

Marine Mammal Monitoring and Mitigation Plan Liberty Development and Production Project

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Submitted by:



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Attachment 1: Ice Road and Trail Mitigation and Monitoring Measures

ACRONYMS AND ABBREVIATIONS

ADFG	Alaska Department of Fish and Game
AEWC	Alaska Eskimo Whaling Association
BOEM	Bureau of Ocean Energy Management
BWCA	Barrow Whaling Captains Association
CAA	Conflict Avoidance Agreement
dB re 1 μ Pa rms	decibels referenced to one microPascal root mean square
FAA	Federal Aviation Administration
ft	feet
GPS	Global Positioning System
Hilcorp	Hilcorp Alaska, LLC
ITA	Incidental Take Authorization
ITR	Incidental Take Request
km	kilometers
KWCA	Kaktovik Whaling Captains Association
LDPI	Liberty Development and Production Island
LOA	Letter of Authorization
m	meters
mi	miles
MMPA	Marine Mammal Protection Act
NSB	North Slope Borough
NMFS	National Marine Fisheries Service
NWCA	Nuiqsut Whaling Captains Association
OCS	Outer Continental Shelf
POC	Plan of Cooperation
PSO	Protected Species Observer
PTS	Permanent Threshold Shift
SDI	Endicott Satellite Drilling Island
SEL	sound exposure level
SLR	single lens reflex camera
SEMS	Safety and Environmental Management System
UAS	Unmanned Aerial Systems
USFWS	U.S. Fish and Wildlife Service
VSM	vertical support member

1. INTRODUCTION

1.1. Purpose of the Plan

In order to issue a Letter of Authorization (LOA) for the incidental taking of marine mammals, Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) states that the National Marine Fisheries Service (NMFS) must set forth “requirements pertaining to the monitoring and reporting of such taking.” The MMPA regulations at 50 CFR 216.104 (a)(13) require that requests for Incidental Take Authorizations (ITAs) must recommend monitoring and reporting methods that provide an understanding of the marine mammals expected to be present in the Action Area and data on the level of taking and potential impacts on populations. This marine mammal monitoring and mitigation plan is a component of Hilcorp Alaska, LLC’s (Hilcorp’s) Petition for Promulgation of Regulations and Request for LOA for the Taking of Marine Mammals Incidental to Construction and Installation of the Liberty Drilling and Production Island, Foggy Island Bay, Beaufort Sea, Alaska.

Hilcorp recognizes that monitoring requirements should be designed that improve the understanding of one or more of the following:

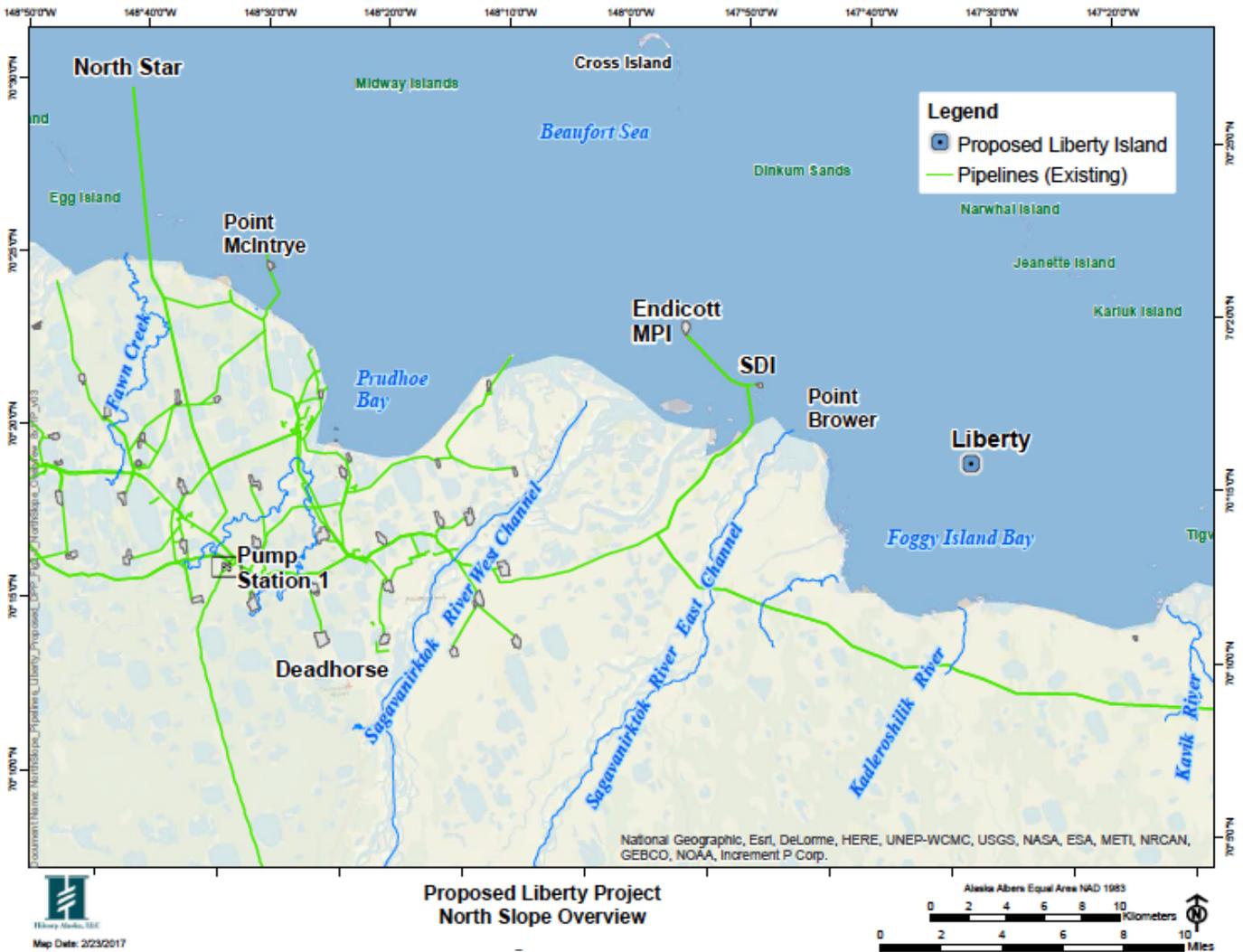
- Occurrence of marine mammal species in the Action Area (e.g., presence, abundance, distribution, density);
- Nature, scope, or context of likely marine mammal exposure to potential stressors/impacts (individual or cumulative, acute or chronic), through better understanding of: 1) action or environment (e.g., source characterization, propagation, ambient noise); 2) affected species (e.g., life history, dive patterns); 3) co-occurrence of marine mammal species with the action; or 4) biological or behavioral context of exposure (e.g., age, calving or feeding areas);
- Individual responses to acute stressors, or impacts of chronic exposures (behavioral or physiological);
- How anticipated responses to stressors impact either: 1) long-term fitness and survival of an individual; or 2) population, species, or stock;
- Effects on marine mammal habitat and resultant impacts to marine mammals; and
- Mitigation and monitoring effectiveness.

In keeping with guidance provided by NMFS, Hilcorp has considered a number of monitoring and reporting opportunities that could contribute to the collective knowledge of marine mammals and marine mammal habitat in the Action Area.

1.2. Project Location

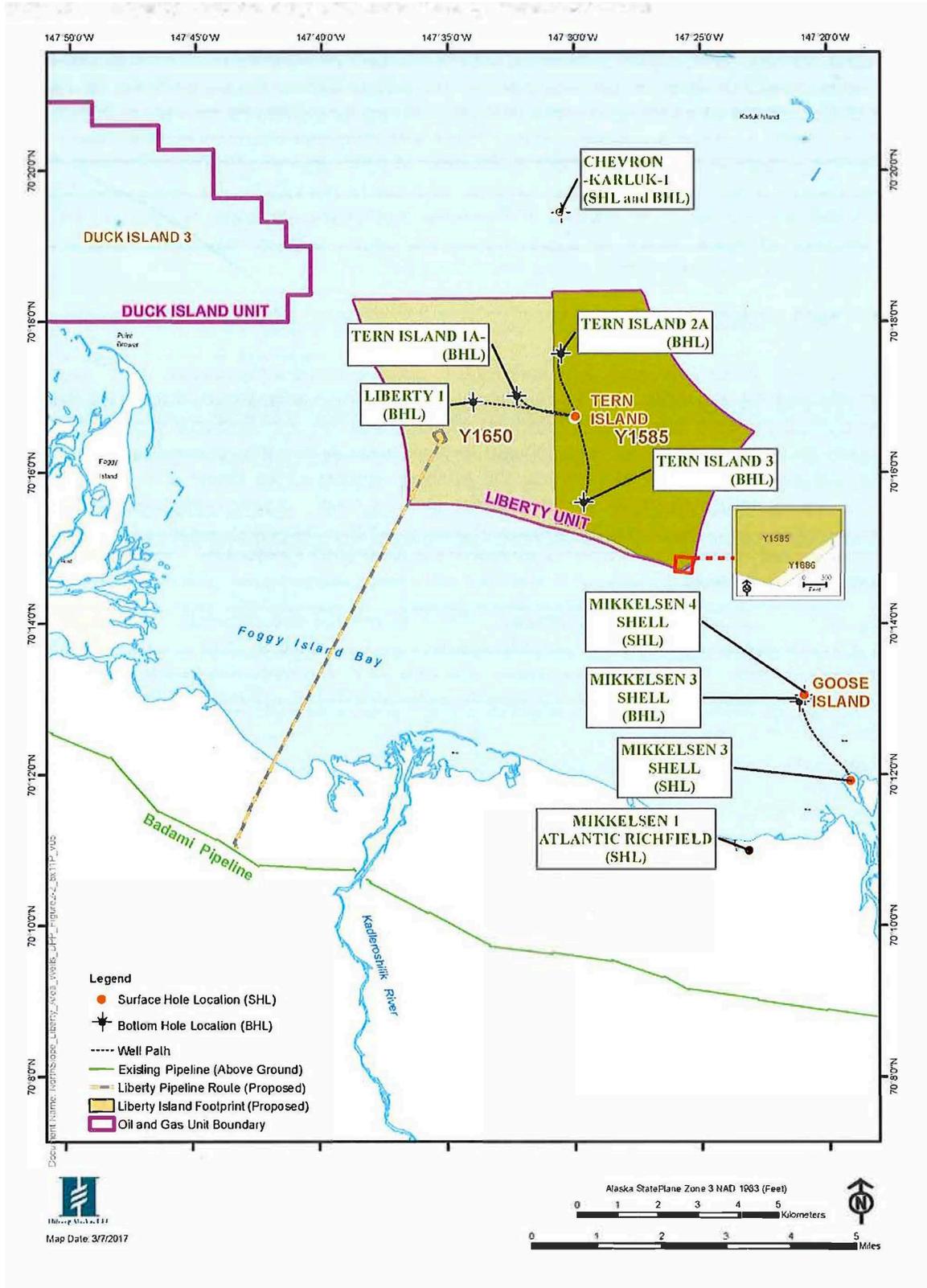
Hilcorp, as the Liberty operator, is proposing to develop the Liberty Oil Field reservoir, located on the Outer Continental Shelf (OCS), in Foggy Island Bay, Beaufort Sea, Alaska (Figure 1-1). The Liberty Oil Field reservoir is approximately 5 to 8 mi (8 to 13 km) to the east of the existing Endicott Satellite Drilling Island (SDI). The proposed Liberty Development includes the Liberty Drilling and Production Island (LDPI), which would be constructed of reinforced gravel in 19 feet (ft) (5.8 meters [m]) of water about 5 miles (mi) (8 kilometers [km]) offshore in Foggy Island Bay. Liberty is located on three leases, OCS-Y-1650, OCS-Y-1886, and OCS-Y-1585 (see Figure 1-2).

