As described in Section 5.1.1 of the Final EIS, in identifying past, present, and reasonably foreseeable future actions germane to this analysis, BOEM considered:

- Past oil and gas activities: activities that resulted in existing infrastructure.
- Present oil and gas activities: activities for which new facilities are under construction.
- Reasonably foreseeable future oil and gas activities: activities where sufficient planning and/or initiation of appropriate permitting processes have begun that are considered likely to proceed during the life of the Proposed Action. These include potential projects in the U.S. and Canadian waters of the Beaufort Sea.
- Past, present, and reasonably foreseeable future actions other than oil and gas activities.

Responses to specific recommendations include the following.

- Whether and when the mine site would turn into fully functional wetlands is speculative. Furthermore, a relatively small loss of functional wetlands on the North Slope would not result in different impact conclusions.
- BOEM recognizes many communities engage in a subsistence way of life and that it may be a challenge for many community members to find time to engage with agencies and regulators on proposed development projects. However, an analysis of the direct, indirect, or cumulative impacts that may occur as a result of BOEM's public involvement efforts is outside the scope of the NEPA analysis.
- Information on projects in Russia is unreliable and considered overly speculative to use in the cumulative impacts analysis.
- Military and homeland security activities and the rationale for including them in the cumulative impacts analysis are discussed in Section 5.1.2.9 of the Final EIS.

Chapter 5 of the Final EIS has been updated to reflect the status of projects and actions evaluated in the cumulative impacts analysis. This includes revisions to the analysis, where necessary, based on changes in project status.

Geographic Scope of the Cumulative Impacts Analysis. The spatial domain considered in this cumulative analysis generally extends across much of the North Slope and the Beaufort and Chukchi Seas, as any activities taking place in these regions tend to use the same infrastructure and impact interconnected resource systems. In some cases, such as with certain species of birds or marine

mammals that migrate great distances, the spatial extent of the analysis may be greater. Projects for which no official proposal has been submitted and which are not certain to occur within the foreseeable future are considered speculative. Speculative actions are not considered reasonably foreseeable and are not analyzed as part of the cumulative impacts associated with this Final EIS. The intent is to keep the cumulative analysis useful, manageable, and concentrated on meaningful potential effects. The cumulative analysis considers in greatest detail activities that are more certain to happen and that are geographically in or near the project area.

Uncertainty in Cumulative Impacts Analysis. Cumulative impacts analyses in NEPA involve, by nature, a degree of uncertainty about future developments and events. BOEM has carefully reviewed reasonably foreseeable future actions and omitted speculative activities and actions from the analysis to keep the cumulative analysis useful, manageable, and concentrated on meaningful potential effects. Although the cumulative analysis considers in greatest detail activities that are more certain to happen, the unavoidable possibility exists that some of those actions may not occur. As such, the potential cumulative actions that "could" occur are disclosed in the EIS because BOEM cannot accurately predict the cumulative impacts that "would" occur due to inherent uncertainty surrounding future events.

Issues Related to Birds. Section 5.2.5 of the Final EIS considers the cumulative impacts of past, present, and reasonably foreseeable actions on birds. For more information on the scope of this analysis, see Section 5.2.5.2, Discussion of Other Relevant Actions. For more information on the overall scope of the cumulative impacts analysis, see Section 5.1.1, Framing the Analysis.

Issues Related to Air Quality. The cumulative air quality analysis in Chapter 5 has been revised in the Final EIS in response to comments received.

Issues Related to Marine Mammals. The Final EIS has been revised in Section 5.2.6.2 to remove the conclusion that no residual effects on marine mammals have occurred in the U.S. Beaufort Sea as a result of oil and gas activities.

Issue 22. Oil Spill Probability

Summary of Comments

A number of comments were submitted stating that the project would be designed and operated safely. One commenter recommended that BOEM should compare the project's risk factors to the risk factors at other drill sites to provide context for the probability of a large oil spill.

A number of criticisms of the fault tree model were included in comments. One comment stated that a comparison should be made regarding the actual number of spills in the Gulf of Mexico and Pacific OCS areas verses the number of spills in the Arctic.

Another commenter provided an extensive critique of the Fault Tree Methodology and Technology Risk Analysis that was used by BOEM to estimate the percentage chance of spills occurring. This commenter's concerns are summarized as follows:

- Insufficient research into potential causes of Arctic spills was described for probability distributions for Arctic spills and a number of unique Arctic effects were not properly evaluated. This includes ice gouging, strudel scour, upheaval buckling, thaw settlement, ice force, and low temperatures.
- The decrease in spill risk for the DPP is based on suspect math used when going from single-walled to pipe-in-pipe construction and from historic to Arctic scenarios.
- Life-of-field or total exposure values are likely to be inaccurate.
- Measurements in the number of spills and spills per volume produced were lower than measurements computed in other related studies.
- Concerns with the Monte Carlo simulations used to assess variables include the number of iterations performed, how the triangle distributions were implemented, the difference between the expected values and the mean values from the triangle distributions, and the confidence intervals.
- Several terms in the equation used to derive the OCS substantial spill rate are incorrect.
- The risks are reported using substantial spills/barrels produced, but expected number of spills over the life of the field would be more useful.
- Focusing on large spills artificially discounts the potential impacts of smaller spills, which are anticipated to occur more frequently.
- A number of types of spills were not included in the fault tree analysis including spills that occurred prior to 1972, spills less than 500 barrels of crude or refined petroleum, and vessel spills.
- The spill listings used in the fault tree analysis were inconsistent with spills from the BOEM database of offshore spills.
- A number of the resources included in the bibliography of the analysis were not cited in the text of the analysis. Other resources cited in the analysis were not used appropriately.
- The assignment of causes to the spills to give each cause appropriate weight in the fault tree were never formally defined, no specific methods or reasons for assigning causes were provided, and there were inconsistencies in how the assignments were made.

- The description of how the low and high factors were calculated for the triangle distribution was difficult to follow and the use of the word "expected" after applying the triangle distribution is unclear.
- There are problems with the methods, math, and assumptions used to calculate the loss of function frequencies.
- The estimation of oil spill risks calculated as loss of containment frequencies appear to show an unfamiliarity with the concepts of probability and the difference between joint probabilities and conditional probabilities.
- There is no way to evaluate if the conditional probabilities used to find the loss of containment frequency have a realistic basis.
- The reasoning for the specific changes to modify historic risks to Arctic conditions in the fault tree analysis did not have sufficient quantitative justification and the changes are baseless.

Source of Comments

- Elected Officials
- Local and Regional Governments
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)
- Individual/General Public

Response to Comments

DOI scientists have conducted cutting edge research and analysis of oil spill probability and behavior for over four decades. The OSRA model in particular was initially developed in 1975. Since that time, DOI has continued to fund new science and update its approach to incorporate the most accurate methodologies, latest and best data, and input from SMEs, state and federal agencies, and stakeholders regarding important physical, biological, and social resources. The result is a state-of-the-art model that provides BOEM's environmental analysts with reliable, long-term estimates of spill risks associated with potential exploration and development activities in federal offshore waters. (BOEM Ocean Science, Vol 11, Issue 3, October/November/December 2014).

In conjunction with preparation of the Liberty EIS, BOEM developed a new OSRA Report specifically analyzing the occurrence, chance of contact, and chance of occurrence and contact of a large oil spill from the Liberty project. The principle author of the OSRA Report for the Liberty project is a physical oceanographer in BOEM's Division of Environmental Sciences, Branch of Physical and Chemical Science. She possesses a Ph.D. in physical oceanography, has worked for NASA's Global Modeling and Data Assimilation Office, and has published multiple peer-reviewed papers. BOEM Alaska region staff contributing substantially to this OSRA Report include a petroleum engineer and two Ph.D. oceanographers, one of whom has nearly thirty years of experience conducting oil spill analysis for BOEM and its predecessor agencies. Based on the results of this technical report along with Appendix A, BOEM has derived a set of estimates and reasonable assumptions which inform the analysis of potential environmental impacts provided in the EIS.

Estimated Probability of Oil Spill Occurrence. The OSRA model estimates, among other things, the probability of oil spills occurring during the production and transportation of a specific volume of oil over the lifetime of the scenario being analyzed. This process uses a spill-rate constant based on

historical accidental spills (modified for Arctic conditions) greater than 1,000 bbl expressed as a mean number of spills per Bbbl of produced or transported oil. The mean spill occurrence estimate is obtained by multiplying the spill rate constant by the volume of oil projected to be handled, which results in the mean number of spills estimated to occur relative to the hypothetical volume of oil produced. The mean number of spills is then used to estimate the probability of one or more spills occurring over the lifetime of the scenario, which in this case is the Proposed Action described in Chapter 2 of the Liberty FEIS.

Best Available Information. BOEM determined that the OSRA model provides the most accurate and useful estimates to inform the environmental impacts analysis in the Liberty EIS. Although several commenters criticized perceived deficiencies of the OSRA model, no superior approach was identified. One commenter provided detailed critique of certain technical details of the BOEM's spill-occurrence methodology. While there is always room for improvement in analysis techniques, BOEM stands by the use of these spill-occurrence rates based on fault tree methodology developed by Bercha Group and applied in the Final EIS. The methodology and assumptions behind the Oil Spill Risk Analysis spill-occurrence rates has been peer reviewed multiple times over the last several decades by the oil-spill community, which is familiar with spill data limitations in both white paper literature and "gray" oil-spill literature (conference proceedings, government reports).

Commenters noted various other studies that tend to compute comparatively higher spill numbers and volumes, but these studies are less applicable to the Proposed Action than the OSRA model. For instance, most of these studies are related to oil and gas leasing, and consider large exploration and development scenarios entailing more production. These studies also tend to be predicated on other inaccurate and simplifying assumptions, such as use of single-walled pipe. The OSRA Report conducted for the Liberty Project and the Final EIS appropriately analyzed one development plan, i.e. the Liberty DPP, which is estimated to produce much less oil than a lease sale and is using a pipe-in-pipe construction rather than single-walled pipe.

Risk Factor Comparison. An estimate of the potential number of spills over the life of the field is already provided. As stated in Appendix A of the Final EIS, there is a 99.32% chance of no large spills occurring and a 0.68% chance of one or more large spills occurring over the life of the Proposed Action.

Comparison with Historical Spills outside the Region. As described in Appendix A of the Draft EIS, the large OCS spill-size assumptions BOEM uses for a spill from the island and an offshore pipeline leak are based on reported spills in the Gulf of Mexico and Pacific OCS because no large spills (≥1,000 barrels) have occurred on the Alaska or Atlantic OCS from oil and gas activities. Because sufficient historical data on offshore oil spills for this region do not exist, an oil spill occurrence model based on fault tree methodology was developed and applied. The fault trees, base data from the Gulf of Mexico and Pacific OCS, and North Sea data on well-control incidents including the variability of the data were modified and augmented to estimate Arctic offshore oil spillage frequencies.

