

MARINE MAMMAL MONITORING AND MITIGATION PLAN
FOR
HILCORP ALASKA AND HARVEST ALASKA
OIL AND GAS ACTIVITIES
COOK INLET, ALASKA
YEAR 1: APRIL 1, 2019-MARCH 31, 2020

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ACRONYMS AND ABBREVIATIONS

2D	two-dimensional
3D	three-dimensional
4MP	Marine Mammal Monitoring and Mitigation Plan
AGL	above ground level
AOGCC	Alaska Oil and Gas Conservation Commission
BOEM	Bureau of Ocean Energy Management
BSEE	Bureau of Safety Environment and Enforcement
cui	cubic inches
dB re 1 μ Pa	decibels referenced to one microPascal
EZ	Exclusion Zone
ft	feet
Harvest Alaska	Harvest Alaska, LLC
Hilcorp Alaska	Hilcorp Alaska, LLC
hrs	hours
IHA	Incidental Harassment Authorizations
ITR	Incidental Take Regulations
kg	kilograms
km	kilometers
lbs	pounds
L _{pk}	peak level
LOA	Letters of Authorization
m	meters
MMPA	Marine Mammal Protection Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
PAM	passive acoustic monitoring
PSO	Protected Species Observer
PTS	permanent threshold shift
rms	root-mean-square
s	seconds
SEL	sound exposure level
SPL	sound pressure level
SSV	sound source verification
SZ	Safety Zone
TTS	temporary threshold shift
UAS	Unmanned Aerial System
VHF	very high frequency

1.0 INTRODUCTION

Hilcorp Alaska, LLC (Hilcorp Alaska) and Harvest Alaska, LLC (Harvest Alaska) hereinafter referred to jointly as the “Applicant” hereby petitioned the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) and the United States Fish and Wildlife Service (USFWS) to promulgate regulations pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) for the non-lethal unintentional taking of small numbers of marine mammals incidental to oil and gas exploration, development, and production activities in Cook Inlet, Alaska for the period of five years beginning April 1, 2019 extending through April 1, 2024. The Applicant hereby requests a Letter of Authorization (LOA) for activities in the first year (Year 1) under the promulgated incidental take regulations (ITRs) for the period of April 1, 2019 through March 31, 2020.

The geographic area of activity covers a total of approximately 2.7 million acres (10,926 square kilometers [km²]) in Cook Inlet. It includes land and adjacent waters in Cook Inlet including both State of Alaska and Federal Bureau of Ocean Energy Management (BOEM) Outer Continental Shelf (OCS) waters (Figure 1). The area extends from the north at the Susitna Delta on the west side and Point Possession on the east side of Cook Inlet to southwest of Homer in lower Cook Inlet.

This document summarizes the marine mammal monitoring and mitigation plan (4MP) for activities planned for the period of April 1, 2019 through March 31, 2020. Marine mammal monitoring and mitigation methods have been designed to meet the requirements and objectives which will be specified in the Year 1 Letter of Authorization (LOA). As this current 4MP is submitted prior to the promulgation of the incidental take regulations (ITR), the Applicant recognizes some details of the 4MP may change upon receipt of the LOAs.