FIGURE 1-1. LOCATION OF LIBERTY DEVELOPMENT, NORTH SLOPE, ALASKA



Source: (Hilcorp 2017)

FIGURE 1-2. LIBERTY LEASE BOUNDARY MAP AND AREA WELLS



Source: (Hilcorp 2017)

Foggy Island Bay is located east of Prudhoe Bay and opens north into Stefansson Sound on the central Beaufort Sea coast. The bay and sound are sheltered from the Arctic Ocean by the McClure group of barrier islands which lie northeast, about 9.5 mi (15.5 km) from the coast and 7 mi (11 km) from the proposed LDPI. The coastal and inland physiography is typical of the Arctic Coastal Plain, a low-angle, sloping plain that extends north from the Brooks Range to the Beaufort Sea. Four rivers empty into the Beaufort Sea and form modern deltas south of the proposed Liberty Island location: from west (closest to the LDPI) to east, the Sagavanirktok, Kadleroshilik, Shaviovik, and Canning rivers.

1.3. Project Activities and Associated Noise Sources

The proposed Liberty Project includes the construction of a gravel island, ice roads/trails, development of a mine-site to supply gravel for the construction of the LDPI. An undersea pipeline would be installed that reaches shore from the LDPI, where it transitions to an above ground, vertical support member (VSM)-mounted pipeline and connects to the existing above-ground Badami pipeline. The LDPI is a self-contained offshore drilling and production facility and would contain infrastructure to support construction and operations including a drill rig and associated equipment, utilities, and living quarters.

The expected timing and dates of Project activities that produce noise and have the potential to result in takes of marine mammals in the Action Area are summarized in Table 1-1. Sound source levels for underwater (ice covered and open water) and airborne noise from Project scenarios are shown in Table 1-2.

1.4. Applicable Noise Criteria

Project activities described in Section 1.3 have the potential to generate underwater noise that may expose up to six species of marine mammals to Level A and Level B¹ harassment: bowhead, gray, and beluga whales; and bearded, ringed, and spotted seals. Acoustic thresholds for causing Permanent Threshold Shift (PTS) in marine mammal hearing are provided in *NMFS Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset Permanent and Temporary Threshold Shifts* (2016). Different thresholds are provided for different marine mammal hearing groups, which are defined in the Technical Guidance. To determine the PTS thresholds, NMFS (2016) uses a dual metric approach considering both cumulative sound exposure and peak sound levels for impulsive sounds. For non-impulsive sounds, only the cumulative sound exposure level was used, unless the impulsive peak level threshold was exceeded. The PTS thresholds corresponding to each hearing group represented in the Action Area are shown in Table 1-3.

NMFS has implemented a behavioral effects threshold (Level B) for impulsive sound of 160 decibels referenced to one microPascal root mean square (dB re 1 μ Pa rms) and 120 dB re 1 μ Pa rms for non-impulsive sound for all marine mammals. These thresholds were used to determine the Level A shutdown zone and Level B monitoring zone described in Sections 2.1.6.2 and 2.1.6.3, respectively.

¹ Level A harassment may result in injury, whereas Level B results in disturbance without the potential for injury.

TABLE 1-1. PROJECT ACTIVITY TIMELINE AND POTENTIAL FOR MARINE MAMMAL TAKES¹

ACTIVITY	TIMING	POTENTIAL FOR TAKE
CONSTRUCTION OPERATIONS		
<i>Summer & Winter Access</i>		
Annual Ice Road (#1)	Year 1 - Year 3, January – mid-May	Yes
Support Ice Roads/Trails (#2 - #4)	Year 1 – Year 3, December – mid-April	Yes
Sea-going Barges	Year 1 - Year 4, June - November	No
Small Marine Vessels	Year 1 - Year 4, June - November	No
<i>Island Construction²</i>		
Pile and Pipe Driving and Slope Shaping	Year 1, July – August ³	Yes
<i>Facilities Construction⁴</i>	Year 2, January - Year 3, June	Yes
<i>Pipeline Construction</i>	Year 2, January - May	Yes
DRILLING OPERATIONS		
<i>Summer & Winter Access</i>		
Annual Ice Road (#1)	Year 3 - Year 5, January – mid-May,	Yes
Sea-going Barges	Year 3 - Year 5, June - November	No
Small Marine Vessels	Year 3 - Year 5, June - November	No
<i>Well Drilling</i>	Year 3 - Year 5	Yes
<i>First Oil/Commissioning</i>	Year 3, June - Year 5	Yes

Source: (BOEM 2017)

¹ Takes have only been requested for the first 5 years due to increase activities at the site (for example, increased number of ice roads and traffic which would diminish after year 5; future LOAs may depend on acoustic monitoring as described in the Incidental Take Request (ITR) petition.

²No takes are being requested for mine site development.

³Planned for Year 1 and would occur in Year 2 only if island construction occurs over two winter seasons as ice conditions allow.

⁴Includes setting foundation piles on island interior. This has been accounted for in the take estimate and proposed monitoring.

TABLE 1-2. SOUND SOURCE LEVELS FOR CONSTRUCTION SCENARIOS

Scenario	Underwater Noise		Airborne Noise
	Ice Covered	Open Water	
	Average Sound Pressure Level (dB re 1µPa at 1m)	Source Sound Pressure Level Peak (dB re 1µPa at 1m)	Overall Source Sound Pressure Level at Distance (dB re 1µPa @ m)
Ice Road/Trail Construction and Maintenance (Graders, Augers, Water Pumps)	189.1	n/a	Graders 64.7 (@100 m) Augers 67.9 (@100 m) Water pumps 72 (@100 m)
Pipeline and Island Construction	Trucks on ice road 179.1 Backhoe 177.7 Ditchwitch 169.6	n/a	Trucks on ice road 74.8 (@100 m) Backhoe 78 (@10 m) Ditchwitch 76.3 (@100 m)
Vibratory sheet Piling, Island Perimeter	221.0	185	81 (@100 m)
Slope shaping, armament installation	n/a	167	64.7(@100 m)
Impact Sheet Piling	235.7	210	93 (@160 m)
Impact pipe driving, island interior ²	171.7	196	93 (@160 m)
Helicopter (take-off, landing)	n/a	n/a	84 (@300 m)
Drilling & Production	170.5	151	80 (@200 m)
Production only ¹	154.5	153	80 (@ 200 m)

Source: SLR 2017 and SMRU 2017.

n/a indicates that the source does not apply

¹Production includes managing the flow of oil, water, and gas and maintaining equipment to ensure long and reliable service and may include overhauls of rotating equipment.

²Richardson and Williams (2001) state the following based on Northstar construction monitoring: “The island-based monitoring work was conducted in phases. The 20” conductor pipes were driven intermittently from 21 to 23 June, and again in late July. The 42” insulator pipes were driven intermittently from 26 to 29 June and again starting on 20 July. Marine mammals were observed during each day with impact pipe driving until the acoustical measurements had confirmed that the 180 and 190 dB radii for the 20”, and later the 42”, pipe-driving operations did not extend into the water.” For this reason, takes are not included for facility construction during ice conditions. However, to be precautionary, takes are included based on the data presented in this table for potential foundation pile driving in open water conditions as needed.

TABLE 1-3. ACOUSTIC NOISE CRITERIA FOR LEVEL A INJURY EFFECTS

Hearing Group	PTS Onset Acoustic Thresholds (Received Level)		
	Impulsive Sources		Non-impulsive source
	Peak Pressure Level (dB re 1 µPa)	Cumulative Auditory-weighted SEL _{24h} (dB re 1 µPa ² -s)	Cumulative Auditory-weighted SEL _{24h} (dB re 1 µPa ² -s)
Low-frequency cetaceans ¹	219	183	199
Mid-frequency cetaceans ²	230	185	198
Phocid pinnipeds water ³	218	185	201

Source: (NMFS 2016)

Notes: Peak sound pressure is “flat” or unweighted. Cumulative sound exposure level has a reference value of 1µPa²s. Cumulative levels should be appropriately weighted for the hearing group for assessment to the threshold.

¹ Bowhead and gray whales

² Beluga whales.

³ Ringed, bearded, and spotted seals.

2. MITIGATION AND MONITORING DURING CONSTRUCTION

All activities associated with the construction at the LDPI will be conducted in accordance with all federal, state and local regulations and in coordination with NMFS, U.S. Fish and Wildlife Service (USFWS), Bureau of Ocean Energy Management (BOEM) Alaska Region, and Alaska Department of Fish and Game (ADFG). Hilcorp has developed mitigation and monitoring measures to ensure the least practicable impact on affected marine mammal species and stocks, and their habitat. Potential measures include consideration of: 1) the degree to which the successful implementation of the measure is expected to minimize adverse impacts to marine mammals; 2) the proven efficacy of the specific measure to minimize adverse impacts as planned based on monitoring plans from previous, similar applications for MMPA authorizations that include pile driving; and 3) the practicability of the measure for implementation. Based on these factors, the mitigation and monitoring measures described in this plan will accomplish these objectives:

- Avoid or minimize injury to or death of marine mammals;
- Minimize the likelihood that impacts will occur to the species, stocks and subsistence use of marine mammals in the occurring in the Action Area of Foggy Island Bay and areas immediately outside of the bay;
- Eliminate the potential for Level A injury takes and eliminate or reduce the potential for Level B harassment takes through the use of Project timing and shutdown zones;
- Avoid overlap of noise producing activities with traditional subsistence hunting locations and events;
- Quantify the number of marine mammals exposed to or taken by harassment (Level B).

