UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
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Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion on the Issuance of a Letter of Authorization under section 101(a)(5)(A) of the Marine Mammal Protection Act to Hilcorp Alaska, LLC and Eni U.S. Operating Co. Inc. for the Construction, Maintenance, and Use of Sea Ice Roads and Trails on the North Slope, Beaufort Sea, Alaska, 2020 to 2025

NMFS Consultation Number: AKRO-2019-00194

Action Agency: Permits and Conservation Division, Office of Protected Resources (Permits Division), National Marine Fisheries Service, NOAA

Affected Species and Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	No	No	N/A
Humpback Whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	No	No	N/A
Bowhead Whale (*Balanea mysticetus*)	Endangered	No	No	N/A
Ringed Seal, Arctic subspecies (*Phoca hispida hispida*)	Threatened	Yes	No	N/A
Bearded Seal, Beringia DPS (*Erignathus barbatus nauticus*)	Threatened	No	No	N/A

Consultation Conducted By: National Marine Fisheries Service, Alaska Region

Issued By: _____
for James W. Balsiger, Ph.D.
Regional Administrator

Date: ___March 26, 2020____

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TERMS AND ABBREVIATIONS

µPa	Micro Pascal
3D	Three-Dimensional
ac	acres
AKR	Alaska Region
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation, and Enforcement
BSEE	Bureau of Safety and Environmental Enforcement
C	Celsius
CFR	Code of Federal Regulations
CWA	Clean Water Act
dB	Decibels
DPS	Distinct Population Segment
DQA	Data Quality Act
EPA	Environmental Protection Agency
ESA	Endangered Species Act
FR	Federal Register
ft	feet
GPS	Global Positioning System
ha	Hectares
Hz	Hertz
IHA	Incidental Harassment Authorization
IPCC	Intergovernmental Panel on Climate Change
ITS	Incidental Take Statement
kHz	Kilohertz
LOA	Letter of Authorization
LOWC	Loss of Well Control
m	Meter
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NSIDC	National Snow and Ice Data Center
OCS	Outer Continental Shelf
opinion	Biological Opinion
Pa	Pascals
PBF	Physical or Biological Features
PEIS	Programmatic Environmental Impact Statement

Permits Division	NMFS Office of Protected Resources, Permits and Conservation Division
PTS	Permanent Threshold Shift
RMS	Root Mean Square
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measure
SONAR	SOund Navigation And Ranging
SPL	Sound Pressure Level
TTS	Temporary Threshold Shift
U.S.	United States
USFWS	United States Fish and Wildlife Services
VLOS	Very Large Oil Spills

1. INTRODUCTION

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA; 16 U.S.C. § 1536(a)(2)) requires each Federal agency to ensure that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When a Federal agency's action "may affect" a protected species, that agency is required to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the endangered species, threatened species, or designated critical habitat that may be affected by the action (50 CFR § 402.14(a)). Federal agencies may fulfill this general requirement informally if they conclude that an action may affect, but "is not likely to adversely affect" endangered species, threatened species, or designated critical habitat, and NMFS or the USFWS concurs with that conclusion (50 CFR § 402.14(b)).

Section 7(b)(3) of the ESA requires that at the conclusion of consultation, NMFS and/or USFWS provide an opinion stating how the Federal agency's action is likely to affect ESA-listed species and their critical habitat. If incidental take is reasonably certain to occur, section 7(b)(4) requires the consulting agency to provide an incidental take statement (ITS) that specifies the impact of any incidental taking, specifies those reasonable and prudent measures necessary or appropriate to minimize such impact, and sets forth terms and conditions to implement those measures.

In this document, the action agency is NMFS's Office of Protected Resources – Permits and Conservation Division (Permits Division), which proposes to issue a Letter of Authorization (LOA) pursuant to section 101(a)(5)(A) of the Marine Mammal Protection Act of 1972, as amended (MMPA) (16 U.S.C. § 1371(a)(5)(A)), to take marine mammals by harassment incidental to ice road, trail, and pad construction, use, and maintenance, in the waters of the Beaufort Sea, by Hilcorp Alaska, LLC and Eni U.S. Operating Company Incorporated from April 2020 to March 2025. The consulting agency for this proposal is NMFS's Alaska Region (AKR).

This document represents NMFS's biological opinion (opinion) on the effects of this proposal on endangered and threatened species and designated critical habitat.

The opinion and ITS were prepared by NMFS Alaska Region in accordance with section 7(b) of the ESA (16 U.S.C. § 1536(b)), and implementing regulations at 50 CFR part 402.

The opinion and ITS are in compliance with the Data Quality Act (44 U.S.C. § 3504(d)(1)) and underwent pre-dissemination review.

1.1 Background

This opinion considers the effects of the issuance of an LOA to take marine mammals by harassment and mortality under the MMPA incidental to the construction, maintenance, and use of sea ice roads, trails, and pads associated with Hilcorp, Alaska Inc. (Hilcorp) and Eni U.S. Operating Company Inc. (Eni) at three drillsites in the North Slope Operations in Alaska. Work

would begin during the ice season starting in 2020, and continue in subsequent winters for five years. The LOA and the accompanying incidental take regulations would be valid from April 2020 to March 2025 (i.e., the effective dates of the LOA).

These actions have the potential to affect the endangered bowhead whale (*Balaena mysticetus*), endangered Western North Pacific DPS and threatened Mexico DPS humpback whale (*Megaptera novaeangliae*), threatened Arctic subspecies of ringed seal (*Phoca hispida hispida*), and threatened Beringia DPS of bearded seal (*Erignathus barbatus nauticus*).

This opinion is based on information provided in the August 2019 revised Petition for Promulgation of Regulations and Request for a LOA by Hilcorp and Eni; *July 2019 Federal Register Notice of Receipt of Application for LOA and Request for Comments and Information* (84 FR 32726; July 9, 2019*)*; *January 2020 Federal Register Notice for the Proposed Rule for Taking Marine Mammals Incidental to Ice Roads and Ice Trails Construction and Maintenance Activities on Alaska's North Slope* (85 FR 2988; January 17, 2020); email and telephone conversations between NMFS Alaska Region and NMFS Permits Division staff; and other sources of information. A complete record of this consultation is on file at NMFS's Anchorage, Alaska office.

1.2 Consultation History

Our communication with the Permits Division and the applicants (Hilcorp and Eni) regarding this consultation is summarized as follows:

- **February 11, 2019:** Hilcorp and Eni submitted the draft petition to the Permits Division for review and comment.
- **April 2, 2019:** Hilcorp and Eni submitted the LOA petition to the Permits Division. This request included an expansion of the action area to include ice road construction at an additional drillsite.
- **April 2019:** The Permits Division and AKR reviewed the LOA petition and returned comments to Hilcorp and Eni.
- **May 21, 2019:** Hilcorp and Eni submitted the updated LOA petition to the Permits Division and AKR.
- **June-August 2019:** NMFS AKR, the Permits Division, and the applicants met to discuss additional questions on the May 21st revised LOA petition.
- **August 28, 2019:** Hilcorp and Eni responded with additional information and a revised LOA petition request.
- **September 30, 2019:** The Permits Division submitted a request to initiate formal section 7 consultation
- **October 1, 2019:** NMFS initiated consultation with the Permits Division.

2. DESCRIPTION OF THE PROPOSED ACTION AND ACTION AREA

2.1 Proposed Action

"Action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR § 402.02).

The purpose of the Permits Division's proposed action is to authorize incidental take of marine mammals during Hilcorp's and Eni's ice road, trail, and pad activities associated with their oil and gas operations on the North Slope, Alaska. Ice road, trail, and pad activities would take place each year from late December to mid-May, during the ice-covered season, with all ice road, trail, and pad construction initiated prior to March 1st.

This opinion considers the effects of the promulgation of an LOA to take marine mammals by harassment and mortality under the MMPA incidental to Hilcorp and Eni's sea ice road, trail, and pad construction, maintenance, and use. The LOA would be valid for five years, from April 2020 to March 2025.

2.1.1 Proposed Activities

Hilcorp and Eni construct ice roads, trails, and pads annually in order to conduct oil and gas operations on the North Slope, Alaska. Hilcorp and Eni are planning on constructing several kilometers of ice roads, trails, and/or pads at three sites (Table 1).

The ice roads, trails, and pads would be constructed to support the drillsites, and thus it would be necessary to construct these roads, trails, and pads for the life of the drillsites. The producing life of the drillsites is dependent on numerous factors, including for how long the drillsites are economically viable, itself dependent on future oil and gas prices and operating costs. Thus, there is some uncertainty in how long the Spy Island, Oooguruk, and Northstar drillsites will operate. For reference, Hilcorp's Liberty Development and Production Project on the North Slope is expected to have a producing life of 15 to 20 years. If we assume a similar producing life for the three drillsites considered in this action, we expect that a similar level of ice road, trail, and pad construction would continue for approximately the same length of time.

Table 1. Amount of ice roads, trails, and pads proposed for construction at the Spy Island Drillsite, the Oooguruk Drillsite, and the Northstar Production Island.

	Ice Road (km)	Ice Trail (km)	Ice Pads (n)
Eni Spy Island Drillsite (Oliktok Point Production Pad)	6.76	0	3
Eni Oooguruk Drillsite	8.9 (Primary)* 11.26 (Alternative)	0	1
Hilcorp Northstar Production Island	11.71	23.3	0

*In most years, Eni anticipates building 8.9 km of ice road at its Oooguruk Drillsite. However, in some years due to operational needs, they may need to build a longer alternate ice road. See Section 2.2 for more details.

Ice Roads, Ice Trails, and Ice Pads

An ice road is constructed to provide a route across sea ice; improved ice roads can be used by any wheeled vehicle, such as pick-up trucks, SUVs, buses, and other trucks to transport personnel and equipment to and from the site during the ice-covered period.

Snow is cleared and graded, and then holes are drilled in the ice to pump seawater across the surface until the desired thickness is achieved. Rig mats are used to bridge small leads and wet cracks during construction and maintenance. The desired thickness for ice roads varies. For example, ice roads in water greater than 10 feet deep must be 8 feet thick to support construction equipment. In other instances, a 6 foot thickness is sufficient. Often, a freshwater cap is put over the top layer to further strengthen the road. This is known as the free-flood method. Flooding occurs 24 hours a day, seven days a week, and is only halted in unsafe weather conditions.

Ice roads consist of a 60 to 100-foot roadway with 50 to 60-foot shoulders on either side. In total, ice road corridors range from 160 to 200 feet wide (Figure 1). Ice roads will be constructed at each of the three oil and gas operation sites.

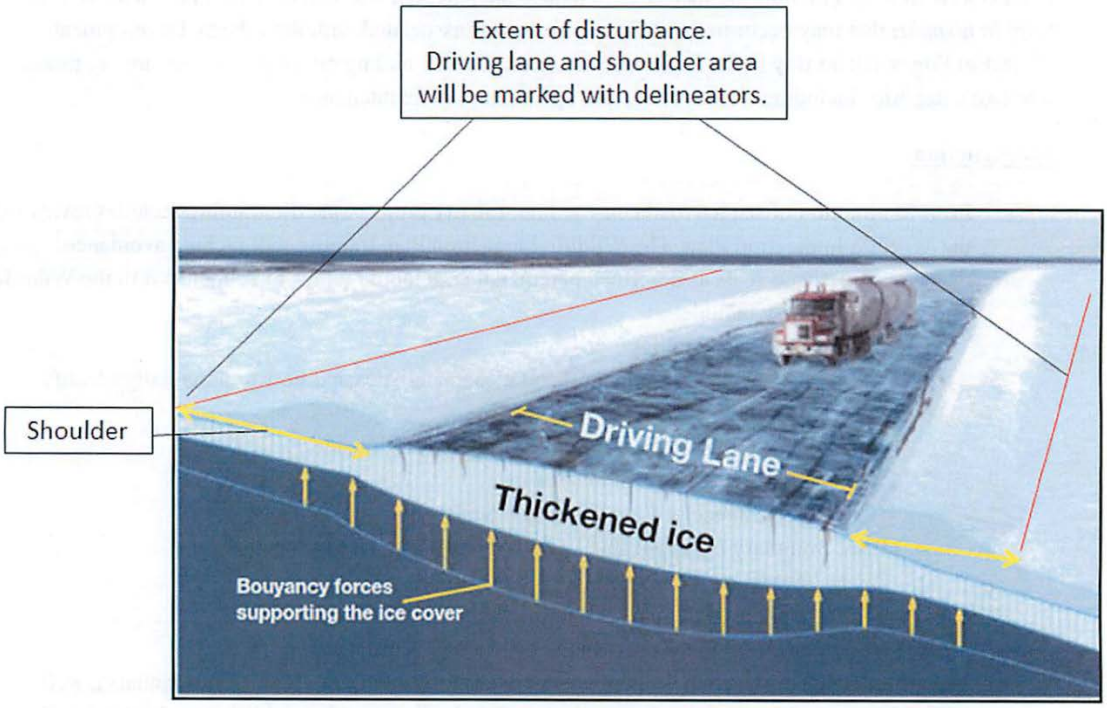

Figure 1. Sea ice road diagram.

Due to local differences, there are a few variations in how ice roads are constructed. One main difference is whether the ice road will be constructed on floating ice or grounded ice (land-based). Ice roads based on floating ice need to be flooded with seawater until they are the desired thickness, and then usually capped with a layer of freshwater. Ice roads on grounded ice typically need minimal freshwater flooding to either cap or repair cracks.

Maintenance of ice roads involves using graders with snow wings and blowers, front-end loaders with snow blower attachments, or personnel with snow blowers. Care is taken so that large berms or large piles of snow are not created adjacent to the road or on the shoulders. When snow blowing, wind direction is used to assist in dispersing the blown snow over a large area so that large berms or piles are not created. Delineators are used to mark the roadways. Corners of rig mats, steel plates, and other materials used to bridge sections of hazardous ice, are clearly marked or mapped using Global Positioning System (GPS) coordinates of the locations.

Hilcorp states that they may elect to not build an ice road in some years, depending on operational needs and weather condition. In those cases, an ice trail would be sufficient. Eni anticipates constructing ice roads every year.

Ice trails are a route across sea ice that is created, used, and maintained by tracked vehicles like Tuckers, Pisten Bullys®, and snow machines. Unlike ice roads, ice trails are not constructed using seawater flooding or a freshwater ice cap. Ice and snow are packed down by the large vehicles, and then allowed to thicken through natural freeze-up. Snow removal or large surface modifications are generally not required for ice trails. Ice trails vary in width, and as they serve as unimproved access corridors, are less elaborate than ice roads and narrower (e.g., 20 feet wide). Ice trails will be constructed for the Northstar Production Island operations, and the Spy Island Drillsite. Ice trails will not be necessary for operations at the Oooguruk Drillsite.

To work around unstable or unsafe areas of ice as the season progresses, Hilcorp and Eni may need to construct several shorter length trails into undisturbed areas. These detour trails may need to be constructed after March 1st, and typically deviate approximately 75 to 150 feet (23 to 46 m) from the original road to safely go around soft spots or cracks.

Ice pads are constructed similarly as ice roads. Eni will construct four ice pads—three at the Spy Island drillsite, and one at the Oooguruk drillsite. Two floating ice pads would serve as parking areas at Spy Island Drillsite. One would be located at the southeast side of the drillsite, measuring 500 by 200 feet (152 by 60 m), and the other at the northeast side of the drillsite 300 by 150 feet (91 by 46 m). The third ice pad would be a grounded ice pad staging area located at the Oliktok Point end of the ice road, measuring 600 by 450 feet (180 by 140 m). At the Oooguruk Drillsite, Eni would construct a grounded ice pad staging area measuring 600 by 450 feet (180 by 140 m).

Dates and Duration

Construction to build the ice roads would begin in late December or early January, depending on weather, and take approximately six weeks to build roads thick enough to travel by wheeled vehicles. All ice road, trail, and pad construction would be initiated before March 1st each year. Ice roads/trails/pads would be used and maintained through mid-May, when the ice becomes too unstable to access.

Timing and Area Restrictions

The timing and location of the on-ice activities and where activities may occur are based on the March 1st deadline and the water depth. Areas with water depths less than 10 feet (3 m) are not considered suitable habitat for ringed seal lairs or breathing holes, and so there are fewer

restrictions on what activities can occur in those areas. Ringed seals begin to establish lairs in late March. Therefore, Hilcorp and Eni will initiate ice road/trail/pad construction no later than March 1st to reduce the potential for disturbance to ringed seal birth lairs or dens. Initiating ice road/trail/pad construction activities before March 1st would prevent pregnant ringed seals from establishing lairs in the disturbed areas.

2.1.2 Mitigation Measures

To avoid and minimize impacts to species protected under the MMPA and the ESA, in particular ringed seals, Hilcorp and Eni worked with NMFS to develop mitigation measures that fall into four categories:

- Wildlife training;
- General mitigation measures (implemented throughout the ice road/trail/pad season, which occurs generally from December through May);
- Mitigation measures to be implemented after March 1st; and
- Reporting requirements.

The purposes of these measures are to:

- Minimize interactions with seals and to avoid takes by serious injury or mortality from the activities;
- Monitor seals within designated zones of influence in the project vicinity;
    - If seals are within the designated shutdown zone after March 1st, to initiate immediate pause of construction activities, making it very unlikely potential injury or serious mortality to seals would occur and ensuring that behavioral harassment of seals would be reduced to the lowest level practicable.
- Set forth the means by which the applicants must monitor ringed seals and report sightings, interactions, and serious injury or mortality.

Wildlife Training

Project personnel associated with ice road/trail/pad construction, maintenance, or use will receive annual training on seal avoidance before the season begins. This training will include seal avoidance mitigation measures that are appropriate for the work that they perform. During the training, project personnel will review the applicable sections of each company's Wildlife Interaction Plan (also referred to as a Wildlife Management Plan), which cover the following measures:

- Approaching or interacting with any wildlife is prohibited.
- When traveling the ice road/trail, follow directions of Security and posted signs.
- Notifications are required if a seal is observed within 50m (164 ft) or if a seal structure (i.e., breathing hole or lair) is observed within 150 m (about 500 ft) of the ice road/trail center line, or the edge of the ice pad or on the ice pad.

- Stay in the vehicle and continue safely on if a seal is observed near the ice road/trail/pad.

In addition, personnel will receive specific instruction on ringed seal identification, life history, habitat and diet requirements (including importance of lairs, breathing holes, and basking), ecology, local occurrence and presence in the project area, effects of disturbance, and applicable laws and regulatory requirements.

General Mitigation Measures

The general mitigation measures are based on the following assumptions:

- Ice road/trail/pad construction occurs from approximately December 1st to mid-February (or as soon as sea ice conditions allow safe access and permit such activity);
- Operations and maintenance generally occur from approximately mid-February through mid- to late May. Ringed seals begin to establish lairs in late March. Therefore, NMFS is requiring that ice road/trail/pad construction be initiated no later than March 1st to reduce the potential for disturbance to ringed seal birth lairs or dens; and
- Disturbance associated with construction prior to March 1st may deter pregnant seals from establishing lairs in the disturbed areas.

Winter sea ice road/trail/pad construction and use will begin prior to March 1st of each year (typically December through mid-February), which is before female ringed seals establish birthing lairs. Initiating on-ice activities early allows ringed seals to establish breathing holes and birthing lairs in undisturbed areas. Prior to establishing lairs, ringed seals are mobile and are expected to avoid the ice roads/trails/pads and construction activities.

The general mitigation measures will be implemented throughout the entire ice road/trail/pad season, including construction, maintenance, active daily use[1], and decommissioning:

- Ice road/trail speed limits will be no greater than 45 miles per hour; speed limits will be determined on a case-by-case basis based on environmental, road conditions, and ice road/trail longevity considerations. Travel on ice roads and trails is restricted to industry staff.
- Delineators will mark the roadway at a minimum, or more frequently than, quarter mile increments on both sides of the ice road to delineate the path of vehicle travel and areas of planned on-ice activities (e.g., emergency response exercises). Delineators may also be used to mark the centerline of the roadway.
    - Delineators will mark one side of an ice trail at a minimum, or more frequently than, quarter mile increments.
- Corners of rig mats, steel plates, and other materials used to bridge sections of hazardous ice will be clearly marked or mapped using GPS coordinates of the locations.

[1] There are periods during which ice road travel does not occur. During these periods, no activity would occur along the road and therefore, implementation of measures would not be necessary.

- Personnel will be instructed that approaching or interacting with ringed seals is prohibited.
- If personnel encounter a ringed seal while driving on the road/trail, they will be instructed to remain in the vehicle and safely continue.
- If a ringed seal is observed within 50 m (164 ft) of the center of an ice road or trail or within 50 m (164 ft) of the ice pad edge or on the ice pad, the company's Security personnel or staff member who observed the seal contacts the Environmental Specialist in accordance with the Wildlife Management Plan to provide the information requested in *Data Collection*. In addition:
    - The location of the seal will be physically marked with a visible marker while maintaining a distance of at least 15 m (50 ft) from the seal. However, markers will be placed in a way that avoids marker placement more than 15 m (50 ft) from the edge of the ice road/trail/pad.
    - The Environmental Specialist will relay the seal sighting location information to all ice road/trail/pad personnel and the company's office personnel responsible for wildlife interaction, following notification protocols described in the company-specific Wildlife Management Plan. All other data will be recorded and logged.
    - The Environmental Specialist or designated person will monitor the ringed seal to document the animal's location relative to the road/trail/pad. All work that is occurring when the ringed seal is observed and the behavior of the seal during those activities will be documented until the animal is at least 50 m (164 ft) away from the center of the ice road/trail or from the edge of the ice pad or until the animal is no longer observed.
    - The Environmental Specialist or designated person will contact appropriate state and federal agencies as required in the company-specific Wildlife Management Plans.

Mitigation Measures After March 1st

After March 1st, the mitigation measures for on-ice activities (i.e., ice road/trail/pad activities) are restricted by the water depth where the activity would occur (Table 2). On-ice activities could only occur on sea ice where water depth is less than 3 m (10 ft)—that is, in habitat not suitable for ringed seal ice lairs and breathing holes. These mitigation measures would be implemented after March 1st, and would continue until decommissioning of ice roads/trails/pads in late May or early June.

Table 2. Timing and location of on-ice activities after March 1st.

Timing of on-ice activities	Water Depth > 10 ft (3 m)	Water Depth < 10 ft (3 m)
After March 1st	On-ice activities can occur anywhere on sea ice	Activities must occur within the boundaries of the driving lane or shoulder area of the ice road/trail (or other previously disturbed areas)

The following measures are implemented after March 1st, in addition to the general monitoring measures described above:

- Ice road/trail/pad construction, maintenance, and decommissioning will be performed within the boundaries of the road/trail/pad and shoulders, with most work occurring within the driving lane.
    - Equipment travel will be limited to within the driving lane and shoulder areas to the extent practicable and when safety of personnel can be ensured.
- Ice road/trail/pad construction and maintenance activities will remain 50 m (164 ft) from a seal and 150 m (about 500 ft) from a seal structure (i.e., breathing holes and lairs) except under emergency conditions when blading or snow blowing is necessary.
- If blading or snow blowing must occur within 50 m (164 ft) from a seal or 150 m (about 500 ft) from a seal structure, operational measures will be used to avoid seal impacts, including the snow will first be pushed so that it is blown downwind of the animal or lair.
- Vehicles will not stop within 50 m (164 ft) of identified seals or within 150 m (about 500 ft) of known seal lairs.
- Tracked vehicle operation will be limited to the previously disturbed ice trail areas when safety of personnel can be ensured. When safety requires a new ice trail to be constructed after March 1st:
    - Construction activities such as drilling holes in the ice to determine ice quality and thickness will be conducted only during daylight with good visibility.
    - Ringed seal structures will be avoided by a minimum of 150 m (about 500 ft) during ice testing and new trail construction.
    - Any observed ringed seal structures will be reported and marked as described in *Reporting*.
    - Once the new ice trail is established, tracked vehicle operation will be limited to the disturbed area to the extent practicable and when safety of personnel is ensured.