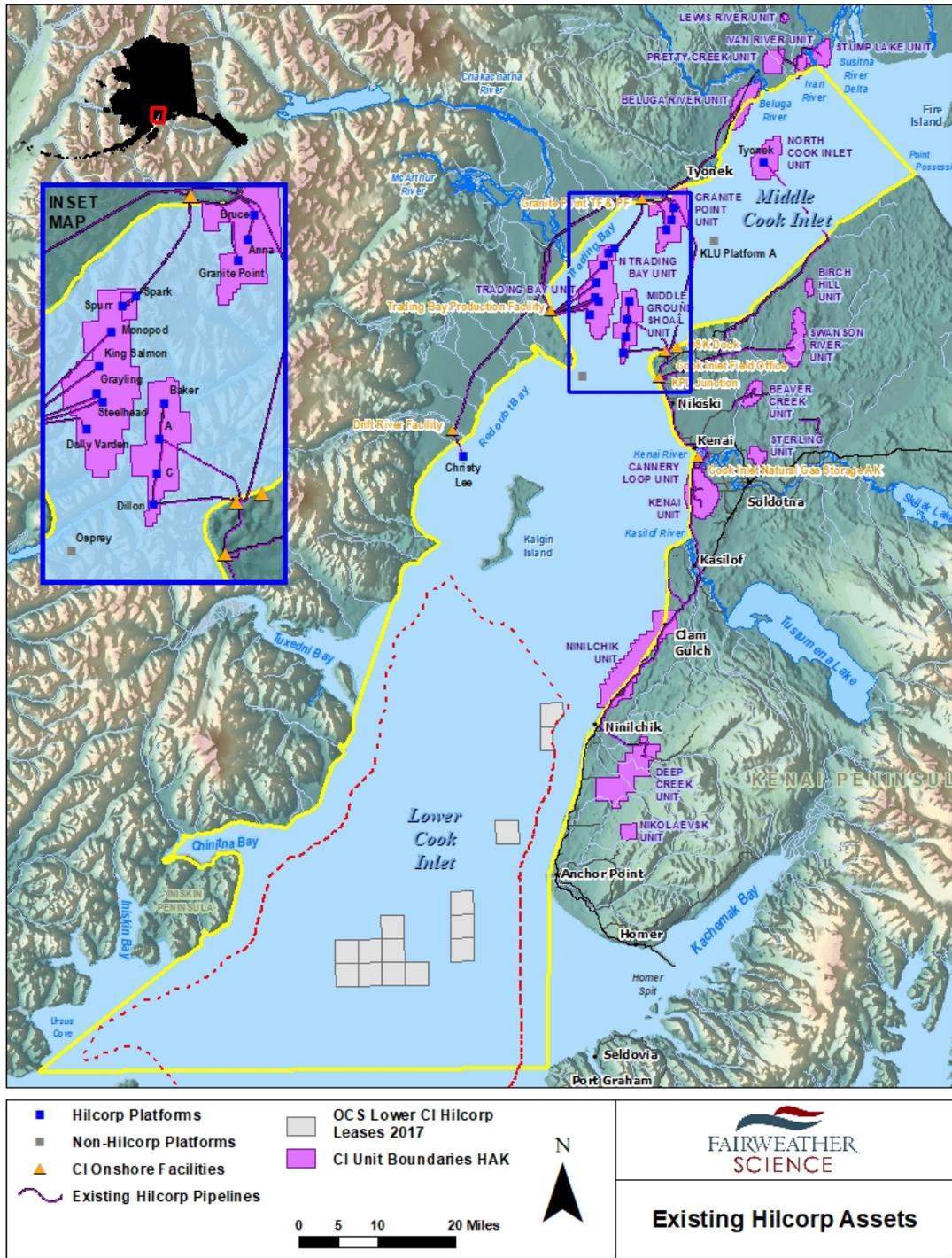


Figure 1. Map showing existing Hilcorp Alaska assets in Cook Inlet.

2.0 DESCRIPTION OF ACTIVITIES

The scope of this LOA request for Year 1 includes three of the four stages of activity described in the ITR Petition, including exploration, development, and production activities within the Applicant’s area of operations in and adjacent to Cook Inlet within the Petition’s geographic area (Figure 2). Table 1 summarizes the planned activities within the geographic scope of this LOA and the following text describes these activities in more detail. This section is organized into two primary areas within Cook Inlet: lower Cook Inlet (south of the Forelands to Homer) and middle Cook Inlet (north of the Forelands to Susitna/Point Possession).

Table 1. Summary of planned activities included the Year 1 LOA request.