Fault Tree Analysis. Due to the limited offshore development and lack of historical large oil spills in the U.S. Beaufort Sea, it was not possible to base oil spill probabilities on empirical data from this region. In order to help identify potential causes of system failures before any failures actually occur, BOEM utilized a fault tree analysis, which is a deductive procedure used to determine the various combinations of technical failures and human errors that could cause an undesired event (here, an oil spill). Fault tree analyses can also be used to evaluate the probability of an event occurring using analytical or statistical methods. BOEM has long considered fault tree analyses to be the most appropriate tool for estimating the potential for oil spills on the Arctic OCS, and has invested

considerable resources over the years contracting for and refining fault tree analyses of proposed oil and gas activities in this region. BOEM has worked closely with the Bercha Group, an engineering firm specializing in risk analysis, engineering, and geomatics with over 40 years and hundreds of projects worth of experience, to develop these analyses. Two fault trees were constructed for the Liberty EIS, one for large pipeline spills and one for large platform/well spills.

Arctic-specific Factors. BOEM's analysis of oil spill probability considers not only historical data of the mean number of spills that have occurred during other OCS operations, but Arctic-specific factors as well. Using fault trees, oil-spill data from the Gulf of Mexico and Pacific OCS were modified and incremented to represent Arctic performance and included both Arctic and non-Arctic variability. BOEM accounted for numerous environmental and engineering variables in the Fault Tree. The effect of the Arctic environment and operations are reflected in the effect on facility and pipeline failure rates in two ways; through "Modified Effects," those changing the frequency component of certain fault contributions such as anchor impacts which are common to both Arctic and temperate zones, and through "Unique Effects," additive elements such as ice gouging which are unique to the Arctic offshore environment. The Fault Tree analysis conducted for the Liberty EIS considered site-specific data concerning the potential for strudel scour, upheaval buckling, and ice gouging in the proposed project area.

Pipe-in-Pipe Spill Risk. Because the proposed subsea pipeline is a pipe-in-pipe pipeline, for which historical data are not available, a reliability analysis was carried out to develop sufficient estimates of loss of containment frequencies applicable to pipeline.

Pre-1972 Spills. The Bercha analysis estimated spill rates for all spills greater than or equal to 50 bbls. Spills less than 50 bbls and those prior to 1972 were excluded from the analysis due to changes in reporting requirements and other regulations, as well as variations of data quality, over time. Spills less than 50 bbls are included in the small spills analysis as described below.

Consideration of Small Spills. The potential impacts of small spills are analyzed in the Final EIS, and the assumptions related to small spills are described in Section 4.1.1 of the Final EIS. The assumptions for small oil spills include the likelihood of a spill, the estimated total number of spills, and the estimated total volume of a spill. Additional detail on these assumptions can be found in Appendix A, Accidental Oil Spills and Gas Releases, of the Final EIS in Section A-1.5.

BOEM's Spill Database. Because BOEM updated the spill database for hurricanes that occurred in the 2000s, comparisons should not be made between the spill listings used in the fault tree analysis and the BOEM database.

Assignment of Spill Causes. The assignment of causes was based on OCS data from the Gulf of Mexico and the Pacific regions as well as Arctic causal factors. BOEM's database of offshore spills was updated to make causal factors consistent with weather, storms, hurricanes, and other similar causal factors.

References. The commenter appears to question why the EIS does not reference certain documents cited in the Bercha analysis. While EIS provides a list of all references cited in the EIS, it need not and does not list documents that are referenced in those documents.

Issue 23. Oil Spill Trajectory Modelling

Summary of Comments

A number of comments were submitted requesting that the oil spill trajectory modelling be modified or supplemented. One commenter stated that additional trajectories are needed to examine growing spill volumes and recommended that the analysis consider the spill trajectory over the time period required for spill clean-up. Two commenters expressed concern regarding how the oil spill trajectories were described and depicted in the Draft EIS and recommended that a more intuitive and reader-friendly presentation be used.

Comments provided expressed concern about the application of the oil spill trajectory model in the Draft EIS and indicated that the model was inappropriately applied in the analysis. Specifically, commenters stated that the model was used in the Draft EIS to provide an estimate of the absolute likelihood of contact, when it is more appropriately applied to show the relative likelihood of contact. One commenter indicated that the model could not provide absolute estimates of contact due to faulty assumptions in the model itself—specifically, the assumptions that spills "behave like a single point" and that spills stop when they contact the mainland coastline. One commenter also expressed concern that the use of the trajectory model in the Draft EIS was misleading due to the way the model delineates ERAs.

Several commenters recommended that additional information be obtained and evaluated in the oil spill trajectory model and analysis. The recommendations included satellite drifter data for more site-specific ocean current data, separate analysis trajectories for nearshore and offshore trajectories, accounting for degrees of oil coverage, more sophisticated modelling of currents, and evaluating how climate change may affect the environmental conditions used in modelling trajectories. One comment requested that the locations of the ERAs be revised to explain how they relate to the environmentally sensitive areas called out in the United Plan's North Slope Sub-area Plan. A comment criticized the model for including an assumption that all spills are instantaneous.

Source of Comments

- Local and Regional Governments
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

BOEM studies how and where large offshore spills move by using an oil-spill trajectory model with the capability of assessing the probability of oil-spill contact to resource areas. This model is known as the OSRA model. The OSRA model analyzes the likely paths of over tens of thousands of simulated oil spill trajectories in relation to biological, physical, and sociocultural resources. The trajectory is driven by wind, sea ice, and current data from a coupled ocean-ice model. The locations of resource areas, including sociocultural resource areas, barrier islands, and the coast within the model study area, are used by OSRA to tabulate the percent chance of oil-spill contact to these areas.

BOEM has invested considerable time, effort, and funding over the past few years to improve oil spill analysis in the Arctic, and continuously evaluates opportunities for refinement of its approach. Although commenters pointed out perceived deficiencies of the BOEM OSRA method, no better data, alternative information, or clear overall approach was provided to incorporate in an analysis. BOEM is using the best available information regarding oil spill risk analysis in the Liberty DPP Final EIS.

The methodology and assumptions behind the OSRA spill-occurrence rates has been peer reviewed multiple times over the last several decades by the oil-spill community, which is familiar with spill data limitations in both white paper literature and the "gray" oil-spill literature (conference proceedings, government reports).

For this analysis, 3,240 trajectories were simulated from each of the 10 launch points over 18 years (1986 through 2004) of wind, current, and ice data, for a total of 32,400 trajectories. Simulations are performed for three timeframes: annual (January 1 through December 31), winter (October 1 through June 30), and summer (July 1 through September 30).

Modeling of hypothetical oil spill trajectories is an inherently complicated process – one that can be difficult to explain in a succinct manner without sacrificing accuracy. The paragraphs below respond to comments criticizing the difficulties in understanding OSRA model results by providing additional succinct explanation of key terms and assumptions.

Conditional Probabilities. Conditional probabilities are based on the assumption (condition) that an oil spill has occurred at a given location. They reflect the hypothetical paths (trajectories) that oil would take based on modeled ocean surface currents, ice, and local wind conditions in the study area. Many trajectories are simulated for each hypothetical spill location, and the number of contacts to environmentally sensitive areas and land segments within 1, 3, 10, 30, 90, and 360 days of travel at sea are tabulated. The percentage of trajectories contacting a given resource is a measure of the "conditional probability" of an oil spill contacting that resource, with the assumption (condition) that the spill occurs at the hypothetical spill location. Conditional probabilities do not incorporate the likelihood of a spill occurring; rather, the spill is assumed to occur.

Combined Probabilities. The "combined probabilities" represent the estimated (overall) probability that one or more large oil spills will both occur and contact environmental resources based on conditional probabilities, spill rates, volume of oil, and transportation scenarios. The result is an estimated probability of one or more spills of 1,000 bbl and greater occurring and contacting that environmental resource over the lifetime of the scenario, here the Proposed Action described in Chapter 2 of the Liberty EIS.

BOEM cautions against the use of undefined terms such as "absolute" or "relative" likelihood to (mis)characterize OSRA results. OSRA results are best understood using the specific terminology employed in the OSRA Report and the EIS.

Environmental Resource Areas. ERAs are spatial areas deemed to have particular importance for one or more social, economic, or biological resources. Estimating the probability that spilled oil would contact a given ERA helps BOEM to evaluate the potential for spilled oil to affect resources of concern. While many ERAs are considered on a year-round basis, some ERAs (such as the ERAs designated for certain migratory species) are considered seasonally or within a limited time period. BOEM, Alaska OCS Region analysts designate these ERAs based on their interpretations of data and study of scientific literature. The analysts work with specialists in other federal and state agencies, academia, and various stakeholders who provide scientific information as well as local and traditional knowledge about these resources. The analysts also designate the months in which these ERAs are vulnerable to spills, meaning the time period those resources occupy or use that spatial location.

A wide variety of information is considered during the development of ERAs, including the Alaska North Slope subarea contingency plan and the Alaska Clean Seas (ACS) Technical Manual (Volume 2 Map Sheets), as well as the best available information from resource agencies and the gray and peer-reviewed literature. BOEM's ERAs are based on many of the same reference sources as those used to define the Sensitive Areas in the Unified Plan, together with information that has become available since the North Slope Subarea Plan was last updated in 2012.

For biological resources, ERAs are determined by several factors including density, important habitat, and life history features. While multiple species may occur within an ERA, ERAs are assigned to those species for which there is sufficient information to confidently identify the area as important. The analysts also designate in which months these ERAs are vulnerable to spills—for example, a migrating bird may be at an ERA only from May to August. While species rare to the area or with limited sightings may preclude representation by specific ERAs the discussion of oil-spill impacts in Chapter 4 considers impacts to those species present in the area should an accidental large spill occur.

Land Segments can be correlated to the ACS map sheets that identify sensitive areas. Generally, the sensitive areas are compatible with the Alaska North Slope subarea contingency plan and the ACS map sheets, although the ACS map sheets identify sensitive areas at a more refined level than the OSRA model. The OSRA model is designed to analyze large areas over long periods of time.

The OSRA Report for Liberty indeed considers a large number of ERAs and land segments. This ensures that all potential oil spill impacts were identified and considered during the development of the EIS.

Shoreline Contact. OSRA model results are based on what are known as ensembles, which are the mean result of all the trajectory simulations. For the Liberty project, BOEM ran 32,800 simulations within three separate timeframes (annual, summer, and winter). These trajectories cover the estimated oil spill dispersion patterns under the meteorological and oceanographic conditions for the region and are considered the most conservative estimate of oiled shoreline. In other words, the variety and sheer number of modeled trajectories provides reasonable assurance that the behavior of an actual oil spill would be encompassed by the results of the OSRA Report.

Continuing to model spill trajectories after contact with a shore segment would create an unrealistic scenario. Shoreline segments are up to 20 kilometers in length, so it is very unlikely that oil would contact more than one shoreline segment. This is especially true for the Beaufort Sea, where tides are relatively small, and where shorelines are generally comprised of relatively porous substrate which results in a higher likelihood of penetration and thus a lower likelihood of remobilization. See Schmidt-Etkin in Fingas, 2014, Handbook of Oil Spill Science and Technology (Wiley).