Ringed Seal Survey Protocol

- When an ice road or trail is in active use[2], under daylight conditions with good visibility, a dedicated observer (not the vehicle operator) will conduct a survey along the sea ice road/trail to observe if any ringed seals are within 150 m (about 500 ft) of the roadway corridor. The following survey protocol will be implemented:
- Surveys will be conducted every other day during daylight hours. Survey protocol consists of driving the ice road/trail and stopping every ½ mile to observe the exposure area (170 m on either side; see *Exposure Calculations*) for approximately five minutes on either side of the corridor to check for the presence of seals.
- Observers for ice road/trail activities need not be trained Protected Species Observers, but they must have received the training described in *Wildlife Training* Section (above) and understand the applicable sections of the Wildlife Management Plan.
    - Observers must be capable of detecting, observing, and monitoring ringed seal presence and behaviors, and accurately and completely recording data.
- When performing observations, observers will have no other primary duty than to watch for and report observations related to ringed seals during the survey.
    - If the observer is driving a vehicle, then the survey must be performed when the driver stops, at periodic intervals sufficient to complete a thorough assessment of the area, given visibility conditions.
    - If weather conditions become unsafe, the observer may be removed from the monitoring activity.

Communication and Monitoring Procedures for Seal and Seal Structure Sightings

If a ringed seal is observed within 50 m (164 ft) or if a seal structure (i.e., breathing hole or lair) is observed within 150 m (about 500 ft) of the centerline of the ice road/trail; or the edge of the ice pad or on the ice pad, the location of the seal or seal structure will be reported to the Environmental Specialist, who will then relay the sighting location information to all ice road personnel. In addition, the company's office personnel responsible for wildlife interaction would be notified following protocols described in each company's specific Wildlife Interaction Plan (see also *Reporting*). The following procedures will also be followed:

- Construction, maintenance, or decommissioning activities associated with ice roads, trails, and pads will not occur within 50 m (164 ft) of the observed ringed seal, but may proceed as soon as the animal moves on its own more than 50 m (164 ft) from the activities or has not been observed within that area for at least 24 hours. Transport vehicles (i.e., vehicles not associated with construction, maintenance, or decommissioning) may continue their route within the designated road/trail without stopping.
- As soon as practicable after the initial sighting, the Environmental Specialist or designated person will observe the ringed seal for approximately 15 minutes to document

[2] Any days when there is no traffic on an ice road, monitoring for ringed seals will not occur in order to minimize potential for interactions with seals.

the animal's location relative to the road/trail/pad. All work that is occurring when the ringed seal is observed and the behavior of the seal during this observation period will be documented until the animal moves more than 50 m (164 ft) from the center of the road/trail, or more than 50 m (164 ft) from the edge of the ice pad, or is no longer observed. If the seal remains in the area after the 15-minute observation period, monitoring will continue every six hours during daylight conditions.

- If a ringed seal structure (i.e., breathing hole or lair) is observed within 150 m (about 500 ft) of the ice road/trail or within 150 m (about 500 ft) of the edge of the ice pad or is on the ice pad, the location of the structure will be reported to the Environmental Specialist who will then carry out notification protocol described above.
    - The seal structure will be marked by placing a pole and flag or other easily visible marker about 15 m (50 ft) from the location of the lair.
    - Monitoring will continue every six hours during daylight conditions on the day of the initial sighting to determine whether a ringed seal is present. Monitoring will consist of observing the structure from a distance of at least 150 m (about 500 ft) for approximately 15 minutes each time. After the first 24 hours, monitoring for the seal will occur every other day the ice road/trail/pad is being used unless it is determined the structure is not actively being used (i.e., a seal is not sighted at that location during monitoring). A lair or breathing hole does not automatically imply that a ringed seal is present.
    - During this monitoring period, maintenance work will proceed cautiously as to minimize impacts or disturbance to area.

Data Collection

The Environment Specialist, or designated person, will record the following information during survey efforts and sighting events:

- The date and start/stop time for each survey including effort in total number of hours of observation. This will include a summary of environmental conditions such as visibility that can affect ringed seal or lair detection;
- Date and time of each significant event (e.g., seal or seal structure sighting) and subsequent monitoring;
- Date, time, and duration for each sighting event;
- Number of animals per sighting event; and number of adults/juveniles/pups per sighting event;
- Primary, and, if observed, secondary behaviors of seals in each sighting event;
- Geographic coordinates for the observed animals or structure (breathing hole or lair), with the position recorded by using the most precise coordinates practicable (coordinates must be recorded in decimal degrees, or similar standard, and defined coordinate system); and
- Mitigation measures implemented to minimize impacts.

Reporting Requirements

Hilcorp and Eni propose to each submit an annual monitoring report within 90 days after the end of the ice road/trail/pad season to summarize the activities during ice road, trail, and pad construction, maintenance, use, and de-commissioning that occurred approximately December through May of that year. Records associated with any ringed seal observations and monitoring will be transmitted to NMFS prior to each subsequent ice road/trail/pad season (i.e., generally by late summer, prior to the subsequent ice road/trail/pad season).

If a specific mitigation or monitoring measure is implemented during the ice road/trail/pad activities (e.g., a breathing hole is monitored for seal presence), then a preliminary report of the activity will be submitted within 14 days after the cessation of that activity.

If a seal is observed within 50 m (164 ft) of the roadway or a seal structure (i.e., breathing hole or lair) is observed within 150 m (about 500 ft) of the roadway during ice road/trail activities or the edge of the ice pad or on the ice pad, then notification to the Environmental Specialist and other staff and agency personnel will be undertaken as described above.

Annual and Final Reports

Annual and final reports will be submitted via electronic mail to the appropriate NMFS staff including the NMFS AKR Protected Resources Division Supervisor and staff in OPR, Permits and Conservation Division in Silver Spring, Maryland.

Digital, query-able documents containing all observations and records, and digital, query-able reports will be submitted to: NMFS AKR Protected Resources Division Supervisor, Greg Balogh, at greg.balogh@noaa.gov and to OPR, Permits and Conservation Division, NMFS, and Shane Guan, at shane.guan@noaa.gov. In the event that this contact information becomes obsolete, call 907-271-5006 for updated reporting contact information.

Unforeseen Event Reports

In the unanticipated event that the specified activities along the ice road/trail/pad construction clearly causes the take of a marine mammal in a manner prohibited by this opinion's ITS or by the LOA, such as an unforeseen injury or mortality to a pinniped, the observer will report the incident to the Environmental Specialist, in accordance with their Wildlife Interaction/Management Plan, who would then relay that information to the OPR, Permits and Conservation Division, NMFS, and NMFS AKR Protected Resources Division (contact information provided above). This communication would occur as soon as practicable. A report documenting the incident would include:

- Time, date, and location (latitude/longitude) of the incident;
- Description of the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, and visibility);
- Species identification or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if equipment is available).

In the event that an observer or Hilcorp or Eni discovers an injured or dead marine mammal, the cause of the injury or death is unknown, and the death is relatively recent (i.e., in less than a moderate state of decomposition), the incident would be reported to the OPR, Chief of the Permits and Conservation Division, NMFS in Silver Spring, Maryland (301-427-8401) and the Marine Mammal Network Alaska Stranding Coordinator in Alaska (Phone number 1-877-925-7773 or 1-877-9-AKR-PRD), as soon as practicably possible. The report would include the same information identified in the paragraph above. Activities would be allowed to continue while NMFS reviews the circumstances of the incident. NMFS would work with Hilcorp or Eni to determine whether modifications in the activities are appropriate.

Under such circumstances that the injury or death is not associated with or related to the project activities addressed in this opinion or authorized in the LOA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), the incident would be reported to the OPR, Chief of the Permits and Conservation Division, NMFS or by email to the Alaska Stranding Coordinator within 24 hours of the discovery. Photographs, video footage (if available), and any other documentation of the stranded animal sighting will be provided to NMFS and the Marine Mammal Stranding Network.

2.2 Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). For this reason, the action area is typically larger than the project area and extends out to a point where no measurable effects from the proposed action occur.

The action area for this opinion will include oil and gas operation sites on the North Slope, Alaska, in the coastal waters of the Beaufort Sea, as described in more detail below. Hilcorp and Eni will construct and maintain ice roads and trails between their respective drillsites, dock, and production pad in support of their oil and gas operations (Figure 2). Hilcorp's activities will take place at the Northstar Production Island area. Eni is proposing ice road, trail, and pad construction at two locations: the Spy Island Drillsite, and Oooguruk Drillsite.

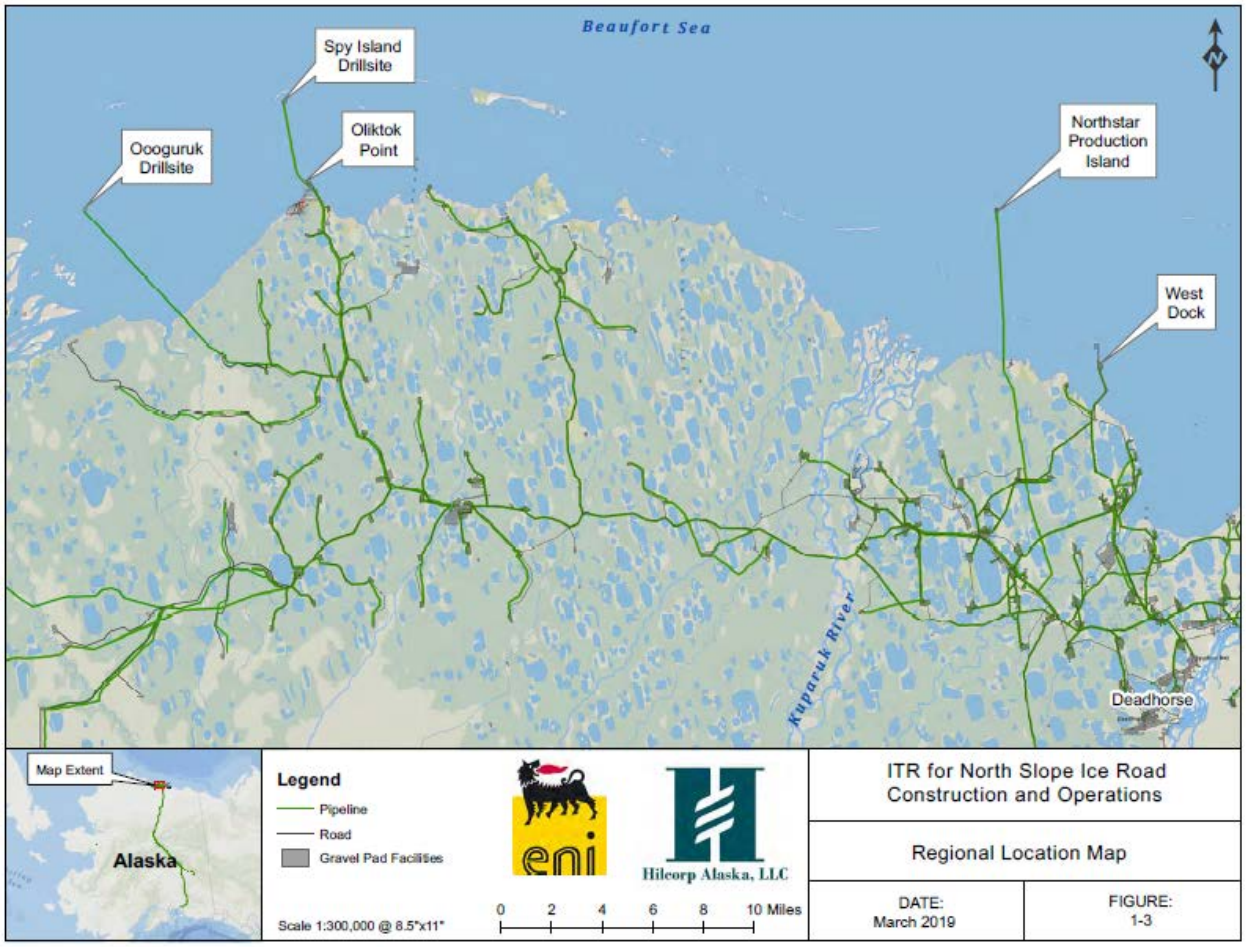

Figure 2. Regional action area map for Hilcorp and Eni's oil and gas operations on the North Slope of Alaska in the Beaufort Sea.

The action area for the ice roads and trails includes corridors extending 170 meters (558 feet) from each side of the center line. This figure was based on the recommended monitoring distance developed in conjunction with NMFS, and is considered the extent of the disturbance for seal structures (i.e., lairs and breathing holes) from ice road, trail, and pad activities.

Hilcorp Northstar Production Island Action Area

Hilcorp will construct ice roads and ice trails for its Northstar Production Island to and from the island, the Northstar valve pad, and the West Dock (Figure 3). The Northstar Production Island is an artificial gravel island about 6 miles (9.7 km) offshore in waters 39 feet (12 m) deep.

There are a total of 7.3 miles (11.7 km) of ice roads proposed at the Northstar site, and 14.55 miles (23.3 km) of ice trails. The ice road would provide access from the West Dock to the Northstar Production Island, while the ice trails would connect the production island to the Northstar valve pad, and the valve pad to the West Dock. There would also be an ice trail going around the West Dock providing additional access to the ice road. The ice trails are as follows:

- Along the pipeline corridor from the valve pad near the Dew Line Site to Northstar Production Island (5.93 miles, 9.5 km),
- From West Dock to the pipeline shore crossing (grounded ice along the coastline [4.82 miles, 7.8 km]), and
- Two unimproved ice road paths from the hovercraft tent at Dockhead 2. One would go under the West Dock causeway bridge to Dockhead 3 (0.9 miles, 1.4 km) and the other would go around West Dock and intersect the main road north of the Seawater Treatment Plant (2.9 miles, 4.6 km).

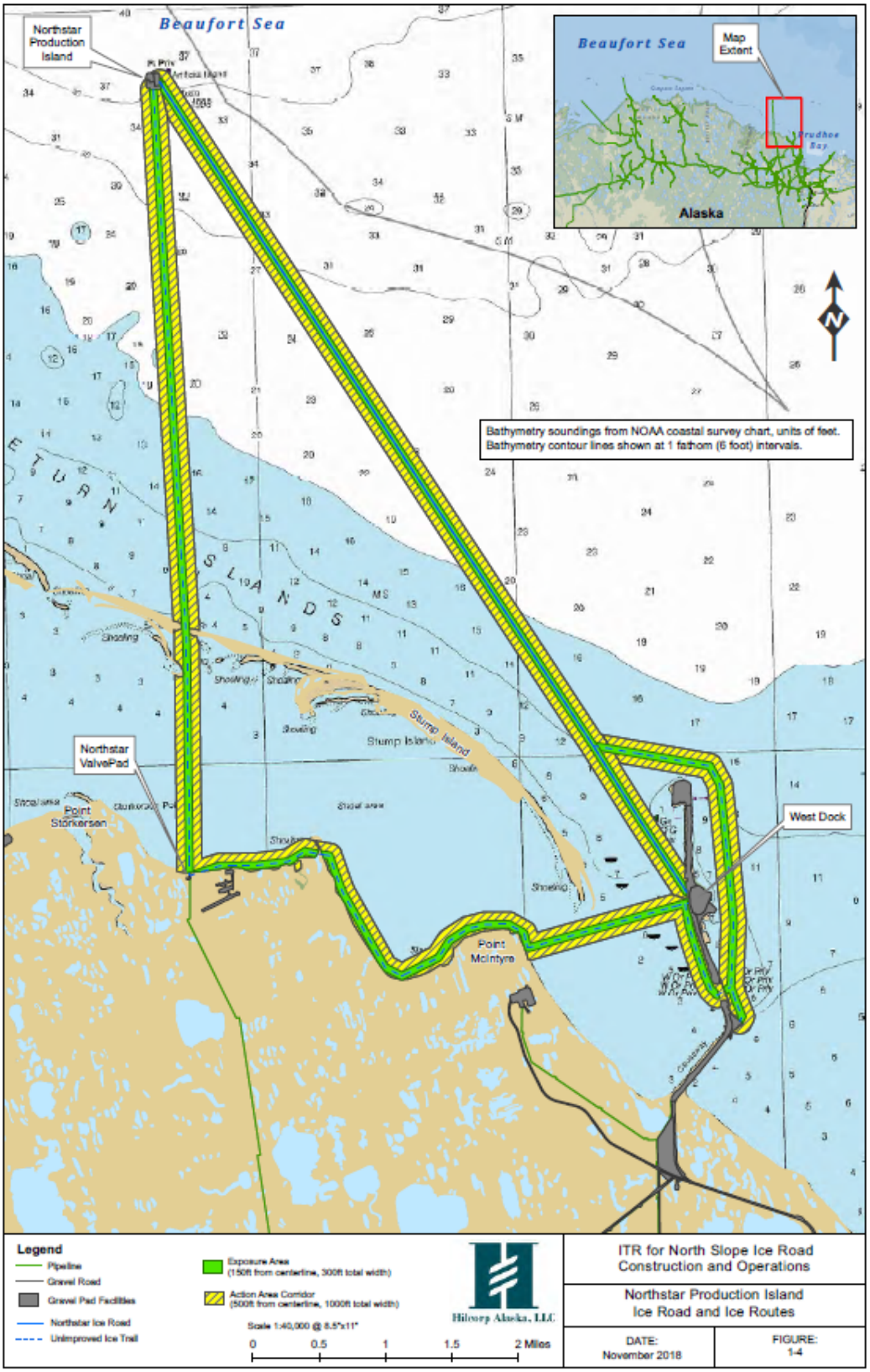

Figure 3. Map of Hilcorp's proposed ice roads and trails for its Northstar Production Island.

Eni Spy Island Drillsite to Oliktok Point Production Pad Action Area

About 4.2 miles (6.8 km) of ice road would be constructed at the Spy Island Drillsite, an artificial gravel island in 6 to 8 feet (1.8 to 2.4 m) of water. The road would go from the Spy Island Drillsite to the Oliktok Production Pad (Figure 4). The Oliktok Production Pad is in about 4 to 6 feet (1.2 to 1.8 m) of water.

At the Spy Island Drillsite, Eni is planning to construct an ice trail approximately 50 to 100 feet (15 to 30 m) west of the ice road, making it within the ice road's 500-foot action area, and thus accounted for in the exposure estimates. This ice trail would only be used temporarily, until the ice road is open to regular traffic. After March 1st, due to safety considerations, Eni may also need to use several shorter length trails in undisturbed areas to work around unstable and unsafe areas of ice as the season progresses. These work-around or detour trails allow PistenBullys® and other tracked vehicles to safely go around soft spots or cracks.

The ice road would have both floating and grounded ice sections. The first 800 feet (244 m) of the ice road from shore would be on grounded ice. Eni also is proposing to construct three ice pads at the Spy Island Drillsite. Two ice pads would be on floating ice, and the third would be on grounded ice. One floating ice pad would be on the southeast side of Spy Island (500 by 200 feet), and the other floating ice pad would be on the northeast side of the drillsite, and measure 300 by 150 feet. The grounded ice pad would by at the Oliktok Point end of the ice road.

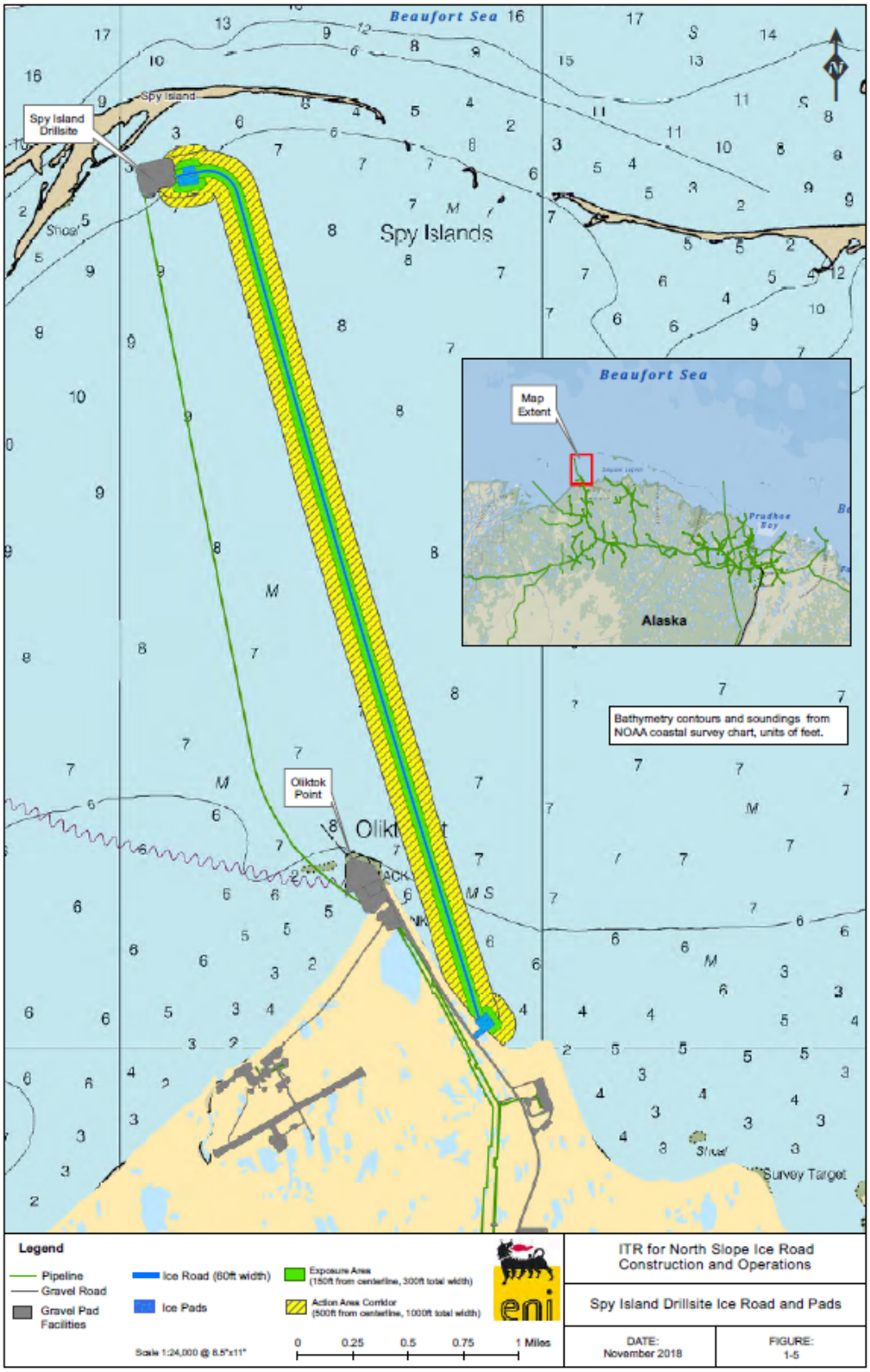

Figure 4. Map of Eni's proposed ice road construction around the Spy Island Drillsite.

Eni Oooguruk Action Area

At the Oooguruk Drillsite, Eni is proposing two possible scenarios: a 5.5 mile (8.9 km) ice road from offshore to the drillsite (Figure 5), and an alternative ice road, 7 miles (11.2 km) in length (Figure 6), that would be built in years when an early road completion is necessary, or when operations require heavy equipment like a drilling rig. Under those circumstances, this alternate ice road would be built instead of the 8.9 km ice road. Either ice road would be the same width (150 feet total (45.7 m)—about 50-foot (15 m) road with a 50-foot shoulder on either side). Oooguruk Drillsite does not require offshore ice trails. However, a coastal trail in very shallow water right off the beach is occasionally needed between Oliktok and the Oooguruk Drillsite. (Both drillsites are operated by Eni.)

The Oooguruk Drillsite is located in 4 to 6 feet of water (1.2 to 1.8 m). The area from the site to the shore typically becomes grounded landfast ice in winter, so the proposed ice roads would be located in grounded ice. There is one small area near the Coleville River that has an open lead for a short duration in December, but freezes solid within a few weeks.

Eni would also construct a grounded ice pad staging area on the southwest edge of the Oooguruk Drillsite, measuring 600 by 450 feet (180 by 140 m). The ice pad would be constructed in both of the proposed or alternative ice road scenarios. Ice bridges or rig mats are not required for construction or maintenance of the ice road or ice pad staging area.