Project Name	Cook Inlet Region	Seasonal Timing	Anticipated Duration	Anticipated Noise Sources
OCS 3D seismic survey	Lower Cook Inlet OCS	April-October	45-60 days	1 source vessel with airguns, 1 support vessel, 1-2 chase vessels
Platform & pipeline maintenance	Middle Cook Inlet	April-October	180 days	Vessels, water jets, hydraulic grinders, pingers, helicopters, and/or sub-bottom profilers
Granite Point Platform Development Drilling (and associated geohazard survey)	Middle Cook Inlet	May-November	120-150 days	1 jack-up rig, tugs towing rig, support vessel, helicopters, and 1 vessel with echosounders and/or sub-bottom profilers

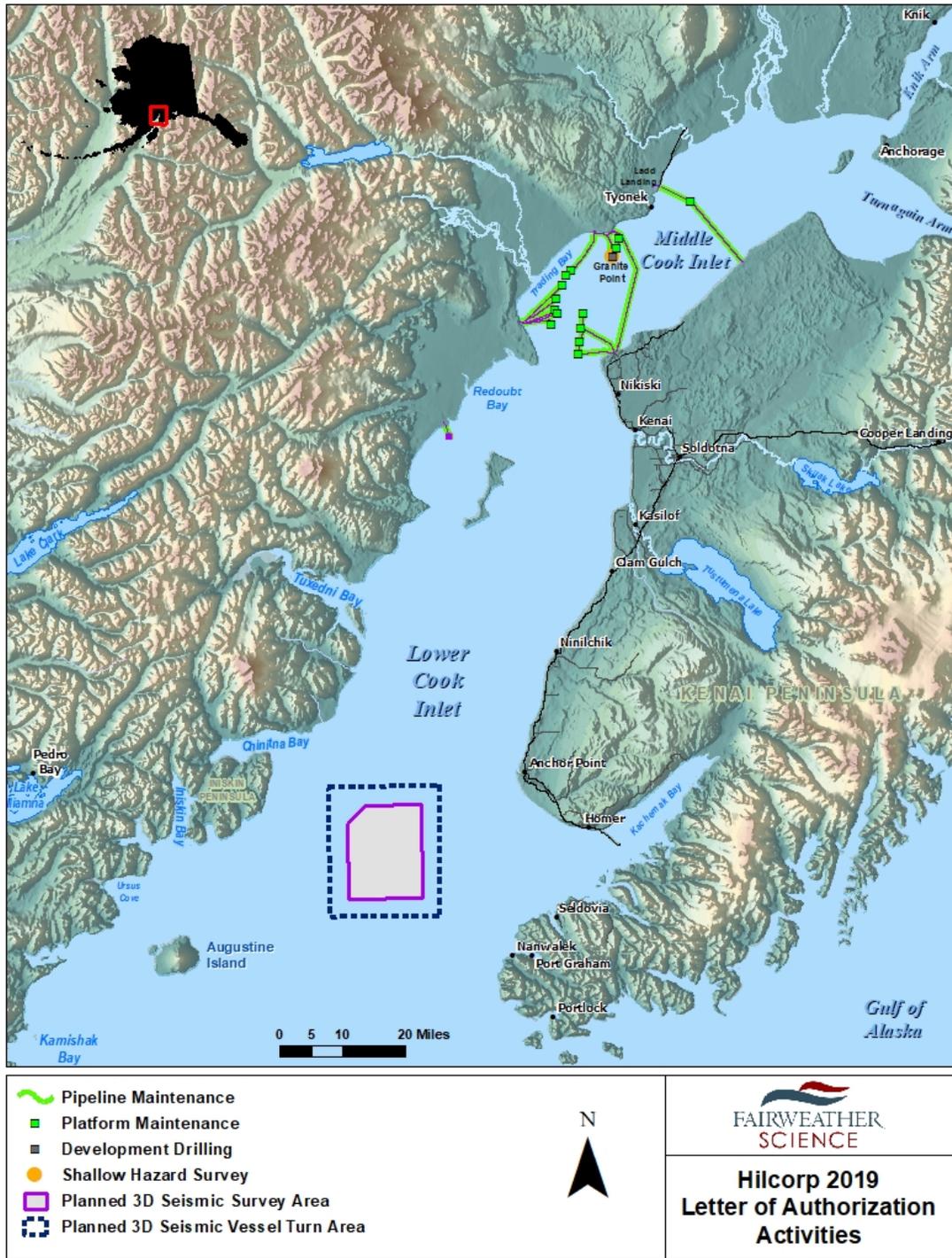


Figure 2. Map showing planned activities Year 1 LOA.

2.1 3D SEISMIC SURVEY

Hilcorp Alaska plans to collect 3D seismic data for approximately 45-60 days starting April 1, 2019 over 11 of the 14 OCS lease blocks in lower Cook (Figure 2). The 3D seismic survey is comprised of an area of approximately 969 km² (375 mi²), which includes a 3D survey area of 451 km² (174 mi²) through 8 blocks (6357, 6405, 6406, 6407, 6455, 6456, 6457, 6458). The survey program target start date is April 1, 2019 but the actual start date will depend on arrival of the seismic source vessel. The survey is planned to last for approximately 45-60 days. The length of the survey will depend on weather, equipment, and marine mammal delays.

Polarcus is the seismic contractor and the general seismic survey design is provided below. The 3D seismic data will be acquired using a specially designed marine seismic vessel towing 8-10 x ~2,400-meters (m; 1.5 miles [mi]) recording cables (i.e., streamers) with a dual air gun array. The survey will involve one source vessel, one support vessel, and one or two chase vessels. Crew changes are expected to occur every four to six weeks using a helicopter or support vessel from shore bases in lower Cook Inlet.