The OSRA model does not discount the possibility that multiple land segments could be contacted by spilled oil simultaneously or within a given time period. Again, BOEM ran 3,280 simulated trajectories for each launch area, times ten launch areas, for a total of 32,800 trajectories. The model certainly allows for the possibility that different trajectories could contact different land segments simultaneously. The model's assumption that a single trajectory (i.e. one of several thousand or several tens of thousands, depending on how many launch areas are considered) would not contact multiple land segments (each up to 20 km in length) at the same time is reasonable because a given portion of spilled oil would not exist in multiple places at the same time.

Arctic-specific Factors. BOEM uses the results from a coupled ice-ocean general circulation model to simulate oil spill trajectories. The wind-driven and density-induced ocean-flow fields and the ice motion fields are simulated using a three-dimensional, coupled, ice-ocean hydrodynamic model. Comparison of model results with observation, including moored current meter data, temperature and salinity measurements, and satellite-based ice measurements, shows considerable skill in the model capability to reproduce observed circulation and sea ice patterns in the Beaufort and Chukchi seas (Curchitser et al., 2013). The model is based on the Regional Ocean Modeling System. The Regional Ocean Modeling System has been coupled to a sea ice model, which consists of elastic-viscous-plastic rheology. This model simulates flow properties and sea ice evolution for the Arctic with enhanced resolution in the Chukchi and Beaufort seas during the years 1985 through 2005. Additionally, BOEM uses satellite drifter data to validate the general circulation models used in the trajectory analysis. While BOEM constantly seeks better data and strives for improvement in its models, it is confident that the suite of data and modeling techniques utilized in developing the OSRA

Report for Liberty are more than sufficient to inform this analysis. Treating spilled oil as moving with the currents and wind whenever sea ice concentration is below 80% is a conservative approach because the velocity of sea ice is generally equivalent to or slower than the ambient current velocities. Furthermore, presence of sea ice can reduce the dispersion of oil by sheltering it from the wind and by creating a herding effect.

The OSRA Report for the Liberty proposal further accounts for seasonal difference in sea ice conditions by estimating separate suites of trajectories for three different time periods: annual, summer, and winter. The thousands of separate trajectories encompass the full spectrum of ice conditions estimated to occur near the action area at any given time.

Stochastic Analysis. It is not accurate to characterize the OSRA model as merely simulating single point trajectories. The OSRA trajectory analysis is stochastic, meaning thousands of trajectories are launched from multiple launch points and summarized for the pipeline and gravel island, for three seasons, over six time periods, which collectively represent how a large spill could move over time from those areas. This stochastic approach facilitates a more fine-scale and therefore more accurate analysis of potential oil spill trajectories than the approach apparently suggested by the commenter, in which a large oil spill is assumed to behave as a cohesive unit.

Spill volumes. The reason that spill volume is not factored into the model is because an oil spill's movement (and resources it contacts) are controlled by the surface winds, sea ice and ocean currents, not by the spill's volume.

Duration of Release. Models that estimate oil spill trajectories from prolonged (as opposed to instantaneous) releases exist but BOEM subject matter experts have determined that they have not been adequately maintained and do not provide superior accuracy as compared with the OSRA model. The OSRA model sufficiently accounts for variations in the conditions affecting oil spill trajectories (i.e. wind, current, ice) by simulating trajectories during different time frames (i.e. annual, summer, winter) and for various travel time durations (1, 3, 10, 30, 90, and 360 days).

Efficacy of Response and Cleanup. The volume of the assumed large oil spills (and the hypothetical VLOS) are not adjusted to account for successful response and cleanup. This approach acknowledges the potential difficulties of responding to a spill under various conditions (i.e., cold, darkness, ice, wind) and furthers the goals of analyzing a low-probability, high impact event. And it does so without relying on incorrect assumptions about the specific suite of response strategies that could be incorporated into the final version of the ORSP (which has yet to be approved by BSEE and remains subject to change), speculating about the specific conditions present during a spill event (which influence recovery rates), or shifting the focus of the environmental effects analysis into a debate about the efficacy of hypothetical spill response techniques. (see Fingas and Hollebone 2014 Oil Behavior in Ice-Infested Waters)

SINTEF model. While the SINTEF model itself does not incorporate currents, beaching, and the effects of slush ice on spreading and weathering, the SINTEF model is a subset of the larger trajectory analysis, which does consider those factors.

Consideration of OSRA Model Results. OSRA model results do not represent the culmination of BOEM's oil spill impacts analysis. Rather, conditional and combined probabilities are estimated to provide a statistical basis for the qualitative, resource-specific analysis of potential impacts provided in Chapter 4 of the EIS. These analyses were developed by BOEM subject matter experts who are well-trained in the accurate interpretation and appropriate use of OSRA modelling results.

Verification of OSRA Results. Given the rarity of large oil spills on the OCS, as well as the difficulties of field testing given higher priorities during such a spill, there has been little opportunity to verify whether actual large spill trajectories are similar to those predicted by OSRA. That said, an OSRA run using historical wind and current data in the Gulf of Mexico produced statistical patterns

similar to actual observations through surface oiling surveys during the Deepwater Horizon event. These results serve to reinforce BOEM's use of the OSRA model as the most accurate and useful model available to predict the behavior of hypothetical large oil spills on the OCS.

Conservative Assumptions. Despite the use of state of the art modeling technology and the input of decades-worth of Arctic specific data, there remains a degree of inherent uncertainty in predicting the behavior of complex events such as hypothetical oil spills. At each step of BOEM's oil spill trajectory analysis – i.e. updating the OSRA model, inputting data into the model, developing the OSRA Report for the Liberty Project, estimating the probability that a given geographic area could be contacted – BOEM's application of best professional judgment was guided by an objective to avoid underestimating of potential impacts. This objective was manifested in a series of conservative assumptions. For instance, BOEM does not assume any reduction in the quantity of spilled oil resulting from the oil spill response and cleanup activities that would commence immediately upon the occurrence of an oil spill, and which under certain conditions could be highly effective at removing and discouraging the spread of spilled oil. Oil estimated to make any contact with a given environmental resource area is assumed to contact that whole area, which can be up to 20 km long. When analyzing the potential impacts that may result from spilled oil contacting key resource areas, BOEM's analysis presumes that the spilled oil would arrive as fresh crude, which is considerably more harmful than highly-weathered oil. For certain biological resources, any contact with oil is presumed to result in mortality to the affect individuals. The result is a set of assumptions that underpin a conservative analysis of potential oil spill impacts that is sufficient to inform a reasoned chose among EIS alternatives.

Issue 24. Very Large Oil Spill Assumptions

Summary of Comments

A commenter expressed support for the assumptions, methods, and conclusions of the very large oil spills (VLOS) analysis in the Draft EIS. Several other commenters requested that new or different information or approaches be used in the determination of assumptions for VLOS. One commenter recommended that the assumptions be expanded to account for commonly occurring Arctic conditions beyond those defined in the Draft EIS. Another commenter recommended that the risk of a blowout leading to a spill during spring breakup or fall freezing should be considered.

Two commenters expressed concern that the VLOS scenarios were developed using criteria based on federal regulations and recommended that more stringent Alaska-specific spill response statutes and regulations be considered in terms of spill response times.

A commenter indicated that there was insufficient information regarding the well ignition scenario in Section 4.5.3 of the Draft EIS.

One commenter recommended that the VLOS assumptions should summarize hydrodynamic modelling from Section 14.3.2.1 of the Development and Production Plan.

Commenters also questioned a number of the VLOS assumptions used in the Draft EIS. Specific concerns and criticisms included the following:

- The assumption in the worst case discharge (WCD) scenario that it may take up to 90 days to drill a relief well is no longer acceptable. Instead, relief well drilling rigs should be on site and ready to drill.
- The assumption that drops of oil less than a certain threshold size would be held aloft by atmospheric turbulence was an assumption of the model, not an assumption from the British Petroleum Exploration Alaska (BPXA) report. BOEM should reference the ACS Technical manual (Tactic T-6, Page 2 of 8, Paragraph 3).
- The assumption that oil only moves with ice when the ice concentration is 80% or greater oversimplifies the model and may not reflect the behavior of a spill during melt-out or freezing.
- The weakness of the SINTEF Oil Weathering Model should be addressed when making assumptions about the behavior of oil in the water.

One commenter requested that citations be provided for the statement in the Draft EIS that VLOS-related emissions would disperse in the air, even in the winter when winds are “very light.” The commenter recommended that more evidence of light winds be provided on a month-by-month basis.

Source of Comments

- Local and Regional Governments
- State Agencies
- Individual/General Public
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

BOEM derives the rates for large oil-spills (of which very large oil spills are a subset) for the Arctic OCS from a fault tree modeling study conducted by Bercha Group Inc. (Bercha Group Inc. 2016). Using fault trees, oil-spill data from the Gulf of Mexico and Pacific OCS (Bercha Group Inc. 2013) were modified and incremented to represent Arctic performance including both Arctic and non-Arctic variability. This effort incorporated results from a study (BOEM 2014-772) which considered the frequency of LOWC events (i.e. blowouts) on the OCS, as well as Canada and the North Sea. These estimated frequencies were then modified for Arctic conditions as part of the fault tree study to estimate the likelihood of a LOWC event related to Liberty, including for the 'Enormous' size category (>=150,000 bbls). Oil well blowout statistics for production wells and the drilling of exploratory and development wells were reviewed and incorporated into the fault tree to address the risk of a blowout leading to a spill.

BOEM uses the SINTEF oil weathering model, one of the few weathering models which actually includes ice in estimating oil weathering (Reed et al. 2005). SINTEF was developed by the Norwegians and used throughout the international community in the Arctic, it has been has been extensively tested with results from full-scale field trials with specific experimental oil slicks. In 1990, the Minerals Management Service (now BOEM) invested heavily to begin the process of including ice in oil weathering and has continued studies on weathering of oil in ice. The use of a stand-alone weathering model allows BOEM the flexibility to look at different types of crude, condensate, and fuel oils and their weathering characteristics rather than a single oil type for multiple different reservoirs. BOEM funds studies specifically to weather oils in both the lab and mesoscale to use this updated information for oil spill weathering.

To judge the effect of a large oil spill, BOEM estimates information regarding how much oil evaporates, how much oil is dispersed, and how much oil remains after a certain time period. BOEM derives the weathering estimates of Liberty crude oil and diesel fuel from modeling results using the SINTEF Oil Weathering Model Version 4.0 (Reed et al. 2015) for up to 30 days. BOEM simulates two general scenarios: one in which the oil spills into open water and one in which the oil freezes into the ice and melts out into 50% ice cover. BOEM assumes that meltout can occur from June through July (see Section 3.1.2.1 in the Draft EIS).