To meet these objectives Hilcorp will use the following monitoring methods (described in detail in Section 2.2), timing, and management practices:

- Two Protected Species Observers (PSOs) will be stationed on the island during pile and pipe driving (approximately July 1-15 Year 1) to visually monitor for marine mammals in the Level A zone and shut down work if necessary. If it is necessary to complete installation of foundation piles in the island interior during the second open water season (Year 2), two PSOs will be placed on the island during this activity to monitor the harassment zone.
- A third island-based PSO will work closely with an aviation specialist to monitor the Level B zone during the pile and pipe driving using an unmanned aircraft system (UAS). This third PSO and the UAS pilot will be located on the island. UAS monitoring will also be used during slope shaping, which may occur in open water intermittently until August 31 of Year 1. UAS will not be used after Year 1.
- If UAS deployment is not possible, the third PSO could conduct marine mammal monitoring from a vessel located at the edge of the Level A zone between July 1 and August 31st of Year 1.
- During Years 2-3, a PSO (and an alternate) will be placed on the island for approximately 4 weeks during the month of August to monitor for the presence of marine mammals around the island.

- During Years 1-5, sightings of marine mammals by staff will be reported to the Hilcorp Environmental Specialist. The Environmental Specialist will include all marine mammal sightings in monitoring reports that will be provided to NMFS (see Section 2.6 Reporting).
- Once the island is constructed, Hilcorp will not operate heavy machinery within 33 ft (10 m) of a ringed seal if sighted near or on the island. Personnel will not approach any seals observed.
- During the open water season of Years 1-4 Hilcorp is proposing to conduct underwater acoustic monitoring (see Section 13.2).
- Based on the results of PSO monitoring and underwater acoustic data, and in consultation with NMFS, Hilcorp will determine whether PSO monitoring is needed during Year 5 to monitor for presence and behavior of marine mammals that may occur within the island vicinity.
- The soft-start technique will be used at the beginning of impact pile driving each day, or if pile driving has ceased for more than thirty minutes.
- As much as possible of the noise producing work associated with island and pipeline construction will be done during the ice-covered winter months to minimize exposure to marine mammals.
- Ice road/trail and ice pad construction will be initiated prior to March 1 to ensure that denning seals will not be crushed by road and pad construction techniques. Additional specific ice road/trail monitoring and mitigation measures are also included in Attachment 1 and will be followed during any ice road/trail construction, operation and maintenance during the 5-year period.
- The existing Plan of Cooperation (POC) between Hilcorp and the subsistence users in the region, will be renewed and construction activities will be coordinated with the North Slope Borough (NSB), representatives and whaling captains (Alaska Eskimo Whaling Association [AEWC], and the Barrow [BWCA], Nuiqsut [NWCA], and Kaktovik [KWCA] Whaling Captains Associations) to minimize potential interference between operational, maintenance, and training activities with the fall subsistence hunt for bowheads whales.
- Opportunities to employ Native observers to collect traditional knowledge will be explored.
- The existing Conflict Avoidance Agreement (CAA) between Hilcorp and the AEWC, will be followed for all North Slope oil and gas activities to minimize potential interference with bowhead subsistence hunting. Hilcorp will attend and participate in the CAA future meetings.

2.1. Mitigation Measures

2.1.1. General Best Management Practices

Construction activities will follow all requirements of Hilcorp's Safety and Environmental Management System (SEMS) to avoid and minimize impacts on the environment, Endangered Species Act (ESA)-listed species, designated critical habitats and species protected under the MMPA. The SEMS addresses water quality, air quality, waste management, wildlife interactions, and response to spills.

Best Management Practices (BMPs) that will be followed during LPDI and pipeline construction activities include:

- Toxic or hazardous material specifications, inventories, separation, confinement, and handling which will be determined, documented, and communicated to appropriate personnel;
- Properly sized equipment will be used to drive piles and sheet pile; and
- Emergency response and control plans will be in place and ready for immediate implementation if needed.

2.1.2. Vessel Management to Avoid Ship Strikes and Disturbance

As described in the 2012 Biological Opinion for Northstar (NMFS 2012), between 1976 and 1992, whalers observed injuries from ship strikes on 236 bowhead whales. Bowhead whales have been documented to allow slow moving vessels that do not change direction or speed suddenly to approach within several hundred meters, indicating some level of tolerance of vessel presence (Richardson, *et al.* 1995, Heide-Jorgensen, *et al.* 2003). Ocean-going barges and other larger vessels associated with the Liberty project would be inshore of the bowhead whale migration corridor. Further, these vessels would not overlap with their fall migration in August/September (heading west from the Canadian Beaufort Sea) or November (heading west and south). Small crew vessels would be operating between shore and LDPI within Foggy Island Bay where bowhead whales are not known to occur (see Section 8.2 of the ITR petition).

During the spring and fall, most beluga whales in the central and eastern Beaufort Sea migrate along the ice edge in deep offshore waters more than 60 mi (96.5 km) north of the coast migration (Clarke, *et al.* 2012, 2013). While beluga whales may occur within Foggy Island Bay, the potential for these cetaceans to interact with a vessel is not likely to occur due to proposed mitigation measures including the slow vessel speeds, avoidance of groups of whales, and the fact that belugas would likely avoid vessel interactions by swimming away from the disturbance.

While bearded and ringed seals are routinely observed during oil and gas exploration activities, there have been no ringed or bearded seals ship-strike incidents documented in Alaska (BOEM 2011). Bearded seals are more likely to be farther out from shore, further reducing the risk of ship/seal interactions.

Therefore, ship strikes from vessel movements to and from the LDPI are not likely and no takes have been requested for vessel movements or ship strikes of marine mammals. However, Hilcorp proposes the following mitigation measures to minimize disturbance to marine mammals due to the physical presence of vessels and to ensure no ship strikes of marine mammals occur:

- Reduce speed to less than 5 kn (9.26 km/hr) prior to coming within 900 ft (274 m) of whales. The reduction in speed will vary based on the situation but must be sufficient to avoid interfering with the whales. Vessels capable of steering around such groups should do so. Vessels may not be operated in such a way as to separate members of a group of whales from other members of the group. A group is defined as being three or more whales observed within a 1,641 ft (500 m) area and displaying behaviors of directed or coordinated activity (e.g., group feeding). Bowhead whale occurrence in the proposed Action Area is considered very limited; therefore, the need to steer around whales should be minimal.
- Avoid multiple, rapid changes in direction.
- Reduce vessel speed when visibility is poor.

- Check waters immediately adjacent to the vessel to ensure no whales will be injured when the vessel's propellers are engaged.
- Do not allow tow lines to remain in the water or trash to be thrown overboard.

Regarding North Pacific right whales and Steller sea lions (applicable for the sea going barge):

- Vessels will not approach within 2,624 ft (800 m) of a North Pacific right whale.
- Vessels shall avoid transiting within designated North Pacific right whale critical habitat. If transit within North Pacific right whale critical habitat cannot be avoided, vessel operators are requested to exercise extreme caution and observe the 10 kn (18.52 km/h) vessel speed restriction. If transiting through North Pacific right whale critical habitat, ocean going barges will have PSO's actively engaged in sighting marine mammals.
- Vessels shall not approach within 3 nm (5.5 km) of a Steller sea lion rookeries or major haulouts.

2.1.3. Aerial Traffic

Potential disturbance to mammals from helicopter flights to support LDPI construction will be minimized by limiting the flights to an established corridor that represents the shortest route from the LPDI to the mainland and, except when limited by weather and during landing and takeoff, will maintain a minimum altitude of 1,500 ft (457 m). If a marine mammal is observed, a horizontal radius of 1,000 ft (305 m) will be maintained. Hilcorp intends to establish the shortest route from mainland to island that safety and weather conditions will allow. By restricting, as practicable, aerial flights within an established flight corridor, potential disturbance to marine mammals will be minimized.

Helicopter and other air traffic will be coordinated as needed with the NSB and AEWC to avoid disrupting subsistence hunting. If safe to do so, air routes can be altered to prevent disturbance to specific subsistence activities.

2.1.4. Ice-Covered Conditions

2.1.4.1. Pipeline, Ice Road/Trail and Ice Pad Construction

Hilcorp will begin winter construction activities in December or as soon as ice conditions allow safe access. Initiation of winter, on-ice activities (ice road/trail construction, ice pad development, and pipeline trenching) prior to March 1, will allow ringed seals to avoid disturbed areas as they establish birthing lairs.

Williams *et al.* (2006) concluded that ringed seal breathing holes and lairs were established in the landfast ice before and during construction activities within a few meters of the Northstar Island oil development. Many of these structures were maintained by seals for up to 163 days, despite the presence of low-frequency industrial noise and vehicular use of ice roads. Considering proposed mitigation measures to avoid seals, scientific literature, and taking into consideration the research conducted for Northstar described here, the risk of injury or mortality to ringed seals from crushing is low assuming ice road/trail construction and activities are initiated prior to March 1 each year. Also, as summarized by Williams *et al.* (2006), disturbance to seals from vehicle activity on ice roads/trails is not likely to result in biologically significant effects to seals.

All ice road and trail activities will be conducted at least 500 ft (150 m) from any observed ringed seal lair. Female ringed seals establish their birth lairs before pupping in late March to April. Additional specific ice road and trail mitigation and monitoring measures proposed by Hilcorp have been developed through close coordination with NMFS and are included in Attachment 1.

2.1.4.2. Island Construction

Island construction would commence in early winter and would include cutting of ice blocks and placement of gravel, island shaping and armoring, and installation of a vertical sheet pile wall. The wall protects the work surface of the island from ice and wave impacts. It is also intended to prevent most marine mammals from entering the work area. This design is similar to that at the Northstar Production Island constructed by BPXA in 2000.