The proposed seismic survey will be active 24 hours (hrs) per day. The array will be towed at a speed of approximately 7.41 km/hr (4 knots), with seismic data collected continuously. Data acquisition will occur for approximately 3-5 hrs, followed by a 1.5-hr period to turn and reposition the vessel for another pass. The turn radius on the seismic vessel is approximately 4,828 m (3 mi), which includes a run-out area where guns are active, but outside the full-fold data acquisition area. The total area of airgun operations will be approximately 528 km² (204 mi²).

The data will be shot parallel to the Cook Inlet shorelines in a north/south direction. This operational direction will keep recording equipment/streamers in line with Cook Inlet currents and tides and keep the equipment away from shallow waters on the east and west sides. The program may be modified if the survey cannot be conducted as a result of noise conditions onsite (i.e., ambient noise). The airguns will typically be turned off during the turns, however, depending on the daylight hours and length of the turn, Hilcorp Alaska may use the smallest gun in the array (45 cubic inch [cui]) as a mitigation airgun where needed. The vessel will turn into the tides to ensure the recording cables/streamers remain in line behind the vessel.

The survey will involve one source vessel, one support vessel, one or two chase vessels, and potentially one mitigation vessel. The source vessel tows the airgun array and the streamers. The support vessel provides general support for the source vessel, including supplies, crew changes, etc. The chase vessel(s) monitors the in-water equipment and maintains a security perimeter around the streamers. Details of anticipated vessels are provided in Table 2. Figure 3 and Figure 4 show a picture of a typical, modern source vessel.

Table 2. Description of the vessels for 3D seismic survey.

Name	Primary Activity	Specifications
<i>M/V Naila, Asima, Adira, or Alima</i> (or similar)	Source /Streamer/Recording vessel	92 m length x 21 m breadth 7.5 m draft 7,420 to 7,894 gross tonnage Built in 2010 Bahamas flag
<i>M/V Maria G or Victory G</i> (or similar)	Support vessel Supports crew changes, supplies, etc.	53.8 m length x 13.8 m breadth 3.8 m draft 1,081 gross tonnage Built in 2009 Panama flag
TBD (1 or 2)	Chase vessel Maintains security around streamers	TBD



Figure 3. Photos of typical marine source / streamer vessel (left) and support vessel (right).