As noted in Section 4.3.5 of the Draft EIS, the WCD volume information submitted by the operator and independently verified by BOEM provides the basis for the volume used in the VLOS scenario. This WCD estimation is required by 30 CFR Part 550.213(g) to accompany an Exploration Plan or a Development and Production Plan and provide a basis for an Oil Spill Response Plan (OSRP) in accordance with 30 CFR Part 254.47. The VLOS scenario is predicated on an unlikely event—a loss of well control during developmental drilling that leads to a VLOS. BOEM bases the VLOS volume estimate on Hilcorp's estimated WCD from a loss of well control incident during developmental drilling. Since the Alaska-specific spill response statutes and regulations are more stringent, the WCD used to estimate the VLOS volume is greater than a WCD under the Alaska statutes. Therefore, BOEM's VLOS assumptions are arguably more conservative.

Well Ignition Scenario. Hilcorp's DPP is available on BOEM's website at https://www.boem.gov/Liberty. For the purposes of this analysis, BOEM's VLOS scenario does not assume that well ignition is used in order to remain conservative. Therefore, in the Final EIS, the reader is pointed to the Hilcorp DPP, section 14.3.1.1 and 14.3.2.1, which describe the well ignition scenario in greater detail. Information can also be found in a report funded by the BSEE on well ignition (Conroy et al. 2016).

Very Large Oil Spill Assumptions. Responses to comments including specific questions or recommendations regarding the VLOS assumptions include the following.

- BOEM conducts its own trajectory model that is summarized in Section A-3.1, *Inputs to the Oil-Spill-Trajectory Model*, in Appendix A of the Final EIS.
- The assumption in the WCD scenario that it may take up to 90 days to drill a relief well is based on Appendix H (Well Control Contingency Plan) of the DPP, which states, "There are two methods of regaining well control—well capping and relief well drilling. Well capping constitutes the best available and safest technology (BAST) for source control of a blowout. In the event of a blowout, Hilcorp would pursue both methods simultaneously; however, it is most likely well capping would provide source control first." The 90 day time to drill a relief well is based on Hilcorp's estimate that it could take between 10 and 30 days to mobilize a relief well rig and then an additional 30 to 60 days to drill a relief well and kill the blowout.
- One commenter stated that the assumption that drops of oil less than a certain threshold size would be held aloft by atmospheric turbulence was an assumption of a particular model, not an assumption from the BPXA report and that the ACS Technical manual should be referenced. BOEM agrees and has revised Section 4.5.3 of the Final EIS to reference the ACS Technical Manual instead of the BPXA report. Additional information supporting the conclusion that VLOS-related emissions would disperse in the air can be found in Section 3.1.5, Air Quality, of the Final EIS.
- BOEM has added the relevant reference (Brandvik and Faksness 2009) to the Final EIS in Section 4.7, and mentioned the reference's discussion on evaporation of oil in Arctic field experiments.

Issue 25. Oil Spill Impacts

Summary of Comments

A number of commenters expressed concern over general and specific impacts that could result from oil spills. One comment stated that the impacts of a potential oil spill are part of a sufficient basis for the denial of the project.

A commenter expressed concern related to impacts on human health from consuming fish and other hunted meat that may become contaminated from waters polluted by an oil spill.

One commenter stated that the Draft EIS failed to provide a comprehensive analysis of the impacts of an oil spill in general. Several other comments identified missing information or analysis and/or requested that additional information or analysis be included in the Final EIS. Specific deficiencies identified or recommendations made for analysis by commenters included the following:

- The Final EIS should specify which process of "degrading" is being referred to in the context of small oil spills and in the conclusion that oil would degrade within the first few days of a small spill into a marine environment.
- The possibility of an oil spill following the salt wedge up Colville River and/or Niglig Channel should be discussed.
- Evidence and references should be provided to support the conclusion that fast-swimming fish would likely avoid some of the effects of an oil spill.

- There is no consideration of the potential for large numbers of polar bears to congregate at the oil-contaminated carcass of a whale killed as a result of a VLOS and to suffer lethal or sub-lethal impacts as a result.
- Additional discussion to incorporate the effects of arctic conditions on evaporation rates and the volatility of dispersants should be included in the analysis of oil spill impacts on air quality.
- The impacts of a VLOS on areas for which there was less than a 5% chance of contact were ignored.
- The Draft EIS failed to take a hard look at the impacts of an oil spill on polar bears, partly due to the faulty assumption that small spills would be readily cleaned up and by ignoring the cumulative impacts of 70 small oil spills.
- The Draft EIS failed to take a hard look at the impacts of an oil spill on whales and ice seals. It ignored uncertainty regarding how large cetaceans respond to oil spills and ignored the available information indicating that spills have a significant impact on whales.
- The dismissal of the impacts of small oil spills is improper because existing studies indicate that small spills can have a substantial negative impact on the Arctic environment.
- The conclusion of the Draft EIS that small oil spills will result on negligible to minor impacts to birds is inconsistent with the assumption in the Draft EIS that any bird coming into contact with oil will die and exposure to oil can also result in long-term reproductive failure.
- The conclusion that a large oil spill would have a negligible impact on threatened Steller's eiders because they are low in abundance and have a low likelihood of contacting oil is illogical considering that the Draft EIS recognizes that they are vulnerable to local extinction.

Source of Comments

- Local and Regional Governments
- Individual/General Public
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Level of Analytical Detail. BOEM provides an appropriate level of information about the proposed action, affected environment, and environmental consequences as they related to potential oil spills and activities for prevention, recovery, and clean up. This includes impacts from small oil spills as well as large spills. CEQ requires NEPA analyses to be concise, direct, and non-encyclopedic. They are to be concise, accurate descriptions of consequences for a federal action, contain relevant information that directly addresses the topic, and should avoid redundancy and additional information that does not add to the discussion in a meaningful way. Likewise, possible impacts that are remote and speculative, such as impacts from an oil spill following the salt wedge upriver, need not be included in the NEPA analysis. The resources of concern and of significance were identified during the scoping process, and BOEM performed effects analyses of these using the existing body of scientific information. The analyses in the document, though sometimes brief, are accurate and meet the above-described standards for NEPA. Unless otherwise noted in a separate comment response, the level of detail for the oil spill impacts analysis in the Final EIS is sufficient to accomplish these goals.

Arctic Conditions Affecting the Oil Spill Analysis. Section 4.2.3 of the Draft EIS described how evaporation of small accidental refined oil spills would result in temporary localized increases in VOC. It also noted the role of arctic winter weather, with high pressure systems creating stable, cold dry conditions and low pressure systems causing precipitation and unstable conditions. The interaction of these two systems results in wind conditions, which do not affect the evaporation rate of VOCs from spilled oil; however, they do increase the dispersion of VOCs once the VOCs are evaporated into the lower atmosphere. More discussion of dispersants was included on Page 333–334 of the Draft EIS.

Impacts of a Low-Probability Very Large Oil Spill. One commenter stated that impacts from spills with less than 5% chance of contact were ignored. For the Draft and Final EIS, BOEM has focused the analysis on significant impacts that are reasonably foreseeable and those that are more likely to occur rather than those that are speculative or unlikely. A VLOS is not estimated to occur during the life of the development project and would be considered well outside the normal range of probability, despite the inherent hazards of oil development-related activities.

Oil Spill Impacts from Fish Consumption. The potential contamination of subsistence resources making them undesirable or unfit for human consumption was evaluated in Section 4.7.9.3 of the Draft EIS.

Oil Spill Impacts on Marine Mammals. The evaluation of potential impacts on marine mammals has been updated in the Final EIS. Section 4.7.6.4.2 of the Final EIS describes how polar bears may consume oiled seal carcasses, potentially resulting in lethal doses of oil and other health effects. It also indicates that polar bears regularly scavenge carcasses of harvested bowhead whales and other marine mammals. The Final EIS has been revised to describe the possibility that polar bears may also consume oiled whale carcasses.

A commenter suggested the analysis of impacts on polar bears overlooked impacts from small spills based on the assumption that such spills would be readily cleaned up. The same commenter suggested the analysis overlooked information and incorrectly underestimated impacts on whales and ice seals. The analysis of potential impacts on marine mammals in the Final EIS is based on comprehensive review of existing literature, with appropriate emphasis on peer-reviewed scientific studies.

Oil Spill Impacts on Birds. Section 4.3.3.1 of the Draft EIS described potential impacts on birds from small spills. As noted in that section, the majority of small accidental spills would quickly dissipate and would be unlikely to affect habitat or individual birds. Small spills would be similarly relatively easy to contain and could affect small areas of habitat and few individuals. Should a fuel spill occur during refueling and escape containment, a small number of birds in the immediate vicinity of the vessel could be affected, depending on current and wind patterns. Few birds, however, are likely to be in the area during refueling and in the unlikely occurrence of a fuel spill, a limited number of individual bird mortalities could occur. Because small spills would dissipate quickly, they would be expected to result in short-term impacts on small areas. For isolated small spills, negligible to minor impacts are expected on birds. Population-level effects would not occur for small accidental spills.

As described in Section 4.3.3.1 of the Draft EIS, if a large oil spill contacted the listed population of spectacled eider or affected its benthic food source, it would be expected to have widespread moderate impacts, depending on number of individuals impacted, how far their breeding range spanned, or temporal and areal extent of impact on food resources, due to the species' limited population size.

Issue 26. Spill Prevention, Response, and Cleanup

Summary of Comments

Several commenters expressed support for the spill prevention, response, and cleanup measures included in the project and support for the project on the basis that those measures would be effective. One commenter who expressed support for the project also requested that more of the smaller oil-skimming boats be deployed to the project site.

Other comments expressed opposition to the project on the basis that there is no safe way to drill in the Arctic and any resulting spill would be impossible to clean up. One commenter asserted that the unique nature of the Arctic Ocean's spill response gap must be addressed and the Final EIS must acknowledge that there is no proven way to recover significant oil quantities in conditions prevalent in the Arctic.

Multiple comments stated that information or analysis regarding spill prevention, response, or cleanup was missing or incomplete in the Draft EIS. Specific criticisms or suggestions included the following:

- The OSRP was not made available for the public to review and is critical for understanding the applicant's plans to respond to and clean up potential large oil spills. The details of the OSRP must be considered when assessing potential impacts and before the project is approved. The public must also be given an opportunity to review and comment on the OSRP.
- It is unclear if the use of dispersants is part of the recovery and cleanup of a VLOS as discussed in Section 4.6 (now Appendix A) of the Draft EIS.
- Spill response scenarios must consider the problematic nature of the operation of heavy equipment on sea ice roads late in the winter season.
- The description of response operations should be revised to reflect that darkness is a limiting environmental condition in the project area and to provide an overview of months when it would limit response operations or require additional equipment and logistics.
- Information on the number of rapid-response oil-skimming vessels available on site and those that would need to be transported should be included.
- The analysis should "connect the dots" between modelled oil spill scenarios, equipment and capacity that would be needed to respond, the extent that the equipment and capacity is actually available, and the time it would take to mobilize the response.
- The more recent version of the Point Thomson Oil Discharge Prevention and Contingency Plan should be referenced in Section 4.6.2 (now Appendix A) of the EIS.
- It should be noted that, in addition to Exxon Mobil, the State of Alaska also considers well ignition to be part of the best available technology for spill response.
- The risk of a blowout leading to an oil spill and the difficulty of containing and recovering spilled oil during spring ice break-up or fall ice freeze-up should be analyzed.