Construction, with the exception of sheet pile driving, conductor pipe drilling, and slope shaping, is planned to occur from January through mid-April, which helps further minimize potential impacts to marine mammals. For the purposes of this mitigation and monitoring plan, it is assumed ice-covered conditions will be present until July 1, a total of 4 months (120 days). During winter and spring activities on the sea ice, the ringed seal is the only marine mammal species under the jurisdiction of NMFS that is likely to be encountered near LDPI. As described in Section 2.1.4.1, winter activities would commence on the sea ice as early as practical (i.e., December).

2.1.4.3. Facility Construction

Facility construction on the interior of the island would begin during the ice-covered season of Year 2 (i.e., February) and likely continue through June of Year 3. Foundation piles (approximately 700-1,000) would be driven into the island interior during this time. Based on data collected during construction of the Northstar facility, Richardson and Williams (2001) reported “The 20-inch conductor pipes were driven intermittently from 21 to 23 June, and again in late July. The 42-inch insulator pipes were driven intermittently from 26 to 29 June and again starting on 20 July. Marine mammals were observed during each day with impact pipe driving until the acoustical measurements had confirmed that the 180 and 190 dB radii for the 20-inch, and later the 42-inch, pipe-driving operations did not extend into the water.” Considering Hilcorp’s plans to install foundation piles during the ice-covered season and this evidence from Northstar construction, harassment of marine mammals due to foundation pile installation during the open water season of Year 2 is not expected. However, to be precautionary, Hilcorp has requested takes for installation of foundation piles if this activity is necessary during approximately two weeks of open water during Year 2. If setting foundation piles is required during open water of Year 2, two PSOs will be stationed on the island to monitor for marine mammals as described at the beginning of Section 2 for Year 1.

2.1.5. Broken Ice Conditions

The period spanning mid-May through July is characterized by warming temperatures, over-flooding of the rivers, formation of melt ponds, and degradation of surface ice (break-up). However, many of the activities supporting construction in winter are appropriately employed well into the broken ice season. Hovercraft, amphibious personnel carriers, amphibious ditchwitch trenchers, and backhoes can be used

during break-up and in varying ice conditions. Hovercraft and amphibious vehicles have been used to transport personnel and light equipment on the North Slope in a variety of conditions for many years.

Assuming construction activities begin in early winter, ice roads/trails are initiated prior to March 1, and other on-island construction is completed by mid-April, work during broken ice conditions will not require any additional mitigation measures. However, as animals begin to move in and out of the broken ice flows, pinniped movements may become more obvious. During Year 1, construction activities that may result in Level A takes (e.g., impact pipe and sheet pile driving, and vibratory pile driving) may occur during broken ice and open water conditions for a period of approximately 15 days (~July 1-15). As described in Section 2.2, island-based PSOs will monitor the Level A zones and will stop work if necessary. This will mitigate the potential for Level A takes. Generally, beluga and bowhead whales are not likely to be present during broken ice conditions because they arrive much later in the open water season.

2.1.6. Open Water Conditions

Although ice-covered conditions or broken ice conditions can last into July, it is assumed that open water conditions will be present beginning approximately July 1. To the extent practicable, Hilcorp intends to complete as much island construction as possible by mid-April. However, during Year 1 some aspects of island construction may require pile and pipe driving during approximately 15 days of open water conditions. During this time, PSOs will be used to monitor the Level A zone and stop work if necessary (see Section 2.2). Sheet pile driving around the island perimeter is expected to be completed prior to beluga whales being present in the Action Area later in July or early August. Bowhead whales generally occur outside of the barrier islands as described in detail in Section 4.1.2 of the ITR petition.

Slope shaping may be necessary during Year 1 between approximately July 15 and August 31st during open water conditions. Slope shaping would not likely occur every day, if at all. If slope shaping is needed during this period, a PSO will work closely with the UAS pilot(s) to monitor the Level B zone to record potential takes of marine mammals in that zone (see Section 2.2.2). If any slope shaping or pile driving is required in Year 2 of construction, PSOs and UAS will be used as described for Year 1.

All work will be consistent with the existing CAA for open water season in the Beaufort Sea. Mitigation of noise producing activities described in the following subsections will result in the reduction of exposures to noise and potential takes to marine mammals.

2.1.6.1. Soft Start Technique

Hilcorp will use the soft-start technique at the beginning of impact pile driving each day, or if pile driving has ceased for more than 30 minutes. Soft-start procedures will be used prior to pile (or sheet pile) installation to allow marine mammals to leave the area prior to exposure to maximum noise levels. For vibratory hammers, the soft start technique initiates noise from the hammer for short periods at a reduced energy level, followed by a brief waiting period. This cycle repeats two additional times. For impact driving, an initial set of three strikes will be made by the hammer at 40 percent energy, followed by a one-minute waiting period. As with vibratory hammers this cycle is repeated two additional times.

2.1.6.2. Level A Zones and Shutdown Procedures

Construction activities that may result in a Level A take include impact pipe and sheet pile driving, and vibratory pile driving (Table 2-1). These activities are expected to be completed in Year 1 prior to the open water season but it is possible they could continue for about 15 days into the open water season (approximately July 1 – 15). As described in Section 2.2, island-based PSOs will monitor the Level A shut down zones during this period.

While slope shaping activities occurring during this time and possibly until August 31 may exceed the Level A threshold, the distance to that threshold is less than 33 ft (10 m) from the island (see Table 2-1). Animals are not expected to approach that close to the island during construction, particularly for any given amount of time that could cause PTS. Therefore, slope shaping is not included in the monitoring and assessment for Level A take. If pile or pipe driving activities extend beyond the anticipated 15-day period, or into Year 2, PSOs will be used to monitor the Level A shutdown zone as in Year 1.

Active impact sheet pile driving is likely to occur for 10 to 20 minutes total per day; however, to be precautionary, the maximum duration of 40 minutes has been used to estimate the ensonified area and shutdown zones shown in Table 2-1. Impact conductor pipe driving is likely to occur only 2 hours total per day.

TABLE 2-1. DISTANCE FROM NOISE SOURCE TO NMFS LEVEL A THRESHOLDS

Marine Mammal Hearing Group and Species	Distance From Source To PTS Threshold			
	Slope Shaping (9.6 hrs)	Vibratory Sheet Piling (2.5 hrs)	Impact Sheet Piling (40 mins)	Impact Pipe Driving (2 hrs)
Low frequency cetaceans (bowhead, gray whales)	<0.01 km (33 ft)	0.05 km 164 ft	1.94 km 6,365 ft	0.87 km 2,854 ft
Mid frequency cetaceans (belugas)	n/a	<0.01 km 33 ft	0.06 km 197 ft	0.03 km 98 ft
Phocid Pinnipeds (bearded, ringed, spotted seals)	<0.01 km (33 ft)	0.02 km 66 ft	0.53 km 1,706 ft	0.24 km 787 ft

Note: During Year 1, Open Water Period.

The Level A shutdown zone of 6,365 ft or 1.94 km for large low frequency whales (see Table 2-1) will be monitored during all pipe driving, sheet pile driving and vibratory sheet piling activities. Level A zones for beluga whales and pinnipeds are considerably smaller than those for bowhead whales (see Table 2-1).

The waters will be scanned by PSOs (both land-based and using UAS) 30 minutes prior to commencing pile driving at the beginning of each day, and prior to commencing pile driving after any stoppage of 30 minutes or greater. If marine mammals enter or were observed within the designated marine mammal shutdown zone 30 minutes prior to pile or pipe driving, the PSO will notify the on-site construction manager to not begin until the animal has moved outside the designated zone.

For an animal to reach Level A exposure thresholds, it would need to spend between 40 minutes and 9.6 hours within the zone as reported in the top row of Table 2-1. In the unlikely event that a low frequency cetacean (i.e., bowhead whale) enters their designated Level A zone (1.94 km for sheet pile driving; 0.87 km for pipe driving), work will be shut down. If a mid-frequency cetacean (beluga) or pinniped (seal)

enters their Level A zone (up to 0.06 km and 0.53 km, respectively), Hilcorp proposes to complete setting that pile (estimated to require less than 10-15 minutes²) but will not initiate driving of new piles until the mid-frequency cetacean or pinniped has left their Level A zone. During this time, PSOs will monitor the animal and record behavior. If after 20 minutes the animal is still within the Level A zone and Hilcorp has not completed setting the pile, shut down procedures will be initiated and no new pile driving will begin until the marine mammal has left the Level A zone. This practical and precautionary measure will minimize the potential for injury given that an animal must remain in the Level A zone for a total of 40 minutes to experience PTS. Any marine mammal observations within the Level A zone will be reported and recorded as a Level A take.

Subsequent pile driving activities will not begin until the animal is clear of the shutdown zone. Generally, any marine mammal observed approaching the Level A zone will have already been exposed to Level B thresholds and recorded as a potential take. If this occurs, observed animal behaviors will be documented.

2.1.6.3. Level B Monitoring Zones

The predicted distances from the noise source to the underwater behavioral impact thresholds (Level B zones) for marine mammals for each of the project scenarios considered in the open water season are shown in Table 2-2.

TABLE 2-2. BEHAVIORAL THRESHOLD DISTANCES AND ENSONIFIED AREAS DURING ISLAND CONSTRUCTION

Scenario	Underwater Noise (Open Water)	
	Distance to Level B Threshold (km)	Ensonified Area (km ²)
Vibratory sheet piling ¹	14.8 (9.2 mi or 48,556 ft)	N-264 (65,000 acres) E-229 (57,000 acres) S-102 (25,000 acres) W-109 (27,000 acres) SW-64 16,000(acres)
Impact sheet piling	2.5 (1.6 mi or 8,202 ft)	19.6 (4,843 acres)
Slope shaping, armament installation	1.16 (0.7 mi or 3,806 ft)	4.2 (1,038 acres)
Impact ² pipe driving	0.31 (0.2 mi or 1,017 ft)	0.3 (74 acres)

Source: (SLR 2017) and (SMRU 2017).

¹Since vibratory sheet piling will occur near the periphery of the island, the area ensonified will depend on the side of the island where vibratory sheet piling is occurring.

²Includes the potential to set foundation piles as part of facility construction during open water in Year 2. Based on data from Northstar construction, setting foundation piles is not expected to result in underwater noise that exceeds the Level B threshold; however to be precautionary, Hilcorp has accounted for this activity in the take estimate and proposed mitigation and monitoring measures (see Section 2.1.4.3).