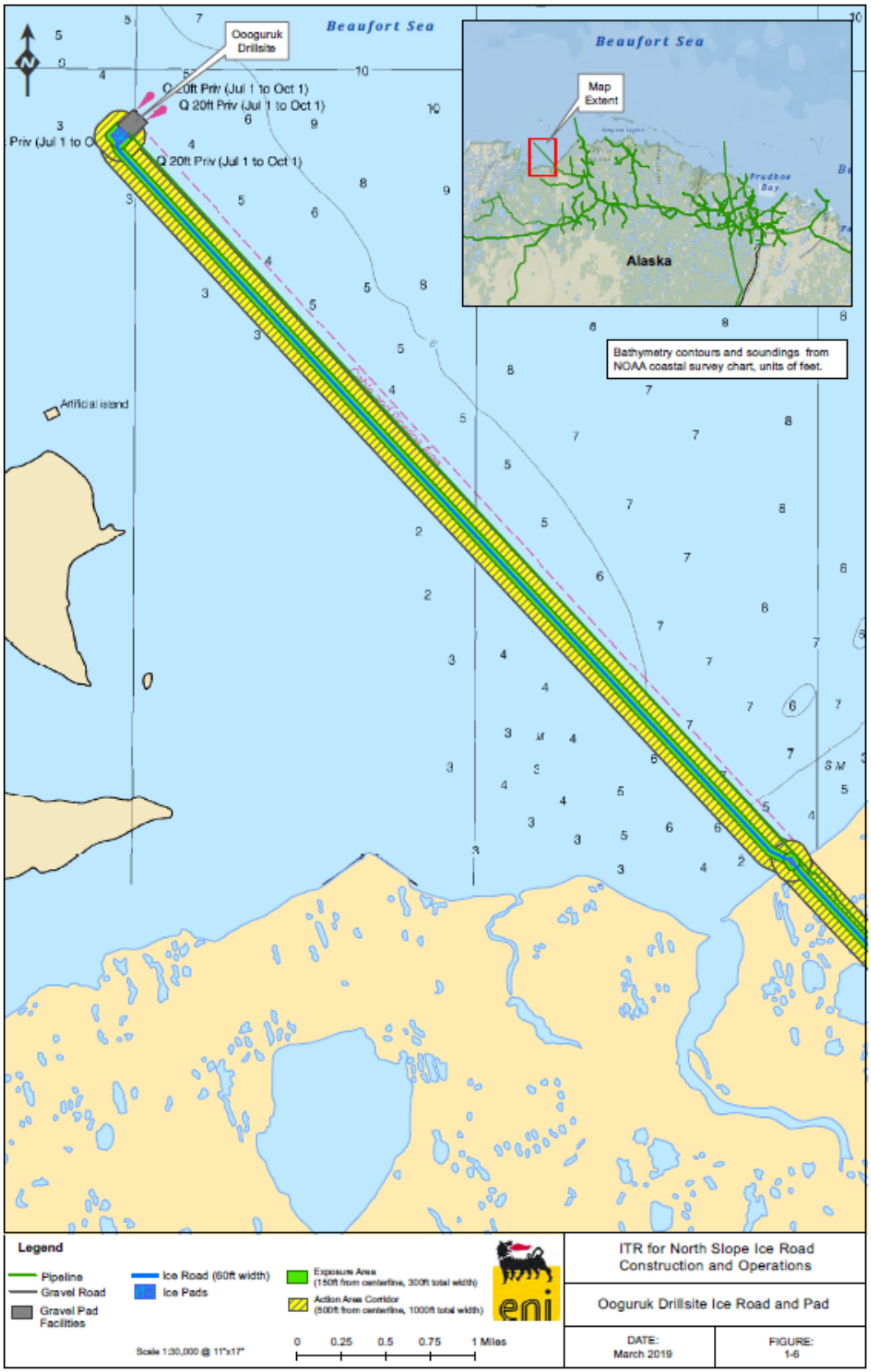

Figure 5. Map of Eni's proposed ice road construction at the Oooguruk Drillsite.

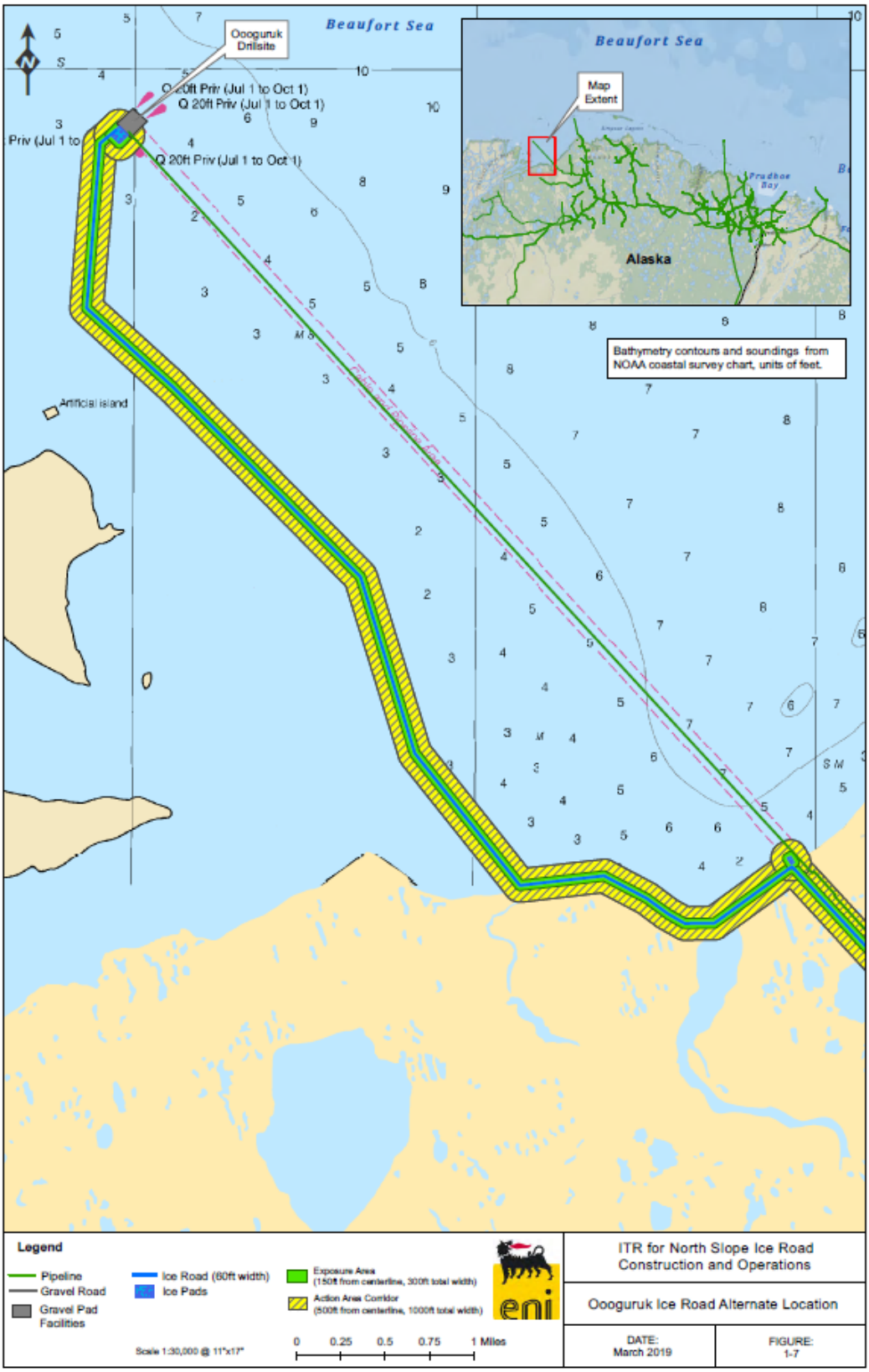

Figure 6. Map of Eni's proposed alternative ice road construction at the Oooguruk Drillsite.

3. APPROACH TO THE ASSESSMENT

Section 7(a)(2) of the ESA requires Federal agencies, in consultation with NMFS, to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. The jeopardy analysis considers both survival and recovery of the species. The adverse modification analysis considers the impacts to the conservation value of the designated critical habitat.

"To jeopardize the continued existence of a listed species" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR § 402.02). As NMFS explained when it promulgated this definition, NMFS considers the likely impacts to a species' survival as well as likely impacts to its recovery. Further, it is possible that in certain, exceptional circumstances, injury to recovery alone may result in a jeopardy biological opinion (51 FR 19926, 19934; June 3, 1986).

Under NMFS's regulations, the destruction or adverse modification of critical habitat means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species (50 CFR § 402.02).

There is no designated critical habitat within the action area, so none will be considered in this biological opinion.

We use the following approach to determine whether the proposed action described in Section 2 of this opinion is likely to jeopardize listed species:

- Identify those aspects (or stressors) of the proposed action that are likely to have effects on listed species. As part of this step, we identify the action area – the spatial and temporal extent of these effects.
- Identify the rangewide status of the species likely to be adversely affected by the proposed action. This section describes the current status of each listed species relative to the conditions needed for recovery. Species status is discussed in Section 4 of this opinion.
- Describe the environmental baseline including: past and present impacts of Federal, state, or private actions and other human activities *in the action area*; anticipated impacts of proposed Federal projects that have already undergone formal or early section 7 consultation, and the impacts of state or private actions that are contemporaneous with the consultation in process. The environmental baseline is discussed in Section 5 of this opinion.
- Analyze the effects of the proposed actions. Identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence (these represent our *exposure analyses*). In this step of our analyses, we try to identify the number, age (or life stage), and gender of the individuals that are likely to be exposed to stressors and the populations or subpopulations those individuals represent. NMFS also

evaluates the proposed action's effects on critical habitat features. The effects of the action are described in Section 6 of this opinion with the exposure analysis described in Section 6.2 of this opinion.

- Once we identify which listed species are likely to be exposed to an action's effects and the nature of that exposure, we examine the scientific and commercial data available to determine whether and how those listed species are likely to respond given their exposure (these represent our *response analyses*). Response analysis is considered in Section 6.3 of this opinion.
- Describe any cumulative effects. Cumulative effects, as defined in NMFS's implementing regulations (50 CFR § 402.02), are the effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area. Future Federal actions that are unrelated to the proposed action are not considered because they require separate section 7 consultation. Cumulative effects are considered in Section 7 of this opinion.
- Integrate and synthesize the above factors to assess the risk that the proposed action poses to species. In this step, NMFS adds the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to assess whether the action could reasonably be expected to: (1) appreciably reduce the likelihood of both survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat for the conservation of the species. These assessments are made in full consideration of the status of the species and critical habitat (Section 4). Integration and synthesis with risk analyses occurs in Section 8 of this opinion.
- Reach jeopardy conclusion. Conclusions regarding jeopardy are presented in Section 9. These conclusions flow from the logic and rationale presented in the Integration and Synthesis Section 8.
- If necessary, define a reasonable and prudent alternative to the proposed action. If, in completing the last step in the analysis, NMFS determines that the action under consultation is likely to jeopardize the continued existence of listed species, NMFS must identify a reasonable and prudent alternative (RPA) to the action.

4. RANGEWIDE STATUS OF THE SPECIES AND CRITICAL HABITAT

Five species of marine mammals listed under the ESA under NMFS's jurisdiction may occur in the action area. There is no designated critical habitat within the action area. This opinion considers the effects of the proposed action on these species and designated critical habitats (Table 3).

Table 3. Listing status and critical habitat designation for marine mammals considered in this opinion.

Species	Status	Listing	Critical Habitat
Bowhead Whale *Balanea mysticetus*	Endangered	NMFS 1970, 35 FR 18319	Not designated
Humpback Whale, Western North Pacific DPS (*Megaptera novaeangliae*)	Endangered	NMFS 1970, 35 FR 18319 NMFS 2016, 81 FR 62260	Not designated
Humpback Whale, Mexico DPS (*Megaptera novaeangliae*)	Threatened	NMFS 1970, 35 FR 18319 NMFS 2016, 81 FR 62260	Not designated
Bearded Seal, Beringia DPS *Erignathus barbatus nauticus*	Threatened	NMFS 2012, 77 FR 76740	Not designated
Ringed Seal, Arctic DPS (*Phoca (pusa) hispida*)	Threatened	NMFS 2012, 77 FR 76706	Not designated

4.1 Species and Critical Habitat Not Likely to be Adversely Affected

Bowhead whales occur in the Beaufort Sea near the action area. Humpback whales (Western North Pacific and Mexico DPS) could occur in the Beaufort Sea. Bowhead whales spend the winter months near the southern edge of the pack ice and move north as the sea ice recedes and breaks up. Humpback whales migrate to Alaskan waters in the summer to feed, and then move to southerly latitudes in winter to mate and calve. Since the proposed action will take place in the ice-covered months when these whales are not likely to be present, we consider exposure (and therefore any effects) to be extremely unlikely. We conclude that bowhead whales and Western North Pacific and Mexico DPS humpback whales are not likely to be adversely affected by the proposed action.

Bearded seals are present in the Beaufort Sea and could be exposed to the proposed action. The ice road and trail activities will take place over land and in waters up to 12 m deep (39 ft) on nearshore or shorefast ice. Bearded seals preferentially occupy areas of moving ice and open water in depths of up to 200 m (656 ft) (Burns and Harbo Jr 1972). Because bearded seals occur in deeper water and on different types of ice than where the action will take place, we consider exposure (and therefore any effects) to be extremely unlikely. We conclude that Beringia DPS bearded seals are not likely to be adversely affected by the proposed action.

There is no critical habitat designated in the action area; thus none will be affected.

4.2 Climate Change

One threat is or will be common to all of the species we discuss in this opinion: global climate change. Because of this commonality, we present this narrative here rather than in the species-specific narrative that follows.

There is widespread consensus within the scientific community that atmospheric temperatures are increasing and that this will continue for at least the next several decades (Watson and Albritton 2001, Oreskes 2004). There is also consensus within the scientific community that this warming trend will alter current weather patterns and patterns associated with climatic phenomena, including the timing and intensity of extreme events such as heat waves, floods, storms, and wet-dry cycles. Warming of the climate system is unequivocal, as is evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (Pachauri and Reisinger 2007).

The Intergovernmental Panel on Climate Change (IPCC) estimated that since the mid-1800s, average global land and sea surface temperature has increased by 0.6°C (±0.2°C), with most of the change occurring since 1976. This temperature increase is greater than what would be expected given the range of natural climatic variability recorded over the past 1,000 years (Crowley 2000). The IPCC reviewed computer simulations of the effect of greenhouse gas emissions on climate variations recorded in the past and evaluated the influence of natural phenomena such as solar and volcanic activity. Based on its review, the IPCC concluded that natural phenomena are insufficient to explain the increasing trend in land and sea surface temperature, and that most of the warming observed over the last 50 years, including substantial warming in the Arctic, is likely to be attributable to human activities (Stocker et al. 2013). In addition, anthropogenic forcings are very likely to have contributed to Arctic sea ice loss since 1979 (Stocker et al. 2013).

Continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century (Watson and Albritton 2001).

The average annual surface air temperature anomaly over land north of 60°N latitude in October 2016 through September 2017 was the second highest (after 2015 and 2016) in the observational

record, which begins in 1900 (Overland et al. 2017). The average global surface temperature rose by 0.85ºC from 1880 to 2012, and it continues to rise at an accelerating pace (IPCC 2014); the 15 warmest years on record since 1880 have occurred in the 21st century (NCEI 2016). 2016 is the warmest year on record, followed by 2019 as the second warmest. The warmest year on record for global sea surface temperature was also 2016, followed by 2019 as the second warmest.[3] Since 2000, the Arctic (latitudes between 60ºN and 90ºN) has been warming at more than twice the rate of lower latitudes because of "Arctic amplification," a characteristic of the global climate system influenced by changes in sea ice extent, atmospheric and oceanic heat transports, cloud cover, black carbon, and many other factors (Serreze and Barry 2011, Overland et al. 2017).

In the first decade of the 21st century, Arctic sea ice thickness and annual minimum sea ice extent (i.e., September sea ice extent) declined at a considerably accelerated rate, and approximately three-quarters of summer Arctic sea ice volume has been lost since the 1980s (IPCC 2013). From 1981 through 2012, the annual minimum extent of perennial and multi-year ice declined by 12 percent and 15 percent, respectively (Comiso 2012). The minimum ice extent reached a record low in 2007 and 2012, when it was 37 percent and 49 percent lower than in the earlier 1979 to 2000 reference period, respectively. Wang and Overland (2009) estimated that the Arctic will be nearly ice-free (i.e., sea ice extent will be less than 1 million square kilometers [km^2]) during the summer between the years 2021 to 2043.

The National Snow and Ice Data Center (NSIDC) reported that the Arctic sea ice extent for March 2018 averaged 14.30 million km^2 (5.52 million square miles [mi^2]), the second lowest in the 1979 to 2018 satellite record. This was 1.13 million km^2 (436,300 mi^2) below the 1981 to 2010 average and 30,000 km^2 (11,600 mi^2) above the record low March extent in 2017. Sea ice extent at the end of March 2018 was far below average in the Bering Sea, as it was in the previous several months, and was slightly below average in the far northern Atlantic Ocean and Barents Sea (NSIDC 2018).

Climate change is projected to have substantial direct and indirect effects on individuals, populations, species, and the structure and function of marine, coastal, and terrestrial ecosystems in the foreseeable future (Houghton 2001, McCarthy 2001, Parry 2007). Effects of climate change on physical aspects of the marine environment include, among others, increases in atmospheric temperatures; decreases in sea ice; and changes in sea surface temperatures, oceanic pH, patterns of precipitation, and sea level. Such changes have impacted, are impacting, and will continue to impact marine species in a variety of ways, such as (IPCC 2014):

- Shifting abundances
- Changes in distribution
- Changes in timing of migration
- Changes in periodic life cycles of species

Thinning and reduced coverage of Arctic sea ice are likely to substantially alter ecosystems that are in close association with sea ice (Loeng et al. 2005). For example, variations in the recruitment of krill (*Euphausia superba*) and the reproductive success of krill predators has been linked to variations in sea-surface temperatures and the extent of sea-ice cover during the winter

[3] https://www.ncei.noaa.gov/news/global-climate-201912

months.
Climate change is likely to have its most pronounced effects on species whose populations are already in tenuous positions (Isaac 2009). Therefore, we expect the extinction risk of at least some ESA-listed species to rise with global warming. Cetaceans with restricted distributions linked to water temperature may be particularly exposed to range restriction (Learmonth et al. 2006, Isaac 2009). Macleod (2009) estimated that, based on expected shifts in water temperature, 88 percent of cetaceans will be affected by climate change, 47 percent will be negatively affected, and 21 percent will be put at risk of extinction. Of greatest concern are cetaceans with ranges limited to non-tropical waters, and preferences for shelf habitats (Macleod 2009).

Bowhead whales are dependent on sea-ice organisms for feeding and polynyas for breathing, so the early melting of sea ice may lead to an increasing mismatch in the timing of these sea-ice organisms and secondary production (Loeng et al. 2005). However, George et al. (2006) showed that landed bowheads had better body condition during years of light ice cover. Shelden et al. (2003) noted that there is a high probability that bowhead abundance will increase under a warming global climate (see Section 5.10 for additional information).

The depth and duration of snow cover are projected to decline substantially throughout the range of the Arctic ringed seal, reducing the areas with suitable snow depths for their lairs by an estimated 70 percent by the end of this century (Hezel et al. 2012). The persistence of this species will likely be challenged as decreases in ice and, especially, snow cover lead to increased juvenile mortality from premature weaning, hypothermia, and predation (Cameron et al. 2010, Kelly et al. 2010). It is likely that, within the foreseeable future, the number of ringed seals will decline substantially, and they will no longer persist in substantial portions of their range (Cameron et al. 2010, Kelly et al. 2010). The persistence of Beringia DPS bearded seals will likely be challenged as reduction in the timing and extent of sea ice lead to spatial separation of sea ice from shallow feeding areas and decreases in ice suitable for molting and pup maturation, which will likely compromise their reproductive and survival rates (Cameron et al. 2010).

4.3 Status of Listed Species

This opinion examines the status of each species that is likely to be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' current "reproduction, numbers, or distribution" as described in 50 CFR § 402.02.

This section consists of a narrative for the one threatened species that occurs in the action area and that is likely to be adversely affected by the proposed action. We present a summary of information on the population structure and distribution to provide a foundation for the exposure analyses that appear later in this opinion. Then we summarize information on the threats to the species and the species' status given those threats to provide points of reference for the jeopardy determination we make later in this opinion. That is, we rely on a species' status and trend to determine whether or not an action's effects are likely to increase the species' probability of becoming extinct.

4.3.1 Ringed Seals—Arctic DPS

Under the MMPA, NMFS recognizes one stock of Arctic ringed seals, the Alaska stock, in U.S. waters (and the action area). The Arctic ringed seal was listed as threatened under the ESA on December 28, 2012, primarily due to expected impacts on the population from declines in sea ice and snow cover stemming from climate change within the foreseeable future (77 FR 76706). Ringed seal population surveys in Alaska have used various methods and assumptions, incompletely covered their habitats and range, and were conducted more than a decade ago; therefore, current and comprehensive abundance estimates or trends for the Alaska stock are not available. Frost et al. (2004) conducted aerial surveys within 40 km (25 mi) of shore in the Alaska Beaufort Sea during May and June from 1996 through 1999 and observed ringed seal densities ranging from 0.81 seals per square kilometer in 1996 to 1.17 seals per square kilometer in 1999. Moulton et al. (2002b) conducted similar, concurrent surveys in the Alaska Beaufort Sea between 1997 and 1999 but reported substantially lower ringed seal densities than Frost et al. (2004). The reason for this disparity was unclear (Frost et al. 2004). Bengtson et al. (2005) conducted aerial surveys in the Alaska Chukchi Sea during May and June of 1999 and 2000.

While the surveys were focused on the coastal zone within 37 km (23 mi) of shore, additional survey lines were flown up to 185 km (115 mi) offshore. Population estimates were derived from observed densities corrected for availability bias using a haul-out model from six tagged seals. Ringed seal abundance estimates for the entire survey area were 252,488 (standard error = 47,204) in 1999 and 208,857 (standard error = 25,502) in 2000. Using estimates from surveys by Bengtson et al. (2005) and Frost et al. (2004) in the late 1990s and 2000, Kelly et al. (2010) estimated the total population in the Alaska Chukchi and Beaufort seas to be at least 300,000 ringed seals. This estimate is likely an underestimate since the Beaufort Sea surveys were limited to within 40 km from shore.

Though a reliable population estimate for the entire Alaska stock is not available, research programs have recently developed new survey methods and partial, but useful, abundance estimates. In spring of 2012 and 2013, U.S. and Russian researchers conducted image-based aerial abundance and distribution surveys of the entire Bering Sea and Sea of Okhotsk (Moreland et al. 2013). The data from these surveys are still being analyzed, but for the U.S. portion of the Bering Sea, Boveng et al. (2017) reported model-averaged abundance estimates of 186,000 and 119,000 ringed seals in 2012 and 2013, respectively. It was noted that these estimates should be viewed with caution because a single point estimate of availability (haul-out correction factor) was used and the estimates did not include ringed seals in the shorefast ice zone, which was surveyed using a different method. The authors suggested that the difference in seal density between years may reflect differences in the numbers of ringed seals using Russian versus U.S. waters between years, and they noted that if this was the case, the eventual development of comprehensive estimates of abundance for ringed seals in the Bering Sea that incorporate data in Russian waters may show less difference between years.

Distribution

Arctic ringed seals have a circumpolar distribution and are found throughout the Arctic basin and in adjacent seasonally ice-covered seas. They remain with the ice most of the year and use it as a haul-out platform for resting, pupping, and nursing in late winter to early spring, and molting in late spring to early summer. During summer, ringed seals range hundreds to thousands of kilometers to forage along ice edges or in highly productive open-water areas (Harwood and Stirling 1992, Freitas et al. 2008, Kelly et al. 2010, Harwood et al. 2015). Harwood and Stirling (1992) reported that in late summer and early fall, aggregations of ringed seals occurred in open-water in some parts of their study area in the southeastern Canadian Beaufort Sea where primary productivity was thought to be high. Harwood et al. (2015) also found that in the fall, several satellite-tagged ringed seals showed localized movements offshore east of Point Barrow in an area where bowhead whales are known to concentrate in the fall to feed on zooplankton. With the onset of freeze-up in the fall, ringed seal movements become increasingly restricted. Seals that have summered in the Beaufort Sea are thought to move west and south with the advancing ice pack, with many seals dispersing throughout the Chukchi and Bering Seas while some remain in the Beaufort Sea (Frost and Lowry 1984, Crawford et al. 2012, Harwood et al. 2012). Some adult ringed seals return to the same small home ranges they occupied during the previous winter (Kelly et al. 2010).

Occurrence in the Action Area

Ringed seals are resident in the Beaufort Sea year-round, and based on results of previous surveys in Foggy Island Bay (Aerts et al. 2008, Funk et al. 2008, Savarese et al. 2010, Smultea et al. 2014), and monitoring from Northstar Island (Aerts and Richardson 2009, 2010), they are expected to be the most commonly occurring pinniped in the action area year-round.