A number of comments stated that the applicant has a history of accidents and violations of state and federal safety rules. Commenters indicated that the Draft EIS had not considered the applicant's history of performance in this regard or how it could affect the potential environmental impacts of the project.

Source of Comments

- Local and Regional Governments
- State Agencies
- Individual/General Public
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

Comments regarding the applicant's previous safety violations were based on pipeline leaks in Cook Inlet, an environment that has extreme tidal influences acting on aging pipeline infrastructure. The action considered in this FEIS includes the construction of a new pipeline and would not use any older infrastructure in marine waters. In addition, the environmental conditions in Foggy Island Bay differ from those in Cook Inlet. These conditions have been considered by the applicant in their pipeline design, and by PHMSA, the regulatory agency responsible for permitting pipelines. Finally, the applicant will be required to follow all applicable existing safety and environmental regulations, procedures, and processes throughout the life of the project.

The BSEE is the federal agency responsible for reviewing oil spill response plans and monitoring oil and gas operations on the Federal OCS. BSEE Regulations applicable to oil, gas, and sulfur lease operations on the OCS are specified in 30 CFR Part 250. Oil-spill prevention and response rules are specified in 30 CFR Part 254.

The OCSLA requires that all OCS technologies and operations use the best available and safest technology that the ASLM determines to be economically feasible, and includes a requirement for an OSRP. As noted in Section 1.4.9.4, safety and prevention of pollution, including accidental oil spills, is the primary focus of BSEE OCS operating regulations and all owners and operators of oil-handling, oil-storage, or oil transportation facilities located seaward of the coastline must submit an OSRP to BSEE for approval. In the OSRP the operator must include an emergency response action plan, a WCD volume and response scenario, an inventory of response equipment sufficient to respond to the WCD scenario, contractual agreements with oil spill removal organizations who will provide response services, a dispersant-use plan, an in-situ burning plan, and a training and response drills plan. Hilcorp has submitted their OSRP to the U.S. Department of the Interior.

The OSRP is a stand-alone document that is independently reviewed by BSEE, which has sole authority to determine whether a proposed OSRP meets all applicable requirements. Pursuant to the Oil Pollution Act of 1990, OSRPs which meet all applicable requirements must be approved, while OSRPs failing to meet all applicable requirements may not be approved. Hilcorp has submitted a proposed OSRP to BSEE for the Liberty project. BSEE's review process is ongoing. BOEM does not provide responses to comments specific to BSEE's permitting actions and authorities in this Final EIS as they are outside of BOEM's jurisdiction.

To inform the environmental effects analysis and, eventually, BOEM and DOI decision makers, spill response activities are described in Appendix A of the Final EIS. BOEM provides a description of acceptable types of spill response equipment and methods to provide the public and the decision-maker with a basic picture of what a response would look like, as well as to facilitate analysis of potential impacts from spill response activities. The effectiveness of typical spill response techniques depend on many factors (for example, oil composition, weather, ice conditions, distance from

response staging area to the spill location, etc.). Since an OSRP has not been finalized and approved for this project, the quantity of various response and cleanup equipment needed has not yet been determined. Similarly, the particular circumstances of a hypothetical spill event (i.e., seasonal timing, weather, oil spill volume) cannot be known with certainty at this time. The Final EIS therefore does not attempt to estimate precise numbers of oil spill response and cleanup equipment needed, or the efficiency of potential oil spill response and cleanup techniques. Given these uncertainties in how a hypothetical oil spill, response, and cleanup event would unfold , BOEM's analysis of oil spill-related impacts does not assume any reduction in the quantity of spilled oil due to spill response and cleanup, and thus avoids underestimating potential impacts.

A number of commenters raised other general questions about the description of the hypothetical VLOS scenario and its potential environmental effects. A hypothetical VLOS scenario is described in Section 4.5 and Section 4.7 assesses the potential effects of that hypothetical scenario. The level of detail in the EIS is sufficient and allows for a full evaluation of potential environmental impacts and a meaningful comparison among alternatives.

Dispersants Use. As described in Section 4.1.1.2 of the Draft EIS, BSEE may require the holder of an OSRP to mobilize equipment used for non-mechanical response options such as dispersant application operations; however, it is highly unlikely that the operator would request or receive approval for dispersant use for operations in the Beaufort Sea because the shallow water depths in the area of operations would not allow adequate dilution of the dispersed oil. Hilcorp's Amendment Development and Production Plan (available at https://www.boem.gov/Hilcorp-Liberty/) summarizes the OSRP submitted to the U.S. Department of the Interior and does not identify if dispersant use is a planned component of the OSRP. However, Section 4.7 of the Final EIS analyzes the potential effects of a VLOS including the use of dispersants on the environment.

Spills in the Arctic Environment. BOEM shares concerns regarding the potentially devastating effects of a catastrophic oil spill. BOEM also acknowledges that, while multiple methods for recovering and cleaning up spilled oil exist, severe weather and/or the presence of ice could interfere with or temporarily preclude each of these methods. To address this, both BOEM and BSEE, as well as industry groups, support on-going research related to spill response and the protection of environmental resources. The risk of oil spills occurring as a result of the Proposed Action, including the impacts of possible oil spills, are analyzed in the Final EIS. An overview of oil spill recovery and cleanup, as well as an analysis of the opportunities for prevention, intervention, and response to oil spills, is provided in Appendix A of the Final EIS. Furthermore, Appendix C includes lease sale stipulations, design features, and best management practices committed to by the applicant, and additional mitigation measures proposed in the Final EIS, many of which are intended to address the safe operation of the Proposed Action and the most effective response to a possible spill event.

As described in Section 4.6 of the Draft EIS, equipment including hovercraft, amphibious Haagland personnel/small equipment carriers, airboats, an amphibious Ditch Witch trencher, and amphibious backhoes would be used to support spill response and cleanup activities during the shoulder season (ice freeze-up or break-up).

As noted in Section 4.6 of the Draft EIS, response operations can continue around the clock during winter months with the use of artificial light. Darkness by itself is not anticipated to limit or restrict response operations and no revisions to the Final EIS are required.

As described in Section 2.1.6 of the Draft EIS, drilling would occur year-round, but drilling into the reservoir would be limited to ice-free (typically July 15th – September 1st) and solid-ice seasons (approximately November 15th – June 1st). This allows for periods when there is either solid ice to

retain any spills above the ocean until cleaned up, or sufficiently open water to allow traditional, vessel based, oil spill response activities. While a loss of well control incident during developmental drilling leading to a blowout and a hypothetical VLOS is not estimated to occur in the shoulder seasons (freeze-up or break-up) due to applicant-proposed restrictions on reservoir drilling, a spill resulting from an open water or winter blowout may persist into the freeze-up or break-up periods. Section 4.5.3.3 of the Final EIS addresses this scenario. As noted in that section, the behavior of oil in sea ice can vary depending on the concentration of ice present. Behaviors may include spreading similar to open-water conditions, spreading restricted to the space between ice floes, oil becoming encapsulated with the ice structure and remaining trapped until spring, or oil remaining on top of the sea ice as it forms. The weather conditions will affect the fate and behavior of the oil.

- **Historic Spills in the Arctic.** An analysis of the potential impacts of the Proposed Action and alternatives focuses on the development plan as proposed, factoring in lease stipulations, best management practices, mitigation measures, and accident prevention plans. A history of spills from the OCS and North Sea is considered in Final EIS Appendix A to estimate the likelihood of future spills from the proposed action. The large OCS spill-size assumptions BOEM uses for a spill from the island and an offshore pipeline leak are based on reported spills in the Gulf of Mexico and Pacific OCS because no large spills (≥1,000 barrels) have occurred on the Alaska or Atlantic OCS from oil and gas activities.

Issue 27. Energy Policy Considerations

Summary of Comments

Several commenters expressed support for the Liberty Project as a means of adding needed throughput to the Trans-Alaska Pipeline System (TAPS), which is presently operating at approximately 25% of full capacity and requires additional volume to continue operating.

One commenter stated that without projects like the Liberty project, oil prices may rise and markets may tighten. A number of comments stated that the project would benefit the further energy development of the North Slope and the Arctic.

Commenters also stated that the project would support broader domestic energy production goals and "energy dominance" for the United States. Some commenters stated that the project would enhance the safe development of fossil fuels and augment national security.

A number of comments stated that the project is inconsistent with national and international GHG and climate change policies and must be rejected to avoid the worst impacts of climate change.

One commenter stated that throughput in TAPS is already increasing without the project.

Source of Comments

- Elected Officials
- Individual/General Public
- Industry Groups
- Environmental Advocacy and Other Public Interest Groups (NGOs)

Response to Comments

The Liberty Reservoir is the largest delineated but undeveloped light oil reservoir on the North Slope. The Proposed Action is projected to deliver a peak production rate of 58,000 barrels of oil per day within 2 years of initial production. This oil will be transported via a new pipeline from the LDPI to existing pipelines that would transport the oil to TAPS. Therefore, the Proposed Action would help extend the life span of TAPS, which BOEM recognizes as critical to the state and local economy. However, as noted in Section 5.2.10.2 of the Draft EIS, while the Proposed Action would add production to TAPS, as a single project it would not be sufficient to reverse the longer-term decline in oil production and TAPS throughput.

While national issues such as energy policy, energy prices, and domestic energy production are important, they exceed the scope of the environmental analysis in the Draft EIS. The Proposed Action is projected to deliver a peak production rate of 58,000 barrels of oil per day within 2 years of initial production with an estimated project life of 22 years. According to the EIA (2018), average daily U.S. oil production was 8,857,000 barrels per day in 2016. Therefore, the effect of the increased oil supply from the Proposed Action on the availability and price of domestic oil is likely negligible.

Issues related to national and international climate policy are beyond the scope of this analysis, except to the extent they pertain to regulatory requirements associated with the Proposed Action. BOEM disagrees with comments that suggest any additional contribution of GHG from the Proposed Action would lead to irreversible problems and costs caused by climate change. At this time, a single,

discrete project's contribution to climate change cannot be reliably linked to particular climate change-related impacts. Section 4.2.4 of the Draft EIS evaluates the effect of the Proposed Action and its alternatives on GHG emissions and considers mitigation measures to reduce this impact.

As noted in Section 1.3 of the Draft EIS, the purpose of the Proposed Action is to recover and process oil from the Liberty oil field and transport sales-quality oil to market. The need for this action is established by DOI's responsibility under OCSLA to make OCS lands available for expeditious and orderly development, subject to environmental safeguards, in a manner which is consistent with the maintenance of competition and other national needs. Increasing the throughput of TAPS is unrelated to the purpose and need for the Proposed Action. According to the Alyeska Pipeline Service Company (2018) who operates TAPS, TAPS had a maximum daily throughput of over 2 million barrels of oil per day in 1988 and in 2017 averaged 527,322 barrels of oil per day; therefore, the additional peak production rate of 58,000 barrels of oil per day from the Proposed Action can be easily accommodated by TAPS.