The farthest distances shown in Table 2-2 represent the maximum behavioral (Level B) threshold distances from the sound source during Year 1 construction activities. Hilcorp will use an island-based PSO and UAS to monitor Level B zones during pile driving and slope shaping activities (see Section 2.2). Vibratory sheet pile driving has potential to produce underwater noise above the behavioral effect threshold over the largest area from the island, within up to 0.24 mi (0.39 km) under ice-covered conditions and 9.2 mi (14.8 km) in open water. It is assumed that vibratory sheet pile driving would be

² During sheet pile driving at Northstar Island, it was observed that “a typical vibrahammer operation lasted for 1 minute or less” (Shepard et al, 2001).

completed within 4 months under ice-covered conditions, but additional work may be required for about 15 days in open water conditions. If pile or pipe-driving is necessary in open water, Hilcorp will use UAS during the approximately 15 days (July 1 – 15) of construction to monitor Level B harassment zones to record any takes by harassment. Between July 15 and August 31st, if slope shaping is necessary, a PSO and UAS will be used to monitor the Level B zone of approximately 4.2 km² (see Section 2.2). Any marine mammal observed within a Level B harassment zone will be recorded as a Level B take and their behavior will also be documented (See Section 2.6.2).

2.1.7. Subsistence Activities

Based on results of previous programs similar to the Liberty Project, the proposed mitigation measures will result in the least practicable impact on marine mammal species or stocks and their habitat, and ensure there is no adverse impact on the availability of any stocks for subsistence purposes.

Between 1994 and 2003, generally three to four whales were harvested per year in Kaktovik and a similar number were taken in Nuiqsut, (Bacon, et al. 2009, Clarke, et al. 2013). Since that time, the same number of whales have typically been harvested each year (BPXA 2009). In all whaling seasons documented since 2001, avoidance of the proposed Action Area by Cross Island whalers probably would have had a negligible adverse effect on the success of those hunts (BOEM 2017). The proposed Action Area was only part of the whale search area during 2005 and 2006, and no whales were struck or landed. Whales were seen and heard in or near the proposed Action Area during those two seasons but could not be approached close enough to make a strike. Therefore, while hunters may pass through the bay in transit, and have observed whales in the area on occasion, Foggy Island Bay has not been reported as a traditional whaling location in recent years.

Beluga whales are taken opportunistically during the bowhead harvest and throughout ice-free months. Generally, no operations are suspended for beluga hunts in this area as they are sporadic and incidental to other subsistence related activities such as fishing. This is different than the beluga whale harvest in the Chukchi where beluga whale occurrence is predictable due to foraging at river mouths on fish moving into area.

Nuiqsut and Kaktovik residents hunt seals in ice-free months primarily July-August in rivers outside of Foggy Island Bay. The most important seal hunting area for Nuiqsut hunters is off the Colville Delta (BOEM 2017) extending as far west as Fish Creek and as far east as Pingok Island (149°40'W). Pingok Island, the closest edge of the main sealing area, is east of Foggy Island Bay. Sealing occurs in this area by snow machine before break-up and by boat during the summer. Cross Island is a productive area for seals but is too far from Nuiqsut to be used on a regular basis. During the whaling season, the hunters at Cross Island concentrate on hunting bowhead whales, not seals.

In April 2018, Hilcorp submitted a POC to NMFS in accordance with 50 CFR 216.104(a)(12) for development of the Liberty Oil Field. The POC documents Hilcorp's stakeholder engagement activities with subsistence communities within the North Slope Region closest to LDPI including Nuiqsut, Barrow and Kaktovik. The POC includes a description of the project, how access to the Project Area would occur, pipeline and island construction techniques, and drilling operations. The plan also describes measures implemented by Hilcorp to minimize adverse effects on marine mammal subsistence species and all activities related to subsistence hunting. The POC is a living document and will be updated throughout

the LDPI review and permitting process. As such, Hilcorp intends to maintain open communication with all stakeholders throughout the Liberty permitting and development process.

In addition to the POC, Hilcorp has signed a CAA in coordination with the AEW and North Slope communities' Whaling Captains' Associations, which outlines activities that will minimize disturbances to marine mammals with respect to subsistence hunting. One element of the agreement states that impact hammering will not occur during the period for Nuiqsut/Cross Island bowhead whale subsistence hunting which usually occurs from the last week in August thru mid-September. This will ensure that disturbance to marine mammals and subsistence hunts is avoided to all practical extent. Further, any non-essential boat, hovercraft, barge, or air traffic will avoid approaching the harvest area around Cross Island during this period. This will avoid potential conflicts with the timing of the Cross Island bowhead hunt as described in the CAA.

Hilcorp understands the importance of subsistence to these communities and will continue to meet with the communities of Nuiqsut, Kaktovik, and Barrow to discuss the LDPI Project and ongoing North Slope operations. In coordination with AEW, Hilcorp currently adheres to the existing CAA for North Slope oil and gas activities to minimize potential interference with bowhead subsistence hunting. Hilcorp will continue to attend and participate in the CAA meetings. The CAA describes the following measures to minimize any adverse effects on the availability of bowhead whales:

- Hilcorp will comply with the POC and CAA terms to address plans to meet with the affected community to resolve conflicts and notify the communities of any changes in the operation. More detailed information about the mitigation measures that will be implemented to reduce impacts to marine mammals are outlined in Section 11 of the ITR petition;
- Vessels will be operated in a manner to avoid areas and times where hunting is occurring;
- Communications and conflict resolution are detailed in the CAA. Since 2017, Hilcorp has hosted the Communications Center at Endicott. For the Liberty Project, Hilcorp plans to continue to support and participate in the Communications Center that is operated annually during the bowhead subsistence hunt;
- Communications with the village of Nuiqsut is of particular importance as their traditional subsistence hunting areas are closest to the Action Area. Hilcorp will meet with the community to discuss community questions or concerns including all subsistence hunting activities; and
- Hilcorp and contractors will follow a Polar Bear and Pacific Walrus Awareness and Interaction Plan addressing food and waste management, personnel training, and safety and communication regarding polar bears.

2.2. Monitoring Methods

2.2.1. Land Based Monitoring

To monitor the Level A shutdown zones described in Section 2.1.6.2, two dedicated PSOs (and an alternate) will be located on the LPDI during construction activities that may occur during open water conditions (approximately July 1 – July 15) of Year 1. If these activities extend beyond the 15-day period or into Year 2, monitoring of the Level A zones during open water will continue as necessary. PSOs will be located at vantage points to monitor from the island out to 6,365 ft (1.94 km) when conditions allow.

Elevated platforms will be used to maximize the potential for viewing marine mammals in the Level A zone. Assuming the average height of an observer is 5 ft 5 inches (1.8 meters), height of the island is 15 ft (4.6 m), and reticle binoculars (5 mils) are used, platforms ~16.5 ft (5 m) high will allow viewing out to a distance of 1.42 mi (2.28 km). This will be sufficient to see any marine mammals approaching the Level A zone. For additional information on PSO equipment see Section 2.2.5.

To provide 360-degree coverage around the island, one PSO will be placed on the side where construction activities are taking place and the other placed on the opposite side. The elevated PSO stations will be moved around the island as needed during construction activities to provide full coverage. PSOs will be switched out such that they will observe for no more than 4 hours at a time and no more than 12 hours in a 24-hour period (see Section 2.3.1).

Distances to nearby marine mammals will be estimated with binoculars containing a reticle to measure the vertical angle of the line of sight to the animal relative to the horizon. Observers may use a laser rangefinder to test and improve their abilities for visually estimating distances to objects in the water. However, previous experience has shown that a civilian grade laser rangefinder was not able to measure distances to seals more than about 230 ft (70 m) away. The device was very useful in improving the distance estimation abilities of the observers at distances up to about 1,968 ft (600 km)—the maximum range at which the device could measure distances to highly reflective objects such as other vessels. Humans observing objects of more-or-less known size via a standard observation protocol, in this case from a standard height above water, quickly become able to estimate distances within about $\pm 20\%$ when given immediate feedback about actual distances during training.

The PSOs will monitor the Level A shutdown zones during all pile and pipe driving activities and for 30 minutes before and after work has stopped. If necessary, PSOs will initiate shutdown procedures as described in Section 2.1.6.2.

In addition to the PSO monitoring the Level A shutdown zones, a third island-based PSO will work closely with an aviation specialist to monitor the Level B zones described in Section 2.1.6.3 using UAS. UAS monitoring of the Level B zones will take place during vibratory and impact pile driving (~July 1-15), and during slope shaping, which could occur intermittently until August 31st of Year 1. This PSO will rotate with an alternate to allow for sufficient breaks. Details regarding monitoring using the UAS are provided in Section 2.2.2. UAS monitoring will not be used after Year 1 unless pile driving or slope shaping activities are extended. If setting of foundation piles is necessary on the island interior during the open water season of Year 2, two PSOs will be stationed on the island to monitor the Level B zone following the same methods described above.

During Years 2 - 4 when drilling activities are occurring, a PSO (and an alternate) will be stationed on the island for approximately 4 weeks during the month of August to monitor for the presence of marine mammals around the island. The Level B zone is expected to be only about 180 ft (55 m) around the island during this time. The PSO will scan waters around the island using equipment described in Section 2.2.5 and following protocols described in Section 2.3.1. ASAMM surveys are typically scheduled for August; therefore, data collected by this PSO could be compared to sighting data collected during ASAMM surveys.

Based on the results of PSO monitoring and underwater acoustic data (see Section 3) and in consultation with NMFS, Hilcorp will determine whether a PSO is needed during Year 5 to monitor for presence and

behavior of marine mammals that may occur within the island vicinity. If, for example, exposure of marine mammals to noise levels that exceed regulatory thresholds is not anticipated, either based on the lack of mammals in the area or because the results of acoustic monitoring indicate the propagation of underwater sound (that exceeds thresholds) during production is exceedingly small, a PSO monitoring during Year 5 may not be needed.

In summary, Hilcorp will monitor a Level A zone shutdown zone during open water construction activities for a 15-day period in July of Year 1. Monitoring will be accomplished using two island-based PSOs. If a bowhead whale or other low frequency cetacean enters the Level A zone, pile or pipe driving will be shut down. If a beluga whale or pinniped enters the Level A zone, work will continue until the pile is completed (estimated to require only ~15-20 minutes), but additional pile driving will not be initiated until the animal has left the Level A zone. During this time, PSOs will monitor the animal and record behavior. If after 20 minutes the animal is still within the Level A zone and the pile has not been completely set, shut down procedures will be initiated, and no new pile driving will begin until the marine mammal has left the Level A zone.