Ringed seals are present in the nearshore Beaufort Sea waters and sea ice year-round, maintaining breathing holes and excavating subnivean lairs in the landfast ice (e.g., landward of Stamukhi Shoal) during the ice-covered season. Ringed seals overwinter in the landfast ice in and around the action area.

There is some evidence indicating that ringed seal densities are low in water depths of less than 3 m, where landfast ice extending from the shoreline generally freezes to the sea bottom in very shallow waters during the course of the winter (Moulton et al. 2002a, Moulton et al. 2002b, Richardson and Williams 2003). Ringed seal movements during winter and spring are typically quite limited, especially where ice cover is extensive (Kelly et al. 2010). During April to early June (the reproductive period), radio-tagged ringed seals inhabiting shorefast ice near Prudhoe Bay had home range sizes generally less than 1,336 ac (500 ha) in area (Kelly et al. 2005). Limited data are available on ringed seal densities in the southern Beaufort Sea during the winter months; however, ringed seal winter ecology studies conducted in the 1980s (Kelly et al. 1986, Frost and Burns 1989) and surveys associated with the Northstar development (Williams et al. 2001) provide information on both seal ice-structure use (where ice structures include both breathing holes and subnivean lairs) and the density of ice structures.

Kelly et al. (1986) found that in the southern Beaufort Sea and Kotzebue Sound, radio-tagged seals used between 1 and at least 4 subnivean lairs. The distances between lairs was up to 4 km (10 mi), with numerous breathing holes in-between (Kelly et al. 1986). While Kelly et al. (1986) calculated the average number of lairs used per seal to be 2.85, they also suggested that this was

likely to be an underestimate. In spring, ringed seals abandon their lairs and are hauled out on the ice (Kelly et al. 2010).

Feeding, Diving, Hauling out, and Social Behavior

Ringed seal pups are born and nursed in the spring (March through May), normally in subnivean birth lairs, with the peak of pupping occurring in early April (Frost and Lowry 1981). Subnivean lairs provide thermal protection from cold temperatures, including wind chill effects, and some protection from predators (Smith and Stirling 1975, Smith 1976). These lairs are especially important for protecting pups. Arctic ringed seals appear to favor shore-fast ice for whelping habitat. Ringed seal whelping has also been observed on both nearshore and offshore drifting pack ice (e.g., (Lentfer 1972)). Seal mothers continue to forage throughout lactation, and move young pups between lairs within their network of lairs. The pups spend time learning diving skills, using multiple breathing holes, and nursing and resting in lairs (Smith and Lydersen 1991, Lydersen and Hammill 1993). After a 5 to 8 week lactation period, pups are weaned (Lydersen and Hammill 1993, Lydersen and Kovacs 1999).

Mating is thought to take place under the ice in the vicinity of birth lairs while mature females are still lactating (Kelly et al. 2010). Ringed seals undergo an annual molt (shedding and regrowth of hair and skin) that occurs between mid-May to mid-July, during which time they spend many hours hauled out on the ice (Reeves 1998). The relatively long periods of time that ringed seals spend out of the water during the molt have been ascribed to the need to maintain elevated skin temperatures during new hair growth (Feltz and Fay 1966). Figure 7 summarizes the approximate annual timing of Arctic ringed seal reproduction and molting (Kelly et al. 2010).

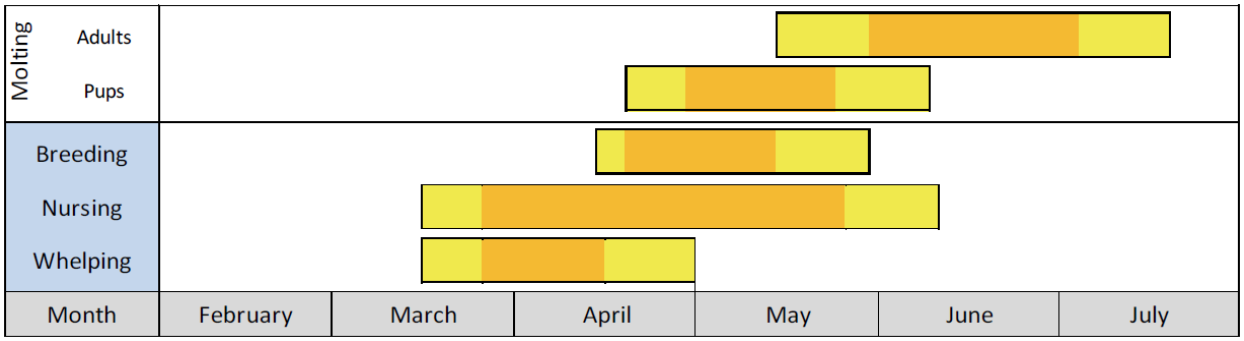

Figure 7. Approximate annual timing of Arctic ringed seal reproduction and molting. Yellow bars indicate the "normal" range over which each event is reported to occur and orange bars indicate the "peak" timing of each event (Kelly et al. 2010).

Ringed seals tend to haul out of the water during the daytime and dive at night during the spring to early summer breeding and molting periods, while the inverse tended to be true during the late summer, fall, and winter (Kelly and Quakenbush 1990, Lydersen 1991, Teilmann et al. 1999, Carlens et al. 2006, Kelly et al. 2010).

Ringed seals feed year-round, but forage most intensively during the open-water period and early freeze-up, when they spend 90 percent or more of their time in the water (Kelly et al. 2010). Many studies of the diet of Arctic ringed seal have been conducted and although there is considerable variation in the diet regionally, several patterns emerge. Most ringed seal prey is small, and preferred prey tends to be schooling species that form dense aggregations. Fish of the

cod family tend to dominate the diet from late autumn through early spring in many areas (Kovacs 2007). Arctic cod (*Boreogadus saida*) is often reported to be the most important prey species for ringed seals, especially during the ice-covered periods of the year (Lowry et al. 1980, Smith 1987, Holst et al. 2001, Labansen et al. 2007). Quakenbush et al. (2011) reported evidence that in general, the diet of Alaska ringed seals sampled consisted of cod, amphipods, and shrimp. Fish are generally more commonly eaten than invertebrate prey, but diet is determined to some extent by availability of various types of prey during particular seasons as well as preference, which in part is guided by energy content of various available prey (Reeves 1998, Wathne et al. 2000). Invertebrate prey seem to become more important in the diet of Arctic ringed seals in the open-water season and often dominate the diet of young animals (e.g., (Lowry et al. 1980, Holst et al. 2001).

Hearing, Vocalizations, and Other Sensory Capabilities

Ringed seals vocalize underwater in association with territorial and mating behaviors. Underwater audiograms for phocids suggest that they have very little hearing sensitivity below 1 kHz, and make calls between 90 Hz and 16 kHz (Richardson et al. 1995b). NMFS defines the function hearing range for phocids as 50 Hz to 86 kHz (NMFS 2018).

Elsner et al. (1989) indicated that ringed seals primarily use vision to locate breathing holes from under the ice, followed by their auditory and vibrissal senses for short-range pilotage. Hyvärinen (1989) suggested that ringed seals in Lake Saimaa may use a simple form of echolocation along with a highly developed vibrissal sense for orientation and feeding in dark, murky waters. The vibrissae likely are important in detecting prey by sensing their turbulent wakes as demonstrated experimentally for harbor seals (Dehnhardt et al. 1998). Sound waves could be received by way of the blood sinuses and by tissue conduction through the vibrissae (Riedman 1990).

5. ENVIRONMENTAL BASELINE

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR § 402.02).

5.1 Existing Stressors within the Action Area

The following discussion summarizes the principal natural and anthropogenic stressors that affect ringed seals:

- Biotoxins, disease, and predation
- Targeted hunts
- Ambient and anthropogenic sound

- Oil and gas development
- Pollutants and contaminants
- Vessel and fisheries interactions
- Research
- Climate change

For more information on all factors affecting the ESA-listed species considered in depth in this opinion, please refer to the following documents:

- "Alaska Marine Mammal Stock Assessments, 2018" (Muto et al. 2019), Available online at https://repository.library.noaa.gov/view/noaa/20606
- "Status Review of the Ringed Seal (*Phoca hispida*)" (Kelly et al. 2010), Available online at: https://repository.library.noaa.gov/view/noaa/3762

5.2 Biotoxins, Disease, and Predation

As temperatures in the Arctic waters are warming and sea ice is diminishing, there is an increased potential for harmful algal blooms that produce toxins to affect marine life (see Figure 8). Biotoxins like domoic acid and saxitoxin may pose a risk to Arctic marine mammals. In addition, increased temperatures can increase Brucella infections. Lefebvre et al. (2016) sampled 905 marine mammals from 13 species including; humpback whales, bowhead whales, beluga whales, harbor porpoises, northern fur seals, Steller sea lions, harbor seals, ringed seals, bearded seals, spotted seals, ribbon seals, Pacific walruses, and northern sea otters. Domoic acid was detected in all 13 species examined and had the greatest prevalence in bowhead whales (68 percent) and harbor seals (67 percent). Saxitoxin was detected in 10 of the 13 species, with the highest prevalence in humpback whales (50 percent) and bowhead whales (32 percent) (Lefebvre et al. 2016).

Figure 8. Algal toxins detected in 13 species of marine mammals from southeast Alaska to the Arctic from 2004 to 2013 (Lefebvre et al. 2016).

Polar bears are the main predator of ringed seals (Cameron et al. 2010, Kelly et al. 2010). Other predators include walruses and killer whales (Burns and Eley 1976, Heptner et al. 1976, Fay et al. 1990, Derocher et al. 2004, Melnikov and Zagrebin 2005). In addition, Arctic foxes prey on ringed seal pups by burrowing into lairs; and gulls, ravens, and possibly snow owls successfully prey on pups when they are not concealed in lairs (Smith 1976, Kelly et al. 1986, Lydersen et al. 1987, Lydersen and Smith 1989, Lydersen and Ryg 1990, Lydersen 1998). The threat currently posed to ringed seals by predation is considered moderate, but predation risk is expected to increase as snow and sea ice conditions change with a warming climate (Cameron et al. 2010, Kelly et al. 2010).

Ringed seals have co-evolved with numerous parasites and diseases, and these relationships are presumed to be stable. Abiotic and biotic changes to ringed and bearded seal habitat could lead to exposure to new pathogens or new levels of virulence, but the potential threats to these seals is considered low (Cameron et al. 2010, Kelly et al. 2010). Beginning in mid-July 2011, elevated numbers of sick or dead seals, primarily ringed seals, with skin lesions were discovered in the Arctic and Bering Strait regions. By December 2011, there were more than 100 cases of affected pinnipeds, including ringed seals, bearded seals, spotted seals, and walruses, in northern and western Alaska. Due to the unusual number of marine mammals discovered with similar symptoms across a wide geographic area, NMFS and USFWS declared a Northern Pinniped Unusual Mortality Event on December 20, 2011. The Unusual Mortality Event lasted until 2016, and was declared closed in June 2018. Disease surveillance efforts in 2012 through 2014 detected few new cases similar to those observed in 2011. No specific cause for this Unusual Mortality Event has been identified.

Since June 1, 2018, there have been elevated ice seal strandings in the Bering and Chukchi Seas involving bearded seals, spotted seals, and ringed seals[4]. This Unusual Mortality Event has been ongoing, and is still in effect as of December 2019, with a current total of 284 stranded seals. Of the seals that were able to be identified to species (198 out of 284), 85 are bearded seals, 69 are ringed seals, and 44 are spotted seals. All age classes have been reported. There is no identified cause for the ice seal strandings at this time.

5.3 Targeted Hunts

While the United States does not allow commercial harvest of marine mammals, including of ringed seals, such harvests are permitted in other portions of the species' ranges. Local population depletions occurred during the 20th century as a result of commercial harvests; however, commercial harvest is not considered to currently pose a significant threat to ringed or bearded seals (Cameron et al. 2010, Kelly et al. 2010).

Ringed seals are important subsistence species for many northern coastal communities. Approximately 64 Alaska Native communities in western and northern Alaska, from Bristol Bay to the Beaufort Sea, regularly harvest ringed seals for subsistence purposes (Ice Seal Committee 2016). Estimates of subsistence harvest of ringed seals are available for 17 of these communities based on annual household surveys conducted from 2009 through 2014 (Table 4), but more than 50 other communities that harvest these species for subsistence were not surveyed within this time period or have never been surveyed. Household surveys are designed to estimate harvest for the specific community surveyed; extrapolation of harvest estimates beyond a specific community is not appropriate because of local differences in seal availability, cultural hunting practices, and environmental conditions (Ice Seal Committee 2017). During 2010 through 2014, the total annual ringed seal harvest estimates across surveyed communities ranged from 695 to 1,286 (Table 4). However, it should be noted that the geographic distribution of communities surveyed varied among years such that these totals may be geographically or otherwise biased.

[4] https://www.fisheries.noaa.gov/national/marine-life-distress/2018-2019-ice-seal-unusual-mortality-event-alaska

Table 4. Alaska ringed seal harvest estimates based on household surveys, 2010–2014 (Ice Seal Committee 2017).

Community	Estimated Ringed Seal Harvest				
	2010	2011	2012	2013	2014
Nuiqsut	-	-	-	-	58
Utqiaġvik	-	-	-	-	428
Point Lay	-	-	51	-	-
Kivalina	-	16	-	-	-
Noatak	-	3	-	-	-
Buckland	-	26	-	-	-
Deering	-	0	-	-	-
Golovin	-	-	0	-	-
Emmonak	-	56	-	-	-
Scammon Bay	-	137	169	-	-
Hooper Bay	458	674	651	667	158
Tununak	162	257	219	-	-
Tuntutuliak	-	-	-	75	-
Quinhagak	163	117	140	160	51
Togiak	1	0	-	-	-
Twin Hills	0	-	-	-	-
Dillingham	-	-	3	-	-
Total	784	1,286	1,233	902	695

5.4 Ambient and Anthropogenic Sound

Ambient sound is the typical environmental soundscape or background sound pressure level at a given location. Generally, a new signal or sound would be detectable only if it is stronger than the ambient noise at similar frequencies. There are many sources that influence ambient noise in the ocean, including wind, waves, ice, rain, and hail; sounds produced by living organisms; noise from volcanic and tectonic activity; and thermal noise that results from molecular agitation (which is important at frequencies greater than 30 kHz).

The presence of ice can contribute substantially to ambient sound levels and affects sound propagation. While sea ice can produce substantial amounts of ambient sounds, it also can function to dampen or heighten ambient sound. Smooth annual ice can enhance sound propagation compared to open water conditions (Richardson et al. 1995b). However, with increased cracking, ridging, and other forms of sub-surface deformation, transmission losses generally become higher compared to open water (Richardson et al. 1995b, Blackwell and Greene 2001). Urick (1983) discussed variability of ambient noise in water, including under Arctic ice; he stated that "the ambient background depends upon the nature of ice, whether continuous, broken, moving or shore-fast, the temperature of air, and the speed of the wind." Temperature affects the mechanical properties of the ice, and temperature changes can result in cracking. The spectrum of cracking ice sounds typically displays a broad range from 100 Hz to 1 kHz, and the spectrum level has been observed to vary as much as 15 dB re 1 μPa at 1 m within 24 hours due to diurnal variability in air temperatures (BOEM (Bureau of Ocean Energy

Management 2011). Data are limited, but in at least one instance it has been shown that ice-deformation sounds produced frequencies of 4 to 200 Hz (Greene 1981).

During the open-water season in the Arctic, wind and waves are important sources of ambient sound with levels tending to increase with increased wind and sea state, all other factors being equal (Richardson et al. 1995b). Wind, wave, and precipitation noise originating close to the point of measurement dominate frequencies from 500 to 50,000 Hz.

There are many marine mammals in the Arctic marine environment whose vocalizations contribute to ambient sound including, but not limited to, bowhead whales, gray whales, beluga whales, walrus, ringed seals, and spotted seals. Walrus, seals, and seabirds all produce sound that can be heard in air as well. Underwater sound source levels of bearded seal songs have been estimated to be up to 178 dB re 1 μPa at 1 m depth (Ray et al. 1969) as cited in (Stirling et al. 1983, Richardson et al. 1995b, Thomson and Richardson 1995). Ringed seal calls have a source level of 95 to 130 dB re 1 μPa at 1 m, with the dominant frequency under 5 kHz (Cummings et al., 1986 as cited in Thomson and Richardson 1995). Bowhead whales produce sounds with estimated source levels ranging from 128 to 189 dB re 1 μPa at 1 m in frequency ranges from 20 to 3,500 Hz. Thomson and Richardson (1995) summarized that most bowhead whale calls are "tonal frequency-modulated" sounds at 50 to 400 Hz.

Ambient noise levels recorded during the open-water season (July 6 through September 22) on the North Slope near the Hilcorp Liberty Development Production Island site varied from approximately 88 to 103 dB re μPa broadband (Aerts et al. 2008). These ambient noise levels may have been influenced by other vessel activities occurring nearby (Aerts et al. 2008). Broadband background sound levels recorded in the water under the ice at 9.4 km (5.8 mi) from Northstar Island were 77 dB 1 re μPa and 76 dB re μPa in 2001 and 2002, respectively (Blackwell et al. 2004b).

Anthropogenic sources (human-caused) of noise in the action area include vessels, shipping, oil and gas activities, geophysical surveys (including seismic activities), drilling, construction, dredging, pile-driving, icebreaking, sonars, and aircraft. The combination of anthropogenic and natural noises contributes to the total noise at any one place and time. Levels of anthropogenic sound can vary dramatically depending on the season, type of activity, and environmental conditions. Several investigators have argued that anthropogenic sources of noise have increased ambient noise levels in the ocean over the last 50 years (NRC 1994, Richardson et al. 1995b, NRC 1996, NRC 2000, NRC 2003, Jasny et al. 2005, NRC 2005). Because responses to anthropogenic noise vary among species and individuals within species, it is difficult to determine long-term effects. Habitat abandonment due to anthropogenic noise exposure has been found in terrestrial species (Francis and Barber 2013). Clark et al. (2009) identified increasing levels of anthropogenic noise as a habitat concern for whales because of its potential effect on their ability to communicate (i.e. masking). Some research (Parks 2003, McDonald et al. 2006, Parks 2009) suggests marine mammals compensate for masking by changing the frequency, source level, redundancy, and timing of their calls. However, the long-term implications of these adjustments, if any, are currently unknown. Additional information on anthropogenic noise sources can also be found in the following section.

5.5 Oil and Gas Development

Offshore petroleum exploration activities have been conducted in State of Alaska waters and the Outer Continental Shelf (OCS) of the Beaufort and Chukchi Sea Planning Areas, in Canada's eastern Beaufort Sea off the Mackenzie River Delta, in Canada's Arctic Islands, and in the Russian Arctic, and around Sakhalin Island in the Sea of Okhotsk (NMFS 2016).

5.5.1 Sound Related to Oil and Gas Activities

Anthropogenic sound levels in the Beaufort Sea are higher than in the Chukchi Sea due to nearshore and onshore oil and gas development on the Alaskan North Slope, particularly in the vicinity of Prudhoe Bay. In the central Beaufort Sea in Alaska, oil and gas exploration, development, and production activities include, but are not limited to: seismic surveys; exploratory, delineation, and production drilling operations; construction of artificial islands, causeways, ice roads, shore-based facilities, and pipelines; and vessel and aircraft operations. Stressors associated with these activities that are of primary concern for marine mammals include noise, physical disturbance, and pollution, particularly in the event of a large oil spill.

Oil and gas exploration activities have occurred on the North Slope since the early 1900s, and oil production started at Prudhoe Bay in 1977. The drillsites where the proposed action will take place—Northstar Production Island, Spy Island, and the Oooguruk drillsite—are all west of Prudhoe Bay. Oil production has occurred for over 40 years in the region, and presently spans from the Alpine-field, which is approximately 96 km (60 mi) west of Prudhoe Bay, to the Point Thomson project, which is approximately 96 km east of Prudhoe Bay. Additionally, onshore gas production from the Barrow gas field began over 60 years ago. Associated industrial development has included the creation of industry-supported community airfields at Deadhorse and Kuparuk, and an interconnected industrial infrastructure that includes roadways, pipelines, production and processing facilities, gravel mines, and docks.

In 1977, the Trans-Alaska Pipeline System began to transport North Slope crude oil to a year-round marine terminal in Valdez, Alaska. Today, it continues to transport the North Slope's entire onshore and offshore oil production, and it is projected to do so for years into the future. Endicott SDI, built in 1987, was constructed to support the first continuous production of oil from an offshore field in the Arctic. Subsequently, the Northstar offshore island was constructed in 1999 and 2000 to support oil production. Northstar, as well as the Nikaitchuq and Oooguruk developments, currently operates in nearshore areas of the Beaufort Sea, and is expected to continue operating in the future. Other oil and gas related activities that have occurred in the Beaufort Sea and Chukchi Sea OCS to date include exploratory drilling, exploration seismic surveys, geohazard surveys, geotechnical sampling programs, and baseline biological studies and surveys. There are also several exploration and development projects occurring on the North Slope including Greater Moose's Tooth 1 and 2, Smith Bay, Nuna, and Nanushuk. In addition, the Alaska Gasoline Development Corporation is developing the Alaska Stand-Alone Gas Pipeline that would extend from the North Slope to Southcentral Alaska. The project would include barging to the North Slope and modifications to West Dock.

Seismic surveys have been conducted in the Chukchi Sea and Beaufort Sea since the late 1960s and early 1970s, resulting in extensive coverage over the area. Seismic surveys vary, but a

typical 2D/3D seismic survey with multiple guns emits sound at frequencies of about 10 Hz to 3 kHz (Austin et al. 2015). Seismic airgun sound waves are directed towards the ocean bottom, but can propagate horizontally for several kilometers (Greene and Richardson 1988, Greene and Moore 1995). Analysis of sound associated with seismic operations in the Beaufort Sea and central Arctic Ocean during ice-free conditions also documented propagation distances up to 1,300 km (808 mi; Richardson 1998, 1999, Thode et al. 2010). Because the Chukchi Sea continental shelf has a highly uniform depth of 30 to 50 m (98 to 164 ft), it strongly supports sound propagation in the 50 to 500 Hz frequency band (Funk et al. 2008).

NMFS has conducted numerous ESA section 7 consultations related to oil and gas activities in the Beaufort and Chukchi Seas. Many of the consultations have authorized the take (by harassment) of bowhead whales and ringed and bearded seals (as well as non ESA-listed marine mammals) from sounds produced during geophysical (including seismic) surveys and other exploration and development activities.

In 2013, NMFS completed an incremental step consultation with BOEM and BSEE on the effects of the authorization of oil and gas leasing and exploration activities in the U.S. Beaufort and Chukchi Seas over a 14-year period, from March 2013 to March 2027 (i.e., the Arctic Regional Biological Opinion; NMFS 2013). The incidental take statement issued with the biological opinion for the 14-year period allows for takes (by harassment) from sounds associated with high-resolution, deep penetration, and in-ice deep penetration seismic surveys of 87,878 bowhead whales, 896 fin whales, 1,400 humpback whales, 91,616 bearded seals, and 506,898 ringed seals. Take will be more accurately evaluated and authorized for project-specific consultations that fall under this over-arching consultation (i.e., stepwise consultations), and the cumulative take for all subsequent consultations will be tracked and tiered to these consultations. Take associated with this project is included in these preliminary estimates of take due to oil and gas activities in Alaska's Arctic waters.

In addition, NMFS completed an incremental step consultation with BOEM and BSEE in 2015 on the effects of oil and gas exploration activities for lease sale 193 in the Chukchi Sea, Alaska, over a nine-year period, from June 2015 to June 2024 (NMFS 2015a). The incidental take statement issued with the biological opinion allows for takes (by harassment) from sounds associated with seismic, geohazard, and geotechnical surveys, and exploratory drilling of 8,434 bowhead whales, 133 fin whales, 133 humpback whales, 1,045,985 ringed seals, and 832,013 bearded seals.

In 2014, NMFS AKR conducted three consultations with NMFS Permits Division on the issuance of incidental harassment authorizations (IHAs) to take marine mammals incidental to 3D ocean bottom sensor seismic and shallow geohazard surveys in Prudhoe Bay, Foggy Island Bay, and the Colville River Delta, in the Beaufort Sea, Alaska, during the 2014 open-water season (NMFS 2014c, b, a). These project-specific consultations were either directly or indirectly linked to the Arctic Regional Biological Opinion. The incidental take statements issued with the three biological opinions allowed for takes (by harassment) of 138 bowhead whales, 744 bearded seals, and 427 ringed seals, total, as a result of exposure to impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms}.