Issue 28. Other Comments on the Liberty DPP Draft EIS/Miscellaneous Comments

Summary of Comments

Several comments requested editorial or typographical revisions in the Final EIS. A number of comments requested that the use of the term "Territorial Seas" be reconsidered as it appeared to be in reference to Alaska State Waters. Two comments indicated that a few of the works cited in the Draft EIS text were missing from the list of references. Source of Comments

- State Agencies
- Industry Groups

Response to Comments

BOEM received and considered many comments of an editorial nature; for example: suggested word changes and corrections, requests for clarification, questions regarding citations, and similar. Where appropriate, BOEM made these suggested revisions to the Final EIS, and these revisions constitute BOEM's response to those editorial comments.

Appendix C

Mitigation Measures

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APPENDIX C MITIGATION MEASURES

INTRODUCTION **C-1**

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C-2 Design Features and Best Management Practices Committed to by the Operator **C-1**

C-3 Requirements of Cooperating Agencies, including State Agencies **C-5**

C-4 Additional Mitigation Measures Proposed in the Liberty DPP EIS **C-10**

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INTRODUCTION

The Council on Environmental Quality (CEQ) states that mitigation can include avoiding, minimizing, rectifying, reducing over time, or compensating for the impacts of an action (40 Code of Federal Regulations [CFR] 1508.20). In analyzing potential impacts from the Proposed Action and other Action Alternatives, Bureau of Ocean Energy Management (BOEM) assumed implementation of, and compliance with, the mitigation measures described in Sections C-1 through C-3. These include:

- lease stipulations,
- design features and best management practices (BMPs) committed to by the operator, and
- other BMPs or requirements of Cooperating Agencies.

Where appropriate, BOEM analysts also identified additional mitigation measures which, if implemented, may further reduce potential impacts to various environmental resources. These additional mitigation measures are described in Chapter 4 under the resource category to which they apply, as well as Section C-4 of this Appendix.

C-1 Lease Stipulations

The effects analysis assumes that Hilcorp Alaska, LLC (HAK) will comply with all of the applicable lease stipulations, found at https://www.boem.gov/liberty/.

C-2 Design Features and Best Management Practices Committed to by the Operator

HAK has included the following design features and BMPs in an effort to avoid, minimize, and/or mitigate potential effects that the Proposed Action may have on the physical, biological, and human environment. The impact analyses in this Environmental Impact Statement (EIS) assume the following measures will be implemented:

- Use of directional drilling enables all proposed wells to be drilled from one island (drill pad).
- The southern pipeline route was selected to avoid or minimize risks of strudel scour.
- Processing on the Liberty Development and Production Island (LDPI) takes advantage of newer air emission sources rather than using existing processing facilities.
- The selected pipeline route avoids areas of mapped high density (greater than or equal to 25 percent) Boulder Patch.
- The pipeline design minimizes the depth and size of the trench required.
- Single phase, pipe-in-pipe design improves detection and containment of leaks.
- The size and layout of the LDPI minimizes gravel requirements and seabed footprint, while still accommodating worker safety and spill prevention and response.
- The LDPI has a mat slope armor protection system that extends from the island bench to the sea floor and a sheetpile wall to minimize the seabed footprint, overall gravel requirements, and long-term maintenance.
- Process modules on the LDPI are a “fit-for-purpose” design which will match equipment sizing and emissions sources to the reservoir and production needs of the Liberty reservoir.

- Drilling muds will not be discharged, but stored on site and disposed via injection when the disposal well is operational. Wastewater from LDPI sewage treatment and potable water plants will also be discharged to the waste disposal well when the well is operational. Temporary and contingency discharge of wastewater under the National Pollution Discharge Elimination System (NPDES) will be required when the waste disposal well is not available. The waste disposal well will be the first well drilled and completed to facilitate wastewater injection instead of discharge.
- Project gravel needs and the construction schedule were designed to minimize gravel pit size and operation time.
- Heated facilities will be elevated on pilings above the gravel or have insulated floors, or both, in order to minimize transmission of building heat to the permafrost.
- Thermo-siphons will be installed where needed to prevent thaw subsidence.

C-2.1 Water Quality

- HAK will comply with NPDES permit stipulations for temporary domestic wastewater discharges until the waste disposal well is in operation and when backhaul of wastewater is infeasible (and also as a contingency if the disposal well is unavailable). Such NPDES permits specify treatment requirements, effluent limitations, monitoring, and compliance with a BMP Plan.
- HAK will use dedicated temporary storage systems and waste minimization to prevent waste from coming in contact with snow or rainwater.
- HAK will use drip pads beneath fuel transfers and engines to prevent drips or spills from contacting water or wetlands.
- HAK will employ the use of a membrane bio reactor (MBR) to reduce the concentration of pollutants in the wastewater effluent.

C-2.2 Fish

- Initial (fill placement phase) island construction and pipeline installation/backfill will occur in winter when fewer fish species are present and when water currents are low, which will reduce total suspended solids (TSS) distribution.
- The LDPI and pipeline were located to avoid impacts to habitat and to minimize alteration of ocean currents.
- The LDPI was designed to minimize the island's footprint and loss of bottom habitat.
- Seawater intake structures were designed to prevent fish entrainment.
- Island armoring will serve to reduce erosion and the spread of silt or gravel over fish habitat.

C-2.3 Birds

- HAK will develop a lighting plan to minimize the potential for bird strikes.
- Towers and other structures on the LDPI will be designed to reduce nesting by predatory birds.
- HAK will employ strict food waste control (e.g., animal-proof dumpsters) to avoid attracting and feeding predators.
- Marine traffic procedures will be implemented to avoid encountering concentrations of molting waterfowl.

- Seasonal air traffic controls (e.g., routing and minimum altitudes) over specific nesting and brooding areas (e.g., Sagavanirktok River Delta, Howe Island) will be implemented.
- Bird use and wetlands mapping in the vicinity of the onshore gravel mine site and gravel pads was considered in order to avoid high quality habitat, particularly for spectacled eiders and snow geese.

C-2.4 Marine Mammals

- The project is located inshore of the barrier islands and inshore of the main fall migration path of the bowhead whale.
- Initial (fill placement phase) island construction and pipeline installation/backfill will take place in winter so that noise from the pipeline installation and gravel placement for the island will not impact bowhead whales or subsistence hunting.
- Impact pile driving at the LDPI that place sounds in the water above 120 decibels (dB) will not be conducted during the bowhead whale migration in the project area – late August through September.
- Barging and other support marine traffic to the LDPI will utilize routes in relatively shallow water inshore of the barrier islands and will avoid the main migration path of the bowhead whale.
- Operational procedures that minimize the risk of contact and noise generation will be in place for project support vessels in transit during bowhead whale migration.
- HAK will implement a polar bear interaction plan which includes commitments to survey potential denning habitat for maternal dens (e.g., forward-looking infrared [FLIR], or similar technology for aerial surveillance) along ice road routes to avoid active denning areas. Protection, agency reporting, and a stop work order will occur in the event of the discovery of previously unidentified polar bear dens, unless alternative action is approved by the U.S. Fish and Wildlife Service (USFWS).
- The steel sheetpile wall protecting the LDPI work surface will deter polar bear access to the island work surface.
- Procedures will be in place for approved marine mammal monitors and those licensed to haze and conduct other intentional takes to defend workers.
- Food handling and waste management procedures to avoid creating attractants will be in place, such as secure storage of food and proper disposal of chemicals and wastes.
- Training will be provided and procedures established to assure safety of workers and animals when working where marine mammals may occur.
- Activities will be set back from active polar bear dens by 1 mile or as otherwise approved by the USFWS.
- The subsea pipeline route was selected in part to provide separation from a historical polar bear denning site at Point Brower.
- Ice road management (e.g., traffic controls, re-routings, etc.) will control access in areas where marine mammals may be encountered.

C-2.5 Terrestrial Mammals

- Winter construction will be used when practical and appropriate to avoid conflict with summer migrants that comprise the majority of animals that utilize the North Slope.
- Strict anti-hunting, anti-harassment, and anti-feeding policies will be implemented to minimize impacts to terrestrial wildlife. Summer access will be restricted as well.

- BMPs developed for the North Slope and the State of Alaska will be followed to provide long-term habitat restoration of the mine site.
- The onshore pipeline will be elevated by approximately 7 feet to reduce impediments to terrestrial mammals.

C-2.6 Vegetation and Wetlands

- Wetland mapping was conducted in the vicinity of alternative mine sites and gravel pad sites to identify and avoid higher value wetland types to the extent feasible.
- Ice Roads
  - Preconstruction surveys and designing ice roads to avoid tussock tundra areas, steep streambanks, and deep freshwater holes would reduce potential impacts to wetlands. Also, locating ice roads in the wettest wetland areas reduces wetland impacts.
  - Establishing speed and weight limits, providing staff training, and installing delineators along both sides of ice roads would reduce tundra damage.
  - Ice roads and pads will be slotted at stream crossings to facilitate drainage during breakup.
- Tundra Travel
  - If summer tundra travel is necessary, tundra-safe low-pressure vehicles will be used. Traffic would be limited as much as possible, avoiding tight turns, using different tracks with each pass, avoiding vegetation communities most sensitive to damage from tundra travel (e.g., tussock tundra), and following the shortest path from origination to destination.
  - Operations will be restricted to drier areas.
  - Crossing deep water or vegetation with more than 2-3 inches of water, and crossing ponds, lakes, and wetlands bordering ponds and lakes will be avoided.
  - Vehicle operators will be familiar with tundra vegetation types to ensure compliance with these stipulations:
    - Incidents of damage to the vegetation mat and follow-up corrective actions that have occurred must be reported to the Alaska Department of Natural Resources, Division of Mining, Land, and Water within 72 hours of occurrence.
    - Vehicles will be tested to determine their ability to operate on the tundra without causing extensive damage.
    - Vehicles cannot carry more payload than was carried during the certification test.
    - Movement of equipment through willow stands must be avoided where possible.
    - Where disturbance to the organic mat is unavoidable, the disrupted area must be stabilized in order to avoid disturbance to the permafrost layer.
- Gravel Mine
  - Discharge of mine dewatering water and hydrostatic test water will be directed towards a natural drainage gradient to minimize warming of the near-surface soils and ponding of surface water. Discharge flow rate will be controlled to avoid erosion of tundra.
  - BMPs developed for the North Slope and the State of Alaska will be followed to provide long-term habitat restoration of the mine site.
- Gravel Pad Construction and Maintenance
  - Gravel pads will be watered, as necessary, to control dust generation.

- Workers will be required to stay on gravel surfaces unless their job duties require them to be on the tundra.
- Slopes of gravel pads will be maintained to prevent sloughing.
- Grading of roads shall not push material into adjacent wetlands.