A third land-based PSO will work closely with the UAS pilot(s) using real-time video to monitor the larger Level B take zones and to document any approach of animals to the Level A shutdown zone throughout the same 15-day open-water period of Year 1. During slope shaping activities that may be necessary between July 15 and August 31st, the PSO and UAS will monitor the Level B zone during that activity and will record any marine mammals that occur within that zone as a Level B take. UAS will not be used beyond Year 1 unless for open water pile driving and slope shaping is extended into Year 2. If setting of foundation piles is necessary on the island interior during the open water season of Year 2, two PSOs will be stationed on the island to monitor the Level B zone using methods described at the beginning of this section.

During Years 3 – 4, a land-based PSO (and an alternate) will monitor for the presence of marine mammals around the island for approximately 4 weeks during the month of August. Based on the results of that monitoring Hilcorp, along with NMFS, will determine if monitoring needs to occur during Year 5.

2.2.2. Monitoring Using Unmanned Aircraft System (UAS)

During pile- or pipe-driving or slope shaping construction activities that could occur in open water conditions in Year 1, a third PSO will work closely with the UAS pilot to monitor Level B harassment zones to both record any takes by harassment, and to monitor and observe the behavior of any animals that may be approaching the Level A shutdown zone. A second UAS pilot will be available to allow for sufficient breaks during monitoring. Pile and pipe-driving activities are likely to only occur during the first two weeks of July (July 1 – 15) and would be the dominant noise source at this time. Between July 15 and August 31st, slope shaping may occur (if needed). If slope shaping is needed after July 15, the PSO will continue to monitor the Level B zone to record any takes by harassment. UAS will not be used after Year 1, unless these activities extend into Year 2. If setting of foundation piles is necessary on the island interior during the open water season of Year 2, two PSOs will be stationed on the island to monitor the Level B zone using methods described in Section 2.2.1.

Recent developments in the technical capacity and civilian use of UASs, defined as vehicles flying without a human pilot on board, have led to investigations into the potential use of these systems for monitoring and conducting aerial surveys of marine mammals (Koski, *et al.* 2009, Hodgson, *et al.* 2013,

Duke 2015). UAS operating under autopilot mounted with global positioning systems (GPS) and imaging systems, have been used and evaluated in the Arctic (Koski, *et al.* 2009). These small aircraft have the potential to replace traditional manned aerial surveys and provide an additional method for monitoring marine mammal populations.

Hilcorp will use a fixed wing UAS, mounted with a live-stream, digital single lens reflex (SLR) camera for monitoring marine mammals. Examples of typical UAS that may be used for monitoring are the ScanEagle (Figure 2-1) and the Puma (Figure 2-2). The ScanEagle has a zero-length catapult launch and snag line recovery system. It has a payload of ~3 kg, loaded weight of <50 lbs. and endurance of up to 24 hours, depending upon configuration and flight conditions. The Puma AE (AeroEnvironment) is a fully waterproof, small UAS designed for land and maritime operations. It is capable of landing in water or on land, providing operational flexibility. The enhanced precision navigation system with secondary GPS provides positional accuracy and reliability. A common ground control system allows the operator to control the aircraft manually or program it for GPS-based autonomous navigation.

FIGURE 2-1. PHOTO OF SCANEAGLE



FIGURE 2-2. PHOTO OF PUMA



The UAS will fly at an altitude of 500 ft (152 m) (or other altitude determined appropriate based on the platform) and a transect width to be determined through discussions with NMFS. UAS will be used to monitor the entire Level B zone. If necessary, Hilcorp will seek a waiver from the Federal Aviation Administration (FAA) to operate the UAS above 400 ft (122 m) and beyond the line of sight of the pilot. Ground control for the UAS will be located on the LPDI, SDI, or other nearby shore-based facility.

Hodgson *et al.* (2013) conducted marine mammal surveys using a ScanEagle UAS flown at 500 ft. The survey consisted of 10 transects spaced at 235 ft (72 m) intervals (the width of view of the water surface within the images). The width of view at each altitude was the effective transect strip width. The image capture rate was set to achieve 10 percent overlap in images. The overlap in images was useful in detecting animals masked by reflection on the sea surface or animals at awkward body angles. A similar approach is suggested for LDPI but specific details can be determined based on the specifications of the UAS to be used and through discussions with NMFS.

Transects over the Action Area will likely be divided into sections that are 30 minutes of longitude across, as done by ASAMM. End points for the survey transects may be selected at random but will specifically cover the Action Area and allow for a continuous flight path within the survey area. If small boats are observed, the UAS pilot will truncate the transect to avoid interference with subsistence activities. The UAS will not be used to circle marine mammals. If it is too windy or other weather conditions prevent use of a UAS, activities will be adjusted accordingly and the backup plan of using a PSO based on land or on a vessel will be implemented. The UAS will not be used to circle marine mammals.

During the fall subsistence hunt of bowhead whales, a minimum altitude will be used near Cross Island. If that altitude cannot be maintained, transects will be truncated to avoid a specific radius around each whaling area (following similar ASAMM protocol for aerial surveys). Sightings recorded by video will be considered “off effort” following ASAMM protocol for recorded data (i.e., processed at a later point in time by a trained PSO).

To maintain consistency of data acquisition with previous years, PSOs responsible for processing recorded video will be trained according to NMFS protocols. UAS surveys are tentatively planned during periods when ASAMM would not be conducting surveys in order to maximize data collection on marine

mammal presence in the area. Additional details on survey schedule and duration (i.e., number of days per survey), survey speed, altitude, and other methods will be further refined in consultation with NMFS. These monitoring measures should result in an effective program that will supplement data collected by PSOs on marine mammal presence and behavior. These data will also be effective in minimizing takes by expanding the area being monitored beyond that which could be done visually by PSOs.

2.2.3. Vessel-Based Observations as Needed

If needed as a back-up to or instead of using the UAS system, a vessel-based PSO could be positioned at the edge of the Level A zone. An observer onboard a vessel at this location will be able to monitor marine mammals out to a distance of 0.9 miles (1.5 km) and record any exposures in the Level B zone out to that distance. Any animals approaching the Level A zone will be tracked and procedures described in Section 2.2.1 will be followed if animals are observed entering the Level A zone. This is considered a less desirable option than using the UAS due to increased underwater noise from the vessel and safety concerns for the observer.

2.2.4. Monitoring at Night and During Poor Visibility Conditions

Hilcorp plans to conduct 24-hr operations. Darkness will not be an issue throughout most or all of the open water season as there will be no periods of darkness in the Action Area until after August. Current scheduling should prevent this condition from occurring. Therefore, PSOs and the UAS will not be on duty during darkness. However, if poor environmental conditions during the open water period restrict the use of the UAS or the PSOs' ability to see within the marine mammal Level A shutdown zone (e.g. excessive wind or fog, high Beaufort state), sheet pile and pile installation will cease unless the operation began prior to poor visibility, with the assumption that no marine mammals would enter the area once the noise was active. UAS systems have been used during poor visibility and windy conditions using, for example, infra-red imaging with minimal impact in the ability to detect marine mammals (Hodgson, Kelly and Peel 2013). However, Hilcorp will consider this only if poor weather conditions persist and require monitoring other than with a PSO.

2.2.5. Field Equipment

Land-based PSOs will utilize the following specialized field equipment: reticle binoculars, GPS unit, laptop computer(s) or paper forms, and digital images and video cameras if practicable.

2.3. Protected Species Observers

2.3.1. PSO Protocols - Roles and Responsibilities

Hilcorp intends to work with PSOs who have had previous experience. All PSOs shall be trained and approved by NMFS. Island-based PSOs will be dedicated to observation and will not have any other construction-related duties. PSOs will be on duty in shifts of a maximum of 4 hours at a time, a maximum of 12 hours watch time per day per PSO; although the exact shift schedule will be established prior to Project initiation.

Two PSOs will scan the area around the island systematically with reticle binoculars and with the naked eye while the third PSO will work with the UAS pilot(s) to monitor the video footage from the UAS in

real time. Each PSO will have an alternate and a second UAS pilot will be available for rotation through shifts. This ensures that sufficient breaks will be provided for PSOs and the UAS pilot. Because the main purpose of the PSOs on the island is detecting marine mammals for the implementation of mitigation measures according to specific guidelines, information to be recorded will be as concise as possible (see Section 2.5). This will allow the observers to focus on detecting marine mammals.

2.3.2. *PSO Qualifications and Training*

Observers will complete a training and refresher session on marine mammal monitoring, to be conducted shortly before the anticipated start of the open water season construction activities.

Primary objectives of the training include:

- Review of this marine mammal monitoring and mitigation plan, including any amendments specified by NMFS, BOEM, or by other agreements Hilcorp may elect to implement;
- Review of marine mammal sighting, identification, and distance estimation methods;
- Review of operation of specialized equipment (reticle binoculars, GPS and UAS systems); and
- Review of, and classroom practice with, data recording and data entry systems, including procedures for recording data on marine mammal sightings, monitoring operations, environmental conditions, and entry error control. These procedures will be implemented through use of a customized computer database and laptop computers.

2.3.3. *PSO Handbook*

A PSO's Handbook will be prepared for Hilcorp's LPDI land- and UAS-based monitoring program. The handbook will contain narrative descriptions, maps, illustrations, and photographs and are intended to provide guidance and reference information to trained individuals who will participate as PSOs.

The PSO Handbook for the Hilcorp Liberty project will include:

- Summary descriptions of project activities;
- List of species that might be encountered (identification and natural history);
- LDPI LOA and other relevant regulations or permits;
- Relevant underwater noise criteria;
- PSO roles and responsibilities;
- Safety precautions;
- Monitoring and mitigation objectives and procedures, including safety radii;
- Data recording procedures;
- Guidance for estimating distance using reticle binoculars;
- Table of wind speed, Beaufort wind force scale, and sea state codes;
- Data quality-assurance/quality-control, delivery, storage, and backup procedures;
- Observation schedule (watches); and
- Instructions for construction crew regarding the marine mammal monitoring and mitigation plan.

2.4. Communication Procedures

If marine mammals are detected within the designated Level A shutdown zones, monitoring and shutdown procedures will be implemented as described in Section 2.1.6.2. To assure prompt implementation of these procedures, multiple channels of communication between the PSOs and the construction supervisor will be established. During the shutdown, PSOs will continue to maintain watch to determine when the animal(s) are outside the shutdown zones. Sheet pile and pipe driving can be resumed if the observers have visually confirmed that the animal(s) moved outside the safety zone, or if the animal(s) were not observed within the shutdown zone for 30 minutes (See Section 2.1.6.2). Direct communication with the construction supervisor will be maintained throughout these procedures.