In 2015, NMFS AKR conducted two consultations with NMFS Permits Division on the issuance of IHAs to take marine mammals incidental to shallow geohazard and 3D ocean bottom node seismic surveys in the Beaufort Sea, Alaska, during the 2015 open-water season. These consultations were also either directly or indirectly linked to the Arctic Regional Biological Opinion. The incidental take statements in the three biological opinions estimated 461 bowhead whales, 202 bearded seals, and 1,472 ringed seals, total, would be taken (by harassment) as a result of exposure to impulsive sounds at received levels at or above 160 dB re 1 μPa_{rms} and one bowhead whale, 10 bearded seals, and 20 ringed seals as a result of exposure to impulsive sounds at received levels at or above 180 dB re 1 μPa_{rms}.

In 2015, NMFS AKR conducted a consultation with NMFS Permits Division on the issuance of an IHA to take marine mammals incidental to ice overflight and ice survey activities conducted by Shell Gulf of Mexico and Shell Offshore Inc., from May 2015 to April 2016 (NMFS 2015c). The incidental take statement issued with the biological opinion authorized takes (by harassment) of 793 ringed seals and 11 bearded seals as a result of exposure to visual and acoustic stimuli from aircraft.

The first stepwise (i.e., tiered) consultation under the lease sale 193 incremental step consultation was conducted in 2015. NMFS Alaska Region consulted with the NMFS Permits Division on the issuance of an IHA to take marine mammals incidental to exploration drilling activities in the Chukchi Sea, Alaska, in 2015 (NMFS 2015b). The incidental take statement issued with the biological opinion allowed for takes (by harassment) of 1,083 bowhead whales, 14 fin whales, 14 humpback whales, 1,722 bearded seals, and 25,217 ringed seals as a result of exposure to continuous and impulsive sounds at received levels at or above 120 dB re 1 μPa_{rms} and 160 dB re 1 μPa_{rms}, respectively.

There were no consultations for oil and gas activities completed with the NMFS Permits Division in 2016 and 2017. In 2019, the NMFS Alaska Region conducted a consultation with the NMFS Permits Division on the issuance of a letter of authorization (LOA) to take marine mammals incidental to oil and gas exploration activities for the Liberty Oil and Gas Development and Production Activities from December 2019 to November 2044. The incidental take statement issued with the biological opinion allowed for takes of ringed seals: 831 by Level B harassment due to noise and physical presence, 8 by Level A harassment due to noise, and 10 by mortality. The incidental take statement also allowed for the following take: for bowhead whales, 120 by Level B harassment and 4 by Level A harassment and for bearded seals, 130 by Level B harassment due to noise and physical presence and 4 by Level A harassment.

Anticipated impacts by harassment from noise associated with oil and gas activities generally include changes in behavioral state from low energy states (i.e., foraging, resting, and milling) to high energy states (i.e., traveling and avoidance).

5.5.2 Sound from Other Arctic Projects

In the winters of 2014, 2017, and 2018, the U.S. Navy has conducted submarine training, testing, and other research activities in the northern Beaufort Sea and Arctic Ocean from a temporary camp constructed on an ice flow toward the northern extent of the U.S. Economic Zone, about

185 to 370 km (115 to 230 mi) north of Prudhoe Bay. Equipment, materials, and personnel were transported to and from the ice camp via daily flights based out of the Deadhorse Airport (located in Prudhoe Bay). The Navy has a National Pollutant Discharge Elimination System (NPDES) permit from EPA for discharges from camp operations for discharge greywater and reject water.

In 2016, NMFS AKR conducted internal consultations with NMFS Permits Division on the issuance of three IHAs to take marine mammals incidental to dock construction, fiber optic cable laying, and anchor retrieval in the Bering, Chukchi, and Beaufort Seas, during the 2016 open water season. The incidental take statements issued with the three biological opinions allowed for takes (by harassment) of 788 bowhead whales, 19 fin whales, 13 humpback whales, 706 bearded seals, 7,887 ringed seals, and 2,185 western DPS Steller sea lion total, as a result of exposure to continuous or impulsive sounds at received levels at or above 120 dB or 160 dB re 1 µPa rms respectively.

Fiber optic cable laying continued in 2017, and NMFS AKR conducted a consultation with NMFS Permits Division on the issuance of an IHA for this project. Quintillion was permitted to install 1,904 km (1,183 mi) of subsea fiber optic cable during the open-water season, including a main trunk line and six branch lines to onshore facilities in Nome, Kotzebue, Point Hope, Wainwright, Barrow, and Oliktok Point. The incidental take statement issued with the biological opinion allowed for takes (by harassment) of 314 bowhead whales, 15 fin whales, 3 Western North Pacific DPS humpback whales, 7 Mexico DPS humpback whales, 62 bearded seals, 855 ringed seals, and 8 Western DPS Steller sea lions, total, as a result of exposure to sounds of received levels at or above 120 dB re 1 µParms from sea plows, anchor handling, and operation and maintenance activities (NMFS 2017).

5.6 Pollutants and Contaminants

Discharges authorized from development activities occurring in portions of the action area are the source of multiple pollutants that may be bioavailable (i.e., may be taken up and absorbed by animals) to ESA-listed species and their prey items (NMFS 2016). Drill cuttings and fluids contain contaminants such as dibenzofuran and polycyclic aromatic hydrocarbons that have high potential for bioaccumulation. Historically, drill cuttings and fluids have been discharged from oil and gas developments in the Beaufort Sea near the action area, and residues from these historical discharges may be present in the environment (Brown et al. 2010). Polycyclic aromatic hydrocarbons are also emitted to the atmosphere by flaring water gases at production platforms or gas treatment facilities. For example, approximately 162,000 million standard cubic feet of waste gas was flared at Northstar in 2004 (Neff 2010).

5.6.1 Authorized Discharges

The Clean Water Act of 1972 (CWA) has several sections or programs applicable to activities in offshore waters. Section 402 of the CWA authorizes the U.S. Environmental Protection Agency (EPA) to administer the NPDES permit program to regulate point source discharges into waters of the United States. Section 403 of the CWA requires that EPA conduct an ocean discharge criteria evaluation for discharges of pollutants from point sources into the territorial seas, contiguous zones, and the oceans. The Ocean Discharge Criteria (40 CFR part 125, subpart M) sets forth specific determinations of unreasonable degradation that must be made before permits may be issued.

On November 28, 2012, EPA issued a NPDES general permit for discharges from oil and gas exploration facilities on the outer continental shelf and in contiguous state waters of the Beaufort Sea (Beaufort Sea Exploration general permit). The general permit authorizes 13 types of discharges from exploration drilling operations and establishes effluent limitations and monitoring requirements for each waste stream.

On January 21, 2015, EPA issued a NPDES general permit for wastewater discharges associated with oil and gas geotechnical surveys and related activities in Federal waters of the Beaufort and Chukchi Seas (Geotechnical general permit). This general permit authorizes twelve types of discharges from facilities engaged in oil and gas geotechnical surveys to evaluate the subsurface characteristics of the seafloor and related activities in federal waters of the Beaufort and Chukchi Seas.

Both the Beaufort Sea Exploration general permit and the Geotechnical general permit establish effluent limitations and monitoring requirements specific to each type of discharge and include seasonal prohibitions and area restrictions for specific waste streams. For example, both general permits prohibit the discharge of drilling fluids and drill cuttings to the Beaufort Sea from August 25 until fall bowhead whale hunting activities by the communities of Nuiqsut and Kaktovik have been completed. Additionally, both general permits require environmental monitoring programs to be conducted at each drillsite or geotechnical site location, corresponding to before, during, and after drilling activities, to evaluate the impacts of discharges from exploration and geotechnical activities on the marine environment.

The principal regulatory mechanism for controlling pollutant discharges from vessels (grey water, black water, coolant, bilge water, ballast, deck wash, etc.) into waters of the Arctic Region OCS is also the CWA of 1972. The EPA issued a NPDES vessel general permit effective from December 19, 2013, to December 18, 2018, that applies to pollutant discharges from non-recreational vessels that are at least 24 m (79 ft) in length, as well as ballast water discharged from commercial vessels less than 24 m. This general permit restricts the seasons and areas of operation, as well as discharge depths, and includes monitoring requirements and other conditions.

In addition, the U.S. Coast Guard has issued regulations that address pollution prevention with respect to discharges from vessels carrying oil, noxious liquid substances, garbage, municipal or commercial waste, and ballast water (33 CFR part 151). The State of Alaska regulates water quality standards within three miles of the shore.

5.6.2 Accidental Discharges—Oil Spill and Gas Releases

Oil and gas activities occur in and around the action area. BOEM and BSEE define small oil spills as <1,000 barrels (bbl). Large oil spills are defined as 1,000-150,000 bbl, and very large oil spills (VLOS) are defined as ≥ 150,000 bbl (BOEM 2017a).

Small Oil Spills

Offshore petroleum exploration activities have been conducted in State of Alaska waters adjacent of the Beaufort and Chukchi Seas since the late 1960s. Based on a review of potential discharges

and on the historical oil spill occurrence data for the Alaska OCS and adjacent State of Alaska waters, several small spills in the Beaufort Sea from refueling operations (primarily at West Dock) were reported to the National Response Center. Small oil spills have occurred with routine frequency and are considered likely to occur (BOEM 2017a).

In the past 30 years, only 43 wells have been drilled in the Beaufort and Chukchi Sea lease program areas. From 1985 to 2013, eight crude oil spills of ≥ 550 bbl were documented along the Alaska North Slope, one of which was ≥ 1,000 bbl. During the same time period, total North Slope production was 12.80 billion bbl of crude oil and condensate. From 1971 through 2011, the highest mean volume of North Slope spills was from pipelines. The mean spill size for pipelines was 145 bbl. The spill rate for crude oil spills ≥ 500 bbl from pipelines (1985 to 2013) was 0.23 pipeline spills per billion bbl of oil produced (BOEM 2016b).

Large Oil Spills and Very Large Oil Spills

In general, historical data show that loss of well control (LOWC) events escalating into blowouts and resulting in oil spills are infrequent and that those resulting in large accidental oil spills are even rarer events (BOEM 2017b). From 1964 to 2010 there were 283 well control incidents, 61 of which resulted in crude or condensate spills (BOEM 2012, 2017b). From 1971 to 2010, fewer than 50 well control incidents occurred. Excluding the volume from the Deepwater Horizon spill, the total spilled volume was less than 2,000 barrels of crude or condensate, with the largest of the 1971 to 2010 spills—other than the Deepwater Horizon event—being 350 bbl. The Deepwater Horizon event was the only VLOS to occur between 1971 and 2010 (BOEM 2012, 2017b). During that same time period, more than 41,800 wells were drilled on the OCS and almost 16 billion barrels of oil were produced.

From 1971 to 2010, industry drilled 223 exploration wells in the Pacific OCS, 46 in the Atlantic OCS, 15,138 in the Gulf of Mexico OCS, and 84 in the Alaska OCS, for a total of 15,491 exploration wells. During this period, there were 77 well control incidents associated with exploration drilling. Of those 77 well control incidents, 14 (18 percent) resulted in oil spills ranging from 0.5 barrels to 200 barrels, for a total 354 barrels, excluding the estimated volume from the Deepwater Horizon spill. These statistics show that, while approximately 15,000 exploration wells were drilled, there were a total of 15 loss-of-well-control events that resulted in a spill of any size: 14 were small spills and one was a large spill (≥1,000 bbl) that resulted in a blowout. That one large/very large spill was the Deepwater Horizon incident (BOEM 2017b).

The risk of an unlikely or rare event, such as a loss of well control incident, is determined using the best available historical data. The 2012 to 2017 Five-Year Program Final Programmatic Environmental Impact Statement (PEIS) (BOEM 2012) provides a detailed discussion of the OCS well control incidents and risk factors that could contribute to a long duration LOWC event. Risk factors include geologic formation and hazards; water depth and hazards; geographic location (including water depth); well design and integrity; loss of well control prevention and intervention; scale and expansion; human error; containment capability; response capability; oil types and weathering/fate; and specific regional geographic considerations, including oceanography and meteorology (BOEM 2017b).

Quantifying the frequency of VLOSs from a loss of well control event is challenging as relatively few large oil spills that can serve as benchmarks have occurred on the OCS (Scarlett et al. 2011). Based on an analysis of this historic data from both the 1971 to 2010 (the modern regulatory era) and the 1964 to 1971 time frames, the frequency of a loss of well control occurring and resulting in a VLOS of different volumes was determined (BOEM 2016a). This analysis, which is set forth in the 2017 to 2022 Five-Year Program Final PEIS, was used to calculate the frequency (per well) of a spill exceeding 4,610,000 barrels, which is the VLOS volume assumed in the Liberty analysis (BOEM 2017b).

Increased oil and gas development in the U.S. Arctic has led to an increased risk of various forms of pollution to whale and seal habitat, including oil spills, other pollutants, and nontoxic waste (Muto et al. 2019).

Metals and hydrocarbons introduced into the marine environment from offshore exploratory drilling activities are not likely to enter the Beaufort Sea food webs in ecologically significant amounts. However, there is a growing body of scientific literature on concentrations of metals and organochlorine chemicals (e.g., pesticides and polychlorinated biphenyls) in tissues of higher trophic level marine species, such as marine mammals, in cold-water environments.

There is particular concern about mercury in Arctic marine mammal food webs (MacDonald 2005). Mercury concentrations in marine waters in much of the Arctic are higher than concentrations in temperate and tropical waters due in large part to deposition of metallic and inorganic mercury from long-range transport and deposition from the atmosphere (Outridge et al. 2008). However, there is no evidence that significant amounts of mercury are coming from oil operations around Prudhoe Bay (Snyder-Conn et al. 1997) or from offshore drilling operations (Neff 2010).

5.6.3 Contaminants

Contaminants research on ringed seals is extensive throughout the Arctic environment where ringed seals are an important part of the diet for coastal human communities. Pollutants such as organochlorine compounds and heavy metals have been found in all of the subspecies of ringed seal (with the exception of the Okhotsk ringed seal). The variety, sources, and transport mechanisms of contaminants vary across ringed seal ecosystems (Kelly et al. 2010).

Heavy metals such as mercury, cadmium, lead, selenium, arsenic, and nickel accumulate in ringed seal vital organs, including liver and kidneys, as well as in the central nervous system (Kelly et al. 2010). Gaden et al. (2009) suggested that during ice-free periods the seals eat more Arctic cod (and mercury). They also found that mercury levels increased with age for both sexes (Dehn et al. 2005, Gaden et al. 2009). Becker et al. (1995) reported ringed seals had higher levels of arsenic in Norton Sound (inlet in the Bering Sea) than ringed seals taken by residents of Point Hope, Point Lay, and Barrow. Arsenic levels in ringed seals from Norton Sound were quite high for marine mammals, which might reflect localized natural arsenic sources.

Research on contaminants in bearded seals is limited compared to the information for ringed seals. However, pollutants such as organochlorine compounds and heavy metals have been found in most bearded seal populations. Climate change has the potential to increase the transport of

pollutant from lower latitudes to the Arctic (Tynan and Demaster 1997).

5.7 Vessel Activity and Fisheries Interactions

In the Arctic, ice retreat and the resulting longer navigation season encourages increased Arctic shipping and fishing (Reeves et al. 2012). Vessel activity can pose a threat to marine mammals primarily because of the risk of ship strikes and the potential disturbance from vessel noise. Vessel activity can also disrupt marine mammal behavior by their presence. Fishing vessels can pose similar risks; however, entanglement in fishing gear is a primary concern for marine mammals.

5.7.1 Vessel Traffic

The amount of vessel travel in the Arctic has been increasing over the past few decades (i.e., from 1990 to 2012) bringing with it an increased risk of vessel interactions for marine mammals (Pizzolato et al. 2014, Halliday et al. 2018). The general pattern of vessel traffic in the Arctic is correlated with seasonal ice conditions, which results in the bulk of the traffic being concentrated within the months of July through October, and unaided navigation being limited to an even narrower time frame. However, this pattern appears to be rapidly changing, as ice-diminished conditions become more extensive during the summer months.

The number of unique vessels tracked via automatic identification systems in U.S. waters north of the Pribilof Islands increased from 120 in 2008 to 250 in 2012, an increase of 108 percent (ICCT 2015). This includes only the northern Bering Sea, the Bering Strait, Chukchi Sea and Beaufort Sea to the Canadian border.

The increase in vessel traffic in 2012 on the outer continental shelf of the Chukchi Sea and the near-shore Prudhoe Bay from oil and gas exploration activity is particularly pronounced (ICCT 2015). This increase is largely from traffic associated with the offshore exploratory drilling program that was conducted by Shell on the OCS of the Chukchi Sea that year. A comparison of the geographic distribution of vessel track lines between 2011 and 2012 provides some insight into the changes in vessel traffic patterns that may occur as a result of such activities (Figure 9). Overall, in 2012 there was a shift toward more offshore traffic and there were also noticeable localized changes in vessel traffic concentration near Prudhoe Bay and in the vicinity of the drilling project in the Chukchi Sea (ICCT 2015).

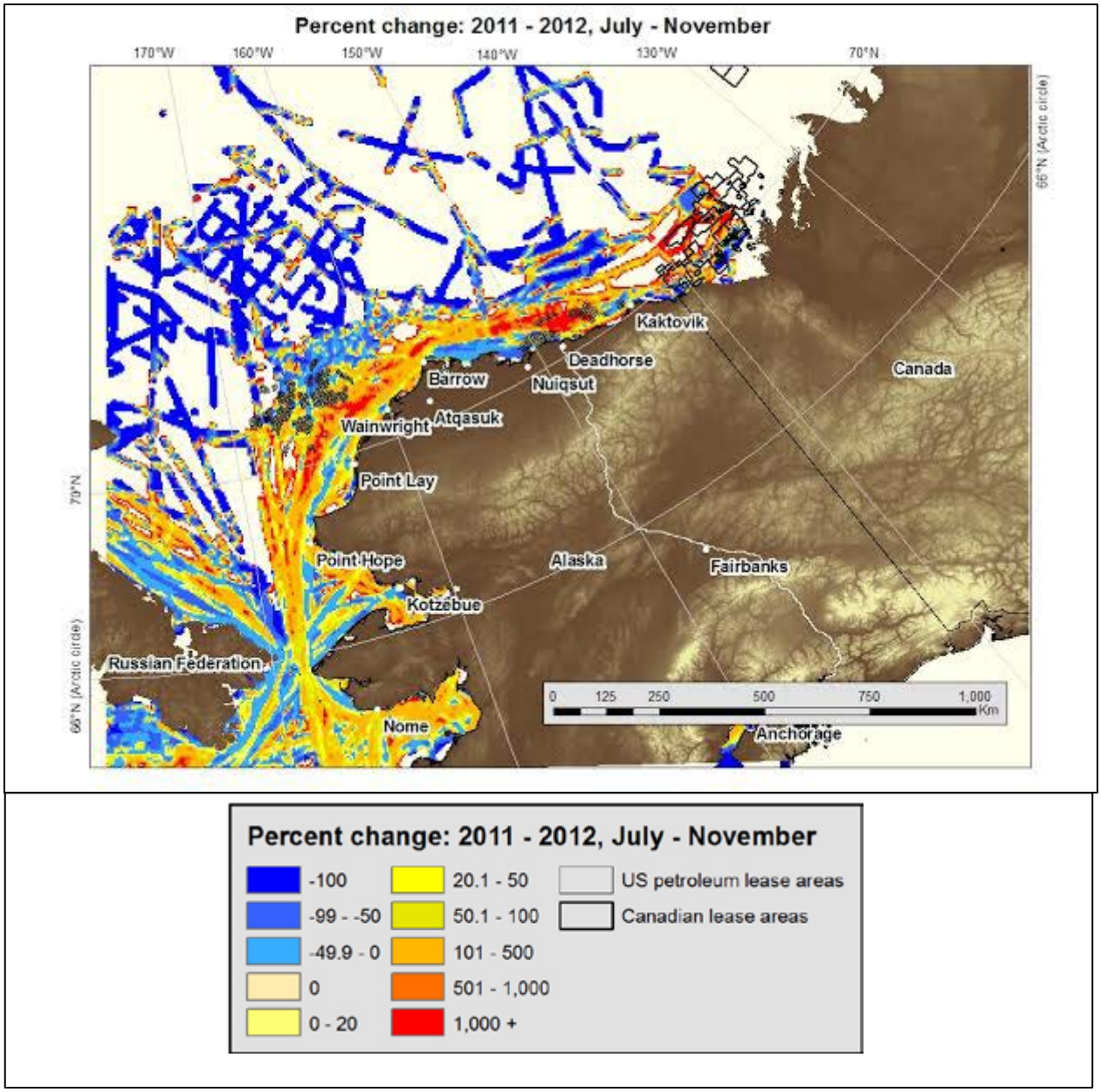

Figure 9. Percent difference in vessel activity between 2011 and 2012 using 5-km grid cells (ICCT 2015).

Vessel activity associated with oil and gas activities is expected to shift in relation to the industry itself. For example, in 2016, Shell relinquished all but one of their federal offshore leases in the Chukchi Sea, citing, among other things, disappointing results during the drilling seasons. Consequently, we would not expect the related 2012 vessel activity noted above for drilling in the Chukchi Sea to continue at those same levels.

5.7.2 Vessel Noise

Commercial shipping traffic is a major source of low frequency (5 to 500 Hz) human generated sound in the oceans (Simmonds and Hutchinson 1996, NRC (National Research Council) 2003).

The types of vessels operating in the Bering, Chukchi, and Beaufort Seas typically include fishing vessels, barges, skiffs with outboard motors, icebreakers, scientific research vessels, and vessels associated with oil and gas exploration, development, and production. The primary underwater noise associated with vessel operations is the continuous noise produced from propellers and other on-board equipment. Cavitation noise is expected to dominate vessel acoustic output when tugs are pushing or towing barges or other vessels. Other noise sources include onboard diesel generators and the main engine, but both are subordinate to propeller harmonics (Gray and Greeley 1980). Shipping sounds are often at source levels of 150 to 190 dB re 1 μPa at 1 m (BOEM 2011) with frequencies of 20 to 300 Hz (Greene and Moore 1995). Sound produced by smaller boats is typically at a higher frequency, around 300 Hz (Greene and Moore 1995). In shallow water, vessels more than 10 km (6.2 mi) away from a receiver generally contribute only to background-sound levels (Greene and Moore 1995). Broadband source levels for icebreaking operations are typically between 177 and 198 dB re 1 μPa at 1m (Greene and Moore 1995, Austin et al. 2015).

5.7.3 Vessel Strikes

Vessels transiting the marine environment have the potential to collide with, or strike, marine mammals (Laist et al. 2001, Jensen and Silber 2003). In general, vessel strike is a significant and widespread concern for the recovery of ESA-listed marine mammals.

Current shipping activities in the Arctic pose varying levels of threats to ringed seals depending on the type and intensity of the shipping activity and its degree of spatial and temporal overlap with their habitats. In the Canadian Arctic in the Beaufort Sea, pleasure crafts like yachts and passenger vessels like cruise ships represent the fastest-growing vessel type in the region (Halliday et al. 2018). The presence and movements of ships in the vicinity of seals can affect their normal behavior (Jansen et al. 2010) and may cause them to abandon their preferred breeding habitats in areas with high traffic (Smiley and Milne 1979, Mansfield 1983). To date, no ringed seal carcasses have been found with confirmed propeller marks. However, Sternfeld (2004) documented a singled spotted seal stranding in Bristol Bay, Alaska that may have resulted from a propeller strike. Icebreakers pose greater risks to ringed seals because they are capable of operating year-round in all but the heaviest ice conditions and are often used to escort other types of vessels (e.g., tankers and bulk carriers) through ice-covered areas. Reeves (1998) noted that some ringed seals have been killed by ice-breakers moving through fast-ice breeding areas.

5.8 Fisheries Interactions

The North Pacific Fishery Management Council closed commercial fishing in the federal waters of the U.S. Arctic in 2009. South of the Bering Strait, however, commercial fishing is permitted.

Commercial fisheries may impact ringed seals through direct interactions (i.e., incidental take or bycatch) and indirectly through competition for prey resources and other impacts on prey populations. While no commercial fishing is currently authorized in the Beaufort Sea, ringed seals may be impacted by commercial fishing interactions as they migrate through the Bering Sea to the Chukchi Sea. Estimates of ringed seal bycatch could only be found for commercial fisheries that operate in Alaska waters. From 2010 through 2014, incidental mortality and serious injury of ringed seals was reported in 4 of the 22 federally-regulated commercial fisheries in

Alaska monitored for incidental mortality and serious injury by fisheries observers: the Bering Sea/Aleutian Islands flatfish trawl, Bering Sea/Aleutian Islands pollock trawl, Bering Sea/Aleutian Islands Pacific cod trawl, and Bering Sea/Aleutian Islands Pacific cod longline fisheries (Muto et al. 2019). An additional ringed seal mortality due to U.S. commercial fisheries was reported to the NMFS Alaska Region stranding network in 2011; however, because the seal was discovered during the offloading process, the resulting mean annual mortality and serious injury rate of 0.2 could not be assigned to a specific fishery (Helker et al. 2016). Based on data from 2010 through 2014, the average annual rate of mortality and serious injury incidental to U.S. commercial fishing operations is 3.9 ringed seals (3.7 from observer data + 0.2 from stranding data) (Muto et al. 2019).