C-2.7 Subsistence

- Criteria for island siting and design were discussed with the Nuiqsut Whaling Captains' Association. HAK discussed marine traffic to support the Proposed Action (e.g., routes, frequency, and schedule).
- HAK has agreed to enter into a Conflict Avoidance Agreement with the AEWC and the Nuiqsut Whaling Captains' Association to mitigate impacts to subsistence whaling.
- Local subsistence representatives will be employed during appropriate project phases.
- Personnel skilled at protected species identification on support vessels will be employed, when warranted, to prevent vessel/marine mammal interaction during the open-water season.
- Preferred marine routes will be established for transport of facilities and supplies to the LDPI.
- Minimum aircraft altitudes and routes for helicopters and other support aircraft will be established to avoid disturbing bowhead whales and other subsistence resources, consistent with safety requirements and weather considerations.
- HAK and contract personnel will be trained on the importance of subsistence and measures to avoid conflicts.

C-3 Requirements of Cooperating Agencies, including State Agencies

In addition to the design features and BMPs committed to by the operator, there are other federal, state, and local laws and policies that are applicable to the Liberty Project. This section describes the typical/standard measures that BOEM analysts assumed would be applied to the project. BOEM's Analyses of Effects in Chapter 4 assume these typical/standard measures will be applied, in addition to Lease Stipulations, and Design Features and BMPs committed to by the operator (Section C-2). Bureau of Safety and Environmental Enforcement (BSEE) requires a Platform Approval Plan and Platform Verification Plan which will be administered by a BSEE-approved third party. BSEE will also approve all Applications to Drill for the wells and will approve the production safety systems put in place on the island. Also, BSEE approves HAK's Oil Spill Response Plan for the Liberty Project. However, specific approval conditions will be developed by BSEE during the detailed permitting phase of the project.

C-3.1 U.S. Army Corps of Engineers

Chapter 1 describes the regulatory authorities of the U.S. Army Corps of Engineers (USACE). Briefly, Section 404 of the Clean Water Act (CWA) requires a Corps permit be obtained for the discharge of fill material into waters of the United States, including wetlands. Section 10 of the Rivers and Harbors Act (RHA) requires that a Corps authorization be obtained prior to placing any structure within, filling, or excavating in navigable waters of the U.S. In addition to any project-specific conditions the Corps may apply, the following are standard conditions that apply to all individual CWA Section 404 and/or RHA Section 10 authorizations:

- Time limits are placed on the permit. If more time is needed to complete the authorized activity, permittees must apply for a time extension.

- The permittee must maintain the authorized activity in conformance with the terms and conditions of the permit, even if the permitted activity is abandoned. If a permittee wishes to cease maintaining the authorized activity or desires to abandon it without transferring the permit to another entity, the permittee must obtain a modification of the permit, which may require restoration of the area.
- If the permittee discovers any previously unknown historic or archeological remains while accomplishing the activity authorized by the permit, the permittee must immediately notify the USACE. Agency coordination is necessary to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.
- If the permittee sells the property associated with this permit, the permittee must obtain the signature of the new owner and forward a copy of the permit to the Corps to validate the transfer of the authorization.
- If a conditioned water quality certification has been issued, the permittee must comply with the conditions specified by that permit.

C-3.2 EPA

Chapter 1 describes the regulatory authorities of the Environmental Protection Agency (EPA). Briefly, Section 402 of the CWA establishes the NPDES permit program to regulate discharges into waters of the U.S. While the EPA has transferred NPDES authority to the Alaska Department of Environmental Conservation (ADEC) under the APDES Program for activities within Alaska, they retain authority over NPDES permitting associated with offshore oil and gas facilities. The EPA also has authority over the storage and management of petroleum products under Section 311, requiring that the applicant develop and submit a Spill Prevention, Control, and Countermeasure Plan (SPCC). For this project, the EPA does not have any standard conditions or BMPs that would be applicable. Compliance with NPDES standards/regulations is assumed for purposes of evaluating effects of the Liberty Development and Production Plan (DPP).

C-3.3 NMFS

As described in Chapter 1, the National Marine Fisheries Service (NMFS) has regulatory responsibilities under the Marine Mammals Protection Act (MMPA), Endangered Species Act (ESA), and the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), among other authorities. Mitigation measures stemming from BOEM's consultation with NMFS on Essential Fish Habitat (EFH) for this EIS are as follows:

- Develop and implement, in coordination with NMFS, a Hazard Analysis and Critical Control Point Plan (HACCP) for prevention and response to marine invasive species associated with operation of the LDPI.
- Establish a monitoring program on the artificial island to include settling plates, trapping, or other means deemed appropriate to track any occurrence of invasive species in the biological colonization of the LDPI. As part of the HACCP, provide for an early detection and rapid response plan to respond to the discovery of any invasive species found during monitoring.

Consultations under both the ESA and the MSFCMA generally result in project-specific requirements that would be included as conditions of BOEM's approval. However, if warranted, the applicant may receive an authorization for incidental take under the MMPA. Such authorizations may contain project-specific conditions in addition to the standard conditions described below that apply to all MMPA authorizations. The USFWS has similar authority under the MMPA and ESA, and the typical/

standard mitigation measures required by NMFS and USFWS to avoid/minimize potential impacts to marine mammals are combined and summarized below.

C-3.4 USFWS

As described in Chapter 1, the USFWS has regulatory responsibilities under the MMPA, the ESA, and the Fish and Wildlife Coordination Act, among others. Consultations under the ESA generally result in project-specific requirements that would be applied as conditions of BOEM's approval. Similar to the NMFS, the applicant may receive an authorization for incidental take under the MMPA. Such authorizations may contain project-specific conditions, if warranted, as well as the standard conditions described below. In addition, in order to comply with the MBTA, there are standard BMPs that are applicable as well.

The analyses of impacts to biological resources in this EIS are based on the assumption that the following typical/standard mitigations required by the NMFS and the USFWS will be implemented.

Typical/Standard Mitigation Measures Required by the NMFS and the USFWS to Avoid/Minimize Potential Impacts to Marine Mammals

General Offshore Development and Production Activities

- The operator will conduct acoustic measurements to document sound levels, characteristics, and transmissions of airborne sounds with expected source levels of greater than or equal to 90 dB in air.
- The operator will conduct acoustic monitoring of sounds produced by project-related activities and acoustic monitoring of the bowhead whale migration beyond the project area.
- The operator will comply with the National Oceanic and Atmospheric Administration's (NOAA's) Marine Mammal Oil Spill Response Guidelines, as described in Appendix G.
- The operator is responsible for ensuring there are no unmitigable adverse impacts on subsistence use of marine mammals. A variety of mechanisms may be used by the NMFS or the USFWS to ensure that the required communication with Alaska Native peoples occurs.

Ice-Covered Season

- To reduce impacts to ringed seals, winter construction activities such as ice roads must begin as soon as possible once weather and ice conditions permit such activity.
- After March 1 of each year, activities should avoid, to the greatest extent practicable, disturbance of any located seal structure. All activity should be at least 492 feet from any identified ice seal structure. If ice-road construction occurs after March 1, the operator must conduct a follow-up assessment in May to determine the fate of all seal structures located during monitoring near physically disturbed areas.
- Operators must observe a 1 mile operational exclusion zone around all known polar bear dens during the denning season (November-April, or until the female and cubs leave the areas). Should previously unknown occupied dens be discovered within 1 mile of activities, work in the immediate area must cease and the USFWS contacted for guidance. The USFWS will evaluate these instances on a case-by-case basis to determine the appropriate action.

General Vessel Traffic

- Operational and support vessels will be staffed with dedicated Protected Species Observers (PSOs) to alert crew of the presence of marine mammals and to initiate adaptive mitigation responses.
- When weather conditions require, such as when visibility drops, support vessels must reduce speed and change direction, as necessary (and as operationally practicable), to avoid the likelihood of injury to marine mammals.
- The transit of operational and support vessels through the region is not authorized prior to July 1. This operating condition is intended to allow marine mammals the opportunity to disperse from the confines of the spring lead system and minimize interactions with subsistence hunters. Exemption waivers to this operating condition may be issued by the NMFS and the USFWS on a case-by-case basis, based upon a review of seasonal ice conditions and available information on marine mammal distributions in the area of interest.
- The transit route for the vessels will avoid known fragile ecosystems.
- Vessels may not be operated in such a way as to separate members of a group of marine mammals from other members of the group.

Vessels in Vicinity of Whales

- Vessels should avoid groups of greater than or equal to 5 whales.
- Vessels will avoid multiple changes in direction and speed when within 300 yards of whales and also operate the vessel(s) to avoid causing a whale to make multiple changes in direction.
- All non-essential boat and barge traffic will be scheduled to avoid periods when bowhead whales are migrating through the area to where they may be affected by sound from the project.
- If the vessel approaches within 1 mile of observed whales, except when providing emergency assistance to whalers or in other emergency situations, the vessel operator will take reasonable precautions to avoid potential interaction with the whales by taking one or more of the following actions, as appropriate:
  - Reducing vessel speed to less than 5 knots within 900 feet of the whale(s).
  - Steering around the whale(s) if possible.
  - Operating the vessel(s) to avoid causing a whale to make multiple changes in direction.
  - Checking the waters immediately adjacent to the vessel(s) to ensure that no whales will be injured when the propellers are engaged.
  - Reducing vessel speed to 9 knots or less when weather conditions reduce visibility to avoid the likelihood of injury to whales.
- Special consideration of North Pacific Right Whales and their critical habitat:
  - Vessels will avoid transit within North Pacific right whale critical habitat. If transit within North Pacific right whale critical habitat cannot be avoided, vessel operators must exercise caution and reduce speed to 10 knots while within North Pacific right whale critical habitat.
  - Vessels transiting through North Pacific right whale critical habitat must have PSOs actively engaged in sighting marine mammals. Vessels will maneuver to keep 875 yards away from any observed North Pacific right whale while within their designated critical habitat, and avoid approaching whales head-on consistent with vessel safety.

- Vessels should take reasonable steps to alert other vessels in the vicinity of whale(s), and report any dead or injured listed whale or pinniped.

Vessels in Vicinity of Pacific Walruses and Polar Bears

- Vessels should take all reasonable precautions (i.e., reduce speed, change course heading) to maintain a minimum operational exclusion zone of 0.5 miles around groups of feeding walruses.
- Except in an emergency, vessels will not approach within 0.5 miles of observed polar bears, within 0.5 miles of walrus observed on ice, or within 1 mile of walrus observed on land.

Aircraft Traffic in Vicinity of Whales or Seals

- Aircraft should not fly below 1,500 feet within 100 feet of whales or seals, except during emergencies and take-offs/landings.
- Helicopter flights should be limited to prescribed transit corridors. Helicopters shall not hover or circle above or within 0.3 miles of groups of whales.
- If ice over-flights or similar repeated aerial surveys are conducted, a PSO shall be stationed aboard all flights and will document all marine mammal sightings.
- Air traffic will be scheduled to avoid periods when bowhead whales are migrating through the area where they may be affected by noise.
- Aircraft traffic will avoid flying over polynyas and along adjacent ice margins as much as possible to minimize potential disturbance to whales.
- Air traffic will maintain a 1 mile radius when flying over areas where groups of greater than or equal to 5 seals appear to be concentrated.
- Aircraft will not land on ice within 1,530 yards of hauled out pinnipeds.