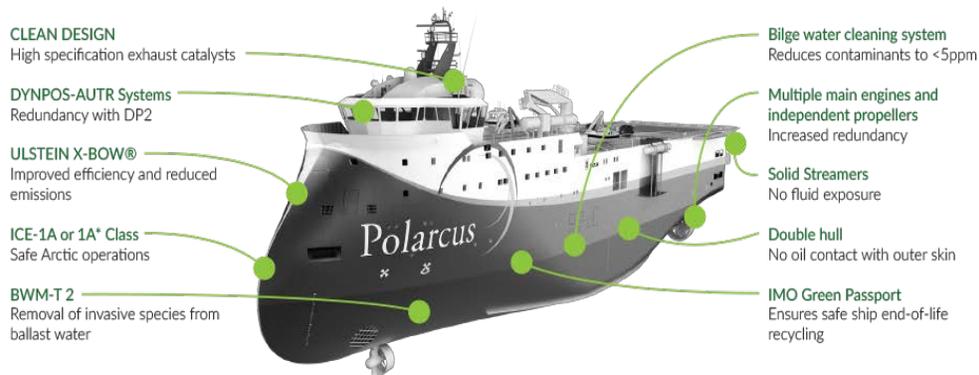


Figure 4. Polarcus source vessel environmental capabilities.

2.2 GEOHAZARD AND GEOTECHNICAL SURVEYS

Hilcorp Alaska plans to conduct a geohazard survey on site-specific regions within the area of interest prior to conducting development drilling at the Granite Point Platform, as well as part of the routine maintenance on pipelines and platforms. The actual survey duration will take approximately 30 days.

The suite of equipment used during a typical geohazards survey consists of single beam and multi-beam echosounders, which provide water depths and seafloor morphology; a side scan sonar that provides acoustic images of the seafloor; a sub-bottom profiler which provides 20 to 200 m (66 to 656 ft) sub-seafloor penetration with a 6- to 20-centimeter (cm, 2.4-7.9-inch [in]) resolution. Magnetometers, to detect ferrous items, may also be used. Geotechnical surveys are conducted to collect bottom samples to obtain physical and chemical data on surface and near sub-surface sediments. Sediment samples typically are collected using a gravity/piston corer or grab sampler.

2.3 ROUTINE MAINTENANCE

Each year, Hilcorp Alaska must verify the structural integrity of their platforms and pipelines located within Cook Inlet. Routine maintenance activities include: subsea pipeline inspections, stabilizations, and repairs; platform leg inspections and repairs; and anode sled installations and/or replacement.

Natural gas and oil pipelines located on the seafloor of the Cook Inlet are inspected on an annual basis using ultrasonic testing (UT), cathodic protection surveys, multi-beam sonar surveys, and sub-bottom profilers. In some cases, a water jet may be required to remove sand and gravel from under or around the pipeline to allow access for assessment and repair. The pipeline surface may also require cleaning using a hydraulic grinder to ensure adequate repair. If pipeline replacement is required, an underwater pipe cutter such as a diamond wire saw or hydraulically-powered Guillotine saw may be used.

Per NMFS guidance, the water jets are the only activity that requires authorization for Level B take. Therefore, monitoring and mitigation measures are only included for this activity.

2.4 PINGERS

Several types of moorings are deployed in support of Hilcorp Alaska operations; all of which require an acoustic pinger for location or release. The pinger is deployed over the side a vessel and a short signal is emitted to the mooring device. The mooring device responds with a short signal to indicate that the device is working, to indicate range and bearing data, or to illicit a release of the unit from the anchor. These are used for very short periods of time when needed.

The types of moorings requiring the use of pingers anticipated to be used in the Year 1 LOA period include acoustic moorings during the 3D seismic survey (assumed 2-4 moorings) and potential current profilers deployed each season (assumed 2-4 moorings). The total amount of time per mooring device is less than 10 minutes during deployment and retrieval. To avoid disturbance, the pinger would not be deployed if marine mammals have been observed within 135 m (443 ft) of the vessel.