5.9 Research

Scientific research permits issued by the NMFS currently authorize studies of ESA-listed species in the waters surrounding Alaska, some of which extend into portions of the action area for the proposed project. The following summarizes current research permits issued, and more information can be found on the NMFS Authorizations and Permits for Protected Species website. NMFS issues scientific research permits that are valid for five years for ESA-listed species. When permits expire, researchers often apply for a new permit to continue their research. Additionally, applications for new permits are issued on an on-going basis; therefore, the number of active research permits is subject to change in the period during which this opinion is valid.

There are several active research permits issued under the provisions of the ESA authorizing scientific research on bowhead whales and ringed and bearded seals. The primary objective of these studies is generally to monitor populations or gather data for behavioral and ecological studies. For bowheads, authorized research includes harassment during aerial and vessel surveys, tagging, and biopsy sampling. For ringed and bearded seals, authorized research includes harassment during aerial and vessel surveys, capture, handling, restraint, tissue sampling, and tagging.

The consultations, which took place on the issuance of each the ESA scientific research permits listed below, each found that the authorized activities would not result in jeopardy to the species or adverse modification of designated critical habitat.

- Permit No. 18890, which expires June 15, 2021, authorizes the annual capture of 2 bearded seals and 2 ringed seals; and take by harassment of up to 8 of each species during vessel surveys.
- Permit No. 21585 expires on December 31, 2023, and authorizes the take by harassment of up to 100 ringed seals during vessel surveys.
- Permit No. 20465, which expires May 31, 2022, authorizes take by harassment of up to 200 ringed seals during aerial surveys.
- Permit No. 19309, which expires March 25, 2021, authorizes the capturing, handling, sampling, and releasing of 154 ringed seals; 5 unintentional mortalities; 3,000 takes by harassment during ground surveys; and 6,700 takes by harassment during aerial surveys.

- Permit No. 20466, which expires August 15, 2022, authorizes the harassment of up to 6,000 ringed seals; 200 takes during capture, handling, sampling, and releasing; and 5 unintentional mortalities.

There are other current permits which authorize the import and export of ringed seal parts for research purposes. Since these permits do not involve the take of live animals, we do not discuss them here.

Occasionally, mortalities have occurred incidental to marine mammal research activities authorized under MMPA research permits. In 2010 through 2014, one mortality was reported incidental to research on the Alaska stock of ringed seals, resulting in an average of 0.2 ringed seal mortalities per year from this stock (Muto et al. 2019).

5.10 Climate Change

"The Arctic marine environment has shown changes over the past several decades, and these changes are part of a broader global warming that exceeds the range of natural variability over the past 1,000 years" (Walsh 2008). The changes have been sufficiently large in some areas of the Arctic such that consequences on marine ecosystems appear to be ongoing (Walsh 2008). The proximate effects of climate change in the Arctic are being manifested as increased average winter and spring temperatures and changes in precipitation amount, timing, and type (Serreze et al. 2000). There are reported changes in sea-ice extent, thickness, distribution, age, and melt duration. In general, the sea-ice extent and thickness is decreasing in the Arctic summer and in winter. The distribution of ice is changing, and its age is decreasing. The melt duration is increasing. These factors lead to a decreasing perennial Arctic ice pack.

It is generally thought that the Arctic will become ice free in summer, but at this time there is considerable uncertainty about when that will happen. Parry (2007) predicted, by taking the mean of several climate models, that the Arctic will be ice free during summer in the latter part of the 21st century (Parry 2007). Holland et al. (2006) estimates that 40 to 60 percent summer ice loss will occur by the middle of the 21st century (Holland et al. 2006). Using a suite of models, Overland and Wang (2007) predicted a 40 percent or more ice loss for the Beaufort and Chukchi Seas by 2050. While the annual minimum sea ice extent is often taken as an index of the state of Arctic sea ice, the recent reductions of multi-year sea ice and sea ice thickness are of greater physical importance. It would take many years to restore the ice thickness through annual growth, and the loss of multi-year sea ice makes it unlikely that the Arctic will return to previous climatological conditions in the foreseeable future.

Increasing ocean acidification is predicted to cause changes in ecosystem processes and present additional stressors to organisms in the Arctic (BOEM 2015). Ocean acidification occurs as carbon dioxide increases in the atmosphere and is absorbed into ocean waters. The increase in carbon dioxide lowers pH over time and reduces the concentration of calcium carbonate in the sea (BOEM 2015). Mathis and Questel (2013) studied the carbonate chemistry in the northeast Chukchi Sea during August, September, and October 2010 and found low saturation rates of calcite and aragonite (two forms of calcium carbonate) as summer progressed.

Changes in sea ice and ocean acidification are expected to result in changes to the biological environment, causing shifts, expansion, or retraction of species' home ranges, changes in behavior, and changes in population parameters of species. Research in recent years has focused on the effects of naturally-occurring or man-induced global climate regime shifts and the potential for these shifts to cause changes in habitat structure over large areas. Although many of the forces driving global climate regime shifts may originate outside the Arctic, the impacts of global climate change are exacerbated in the Arctic (ACIA 2005). These threats will be most pronounced for ice-obligate species such as the polar bear, walrus, ringed seal, and bearded seal.

The main concern about the conservation status of ringed seals stems from the likelihood that their sea ice habitat has been modified by the warming climate and, more so, that the scientific consensus projects accelerated warming in the foreseeable future. A second concern, related by the common driver of carbon dioxide emissions, is the modification of habitat by ocean acidification, which may alter prey populations and other important aspects of the marine ecosystem (77 FR 76706, 76708; December 28, 2012). According to climate model projections, snow cover is forecasted to be inadequate for the formation and occupation of birth lairs for ringed seals within this century over the Alaska stock's entire range (Kelly et al. 2010).

A decrease in the availability of suitable sea ice conditions may not only lead to high mortality of ringed seal pups but may also produce behavioral changes in seal populations (Loeng et al. 2005). Changes in snowfall over the 21st century were projected to reduce areas with suitable snow depths for ringed seal lairs by 70 percent (Hezel et al. 2012). In addition to changes in snowfall, increases in spring rainfall can negatively affect seal pup recruitment because spring rainfall collapses lairs, killing pups (Ritchie 2018).

The ringed seal's broad distribution, ability to undertake long movements, diverse diet, and association with widely varying ice conditions suggest they may be somewhat resilient in the face of environmental variability. Although no scientific studies have directly addressed the impacts of ocean acidification on ringed seals, the effects would likely be through their ability to find food. The decreased availability or loss of prey species from the ecosystem may have a cascading tropic effects on this species (Kelly et al. 2010).

There have recently been increases of subarctic species seasonally found in the Chukchi Sea. With increasing sea-surface temperatures in the Arctic, the potential northward movement of non-native species increases (Nordon 2014).

6. EFFECTS OF THE ACTION

Per 50 CFR § 402.02, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action.

This biological opinion relies on the best scientific and commercial information available. We try to note areas of uncertainty, or situations where data is not available. In analyzing the effects of the action, NMFS gives the benefit of the doubt to the listed species by minimizing the

likelihood of false negative conclusions (concluding that adverse effects are not likely when such effects are, in fact, likely to occur).

We organize our effects analysis using a stressor identification – exposure – response – risk assessment framework for the proposed activities.

We conclude this section with an *Integration and Synthesis of Effects* that integrates information presented in the *Status of the Species* and *Environmental Baseline* sections of this opinion with the results of our exposure and response analyses to estimate the probable risks the proposed action poses to endangered and threatened species.

6.1 Project Stressors

Based on our review of the data available, the proposed ice road, trail, and pad construction, use, and maintenance activities may cause these primary stressors:

1. Acoustic disturbance from activities associated with ice road, trail, and pad construction use, and maintenance;
2. Direct injury, mortality, or harassment from on-ice activities;
3. Visual disturbance from vehicles and project activities; and
4. Habitat alteration from the ice road, trail, and pad construction.

NMFS identified and addressed all potential stressors, and NMFS considered all consequences of the proposed action, individually and cumulatively, in developing the analysis and conclusions in this opinion regarding the effects of the proposed action on ESA-listed species (ringed seals).

6.2 Exposure Analysis

As discussed in the *Approach to the Assessment* section of this opinion, exposure analyses are designed to identify the listed species that are likely to co-occur with these effects in space and time and the nature of that co-occurrence. In this step of our analysis, we try to identify the number, age (or life stage), and sex of the individuals that are likely to be exposed to an action's effects and the populations or subpopulations those individuals represent.

Following the exposure analysis in the response analysis. The response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on the listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

6.2.1 Acoustic Disturbance from Ice Road, Trail, and Pad Construction, Use, and Maintenance

As described in Section 2.1.2, the Permits Division intends to authorize ice road, trail, and pad construction, use, and maintenance activities, which can expose ringed seals to sound that can result in acoustic disturbances.

The MMPA defines "harassment" as: "any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment]" (16 U.S.C. § 1362(18)(A)).

While the ESA does not define "harass," NMFS issued guidance interpreting the term "harass" under the ESA as to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016a). For the purposes of this consultation, any action that amounts to incidental harassment under the MMPA—whether Level A or Level B—constitutes an incidental "take" under the ESA and must be authorized by the ITS (Section 10 of this opinion).

Since 1997, NMFS has used generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to marine mammals (70 FR 1871, 1872; January 11, 2005). NMFS recently revised the comprehensive guidance on sound levels likely to cause injury to marine mammals through onset of permanent and temporary threshold shifts (PTS and TTS; Level A harassment) (83 FR 28824; June 21, 2018). NMFS is in the process of developing guidance for behavioral disruption (Level B harassment). However, until such guidance is available, NMFS uses the following conservative thresholds of underwater sound pressure levels[5], expressed in rms[6] from broadband sounds that cause behavioral disturbance, and referred to as Level B harassment under section 3(18)(A)(ii) of the MMPA (16 U.S.C § 1362(18)(A)(ii)):

- impulsive sound: 160 dB re 1 μPa_{rms}
- continuous sound: 120 dB re 1μPa_{rms}

Under the PTS/TTS Technical Guidance, NMFS uses the following thresholds for underwater sounds that cause injury, referred to as Level A harassment under section 3(18)(A)(i) of the MMPA (16 U.S.C § 1362(18)(A)(i)) (NMFS 2018). Different thresholds and auditory weighting functions are provided for different marine mammal hearing groups, which are defined in the Technical Guidance (NMFS 2018). The generalized hearing range for each hearing group is in Table 5.

[5] Sound pressure is the sound force per unit micropascals (μPa), where 1 pascal (Pa) is the pressure resulting from a force of one newton exerted over an area of one square meter. Sound pressure level is expressed as the ratio of a measured sound pressure and a reference level. The commonly used reference pressure level in acoustics is 1 μPa, and the units for underwater sound pressure levels are decibels (dB) re 1 μPa.

[6] Root mean square (rms) is the square root of the arithmetic average of the squared instantaneous pressure values.

Table 5. Underwater marine mammal hearing groups (NMFS 2018).

Hearing Group	ESA-listed Marine Mammals In the Action Area	Generalized Hearing Range[1]
Low-frequency (LF) cetaceans *(Baleen whales)*	None	7 Hz to 35 kHz
Mid-frequency (MF) cetaceans *(dolphins, toothed whales, beaked whales)*	None	150 Hz to 160 kHz
High-frequency (HF) cetaceans *(true porpoises)*	None	275 Hz to 160 kHz
Phocid pinnipeds (PW) *(true seals)*	Ringed seals	50 Hz to 86 kHz
Otariid pinnipeds (OW) *(sea lions and fur seals)*	None	60 Hz to 39 kHz

[1]Respresents the generalized hearing range for the entire group as a composite (i.e., all species within the group), where individual species' hearing ranges are typically not as broad. Generalized hearing range chosen based on ~65 dB threshold from normalized composite audiogram, with the exception for lower limits for LF cetaceans (Southall et al. 2007) and PW pinniped (approximation).

The PTS onset acoustic thresholds are presented in Table 6, using dual metrics of cumulative sound exposure level (L_E) and peak sound level (PK) for impulsive sounds and L_E for non-impulsive sounds.

Level A harassment radii can be calculated using the optional user spreadsheet[7] associated with NMFS Acoustic Guidance, or through modeling.

[7] The Optional User Spreadsheet can be downloaded from the following website: http://www.nmfs.noaa.gov/pr/acoustics/guidelines.htm

Table 6. PTS Onset Acoustic Thresholds (NMFS 2018).

Hearing Group	PTS Onset Acoustic Thresholds* (Received Level)	
	Impulsive	Non-impulsive
Low-Frequency (LF) Cetaceans	$L_{pk,flat}$: 219 dB $L_{E,LF,24h}$: 183 dB	$L_{E,LF,24h}$: 199 dB
Mid-Frequency (MF) Cetaceans	$L_{pk,flat}$: 230 dB $L_{E,MF,24h}$: 185 dB	$L_{E,MF,24h}$: 198 dB
High-Frequency (HF) Cetaceans	$L_{pk,flat}$: 202 dB $L_{E,HF,24h}$: 155 dB	$L_{E,HF,24h}$: 173 dB
Phocid Pinnipeds (PW) (Underwater)	$L_{pk,flat}$: 218 dB $L_{E,PW,24h}$: 185 dB	$L_{E,PW,24h}$: 201 dB
Otariid Pinnipeds (OW) (Underwater)	$L_{pk,flat}$: 232 dB $L_{E,OW,24h}$: 203 dB	$L_{E,OW,24h}$: 219 dB

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.

Note: Peak sound pressure (L_{pk}) has a reference value of 1 µPa, and cumulative sound exposure level (L_E) has a reference value of 1µPa²s. The subscript "flat" is being included to indicate peak sound pressure should be flat weighted or unweighted within the generalized hearing range. The subscript associated with cumulative sound exposure level thresholds indicates the designated marine mammal auditory weighting function (LF, MF, and HF cetaceans, and PW and OW pinnipeds) and that the recommended accumulation period is 24 hours. The cumulative sound exposure level thresholds could be exceeded in a multitude of ways (i.e., varying exposure levels and durations, duty cycle). When possible, it is valuable for action proponents to indicate the conditions under which these acoustic thresholds will be exceeded.

For the proposed action, the principal noise producing activities would be from the ice augering, pumping sea water to flood the ice and build the road, bulldozers plowing snow, and the use of equipment to cut the ice. We would consider these noise sources to be continuous (i.e., non-impulsive), and thus for ringed seals, the PTS onset acoustic threshold would be 201 dB re 1µPa$_{rms}$ (NMFS 2018).

Based on a sound source verification study conducted at Northstar (Greene et al. 2008) and modeling conducted by SLR Consulting, it is anticipated that ice road, ice trail, and ice pad construction and maintenance activities will result in an average underwater sound pressure level of 189.1 dB re 1µPa (SLR Consulting 2017), and a Level B harassment threshold extending out to 0.17 km (558 ft). The proposed action will use equipment comparable to that used in the sound source verification study at Northstar.

Since we expect the noise source to be below the Level A threshold for pinnipeds (i.e., ringed seals), we do not expect Level A harassment or PTS to occur. However, since the underwater sound pressure level is expected to be above 120 dB re 1µPa$_{rms}$, we expect that Level B harassment would occur.

In addition, NMFS uses the following thresholds for in-air sound pressure levels from broadband sounds that cause Level B behavioral disturbance under section 3(18)(A)(ii) of the MMPA (16 U.S.C § 1362(18)(A)(ii)):

- 100 dB re 20μPa_{rms} for non-harbor seal pinnipeds

The sound source pressure levels at 100m for airborne noise for activities associated with ice road construction are: 64.7 dB re 20μPa_{rms} for bulldozers, 67.9 dB re 20μPa_{rms} for augers, and 72 dB re 20μPa_{rms} for water pumps. Trucks on the ice road create in-air sound levels of 74.8 dB re 20μPa_{rms} (at 100 m) (Greene et al. 2008). The distance to the Level B threshold for airborne noise for these activities is less than 0.02 km (66 ft).

6.2.2 Ringed Seal Exposure Estimates

For our exposure analyses, NMFS generally considers an action agency's estimates of the number of marine mammals that might be "taken" over the duration of the proposed action. As part of their LOA application Hilcorp and Eni provided a five-year, quantitative exposure analysis. NMFS AKR and the Permits Division conducted our own analysis and review of the methodology Hilcorp and Eni used in their exposure estimate in order to estimate the number of exposures to ringed seals that may result from stressors produced by the proposed action.

As discussed in Section 2.1.2 above, the Permits Division proposed mitigation measures that should avoid or minimize exposure of ringed seals to stressors associated with ice road/trail/pad construction, use, and maintenance (e.g., noise, direct harassment, injury, or mortality). To minimize the risk of takes of ringed seals from on-ice activities, Hilcorp and Eni will adhere to the Mitigation Measures developed in collaboration with and approved by NMFS (see Section 2.1.2.).

Ringed seals could be encountered during the ice covered season. Ringed seals are more likely to use shorefast ice areas surrounding the proposed drillsites during the ice-covered season (see Section 4.3). Ringed seals may be encountered on floating ice within the action area, but are not expected to be present on bottom-fast ice, which typically occurs in waters with a depth of less than 3 m (9 ft).

It is not possible to estimate the number of ringed seal individuals by age or sex that may be affected by the proposed action; however, there is density information available on the number of individuals across all age classes and sex for ringed seals. During consultation, we reviewed the densities Hilcorp and Eni used in their LOA application to calculate take of ringed seals by harassment. We have adopted the calculated exposures for harassment presented by Hilcorp and Eni in the Request for Incidental Take Authorization and the associated proposed rule (85 FR 2988; January 17, 2020) for our exposure analysis for the proposed action (Eco49 2019). However, after review of Hilcorp and Eni's methodology to estimate mortality and serious injury of ringed seals, NMFS disagreed, and developed our own methodology; see discussion below.

Seasonal Ringed Seal Density

Since the proposed action will take place from December to May, encompassing two seasons, winter and spring, we needed to examine seasonal differences in ringed seal densities and

account for those in our exposure estimates. For the purposes of this analysis, we consider winter to be November through March, and spring to be April through June.

Winter ringed seal densities were estimated by using the average density of seal structures divided by the average number of structures per seal. The data used to calculate the winter seal structure density are from aerial surveys flown in the early 1980s and 1999 to 2000. To the best of our knowledge, there are not more recent data available, so we rely on the data found in the sources in Table 7.

Table 7. Average densities of ringed seal ice structures and estimated ringed seal winter density on the North Slope.

Year	Ice Structure density/km^2	Source
1982	3.6	(Frost and Burns 1989)
1983	0.81	(Kelly et al. 1986)
December 1999	0.71	(Williams et al. 2001)
May 2000	1.2	(Williams et al. 2001)
Average structure density/km^2	1.58	
Average number of structures used by seals	2.85	(Kelly et al. 1986)
Estimated density (seals/ km^2)	**0.554**	

Male and female ringed seals maintain numerous breathing holes and haul out in more than one subnivean lair during the ice-covered season. As such, simply using the ice structure density as a substitute to estimate the number of individuals would not be appropriate, since we know that a single ringed seal may use multiple ice structures. Kelly et al. (1986) examined movement patterns of tagged ringed seals, and found that the average number of lairs used by an individual seal was 2.85 (SD=2.51) per animal (which the authors point out was likely an underestimate).

The average structure density (Table 7) was divided by the average number of structures used by seals (Kelly et al. 1986). The estimated winter density of ringed seals is 0.554 seals per km^2. However, this density is likely to be an overestimate because the equation denominator (2.85) is assumed to be an underestimate.

The spring density calculation relied upon aerial surveys flown in May and June along the North Slope in the vicinity of the action area. The data presented in Table 8 was used to calculate the uncorrected spring densities of ringed seals. To the best of our knowledge, these studies represent the most recent ringed seal density surveys available.

For spring ringed seal densities, aerial surveys flown in 1997 through 2002 over Foggy Island Bay and west of Prudhoe Bay during late May and early June (Figure 10) (Figure 24; Frost et al.

2002, Moulton et al. 2002b, Richardson and Williams 2003), when the greatest percentage of seals have abandoned their lairs and are hauled out on the ice (Kelly et al. 2010), provides the best available information on ringed seal densities.

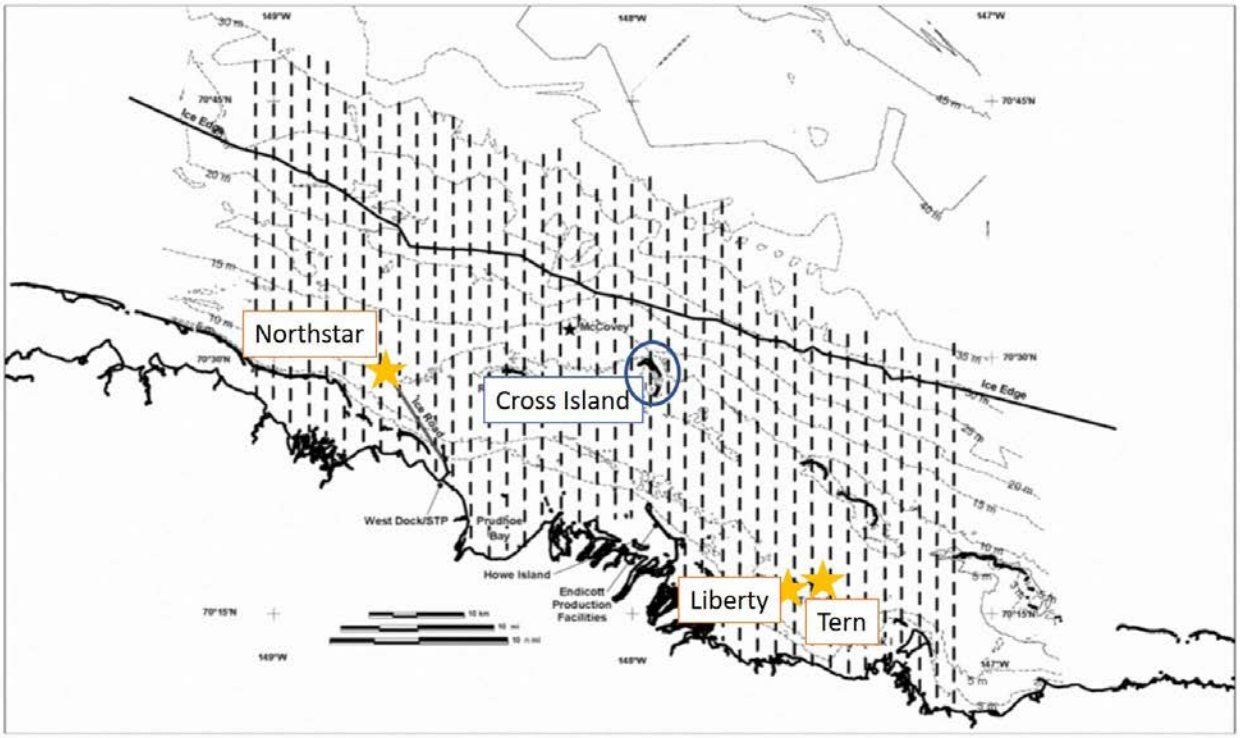

Figure 10. Aerial survey transects flown in May-June 2002. Similar surveys were flown in each year 1997-2001 (Figure taken from Richardson and Williams 2002).

Table 8. Ringed seal spring densities, 1996 to 2002.

Year	Density (no./km^2) Moulton et al. 2002, 2005*	Density (no./km^2) Frost et al. 2002, 2004†	Average Uncorrected Density (no./km^2)
1996	n/a	0.81	n/a
1997	0.43	0.73	0.58
1998	0.39	0.64	0.52
1999	0.63	0.87	0.75
2000	0.47	n/a	0.47
2001	0.54	n/a	0.54
2002	0.83	n/a	0.83
		Average Total	**0.61**

*Shallow areas (less than 3m deep) excluded from the calculations; see below.
†Frost et al. 2004 recalculated their densities for 1997-1999 to compare their estimates with Moulton et al. 2005.