2.5. Field Data Recording, Verification, Handling, and Security

The following information will be collected:

- Environmental conditions – consisting of sea state (in Beaufort Scale according to NOAA), visibility (in km, with 10 km indicating the horizon on a clear day), and sun glare (position and severity). These will be recorded at the start of each shift, whenever there is an obvious change in one or more of the environmental variables, and whenever the observer changes shifts.
- Project activity – number of sheet piles or conductor pipes driven, duration of slope shaping, etc.
- Sighting information – species (if determinable), number (individual or group size), position and heading, behavior, movement, and distance relative to the island (initial and closest approach).

PSOs will record real-time observations directly into computers. Paper datasheets will be available as backup if necessary. The accuracy of the data entry will be verified in the field by computerized validity checks as the data are entered, and by subsequent manual checking of the database printouts. These procedures will allow initial summaries of data to be prepared during and shortly after the field season, and will facilitate transfer of the data to statistical, graphical or other programs for further processing. Quality control of the data will be facilitated by the start-of-season training session, and ongoing data checks during the field season.

In addition to routine PSO duties, observers will have available Traditional Knowledge and Natural History datasheets and voice recorders to document observations that are not captured by the sighting or effort data. Copies of these records will be available to PSOs for reference if they wish to prepare a statement about their observations. If prepared, this statement will be included in the 90-day and final reports documenting the monitoring work.

2.6. Reporting

2.6.1. Data Collection and Field Reports

Throughout the survey program, PSOs will prepare a report each day or other interval as required, summarizing the recent results of the monitoring program. The reports will summarize the species and numbers of marine mammals sighted. These reports will be provided to NMFS and to the survey operators. An example observation sheet is provided as Figure 2-3.

Among the pieces of information recorded, the PSOs will record detailed information about any implementation of shutdowns including the distance of animals to the construction activity, description of

specific actions that ensued and resulting behavior of the animal, if any. At a minimum, the following information will be collected on the observer forms:

- Date and time that monitored activity begins or ends;
- Construction activities occurring during each observation period;
- Weather parameters (e.g., percent cover, visibility);
- Water conditions (e.g., sea state, tide state);
- Species, numbers, and if possible, sex and age class of marine mammals;
- Description of marine mammal behavior, including bearing and direction of travel;
- Distance from construction activities to marine mammals and distance from the marine mammals to the observation point;
- Description of implementation of mitigation measures (e.g., shutdown or delay);
- Locations of all marine mammal observations; and
- Any other human activity in the area.

2.6.2. 90-Day and Annual Monitoring Reports

The results of the Liberty marine mammal monitoring program including estimates of “take by harassment”, will be presented in 90-day and final technical reports. Reporting will address the requirements established by NMFS.

The technical reports will include:

- Summaries of monitoring effort: total hours, total distances, and distribution of marine mammals throughout the study period;
- Analyses of the effects of various factors influencing detectability of marine mammals including sea state, number of observers, and fog/glare;
- Species composition, occurrence, and distribution of marine mammal sightings including date, water depth, numbers, age/size/gender categories (for example, coloration in beluga whales may indicate a difference between adult whales and subadults or calves), group sizes, and ice cover;
- Sighting rates of marine mammals during periods with and without construction activities (and other variables that could affect detectability);
- Distance of initial sighting(s) as well as distances during construction activity (impulse or vibratory driving or slope shaping);
- Observed behaviors and types of movements during observation;
- Numbers of sightings/individuals seen during construction activity;
- Summaries of sound-producing activity start and end dates, duration, type of equipment, and sound source verification of sound producing activities;
- Complete descriptions of any work shutdowns;
- Analyses of the effects of construction operations;
- Estimates of “take by harassment”; and
- If applicable, a summary of any injured or dead marine mammals discovered.

Results and a complete description of methods used to survey for ringed seals will be submitted as part of the annual report. The annual monitoring report will summarize the type of activities conducted, marine mammal observations and findings regarding potential impacts. Findings associated with LDPI will be compared to other developments based on available reports (i.e., from Northstar and other Beaufort Sea offshore and nearshore developments). Information summarized for LDPI will add to the overall data and knowledge of marine mammals in the Action Area, and to a larger extent marine mammal use of coastal waters inside the barrier islands.

In the unanticipated event that the specified activity at LDPI clearly causes an injury or mortality of a marine mammal in a manner prohibited by the LOA, PSOs will report the incident to Hilcorp, who will report the incident to the NMFS Chief of the Permits and Conservation Division, Office of Protected Resources and NMFS Alaska Regional Office. This communication will occur as soon as practicable. In the event of a ship strike, operations will not cease but the PSO will report the incident to NMFS and Hilcorp, and Hilcorp will work with NMFS to determine appropriate follow on actions.

A report documenting this type of incident will include:

- Time, date, and location (latitude/longitude) of the incident;
- Description of the incident;
- Name and type of vessel involved (if applicable);
- Vessel speed during and leading up to the incident (if applicable);
- Status of all sound source use in the 24 hours preceding the incident;
- Water depth;
- Environmental conditions (e.g., wind speed and direction, Beaufort state, cloud cover, and visibility);
- Description of all marine mammal observations in the 24 hours preceding the incident;
- Species or description of the animal(s) involved;
- Fate of the animal(s); and
- Photographs or video footage of the animal(s) (if available).

In the event that an observer 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), Hilcorp will report the incident to the NMFS Chief of the Permits and Conservation Division, Office of Protected Resources in Silver Spring, Maryland and the Alaska Stranding Coordinator in Juneau, Alaska, as soon as practicably possible. The report will include the same information identified in the paragraph above. Activities will be allowed to continue while NMFS reviews the circumstances of the incident. NMFS will work with Hilcorp to determine whether modifications to construction or monitoring activities are appropriate.

If the injury or death is not associated with or related to the activities authorized in the LOA (e.g., previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), Hilcorp will report the incident by email to the NMFS Chief of the Permits and Conservation Division, Office of Protected Resources and to the Alaska Stranding Coordinator within 48 hours of the discovery. Hilcorp will provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

3. ACOUSTIC MONITORING PLAN

3.1. Objectives and General Methods

Passive Acoustic Monitoring will be undertaken using autonomous sound recorders deployed to the seabed at the start of the open water season in Years 1-5 (approximately in July, dependent on ice conditions) and will record sounds continuously through to the end of each open water season (approximately through October, dependent on ice conditions). Recorders will be positioned to simultaneously record sound levels at multiple ranges from the project activities. During winter, when long-term autonomous moorings are at significant risk for loss or damage from ice, brief spot-measurements will be collected using hand-deployed hydrophones, lowered in holes drilled through the ice. Such measurements will be targeted to capture a representative sampling of the five noise sources listed in Section 1 (if they occur in winter) but will not be continuous through the entire winter seasons. The durations of these winter recordings will depend on the weather conditions and the ability to maintain an opening in the ice sufficient to extract the hydrophone.

Data recorded during times with no project activities, if such times exist, will be analyzed for ambient sound level statistics. JASCO's PamLab software will be used for automated calculation of sound level statistics and distances to marine mammal impact thresholds will be determined through a regression of the sound level versus range data. The detailed Acoustic Monitoring Plan is included as Appendix D of the ITR petition.

Open water season construction, drilling and production activities are expected to occur according to the following tentative timeline:

- Year 1-2: slope shaping, armament installation, sheet pile installation, facility construction, equipment mobilization
- Years 3-5: equipment mobilization, drilling and production³.

The recorder arrangement will be configured each year based on the anticipated activities for that season and the modelled sound propagation estimates for the relevant sources. The recorders will provide data on ambient noise conditions and characterize or verify the long-range propagation of sounds emanating from the LDPI during construction activities at an offshore location.

3.2. Analysis of Results and Reporting

Acoustic recordings will be processed at the end of each season using JASCO's customized PAMLab software to compute sound level statistics from the recorded data. Within 90 days of each season, Hilcorp will provide a summary report describing results of the monitoring as described in more detail in the Acoustic Monitoring Plan (Appendix D).

³ Year 2 may include some pipe driving in the island interior during open water. Based on data from Northstar (Richardson and Williams 2001), the 180 and 190 dB radii for underwater noise thresholds did not extend into the water during this activity however, to be precautionary, takes have been included for one month of this activity during open water conditions.

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Attachment 1

Ice Road and Ice Trail Best Management Practices

Alaska North Slope

Ice Road and Ice Trail Best Management Practices

Best Management Practices Introduction and Definitions

The following Best Management Practices (BMPs) and monitoring measures are applicable to operations on the Alaska North Slope. They are proposed for the construction and maintenance of sea ice roads and sea ice trails in areas where water depth is greater than 10 feet (ft) (the minimum depth required to establish ringed seal lairs) as well as any open leads in the sea ice requiring a temporary bridge during the ice road season. These BMPs do not apply to land-based ice roads/trails or ice roads/trails crossing lakes. These measures are intended to avoid and minimize interactions with ringed seals. For the purposes of these BMPs, sea ice roads and trails are generally defined¹ as follows:

- Sea Ice Road: a route across sea ice created by clearing and grading snow, then pumping seawater through drilled holes in the sea ice until the desired thickness is achieved. The top layer is typically strengthened by a fresh water cap of ice.
- Sea Ice Trail: a route across sea ice created, used and maintained by equipment such as Tuckers, PistenBullys, snow machines or similar tracked equipment. Sea ice trails do not require seawater flooding.

These BMPs and monitoring activities are organized into the following categories:

Section 1: Wildlife Training

Section 2: General BMPs Implemented Throughout the Ice Road/Trail Season

Section 3: BMPs Implemented Before March 1st

Section 4: BMPs Implemented After March 1st

Section 5: Reporting

Section 1: Wildlife Training

Prior to initiation of sea ice road- and ice trail-related activities, project personnel associated with ice road construction, maintenance, use or decommissioning (i.e., ice road construction workers, surveyors, security personnel, and the environmental team) will receive annual training² on these BMPs. Personnel are advised that interactions with, or approaching, any wildlife is prohibited. Annual training also includes reviewing the company's Wildlife Management Plan³. In addition to the BMPs, other topics in the training will include:

- Ringed Seal Identification and Brief Life History
- Physical Environment (habitat characteristics and how to potentially identify habitat)
- Ringed Seal Use in the Ice Road Region (timing, location, habitat use, birthing lairs, breathing holes, basking, etc.)
- Potential Effects of Disturbance

¹ Specific construction techniques may vary depending on site-specific conditions. However, this description generally describes the process by which a sea ice road is constructed.