3.0 MITIGATION AND MONITORING

The Applicant will implement a robust monitoring and mitigation program for the protection of marine mammals using NMFS/USFWS-approved Protected Species Observers (PSOs) for LOA activities. Marine mammal monitoring and mitigation methods have been designed to meet the requirements and objectives which will be specified in the ITRs promulgated by NMFS and USFWS. The Applicant recognizes some

details of the monitoring and mitigation may change upon receipt of the LOA issued by NMFS and USFWS each year. Specific mitigation measures will depend on the specific project.

3.1 MITIGATION MEASURES

3.1.1 Applicable Noise Criteria

Under the MMPA, NMFS and USFWS have defined levels of harassment for marine mammals. Level A harassment is defined as "...any act of pursuit, torment, or annoyance which has the potential to injure a marine mammal or marine mammal stock in the wild." Level B harassment is defined as "...any act of pursuit, torment, or annoyance which 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."

For Level A, the NOAA Technical Memorandum NMFS-OPR provides guidelines for assessing the onset of permanent threshold shifts (PTS) from anthropogenic sound. Under this guideline, marine mammals are separated into five functional hearing groups; source types are separated into impulsive (e.g., seismic, pipe driving, sub-bottom profiler) and non-impulsive (tugs towing rigs, drilling, water jet, hydraulic grinder); and require analyses of the distance to the peak received sound pressure level (SPL, L_{pk}) and 24-hr cumulative sound exposure level (SEL_{24h}).

The current NMFS Level B (disturbance) threshold for assessing the onset of temporary threshold shifts (TTS) for impulsive sound is 160 decibels referenced to one microPascal (dB re 1 μ Pa) root mean square (rms) for impulsive and 120 dB re 1 μ Pa rms for non-impulsive sound for all marine mammals.

Under current USFWS guidelines, Level A (injury) threshold for impulsive sound is considered to be 190 dB re 1 μ Pa rms and 180 dB re 1 μ Pa rms for non-impulsive sound. The Level A thresholds for otariid pinnipeds are considered a proxy for sea otters. The current USFWS Level B (disturbance) threshold for both impulsive and non-impulsive sounds is 160 dB re 1 μ Pa rms.

Table 3 provides a summary of the disturbance guidelines. For purposes of this section, all underwater SPLs are reported as dB re 1 μ Pa.

Table 3. Summary of NMFS acoustic thresholds.

Marine Mammals	Injury (Level A) Threshold		Disturbance (Level B) Threshold	
	Impulsive	Non-Impulsive	Impulsive	Non-Impulsive
Low-Frequency Cetaceans	219 dB L _{pk} 183 dB SEL	199 dB SEL	160 dB rms	120 dB rms
Mid-Frequency Cetaceans	230 dB L _{pk} 185 dB SEL	198 dB SEL	160 dB rms	120 dB rms
High-Frequency Cetaceans	202 dB L _{pk} 155 dB SEL	173 dB SEL	160 dB rms	120 dB rms
Phocid Pinnipeds/Sea Otters	218 dB L _{pk} 185 dB SEL	201 dB SEL	160 dB rms	120 dB rms
Otariid Pinnipeds	232 dB L _{pk} 203 dB SEL	219 dB SEL	160 dB rms	120 dB rms
Sea Otters	190 dB rms	180 dB rms	160 dB rms	

3.1.2 Description of Exclusion and Safety Zones

The Exclusion Zone (EZ) is defined as the area in which all operations are **shut down** in the event a marine mammal enters or is about to enter this zone. For activities included in this Petition, there are different EZs depending on the species and sound source. The EZ for sea otters is based on USFWS requirements which are different than NMFS for Level A. The EZ for beluga whales is based on the NMFS Level B zone instead of the Level A zone because of the low numbers of allowable Level B “takes” by harassment due to their critically endangered status.