Moulton et al. (2005) excluded shallow areas in calculating the spring densities. The study observed very low densities (averaging 0.07 seal/km^2 over six years) in areas where summer

water depths are less than 3 m. In spring, much of (or the entire) water column in waters less than 3 m is frozen.

Moulton et al. (2005) noted that the observed densities varied by a factor of about two between years, and that other studies in the Alaskan Beaufort Sea have also reported comparable or greater interannual variability. Frost et al. (2004) also observed interannual variability in their densities. Other authors (Stirling et al. 1982, Frost et al. 1988, Lunn et al. 1997) have attributed the differences in density to the difference in the proportion of the number of seals hauled out and the timing of the survey relative to ice conditions and the annual molt.

In addition to interannual ability, authors have also observed variability on a daily basis. For instance, in 1999, both Frost et al. (2004) and Moulton et al. (2005) surveyed a similar area at close to the same time. In addition, another researcher, Kelly et al. (2005) was conducting a study on tagged ringed seals in the area at the same time, looking at spatial and temporal patterns of lair use.

Kelly et al. (2005) observed what they described as a "transition period" when the weather warms and ringed seals gradually leave their lairs to bask outside. The warmer temperature also means that the lairs become less stable. On May 29, 1999, 12 percent of the tagged seals present were hauled out. On June 4th, 40 percent of the tagged seals were hauled out and visible outside their lairs. Kelly et al. (2005) stated that overall, "the proportion of seals visible during survey periods changed rapidly from day to day."

Based on these studies, we expect there to be some variability in the springtime densities of ringed seals over the course of the proposed action, although we are unable to quantify it.

Exposure Calculations

Table 9 summarizes the densities for ESA-listed ringed seals used to calculate exposure estimates. The number of ringed seals exposed to behavioral harassment from the proposed action is calculated by multiplying these expected densities of ringed seals in the project area by the area ensonified and defined as Level B harassment (see section 6.2.1).

Table 9. Winter and spring densities for ringed seals used in exposure analysis.

Winter Average Density (seals/km^2)	Spring Average Density (seal/km^2)
0.55	0.61

To estimate exposures of ringed seals to disturbance that may result in a take, the total area of potential disturbance (i.e., exposure area) associated with construction and maintenance of the roads/trails/pads is defined as 170 m (approximately 558 ft) on either side of the road/trail/pad centerline; a total width of 340 m (approximately 1,115 ft).

This distance is the approximate width of disturbance for ice road/trail/pad construction plus a buffer. Greene et al. (2008) reported received levels of 120 dB re 1 μPa (i.e., the Level B

harassment threshold) for overall ice road construction at approximately 170 m (558 ft). Furthermore, the 1999 ringed seal surveys conducted by Dr. Kelly's trained dogs at Northstar located two seal structures within 10-50 m (33-164 ft) of the ice road after it was constructed, indicating that seals may occur in this exposure area despite the activities (Williams et al. 2001).

The total width of the exposure area (340 m) is multiplied by the total length of roads/trails likely to be constructed each year to calculate the exposure area in square kilometers. Due to the variability in the length of ice roads/trails that may be needed from year to year, 10 percent has been added to the total length and is accounted for in the total area calculated. The total area of exposure is then multiplied by the seasonal ringed seal density to calculate the total estimated ringed seals exposed each season. Since there are two seasons during which ringed seals may be exposed to ice road activity (winter and spring), the exposure estimates for winter and spring are then added together to calculate the total number of seals exposed per year.

Based on the exposure estimates, Eni and Hilcorp request authorization of Level B harassment for the 5-year period as shown in Table 10. Takes are presented annually for each company at each drillsite and are requested for ice road, ice trail, and ice pad construction, operation, and maintenance expected to occur between December and May of each year, depending on local conditions. Takes could occur in all five years.

Table 10. Ringed seal harassment (Level B) take estimate associated with ice road/trail activities

	Total ice road length (km)	Total ice trail length (km)	Total length plus 10% buffer[1]	Total width (km)	Total area of exposure (km^2)	Est. no. seals exposed during winter (density[2] x area)	Est. no. seals exposed during spring (density[2] x area)	Total est. takes per year	Total Level B take estimates	Total est. takes over 5 years
Eni SID	6.76	0[3]	7.43	0.42	3.12	1.72	1.90	3.62	4	20
Eni ODS	11.26[4]	0	12.39	0.34	4.21	2.32	2.57	4.89	5	25
Hilcorp Northstar	11.71	22.94	38.12	0.34	12.96	7.13	7.91	15.03	16	80

[1] To account for variability
[2] Density: Winter=0.55 seals/km^2; Spring=0.61 seals/km^2
[3] Note that Eni constructs an ice trail each year that is approximately 15 to 30 m west of the ice road. The trail is located within the exposure area of 170m and is accounted for in estimated takes.
[4] Length of alternate route used as worst case.

6.2.2 Direct Injury and Mortality

In addition to acoustic and physical harassment, seals may injured, or killed by the use of on-ice equipment associated with ice roads, ice trails, and ice pads.

Since 1998, there have been three documented incidents of ringed seal takes from oil and gas activities on the North Slope, with one recorded mortality. On April 17, 1998, during a vibroseis on-ice seismic operation outside of the barrier islands east of Bullen Point in the eastern Beaufort Sea, a ringed seal pup was killed when its lair was destroyed by a Caterpillar tractor clearing a

road. The lair was located on ice over water 9 m (29 ft) deep with an ice thickness of 1.3 m (4.3 ft). It was reported that an adult may have been present in the lair when it was destroyed. Crew found blood on the ice near an open hole approximately 1.3 km (0.8 mi) from the destroyed lair; this could have been from a wounded adult (MacLean 1998). On April 24, 2018, a tucker traveling on a Northstar sea ice trail broke through a brine pocket. After moving the tucker, a seal pup climbed out of the hole in the ice, but no adult was seen in the area. The seal pup remained in the area for the next day and a half. This seal was seen in an area with an estimated water depth of 6 to 7 m (20 to 24 ft) (Hilcorp 2018). The third reported incident occurred April 28, 2018, when an Eni contractor performing routine maintenance activities to relocate metal plates beneath the surface of the ice road from Oliktok Point to Spy Island Drillsite spotted a ringed seal pup next to what may have been a disturbed lair site. No adult was seen in the area. The pup appeared to be acting normally and was seen going in/out of the opening several times (ENI 2018).

Initially, Hilcorp and Eni requested authorization of 10 ringed seal mortalities per ice road over 5 years in association with ice road, trail, and pad activities (three ice roads, 30 mortalities total). Given the relatively low amount of ringed seal mortality previously observed, and given what we consider is likely in terms of amount of expected exposure, we did not find this request supportable to determine the take reasonably certain to occur from the proposed action (50 CFR § 402.14(g)(7)). After discussions with the Permits Division, we estimated lethal take based on other similar actions (e.g., Hilcorp's 2019 Liberty Development and Production Island LOA, issued by the Permits Division in December 2019 (84 FR 70274, December 20, 2019)). We expect that the approach presented in the Liberty Development and Production Island LOA is a more realistic assessment of the ringed seal mortality that may occur because it is based on observed mortality from the past, and is thus a more conservative approach. The Liberty Development and Production Island is on the North Slope, in the vicinity of Hilcorp's and Eni's drillsites proposed in this action. Both actions include ice road, trail, and pad construction, and both request ringed seal mortalities in association with those activities. Due to the similarities between the two actions, it is appropriate to compare them for the purposes of assessing the amount of ringed seal mortality in this proposed action.

Hilcorp and Eni would be operating three separate drillsites, and each would be constructing a different amount of ice roads or trails for their respective operations: the Oooguruk Drillsite (Eni), the Spy Island Drillsite (Eni), and the Northstar Production Island (Hilcorp). Hilcorp will be constructing 34.65 km of ice roads and trails in total. Compared to Eni's 18.02 km, Hilcorp will be constructing 1.9 times as many ice road/trail kilometers as Eni. A total of 52.7 km of ice roads and trails would be constructed annually for each of the three drillsites combined (Table 11).

Table 11. Total kilometers of ice roads and trails proposed for construction at each drillsite.

Company and Drillsite	Ice Road (km)	Ice Trail (km)	Total (km)	Total km by Company
Eni Spy Island	6.76	0	6.76	18.02
Eni Oooguruk	11.26	0	11.26	
Hilcorp Northstar	11.71	22.94	34.65	34.65

The applicants requested authorization of the mortalities per ice road; however, we have no reason to believe that mortality can only occur on ice roads. Of the three reported cases of ringed seal injury or mortality associated with ice roads or ice trails, two incidents took place on ice roads, and one took place on an ice trail. As such, we are considering that the mortalities could occur for on-ice activities (road, trail and pad) associated with each drillsite.

In the 2019 Liberty Development and Production Island LOA, for the ice road construction and maintenance activities, there are two lethal takes proposed over the first 5 years (and eight over the following 20 years, for 10 total moralities over 25 years). In that action, four ice roads, totaling 51.5 km in length would be constructed: in Years 1 through 3, all four roads would be constructed; in Years 4 and 5, only Road #1 would be constructed (11.3 km in length) (Table 12).

By comparing the two actions, Hilcorp and Eni are constructing 1.5 times the ice roads/trails than Hilcorp is at the Liberty site over a five-year period.

Table 12. Comparison of proposed ringed seal mortalities between the proposed action and the Liberty Development and Production Island LOA.

	Year 1 (km constructed)	**Year 2 (km constructed)**	**Year 3 (km constructed)**	**Year 4 (km constructed)**	**Year 5 (km constructed)**	**Totals (km)**
Hilcorp Liberty 2019 LOA	51.5	51.5	51.5	11.3	11.3	**177.1**
Authorized Mortality						**2 (over 5 years)**
Hilcorp/Eni Ice Road LOA	52.7	52.7	52.7	52.7	52.7	**263.35**
Initial Requested Mortality	6	6	6	6	6	**30 (10 per ice road)**

If, over five years, Hilcorp and Eni are proposing to construct 1.5 times the length of ice roads/trails as at the Hilcorp Liberty site, the proposed mortality can be 1.5 times the Hilcorp Liberty amount over the same time. Therefore, two mortality/serious injury takes times 1.5 is three takes over 5 years.

In terms of portioning take to the two companies, Hilcorp is constructing 1.9 times as many ice road/trail kilometers as Eni (round up to 2). Since Hilcorp is engaging in more activity than Eni, it is reasonable to expect that there is a higher likelihood of ringed seal interaction for their activities.

Based on these calculations, we assume three authorized serious injury/mortalities for ice road/trail/pad activities at each of Eni's sites (Spy Island and Ooguruk), and six authorized serious injury/mortalities for Hilcorp's Northstar site, all over five years. Following a discussion, the applicants (Eni and Hilcorp) and the Permits Division agreed to this estimate of the likely

amount of injury/mortality.

6.2.3 Visual Disturbance from Vehicles and Project Activities

In addition to the stressors associated with acoustic disturbance from ice road, trail, and pad construction, use, and maintenance, ringed seals could also be exposed to stressors caused by visual disturbance from vehicles and project activities.

Visual disturbance could occur during all vehicle and project activities. A ringed seal could react to project activities by being startled by vehicles. Disturbance from project activities or vehicles could temporarily increase stress levels or displace an animal from its habitat. Vehicle traffic would occur on the ice roads and trails regularly, every day, from the time the roads and trails are built until the time when it is unsafe to use them. Vehicles and personnel would also use ice pads (e.g., for parking). Project activities would include use of the construction equipment for making the ice roads, trails, and pads.

We expect some visual disturbance to occur while ringed seals remain on the ice, for example, while they are molting from late spring to early summer. Ringed seals also use the ice as a haul-out platform at other times during the year (e.g., for resting), and could be exposed then as well.

We expect that the total width of the exposure area (340 m, as described in the previous section), and the calculated exposure estimates would account for the ringed seals that are likely to be exposed to visual disturbance from vehicle and project activities.

6.2.4 Habitat Alteration from Ice Road, Trail, and Pad Construction

The proposed action will include the construction, use, and maintenance of ice roads, trails, and pads on the North Slope. The proposed action will alter habitat for ESA-listed ringed seals, amounting to approximately 52.7 km of ice roads and trails annually, as well as 0.00637 km^2 of ice pads. Ringed seals could be affected by the habitat alterations from these activities.

Ringed seals are regularly documented on the North Slope and in the vicinity of the three drillsites considered in the proposed action. However, the amount of habitat being reduced by the construction of the ice roads, trails, and pads is extremely small compared to the amount of habitat available on the North Slope and the Beaufort Sea. Furthermore, not all of the action area overlaps with optimal ringed seal habitat, which is related to water depth. The Spy Island and Oooguruk drillsites are in shallower water than the Northstar drillsite, so habitat alteration that occurs at Spy Island and Oooguruk is expected to have less of an impact to ringed seal habitat. The overall impact of habitat alteration is expected to be minor.

6.3 Response Analysis

As discussed in the *Approach to the Assessment* section of this opinion, response analyses determine how listed species are likely to respond after being exposed to an action's effects on the environment or directly on listed species themselves. Our assessments try to detect the probability of lethal responses, physical damage, physiological responses (particular stress responses), behavioral responses, and social responses that might result in reducing the fitness of

listed individuals. Ideally, our response analyses consider and weigh evidence of adverse consequences, beneficial consequences, or the absence of such consequences.

Possible responses by ESA-listed ringed seals to project activities in this analysis are:

- Threshold shifts
- Auditory interference (masking)
- Behavioral responses
- Physical or physiological effects

6.3.1 Threshold Shifts

Exposure of marine mammals to very loud noise can result in physical effects, such as changes to sensory hairs in the auditory system, which may temporarily or permanently impair hearing. Temporary threshold shift (TTS) is a temporary hearing change, and its severity is dependent upon the duration, frequency, sound pressure, and rise time of a sound (Finneran and Schlundt 2013). TTSs can last minutes to days. Full recovery is expected, and this condition is not considered a physical injury.

At higher received levels, or in frequency ranges where animals are more sensitive, permanent threshold shift (PTS) can occur. When PTS occurs, auditory sensitivity is unrecoverable (i.e., permanent hearing loss). The effect of noise exposure generally depends on a number of factors relating to the physical and spectral characteristics of the sound (e.g., the intensity, peak pressure, frequency, duration, duty cycle), and relating to the animal under consideration (e.g., hearing sensitivity, age, gender, behavioral status, prior exposures).

Both TTS and PTS can result from a single pulse or from accumulated effects of multiple pulses from an impulsive sound source (i.e., impact pile or pipe driving) or from accumulated effects of non-pulsed sound from a continuous sound source (i.e., vibratory pile driving). In the case of exposure to multiple pulses, each pulse need not be as loud as a single pulse to have the same accumulated effect.

As it is a permanent auditory injury, the onset of PTS may be considered an example of "Level A harassment" as defined in the MMPA. As discussed earlier, we do not expect PTS or Level A harassment to occur from the proposed action. TTS is by definition recoverable rather than permanent, and has historically has been treated as "Level B harassment" under the MMPA. Behavioral effects may also constitute Level B harassment, and are expected to occur at even lower noise levels than would generate TTS.

6.3.2 Auditory Interference (Masking)

Auditory interference, or masking, occurs when an interfering noise is similar in frequency and loudness to (or louder than) the auditory signal received by an animal while it is processing echolocation signals or listening for acoustic information from other animals (Francis and Barber 2013). Masking can interfere with an animal's ability to gather acoustic information about its environment, such as predators, prey, conspecifics, and other environmental cues (Francis and

Barber 2013).

Auditory masking is quantified by using critical ratios, a measure of the relative ability of an animal to extract signals from noise, and these critical ratios have been determined for pinnipeds (Southall et al. 2000, Southall et al. 2003). These studies provide baseline information from which the probability of masking can be estimated. Phocids (e.g., ringed seals) have good low-frequency hearing; thus, it is expected that they will be more susceptible to masking of biologically significant signals by low frequency sounds, such as those associated with ice road construction (Gordon et al. 2003, Greene et al. 2008).

Evidence suggests that at least some marine mammals have the ability to acoustically identify predators. For example, harbor seals that reside in the coastal waters off British Columbia are frequently targeted by certain groups of killer whales, but not others. The seals discriminate between the calls of threatening and non-threatening killer whales (Deecke et al. 2002), a capability that should increase survivorship while reducing the energy required for attending to and responding to all killer whale calls. Auditory masking may prevent marine mammals from responding to the acoustic cues produced by their predators. The effects of auditory masking on the predator-prey relationship depends on the duration of the masking and the likelihood of encountering a predator during the time that predator cues are impeded.

Ice road, trail, and pad construction, use, and maintenance activities are not expected to result in extended periods of time where masking could occur. Ice road, trail, and pad construction would be completed by March 1st, and would take only as long as is necessary to construct those structures (i.e., the construction activities would not happen continuously throughout that period). Other activities (use and maintenance) would continue into mid-May. Masking only exists for the duration of time that the masking sound is being emitted.

6.3.3 Behavioral Responses

NMFS expects the majority of ESA-listed species responses to the proposed activities will occur in the form of behavioral response. Marine mammals may exhibit a variety of behavioral changes in response to underwater sound and the general presence of project activities and equipment, which can be generally summarized as:

- Modifying or stopping vocalizations
- Changing from one behavioral state to another
- Movement out of feeding, breeding, or migratory areas

The response of a marine mammal to an anthropogenic sound will depend on the frequency, duration, temporal pattern, and amplitude of the sound as well as the animal's prior experience with the sound and the context in which the sound is encountered (i.e., what the animal is doing at the time of the exposure). The distance from the sound source and whether it is perceived as approaching or moving away can affect the way an animal responds to a sound (Wartzok et al. 2003). For marine mammals, a review of responses to anthropogenic sound was first conducted by Richardson et al. (1995c). More recent reviews (e.g., Ellison et al. 2012; Nowacek et al. 2007; Southall et al. 2009; Southall et al. 2007a) address studies conducted since 1995 and focus on

observations where the received sound level of the exposed marine mammal(s) was known or could be estimated.

Except for some vocalization changes that may be compensating for auditory masking, all behavioral reactions are assumed to occur due to a preceding stress or cueing response; however, stress responses cannot be predicted directly due to a lack of scientific data. Responses can overlap; for example, an increased respiration rate is likely to be coupled with a flight response. Differential responses are expected among and within species since hearing ranges vary across species and individuals, the behavioral ecology of individual species is unlikely to completely overlap, and individuals of the same species may react differently to the same, or similar, stressor.

A review of behavioral reactions by pinnipeds to impulsive noise can be found in Richardson et al. (1995a) and Southall (2007). Blackwell et al. (2004a) observed that ringed seals exhibited little or no reaction to drilling noise with mean underwater levels of 157 dB re 1 µPa rms and in air levels of 112 dB re 20 µPa, suggesting the seals had habituated to the noise. In contrast, captive California sea lions avoided sounds from an impulsive source at levels of 165 to 170 dB re 1 µPa (Finneran et al. 2003).

Experimentally, Götz and Janik (2011) tested underwater responses to a startling sound (sound with a rapid rise time and a 93 dB sensation level [the level above the animal's threshold at that frequency]) and a non-startling sound (sound with the same level, but with a slower rise time) in wild-captured gray seals. The animals exposed to the startling treatment avoided a known food source, whereas animals exposed to the non-startling treatment did not react or habituate during the exposure period. The results of this study highlight the importance of the characteristics of the acoustic signal in an animal's habituation.

In cases where seal response is brief (i.e., changing from one behavior to another, relocating a short distance, or ceasing vocalization), effects are not likely to be significant at the population level, but could rise to the level of take of individuals.

Marine mammal responses to anthropogenic sound vary by species, life stage, prior exposure, current activity, reproductive state, time of day, and other factors (Ellison et al. 2012). This is reflected in a variety of aquatic, aerial, and terrestrial animal responses to anthropogenic noise that may ultimately have fitness consequences (Francis and Barber 2013).

6.3.4 Physical or Physiological Effects

Physiological effects can occur in individuals exposed to noise, causing them to experience stress and distress, where stress is an adaptive response that does not normally place an animal at risk, and distress is a stress response resulting in a biological consequence to the individual. Both stress and distress can affect survival and productivity (Curry and Edwards 1998, Cowan and Curry 2002, Herráez et al. 2007, Cowan and Curry 2008). Mammalian stress levels can vary by age, sex, season, and health status (St. Aubin et al. 1996, Gardiner and Hall 1997, Hunt et al. 2006, Romero et al. 2008).

Anthropogenic activities have the potential to provide additional stressors above and beyond those that occur naturally. For example, various efforts have investigated the impact of vessels on marine mammals (both whale-watching and general vessel traffic noise) and demonstrated that

impacts do occur (Bain 2002, Erbe 2002, Williams and Ashe 2006, Noren et al. 2009, Williams and Noren 2009, Pirotta et al. 2015). Exposure to loud noise can also adversely affect reproductive and metabolic physiology (Kight and Swaddle 2011). In a variety of factors, including behavioral and physiological responses, females appear to be more sensitive or respond more strongly than males (Kight and Swaddle 2011).

Physical effects to ringed seals from the proposed action could take the form of acoustic disturbance or physical harassment.

Acoustic Disturbance
Ringed seals could be affected by noise (underwater and in-air) and vibrations associated with ice road, ice trail, and ice pad construction and maintenance and the physical presence of humans and project equipment. During ice road construction at Northstar the distance to the median background ambient sound for the strongest one-third octave bands for bulldozers, augers, and pumps was less than 2 km for underwater noise, 1 km for in-air noise, and 4 km for ice borne vibrations (Greene et al. 2008). Even though sound may be audible or vibrations detectable out to these distances, it is not expected that seals will be affected at these distances. In addition to using NMFS generic sound exposure thresholds to determine whether an activity produces underwater sounds that might result in impacts to ringed seals, we also looked at the hearing sensitivity range to determine possible exposure.

Since there is a lack of information on underwater and in-air hearing sensitivities specific to ringed seals, we used available information on harbor seals (*Phoca vitulina*), a close relative of ringed and bearded seals. NMFS has defined phocid hearing range to be from 50 Hz to 86 kHz (which encompasses the hearing range all species within the group); however, the optimum underwater hearing sensitivity frequency range for harbor seals is 1 to 50 kHz with a rapid diminishing sensitivity at higher frequencies and a slow weakening sensitivity at lower frequencies (Richardson 2008). The majority of ice road construction noise occupies frequencies below the 1 kHz (or 1,000 Hz; Table 13). Ice trail and ice pad construction noises are anticipated to be similar to ice road construction. These frequencies are below the optimal hearing sensitivity range for harbor seals; therefore, ringed seals may not hear noise propagating to the distance of ambient background noise or the calculated Level B harassment threshold during ice road, ice trail, or ice pad construction and maintenance activities (Richardson 2008).

Table 13. Underwater sound source levels and frequencies measured during ice road construction at Northstar (Blackwell et al. 2004a, Greene et al. 2008, BOEM 2017a).

Sound Source	Broadband Sound Pressure Level (SPL) at 100 m (dB re 1 µPa)	Frequency Bandwidth of produced noise ≥100 (dB re 1 µPa)
Ambient background noise[1]	78 – 110	20 Hz – 5 kHz
Bulldozer	114.2	31.5 Hz – 125 Hz
Augering	103.3	None
Pumping	108.1	500 Hz – 1 kHz
Ditchwitch	122	< 5 Hz – 3.15 kHz
Trucks	123.2	<5 Hz – 500 Hz

[1]Highly variable due to changing environmental variables.

Seals hauled out on the sea ice could hear in-air noise from ice road, ice trail, or ice pad construction and maintenance up to 1 km away (0.6 mi) (Greene et al. 2008); however, based on NMFS's 100 dB in-air Level B harassment threshold, harassment of seals hauled out on ice is only anticipated within 0.02 km (66 ft) from the noise source (see Section 6.2.1). Aerial surveys conducted from 1997 through 2002 did not show any detectable effects from the Northstar development on the local distribution of basking ringed seals. Seals were often documented within 1 km of the island and ice roads. There were no significant differences between seal densities before development or closer to Northstar infrastructure and those farther away (Richardson 2008).