Aircraft Traffic in Vicinity of Walruses and Polar Bears

- Helicopters will not operate at an altitude lower than 3,000 feet within 1 mile of walrus groups observed on land, and fixed-wing aircraft will not, except in an emergency, operate at an altitude lower than 1,500 feet within 0.5 miles of walrus groups observed on ice, or within 1 mile of walrus groups observed on land. Helicopters may not hover or circle above such areas or within 0.5 miles of such areas (USFWS, 2011).
- Aircraft should not fly below 1,500 feet within 0.5 miles of walruses on ice, and polar bears on ice or land, except during emergencies and take-offs/landings.
- When weather conditions do not allow a 1,500-foot flying altitude, aircraft may be operated below 1,500 feet; however, when aircraft are operated at altitudes below 1,500 feet, the operator must avoid areas of known walrus and polar bear concentrations and should take precautions to avoid flying directly over or within 0.5 miles of these areas.

Onshore Development and Production Activities

- All personnel and activities will comply with HAK's Polar Bear and Pacific Walrus Interaction Plan that details bear avoidance and encounter procedures and training; bear guard training; safety and communication procedures; HAK's Waste Management Plan, and the NMFS and USFWS reporting requirements.
- Holders of a Letter of Authorization (LOA) may be required to hire and train polar bear monitors to alert crew of the presence of polar bears and initiate adaptive mitigation response.

- Operators seeking to carry out onshore activities in known or suspected polar bear denning habitat during the denning season (November to April) must make efforts to locate occupied polar bear dens within and near proposed areas of operation. All observed or suspected polar bear dens must be reported to the USFWS prior to the initiation of activities.

Exclusion Zones/Monitoring

- The operator will establish and monitor, during all daylight hours, a 180 dB re 1 μPa (RMS) exclusion zone for all cetaceans (whales, dolphins, and porpoises), and a 190 dB re 1 μPa (RMS) exclusion zone for all pinnipeds.
- The exclusion zones will be monitored continuously for 30 minutes prior to initiating any activity with the potential to produce sound pressure levels (SPLs) greater than 160 dB re 1 μPa (RMS). The entire exclusion zone must be visible for the entirety of the 30 minutes period. The exclusion zones will also be monitored for 30 minutes after the activity has ended.

Typical/Standard Mitigation Measures Required by the USFWS to Avoid/Minimize Potential Impacts to Birds

Vegetation clearing and land disturbance activities that could harm active nests, eggs, and nestlings (e.g., for the gravel material sites, fill pads, or any other purpose) shall not occur between June 1 and July 31.

C-3.5 State of Alaska

The State of Alaska (SOA) has regulatory, statutory, and permitting authority over waters and lands on the North Slope (including submerged lands of the Beaufort Sea), other than those that are part of native allotments. The SOA will have permitting authority over several actions associated with the Liberty Development that will occur subsequent to BOEM's approval of the Proposed Action or one of the Alternatives analyzed in this EIS. These actions include the construction of onshore ice roads and ice pads, gravel use, and gravel mine reclamation. The SOA will coordinate the approval of these actions across its agencies and determine whether to approve or deny permits and leases for use of State land. The SOA does not have any standard conditions or BMPs that would be applicable, however as part of the SOA's approval process, they will apply additional mitigation measures for the protection of wildlife, air and water quality, and subsistence practices. For example, abandonment and rehabilitation of the gravel mine site for Liberty would be described in a Mining and Rehabilitation Plan submitted for approval to the ADNR and USACE. Site-specific reclamation details would be developed during that process.

C-4 Additional Mitigation Measures Proposed in the Liberty DPP EIS

BOEM analysts identified additional mitigation measures which, if implemented, may further reduce potential impacts. These additional mitigation measures are described below as well as in relevant chapters to which they apply, i.e. Chapters 2 and/or 4.

1. Solid Ice Condition - Hilcorp will adhere to the following condition to minimize the likelihood of an oil spill reaching open-water:
    - Reservoir drilling is authorized only during times of solid ice conditions. For the purposes of this condition, "reservoir drilling" is defined to include initial development drilling (as opposed to workovers, recompletions, and other such well operations subsequently conducted on existing wells) beyond the shoe (base) of the last casing string above the Kekiktuk Formation (i.e. drilling that exposes the Kekiktuk Formation to an

open, uncased wellbore). 'Solid ice conditions' is defined as at least 18 inches of ice in all areas within 500 ft of the LDPI.

2. Hilcorp will offset the emissions of greenhouse gases during the life of the proposed action by reforesting 9,000 acres of public lands.
3. Vehicles shall adhere to a speed limit of 25 mph on all roads, except Endicott Road where it crosses the Sagavanirktok River delta (i.e., north of the intersection with the Badami Pipeline to the shore of the Sagavanirktok River delta) between July1 – August 15 where and when they shall adhere to a speed limit of 15 mph to minimize collision and disturbance hazards with waterbird broods.
4. Personnel shall be trained to watch for and stop for adult birds with broods attempting to cross roads.
5. Equipment shall be staged in winter or as early in the spring season as possible to deter birds from nesting in areas planned for construction or gravel extraction.
6. Collision impacts to flying birds, including those caused by light attraction, shall be mitigated by the use of the following monitoring and adaptive management strategies:
    - A lighting plan shall be developed in cooperation with the USCG, BOEM, BSEE, USFWS, and FAA to minimize potential bird strikes. The lighting plan should include details on design, installation, and day-to-day operation of lighting on the LDPI and large vessels (e.g., assist tug and similar length or larger which may be offshore over-night or longer), and shall include a contractor/staff education component. The lighting plan shall include, at minimum, the following:

        The LDPI should be designed such that all exterior lights are reduced (where safety allows) and down-shielded. Black-out curtains (where safety permits) should regularly be used to reduce attraction to interior lights.

        Where possible, green or blue exterior lights shall be used instead of white lights. Green and blue artificial lights have been shown to decrease the number of mortalities among nocturnally migrating birds.

        A strobe-based light-repellant system, similar to that used at Northstar, shall be designed and implemented for use on buildings and other structures.
    - Buildings shall be painted light tan, rather than white or very dark colors, to reduce the attractiveness of the LDPI to migrating birds.
    - Crane booms should be lowered when not in use. Unused cranes or other large heavy equipment should not be unnecessarily stored on-site.
    - The design height of the flare boom shall include consideration of the mean flight altitude of birds in the area, along with other relevant design criteria. Low-flying, at-risk species have been shown to migrate across the area at about 20 m. Flare booms higher than 20 m (*above* the typical flight path of at-risk species) have been shown to be beneficial at Northstar.
    - Operating procedures shall minimize gas flaring on low visibility nights during the spring and fall passerine migration seasons (approximately April 20 to May 30 and July 20 to September 20).
    - The onshore portion of the pipeline shall be removed after the Proposed Action is complete.

- An adaptive monitoring plan shall be developed to record all avian mortalities and collisions, including vehicle collisions. At minimum, the plan shall include daily surveys of the LDPI for the presence of birds, stranded or dead, and the circumstances of their death. Surveys may be performed in conjunction with other work/surveys. Records shall be kept according to protocols developed in cooperation with BOEM, BSEE, and the USFWS, and the data shall be annually submitted in an electronic format to BOEM and USFWS. Surveys shall be conducted for the life of the project, unless all parties agree to a different timeline.

7. The operator shall work with BOEM, the USFWS, and the State of Alaska to develop a Wildlife Interaction Plan that, at minimum, includes the following:
    - Contractor/employee education on problems associated with feeding wildlife; prohibitions against feeding or encouraging wildlife; procedures for reporting all wildlife encounters; and training on waste management and using animal-proof dumpsters;
    - Monitoring to detect nest building on towers or other structures, and to detect fox denning on / near any of the Proposed Action facilities;
    - Strategies to discourage nest building and denning activities, including timely removal of any found nests or dens as appropriate and consistent with state or federal laws or permits;
    - Site-specific strategies to reduce the number of personnel and opportunity for disturbance to wildlife during sensitive time period stages, such as calving, molting, etc.;
    - Procedures for reporting evidence of predator attractions to the facilities, including nesting or denning; anthropogenic feeding, food caching, or stealing; persistent perching; etc., for the purpose of adaptive management;
    - All potential necessary permits for nest and den removal or other wildlife interactions, as discussed/approved/permitted in advance as necessary with appropriate State of Alaska and federal regulators prior to initiating construction.
8. Fixed-wing aircraft shall be used in lieu of helicopters, when/if possible feasible, to reduce potential disturbance to marine mammals.
9. Vessels traveling between West Dock/Endicott and Foggy Island Bay shall not exceed speeds of 10 knots in order to reduce potential whale strikes.
10. Aircraft shall maintain a minimum altitude of 1,500 AGL (where safety allows). Aircraft shall avoid flights over groups (3 or more) of observed large terrestrial mammals.
11. To minimize encounters with / disturbance to terrestrial mammals, vehicles shall be restricted to the area immediately around work areas and camps and roads. If musk ox are encountered, vehicles shall maintain a minimum distance of 600 m (0.37 mi).
12. The onshore segment of the ice road route shall be surveyed prior to construction to avoid bear dens, and bear-human avoidance protocols shall be established.
13. To reduce potential disturbance to Cross Island subsistence whaling activities, the following activities are prohibited from August 1 through the end of the hunt: (1) pile-/pipe-driving activities at the LDPI; and (2) marine vessel traffic seaward of the barrier islands. These activities can resume after the Nuiqsut bowhead whale quota is met or after the Cross Island-based whalers officially end their whaling activities for the season. In the event that Nuiqsut whalers communicate an intent to conduct subsistence whaling activities south of Narwhal Island, HAK must make all reasonable efforts to

minimize conflicts between operations (including marine vessel traffic) and subsistence hunting activities.

14. The operator shall coordinate with NMFS to develop a Hazard Analysis and Critical Control Point Plan (HACCP) for prevention and response to marine invasive species associated with operation of the LDPI.
15. The operator shall establish a monitoring program on the artificial island that includes settling plates, trapping, or other means deemed appropriate to track occurrence of invasive species in the biological colonization of the LDPI. This plan shall be included as part of the HACCP, and help provide for early detection and rapid response if invasive species are found during monitoring.
16. Another proposed mitigation measure that may help reduce impacts to subsistence whaling is to require monitoring of factors that may interfere with the bowhead hunt or reduce the desirability of whales, such as noise impacts or water quality contamination. The results from a monitoring program could help assure stakeholders and regulators that negative impacts are not occurring and/or alert these parties to any unforeseen impacts which do occur.

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The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island communities.

BOEM
Bureau of Ocean Energy Management

The Bureau of Ocean Energy Management Mission

The Bureau of Ocean Energy Management (BOEM) manages development of U.S. Outer Continental Shelf energy and mineral resources in an environmentally and economically responsible way.