² Training rosters can be made available to audit if requested.

³ May also be referred to as a Wildlife Interaction Plan.

- Importance of Lairs, Breathing Holes and Basking to Ringed Seals

Brief Summary of Applicable Laws and Regulatory Requirements

- Marine Mammal Protection Act (MMPA)
- Endangered Species Act (ESA)

Section 2: General BMPs Implemented Throughout the Ice Road/Trail Season

General BMPS will be implemented through the entire ice road/trail season including during construction, maintenance, use and decommissioning.

1. Ice road/trail speed limits will be no greater than 45 miles per hour (mph); speed limits will be determined on a case-by-case basis based on environmental, road conditions and ice road longevity considerations. Travel on ice roads and trails is restricted to industry staff.
2. Following existing safety measures, delineators will mark the roadway in a minimum of ¼-mile increments⁴ 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). Following existing safety measures currently used for ice trails, delineators will mark one side of an ice trail a minimum of every ¼ mile. Delineators will be color-coded⁵, following existing safety protocol, to indicate the direction of travel and location of the ice road or trail.
3. 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.
4. Project personnel will be instructed that approaching or interacting with ringed seals is prohibited.
5. Personnel will be instructed to remain in the vehicle and safely continue, if they encounter a ringed seal while driving on the road.
6. If a ringed seal is observed within 150 ft of the center of an ice road or trail, the operator's Environmental Specialist will be immediately notified with the information provided in the Reporting section below.
 - a. The Environmental Specialist will relay the seal sighting location information to all ice road 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.
 - b. The Environmental Specialist or designated person will monitor the ringed seal to document the animal's location relative to the road/trail. 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 150 ft away from the center of the road/trail or is no longer observed.
 - c. The Environmental Specialist or designated person will contact appropriate state and federal agencies as required⁶ (see company-specific Wildlife Plans for notification details).

⁴ The interval between delineators is specific to existing ice road safety measures and relates to how drivers assess and report weather and roadway conditions.

⁵ For example, a specific color to the driver's right or left will indicate direction of travel as well as the route.

⁶ As detailed in the Wildlife Management Plan.

Section 3: BMPs Implemented Prior to March 1st

Winter sea ice road/trail construction and use will begin as early as possible (typically December 1st through mid-February). It is anticipated that all ice road construction activities will be initiated prior to March 1st, before the time when female ringed seals establish birth lairs. Prior to establishing lairs, ringed seals are mobile and are expected to generally avoid the ice roads/trails and construction activities.

Other on-ice activities occurring prior to March 1st could also include spill training exercises, pipeline surveys, snow clearing, and work conducted by other snow vehicles such as a PistenBullys, snow machines, or rollagons. Prior to March 1st, these activities could occur outside of the delineated ice road/trail and shoulder areas. During this period, General BMPs (described in Section 2) will be implemented.

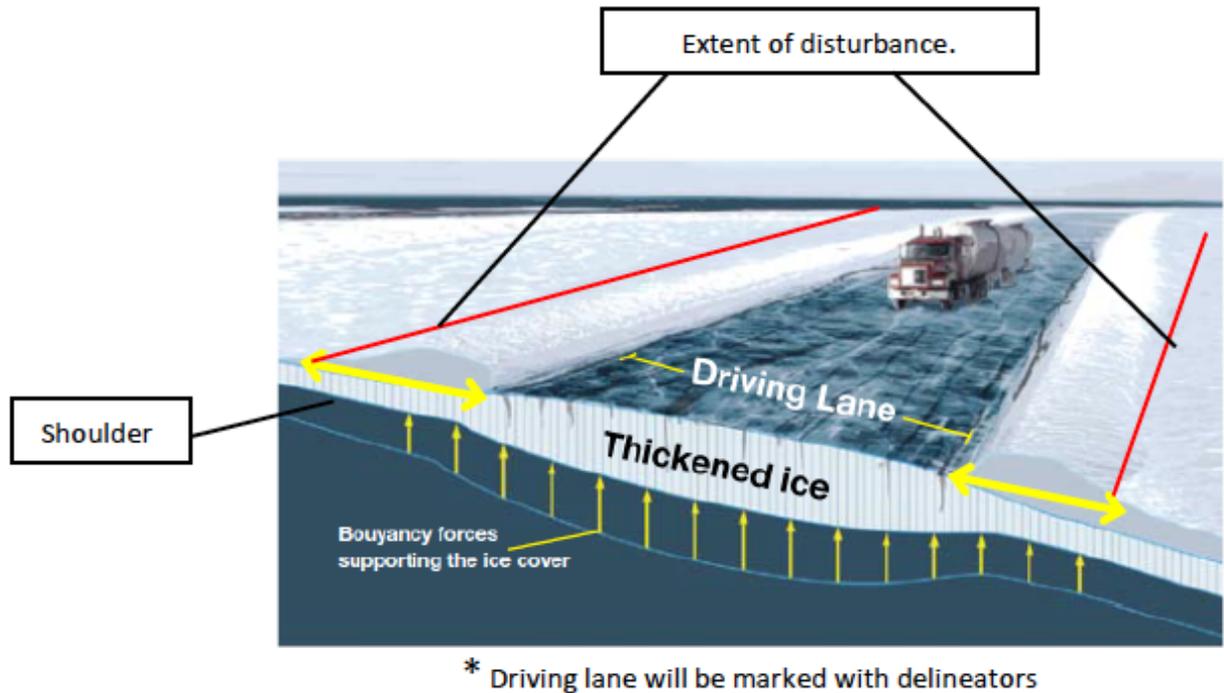
Section 4: BMPs Implemented After March 1st

After March 1st, and continuing until decommissioning of ice roads/trails in late May or early June, the on-ice activities mentioned above can occur anywhere on sea ice where water depth is less than 10 ft (i.e., habitat is not suitable for ringed seal lairs). However, if the water is greater than 10 ft in depth, these activities should only occur within the boundaries of the driving lane or shoulder area of the ice road/trail and other areas previously disturbed (e.g., spill and emergency response areas, snow push areas) when the safety of personnel is ensured.

In addition to the general BMPs, the following BMPs will also be implemented after March 1st:

7. Ice road/trail construction, maintenance and decommissioning will be performed within the boundaries of the road/trail and shoulders, with most work occurring within the driving lane. To the extent practicable and when safety of personnel is ensured, equipment will travel within the driving lane and shoulder areas (see Figure 1).
8. Blading and snow blowing of ice roads will be limited to the previously disturbed ice road/shoulder areas to the extent safe and practicable. Snow will be plowed or blown from the ice road surface.
9. In the event snow is accumulating on a road within a 150 ft. radius of an identified downwind seal or seal lair, operational measures will be used to avoid seal impacts, such as pushing snow further down the road before blowing it off the roadway. Vehicles will not stop within 150 ft of identified seals or within 500 ft of known seal lairs.
10. To the extent practicable and when safety of personnel is ensured, tracked vehicle operation will be limited to the previously disturbed ice trail areas. 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 hours with good visibility. Ringed seal structures will be avoided by a minimum of 150 ft during ice testing and new trail construction. Any observed ringed seal structures will be reported following BMP #6. 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.

Figure 1. Graphic Representation of Ice Road



11. If an ice road or trail is being actively used⁷, 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 500 ft of the roadway corridor. The following survey protocol will be implemented:
 - a. Surveys will be conducted every other day during daylight hours.
 - b. Observers for ice road activities need not be trained Protected Species Observers (PSOs), but they must have received the training described in Section 1 and understand the applicable sections of the Wildlife Management Plan. In addition, they must be capable of detecting, observing and monitoring ringed seal presence and behaviors, and accurately and completely recording data.
 - c. Observers will have no other primary duty than to watch for and report observations related to ringed seals during this survey. If weather conditions become unsafe, the observer may be removed from the monitoring activity.

12. If a seal is observed on ice within 150 feet of the centerline of the ice road/trail, BMP #6 shall be initiated and:
 - a. Construction, maintenance or decommissioning activities associated with ice roads and trails will not occur within 150 ft of the observed ring seal, but may proceed as soon as

⁷ 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 ringed seal, of its own accord, moves farther than 150 ft distance away 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.

13. If a ringed seal structure (i.e., breathing hole or lair) is observed within 150 ft of the ice road/trail, the location of the structure will be reported to the Environmental Specialist⁸ who will then carry out notification protocol identified in BMP #7 above and:
 - a. a qualified observer (see BMP #11) will monitor the structure every six hours on the day of the initial sighting to determine whether a ringed seal is present. Monitoring for the seal will occur every other day the ice road 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.
 - b. Construction, maintenance or decommissioning work will proceed following all other BMPs to minimize impacts or disturbance in the area.

Section 5: Reporting (as needed)

A final end-of-season report compiling all ringed seal observations will be submitted to NMFS Alaska Region Protected Resources Division (greg.balogh@noaa.gov) and NMFS Office of Protected Resources Permits Division (jaclyn.daly@noaa.gov) within 90 days of decommissioning the ice road/trail. The report will include:

- a. Date, time, location of observation.
- b. Ringed seal characteristics (i.e., adult or pup, behavior [avoidance, resting, etc.]).
- c. Activities occurring during observation including equipment being used and its purpose, and approximate distance to ringed seal(s).
- d. Actions taken to mitigate effects of interaction emphasizing: 1) which BMPs were successful; 2) which BMPs may need to be improved to reduce interactions with ringed seals; 3) the effectiveness and practicality of implementing BMPs; 4) any issues or concerns regarding implementation of BMPs; and 5) potential effects of interactions based on observation data.
- e. Proposed updates (if any) to Wildlife Management Plan(s) or BMPs.
- f. Reports should be able to be queried for information.

NMFS, in consultation with the operator, may make modifications to these BMPs based on this information for the next ice road season.

In the unanticipated event a seal is killed or seriously injured by ice road/trail activities, NMFS will be notified immediately (see contact information above).

In the event ice road/trail personnel discover a dead or injured seal but the cause of injury or death is unknown or believed not to be related to ice road/trail activities, NMFS will be notified within 48 hours of discovery (see contact information above).

⁸ Also referred to as an Environmental Advisor in Wildlife Management / Interaction Plans.

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