Additionally, ringed seals build lairs typically concentrated along pressure ridges, cracks, leads, stamukhi (shear zones), or other surface deformations (Smith and Stirling 1975, Hammill and Smith 1989, Furgal et al. 1996). Ringed seals create their lairs on relatively stable landfast ice (Williams et al. 2006), with at least 34 cm of ice (Hammill 1987). Industry needs similar stable ice for construction activities. Ringed seals located inside of lairs are expected to experience a considerable reduction in received in-air sound levels because snow dampens the effect of in-air noise on an order of ~40 dB (broadband) per meter of snow thickness (Blix and Lentfer 1992). The average snow depth of ringed seal lairs is 0.55 m but ranges from 0.20 to 1.2 m (Frost and Burns 1989, Richardson and Williams 2002, Richardson 2008). Since ringed seals spend approximately 180 days a year within snow covered subnivean lairs, ringed seals are unlikely to be impacted by in-air noise (Richardson 2008).

Seals on sea ice or in lairs may also sense vibrations from industry construction and operations. There are no specific studies assessing the sensitivity of seals to ice borne vibrations; however, Williams et al. (2006) shows that there was no documented change in the presence of ringed seals around the Northstar infrastructure from vibrations or in-air and underwater noise. Williams et al. (2006) studied the use of ringed seal lairs near Northstar activities (including ice roads) and predicted that ringed seals lairs near the Northstar Island would likely have a higher abandonment rate. However, the abandonment rate was not significantly different closer to the Northstar infrastructure (less than 2 km), including ice roads, versus farther away (2 to 3.5 km). Ringed seals were detected building breathing holes and lairs within a few meters of ice roads before and during Northstar activities and maintained these structures for extended periods of time (up to 163 days). Ringed seals were documented creating and using sea ice structures within 11 to 3,500 m (36 to 11,482 ft) of Northstar activities. Birth lairs closest to North Star infrastructure were 882 m and 144 m (2,894 and 374 ft) from the island and ice road, respectively (Williams et al. 2006). Spring ice road traffic did not influence ringed seal use of sea ice. Two basking holes were found within 11 and 15 m (36 and 49 ft) from the nominal centerline of a Northstar ice road and were still in use by the end of the study (Williams et al. 2006). The analysis suggested (with marginal significance) that abandonment was more likely to occur farther from ice roads. Williams et al. (2006) found that abandonment of ice structures was strongly related to: 1) the time of year when the structure was originally found, and 2) ice deformation, rather than the distance from Northstar activities. Higher ringed seal densities occurred in areas with lower ice deformation (Moulton et al. 2002b, Moulton et al. 2005). Adult ringed seals must balance the need to use habitats with some ice deformation (which promotes the snow accumulation needed for lairs) against the possible instability of deformed ice and its possible use as cover by approaching polar bears (Williams et al. 2006).

Visual Disturbance from Vehicles and Project Activities
In addition to acoustic harassment, ringed seals may harassed via visual disturbance by the use of on-ice equipment through the physical presence of the vehicles and other equipment used during ice road, trail, and pad construction, use, and maintenance. The effects may occur periodically over the 5-year life of the proposed action, but only when ice roads, ice trails, and ice pads are constructed and used.

Hilcorp and Eni plan to commence winter activities on the sea ice as early as practical, and prior to March 1st of each year before female ringed seals have established their birth lairs. On-ice construction activities initiated (in an undisturbed area) after March 1st may harm or harass ringed seals in lairs which are virtually undetectable. To minimize the risk of takes of ringed seals from on-ice activities, Hilcorp and Eni will adhere to the Mitigation Measures developed in collaboration with and approved by NMFS (see Section 2.1.2.).

In April 2018, Hilcorp and Eni work crews encountered two ringed seals; one along the ice trail at the Northstar drillsite and one along the ice road at the Spy Island drillsite (Eco49 2019).

Research from Northstar (Williams et al. 2006) reported that ringed seals exposed to disturbance due to vehicle or human presence maintained breathing holes and lairs for up to 163 days despite the presence of vehicular use of ice roads. These structures were established within a few meters of the Northstar Development in the landfast ice before and during construction activities.

Given that there was no significant difference in the presence of seals before and after the development of the Northstar Island and given the implementation of the above mitigation measures by Hilcorp and Eni for their activities, it is expected that only a small number of adult ringed seals and pups could be affected or displaced by ice road, ice trail, and ice pad construction and maintenance in association with the proposed action.

7. CUMULATIVE EFFECTS

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area (50 CFR § 402.02). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

We searched for information on non-Federal actions reasonably certain to occur in the action area. We did not find any information regarding non-Federal actions other than what has already been described in the Environmental Baseline (see Section 5 of this opinion). We expect fisheries, subsistence harvest, noise, oil and gas activities, pollutants and discharges, scientific research, and ship strike will continue into the future. We expect bans on commercial sealing will remain in place, aiding in the recovery of ESA-listed pinnipeds.

8. INTEGRATION AND SYNTHESIS

The Integration and Synthesis section is the final step of NMFS's assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 6) to the environmental baseline (Section 5) and the cumulative effects (Section 7) to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) result in appreciable reductions in the likelihood of both the survival or recovery of the species in the wild by reducing its numbers, reproduction, or distribution; or (2) result in the adverse modification or destruction of critical habitat as measured through direct or indirect alterations that appreciably diminish the value of designated critical habitat as a whole for the conservation of the species. These assessments are made in full consideration of the status of the species (Section 4).

As we discussed in the *Approach to the Assessment* section of this opinion, we begin our risk analyses by asking whether the probable physical, physiological, behavioral, or social responses of endangered or threatened species are likely to reduce the fitness of endangered or threatened individuals or the growth, annual survival, or reproductive success, or lifetime reproductive success of those individuals. If we would not expect individuals of the listed species exposed to an action's effects to experience reductions in the current or expected future survivability or reproductive success (that is, their fitness), we would not expect the action to have adverse consequences on the viability of the populations those individuals represent or the species those populations comprise (Stearns 1977, Brandon 1978, Mills and Beatty 1979, Stearns 1992, Anderson 2000). Therefore, if we conclude that individuals of the listed species are not likely to experience reductions in their fitness, we would conclude our assessment because we would not expect the effects of the action to affect the performance of the populations those individuals represent or the species those population comprise. If, however, we conclude that individuals of the listed species are likely to experience reductions in their fitness as a result of their exposure to an action, we then determine whether those reductions would reduce the viability of the population or populations the individuals represent and the "species" those populations comprise (species, subspecies, or distinct populations segments of vertebrate taxa).

As part of our risk analyses, we identified and addressed all potential stressors, and we considered all of the consequences of exposing endangered or threatened species to all of the stressors associated with the proposed action, individually and cumulatively, given that the individuals in the action area for this consultation are also exposed to other stressors in the action area and elsewhere in their geographic range. In assessing risks to listed species from the proposed action, we assume that the same or similar potential stressors and exposures will occur over the life of Eni's and Hilcorp's drillsites.

We also assume that existing regulations or similar regulatory requirements will apply over the life of the LOA. Regulatory changes may require reinitiation of consultation per 50 CFR § 402.16. In addition, we assume that all required mitigation measures will be implemented. If required mitigation measures are not incorporated into the proposed action by Hilcorp and Eni, the action agency may need to reinitiate consultation per 50 CFR § 402.16.

Ringed Seal Risk Analysis

Based on the results of the exposure analysis (see Section 6.2), we expect ringed seals may be exposed to disturbance from the construction, use, and maintenance of ice roads, trails, and pads that may result in Level B harassment takes. Exposure to vehicle noise and habitat alteration may occur but are considered insignificant and would not rise to the level of take. Stressors associated with on-ice activities (ice road, ice trail, and ice pad construction, maintenance, operation, and decommissioning) may result in Level B harassment through noise for ringed seals; Level B harassment through physical presence for ringed seals; and mortality for ringed seals.

Mitigation measures required for ice roads, trails, and pads would further reduce the impacts to ringed seals (Section 2.1.2).

The primary mechanism by which the behavioral changes we have discussed affect the fitness of individual animals is through the animal's energy budget, time budget, or both (the two are related because foraging requires time). Fall and early winter periods, prior to the occupation of breeding sites, are important in allowing female ringed seals to accumulate enough fat stores to support estrus and lactation (Kelly et al. 2010). This fall and early winter time period overlaps with ice road construction. However, the individual and cumulative energy costs of the behavioral responses we have discussed are not likely to reduce the energy budgets of ringed seals. As a result, the ringed seal's probable responses (i.e., tolerance, avoidance, short-term masking, and short-term vigilance behavior) to close approaches by vehicles and their probable exposure to noise or human disturbance are not likely to reduce the fitness or current or expected future reproductive success or reduce the rates at which they grow, mature, or become reproductively active. Therefore, these exposures are not likely to reduce the abundance, reproduction rates, and growth rates (or increase variance in one or more of these rates) of the populations those individuals represent. For physical disturbance, if an active ringed seal lair is not detected and is incidentally impacted by heavy equipment, the adult female could likely escape into the water but the pup could be killed by crushing or premature exposure to the water or frigid air. Timing restrictions would likely avoid adverse effects to newborn ringed seal pups, particularly when nursing and molting. However, if activities associated with ice roads, trails, or pads occur after March 1st a few injuries, mortalities, or physical harassments may occur. While individuals may be impacted, these impacts are not likely to reduce the abundance, reproductive rates, or growth rates of the populations those individuals represent.

In total, the proposed action is anticipated to result in 125 instances of exposure to ringed seals due to harassment during ice road, trail, and pad construction, use, and maintenance over the course of five years. Ice road construction and maintenance may result in up to 12 ringed seal mortalities over the life of the proposed action (over the course of five years). The best available data on abundance estimates indicates the population in the Chukchi and Beaufort Seas to be at least 300,000 ringed seals (Kelly et al. 2010). The potential mortality of 12 ringed seals over a five year period is not expected to have population-level effects. These estimates represent the total number of takes that could potentially occur, not necessarily the number of individual seals taken, as a single individual may be "taken" multiple times over the course of the proposed action. These exposure estimates are likely to be overestimates because they assume a uniform distribution of seals, do not account for avoidance or the effectiveness of mitigation measures in reducing take, and assume all of the planned ice roads, trails, and pads will be constructed. In

assessing the risks posed to the listed species (ringed seals), NMFS assumes that this level of anticipated exposure and mortalities will occur over the life of Eni's and Hilcorp's drillsites (approximately 15 to 20 years).

Although the ice road, trail, and pad activities are likely to cause some individual ringed seals to experience changes in their behavioral states that might have adverse consequences (Frid and Dill. 2002), these responses are not likely to alter the physiology, behavioral ecology, and social dynamics of individual seals in ways or to a degree that would reduce their fitness because even if the seals are present around the construction operations they can avoid intense exposure by leaving their lairs or moving away from the disturbance.

Ringed seals that avoid these sound fields or exhibit vigilance are not likely to experience significant disruptions of their normal behavior patterns because ringed seals seem rather tolerant of similar low frequency noise, like that associated with drilling operations. For example, drilling operations at Northstar facility during the open-water season resulted in brief, minor localized effects on ringed seals with no consequences to ringed seal populations (Richardson and Williams 2004). Adult ringed seals seem to tolerate drilling activities. Brewer et al. (1993) noted ringed seals were the most common marine mammal sighted and did not seem to be disturbed by drilling operations at the Kuvlum #1 project in the Beaufort Sea. Southall et al. (2007) reviewed literature describing responses of pinnipeds to continuous sound and reported that the limited data suggest exposures between ~90 and 140 dB re 1 μPa generally do not appear to induce strong behavioral responses in pinnipeds exposed to continuous sounds in water. We expect ringed seals to react similarly to disturbances associated with the proposed action.

As we discussed in the *Approach to the Assessment* section of this opinion, an action that is not likely to reduce the fitness of individual seals would not be likely to reduce the viability of the populations those individual seals represent (that is, we would not expect reductions in the reproduction, numbers, or distribution of such populations). For the same reasons, an action that is not likely to reduce the viability of those populations is not likely to increase the extinction probability of the species those populations comprise; in this case, the Arctic ringed seal. As a result, the ice road, trail, and pad activities associated with Hilcorp's and Eni's three drillsites are not likely to appreciably reduce the species' reproduction, numbers, or distribution and therefore are not likely to appreciably reduce the likelihood of the Arctic ringed seal surviving or recovering in the wild.

9. CONCLUSION

After reviewing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, and cumulative effects, it is NMFS's biological opinion that the proposed action is not likely to jeopardize the continued existence of Arctic ringed seals.

No critical habitat has been designated for this species, therefore, none will be affected.

In addition, the proposed action is not likely to adversely affect:

- Mexico DPS humpback whales
- Western North Pacific DPS humpback whales
- Bowhead whales
- Beringia DPS bearded seals

10. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA prohibits the take of endangered species unless there is a special exemption. The ESA does not prohibit the taking of threatened species unless special regulations have been promulgated, pursuant to ESA Section 4(d), to promote the conservation of the species. ESA Section 4(d) rules have not been promulgated for Arctic ringed seals; therefore, ESA section 9 take prohibitions do not apply to this species. This incidental take statement, however, includes numeric limits on taking of ringed seals since those numbers were analyzed in the jeopardy analysis and to provide guidance to the action agency on its requirement to re-initiate consultation if the take limit covered by this opinion is exceeded. This ITS includes reasonable and prudent measures and terms and conditions designed to minimize and monitor take.

"Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct (16 U.S.C. § 1532(19)). "Incidental take" is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity (50 CFR § 402.02). Based on NMFS guidance, the term "harass" under the ESA means to: "create the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering" (Wieting 2016b). The MMPA defines "harassment" as: any act of pursuit, torment, or annoyance which (i) has the potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]; or (ii) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering [Level B harassment] (16 U.S.C. § 1362(18)(A)(i) and (ii)). For this consultation, we anticipate that Level B harassment of ringed seals associated with noise exposure and associated with physical presence during ice road/trail/pad construction, maintenance, and use will occur. No Level A takes associated with noise exposure are authorized. However, we anticipate and authorize take by mortality and serious injury associated with ice road/trail/pad construction, maintenance, and use.

Under the terms of Section 7(b)(4) and Section 7(o)(2) of the ESA, taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA, provided that such taking is in compliance with the terms and conditions of an Incidental Take Statement (ITS).

In light of the absence of ESA Section 4(d) regulations, the ESA does not prohibit the take of ringed seals. If such regulations were promulgated to prohibit take, then Section 7(b)(4)(C) of the

ESA provides that the taking of an endangered or threatened marine mammal must first be authorized by Section 101(a)(5) of the MMPA. Accordingly, the terms of the incidental take statement and the exemption from Section 9 of the ESA would become effective only upon the issuance of MMPA authorization to take the marine mammals, and absent such authorization, the incidental take statement would be inoperative.

The terms and conditions described below are nondiscretionary. The NMFS Permits Division has a continuing duty to regulate the activities covered by this ITS. In order to monitor the impact of incidental take, the NMFS Permits Division must monitor and report on the progress of the action and its impact on the species as specified in the ITS (50 CFR § 402.14(i)(3)). If the NMFS Permits Division (1) fails to require the authorization holder to adhere to the terms and conditions of the ITS through enforceable terms that are added to the authorization, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

10.1 Amount or Extent of Take

Section 7 regulations require NMFS to estimate the number of individuals that may be taken by proposed actions or utilize a surrogate (e.g., other species, habitat, or ecological conditions) if we cannot assign numerical limits for animals that could be incidentally taken during the course of an action (50 CFR § 402.14(i)(1); see also 80 FR 26832; May 11, 2015).

NMFS anticipates the proposed ice road, trail, and pad construction, use, and maintenance activities are likely to result in the incidental Level A (mortality and serious injury) take and Level B harassment (noise and physical presence) of ringed seals. As discussed in Section 6.2 (Exposure Estimates) of this opinion, the proposed action is expected to take the following number of ESA-listed individuals described in Table 14.

Table 14. Summary of instances of exposure associated with the proposed action's activities resulting in the incidental take of ringed seals by behavioral harassment, serious injury, or mortality.

Drillsite	Type of Take	Year 1	Year 2	Year 3	Year 4	Year 5	Total Take over the life of the LOA*
Northstar	Level B	16	16	16	16	16	80
	Mortality or Serious Injury	--	--	--	--	--	6
Spy Island	Level B	4	4	4	4	4	20
	Mortality or Serious Injury	--	--	--	--	--	3
Oooguruk	Level B	5	5	5	5	5	25
	Mortality or Serious Injury	--	--	--	--	--	3

*Serious injury or mortality takes are not assigned to a particular year, and may occur at any time over the course of the five year LOA.

Over all five years, across all drillsites, the total take by harassment is 125 takes, and 12 serious injuries or mortalities.

10.2 Effect of the Take

In Section 9 of this opinion, NMFS determined that the level of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species.

The majority of expected takes from the proposed action are associated with behavioral harassment from noise and equipment presence, and a small number of ringed seals are anticipated to be taken by serious injury or mortality (Section 6 Exposure Analysis). Although the biological significance of behavioral responses remains unknown, this consultation has assumed that exposure to major noise sources might disrupt one or more behavioral patterns that are essential to an individual animal's life history. However, any behavioral responses of ringed seals to major noise sources and any associated disruptions are not expected to affect the reproduction, survival, or recovery of this species. The expected serious injury or mortality of ringed seals is a very small fraction of the overall population.

10.3 Reasonable and Prudent Measures (RPMs)

Reasonable and prudent measures are those actions "necessary or appropriate to minimize the impacts, i.e., amount or extent, of incidental take" (50 CFR § 402.02). RPMs are nondiscretionary.

The RPMs included below, along with their implementing terms and conditions, are designed to minimize the impact of incidental take that might otherwise result from the proposed action. NMFS concludes that the following RPMs are necessary and appropriate to minimize or to monitor the incidental take of ringed seals resulting from the proposed action.

1. This ITS is valid only for the activities described in this biological opinion, and which have been authorized under section 101(a)(5) of the MMPA.
2. The take of ESA-listed species by serious injury or mortality, whether authorized or unauthorized, will be immediately reported to NMFS AKR.
3. The NMFS Permits Division must implement a monitoring program that allows NMFS AKR to evaluate the take estimates contained in this biological opinion and that underlie this incidental take statement.
4. The NMFS Permits Division must submit reports to NMFS AKR that evaluate its mitigation measures and the results of its annual monitoring program.

10.4 Terms and Conditions

"Terms and conditions" implement the reasonable and prudent measures (50 CFR § 402.14). These must be carried out for the exemption in section 7(o)(2) to apply.

In order to be exempt from the prohibitions of section 9 of the ESA, the NMFS Permits Division or any applicant must comply with the following terms and conditions, which implement the RPMs described above and the mitigation measures set forth in Section 2.1.2 of this opinion. The NMFS Permits Division or any applicant has a continuing duty to monitor the impacts of

incidental take and must report the progress of the action and its impact on the species as specified in this incidental take statement (50 CFR § 402.14).

Partial compliance with these terms and conditions may result in more take than anticipated, and may invalidate this take exemption. These terms and conditions constitute no more than a minor change to the proposed action because they are consistent with the basic design of the proposed action.

To carry out RPM#1, the NMFS Permits Division or their permittees must undertake the following:

A. The NMFS Permits Division must require the permittees (Hilcorp and Eni) to apply for and receive the appropriate authorizations under section 101(a)(5) of the MMPA, for activities that involve the take of threatened or endangered marine mammals.

B. Any take must be authorized by a valid, current LOA issued by NMFS under section 101(a)(5) of the MMPA, and such take must occur in compliance with all terms, conditions, and requirements included in such authorization.

To carry out RPM#2, Hilcorp and Eni must undertake the following:

A. In the event that the proposed action causes take (authorized or unauthorized) of a ringed seal that results in an observed serious injury or mortality, that incident must be reported within 24 hours to NMFS AKR, Protected Resources Division at 907-586-7638 and/or by email to greg.balogh@noaa.gov, the Marine Mammal Stranding Hotline at 877-925-7773, and NMFS Permits Division Shane Guan at 301-427-8418 for any MMPA authorization issues. The report must include the following information:

   i. Time, date, and location (latitude/longitude) of the incident;

   ii. details on the nature and cause of the take (e.g., vehicles, vessels, and equipment in use at the time of take);

   iii. if applicable, an account of all known sound sources above 120 dB that occurred in the 24 hours preceding the incident;

   iv. water depth at the location of the take;

   v. environmental conditions (e.g., wind speed and direction, Beaufort sea state, cloud cover, and visibility);

   vi. description of marine mammal observations in the 24 hours preceding the incident;

   vii. species identification or description of the animal(s) involved;

   viii. the fate of the animal(s);

   ix. and any photographs or video footage of the animal obtained.

To carry out RPM#3, Hilcorp and Eni must undertake the following:

A. Hilcorp and Eni shall require all project personnel associated with ice road and trail construction, use, and maintenance (i.e., construction workers, surveyors, vehicle operators, security personnel, and the environmental team) to complete a wildlife training course. All wildlife training programs must:

   a. Furnish the NMFS Permits Division a course information packet that includes the name and qualifications (i.e., experience, training completed, or educational background) of the instructor(s), the course outline or syllabus, and course reference material

   b. Furnish each trainee with a document stating successful completion of the course, and

   c. Provide the NMFS Permits Division with names, affiliations, and course completion dates for trainees. The course must contain the following topics:

      i. Brief overview of the MMPA and the ESA as they relate to the ice road/trail/pad construction, use, and maintenance

      ii. Brief overview of the project activities to be monitored

      iii. Overview of mitigation measures and the wildlife training program

      iv. Discussion of the role and responsibilities of the project personnel, including

         1. Legal requirements

         2. Professional behavior (code of conduct)

         3. Assigned duties

         4. Reporting violations and coercion

         5. Identification of marine mammals

         6. Cues and search methods for locating marine mammal

         7. Distance determination techniques and training

         8. Data collection and reporting requirements

To carry our RPM#4, the NMFS Permits Division or its permittees (Hilcorp and Eni), must undertake the following:

A. In the event that an operator reaches, or appears likely to exceed, the limit on annual take authorized for any specific activity as described in this ITS, Hilcorp or Eni must contact the Assistant Regional Administrator, Protected Resources Division, NMFS, Juneau office at 907-586-7638, and/or by email to greg.balogh@noaa.gov and NMFS Permitting Division at 301-427-8418, and email Shane Guan at Shane.guan@noaa.gov. NMFS AKR will work with the permittee to determine what is necessary to minimize the likelihood of further take, and determine if reinitiation of consultation is warranted (50 CFR § 402.16).

B. NMFS Permits Division must ensure that Hilcorp and Eni prepare an annual report summarizing ESA-listed marine mammal sightings and annual takes of listed marine mammals. The annual report will be submitted no later than September 1st following the end of the ice road season. The annual report will be subject to review and comment by NMFS AKR. Comments and recommendations made by NMFS AKR must be addressed in the final annual report prior to NMFS acceptance of the final report. The draft report will be considered final for the activities described in this opinion if NMFS AKR has not provided comments and recommendations within 90 days of receipt of the initial report. This annual report must contain the following information:

    a. A description of the implementation and qualitative assessment of the effectiveness of mitigation measures for minimizing adverse effects of the action on ESA-listed species

    b. Lessons learned and recommendations for improvement of mitigation measures and monitoring techniques, and

    c. A digital file that can be queried containing all observer monitoring data and associated metadata.

11. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR § 402.02).

1. The NMFS Permits Division and its permittees should continue to work with NMFS AKR to jointly refine the Ice Road BMPs first set forth in 2018.

In order to keep NMFS's Protected Resources Division informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, the NMFS Permits Division and its permittees should notify NMFS of any conservation recommendations they implement in their final action.

12. REINITIATION OF CONSULTATION

As provided in 50 CFR § 402.16, reinitiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the agency action on listed species or designated critical habitat in a manner or to an extent not considered in this opinion, (3) the agency action is subsequently modified in a manner that causes an effect on the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, section 7 consultation must be reinitiated immediately (50 CFR § 402.14(i)(4)).

13. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

Section 515 of the Treasury and General Government Appropriations Act of 2001 (Public Law 106-554) (Data Quality Act (DQA)) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

13.1 Utility

This document records the results of an interagency consultation. The information presented in this document is useful to the NMFS Permits Division, and the general public. These consultations help to fulfill multiple legal obligations of the named agencies. The information is also useful and of interest to the general public as it describes the manner in which public trust resources are being managed and conserved. The information presented in these documents and used in the underlying consultations represents the best available scientific and commercial information and has been improved through interaction with the consulting agency.

This consultation will be posted on the NMFS Alaska Region website http://alaskafisheries.noaa.gov/pr/biological-opinions/. The format and name adhere to conventional standards for style.

13.2 Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

13.3 Objectivity

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the ESA Consultation Handbook, ESA Regulations, 50 CFR 402.01 et seq.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the literature cited section. The analyses in this opinion contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA implementation, and reviewed in accordance with Alaska Region ESA quality control and assurance processes.

14. REFERENCES

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