The Safety Zone (SZ) is an area larger than the EZ and is defined as the area within which operations may power down in the event a marine mammal enters, is about to enter or may be considered a Level B harassment. There is no SZ for beluga whales, as the Level B zone is considered the Level A zone because of the low numbers of allowable Level B “takes” by harassment due to their critically endangered status.

The distances for the EZ and SZ for the activities are summarized in Table 4 and described in the following text.

- 1) The distances to the Level A thresholds for the 3D seismic activity were calculated using the methods described in Section 6 of the ITR Petition and the Level B is based on Apache field-verified distance (81 FR 47239).
 - a) The EZ for sea otters is 50 m.
 - b) The EZ for all other marine mammals is rounded up to 500 m, similar to what has been implemented by NMFS for the Atlantic Sea seismic programmatic MMPA authorization (82 FR 26244).
 - c) The SZ for all marine mammals is 7,300 m. *Hilcorp Alaska endeavors to implement this as a shut down zone for beluga whales to manage for the low number of allowable Level B takes.*
- 2) The distances to the thresholds for the sub-bottom profiler were calculated using the methods described in Section 6 of the ITR Petition.
 - a) The EZ for sea otters is 50 m.
 - b) The EZ for all other marine mammals is 100 m.

- c) The distance to the SZ for all marine mammals is 3,000 m. *Hilcorp Alaska endeavors to implement this as a shut down zone for beluga whales to manage for the low number of allowable Level B takes.*
- 3) The distances to the Level A thresholds for the water jet were calculated using methods described in Section 6 of the ITR Petition and the distance to the Level B is based on Austin (2017) measurements of 860 m to the 120 dB zone.
 - a) The EZ for all marine mammals is 15 m.
 - b) The SZ for all marine mammals is 860 m. *Hilcorp Alaska endeavors to implement this as a shut down zone for beluga whales to manage for the low number of allowable Level B takes.*
- 4) To avoid disturbance, the pinger would not be deployed if marine mammals have been observed within 135 m (443 ft) of the vessel.

Table 4. Radii of exclusion zone (EZ) and safety zone (SZ) for Petition activities.

Source	Exclusion Zone (EZ) Radius (m)						SZ Radius
	LF Cetaceans	MF Cetaceans	HF Cetaceans	Pinnipeds	Beluga whales	Sea otters	All marine mammals (other than beluga whales)
3D seismic survey ¹	500 m	500 m	500 m	500 m	7,300 m	50 m	7,300 m
Sub-bottom profiler	100 m	100 m	500 m	100 m	3,000 m	50 m	3,000 m
Water jet	15 m	15 m	15 m	15 m	860 m	15 m	860 m

3.1.3 Sound Source Verification Survey

When site-specific measurements are not available for noise sources of concern for acoustic exposure, NMFS often requires a sound source verification (SSV) to characterize the sound levels, propagation, and to verify the monitoring zones (EZ and SZ). Hilcorp Alaska plans to perform an SSV for the 3D seismic survey in lower Cook Inlet. Hilcorp Alaska will work with NMFS to determine if an SSV is needed for other activities occurring in the LOA area.

3.1.4 Aircraft Mitigation Measures

To minimize the possibility of adverse effects from aircraft noise on marine mammals, Hilcorp Alaska will ensure that helicopters used to transport equipment and personnel will maintain an altitude of 304 m (1,000 ft) as practicable and safe when transiting over Cook Inlet waters. Practicability and safety risk is determined by the pilot in command. Conditions that will make it impracticable to maintain this altitude may include: adverse weather conditions, safety considerations, and reduced flight time (e.g., very short platform to platform flights do not have the time to reach 1,000 ft).

3.1.5 Seismic and Geohazard Survey Mitigation Measures

For the 3D survey, PSOs will be stationed on two of the project vessels, the source vessel and the chase vessel. At NMFS request, an aerial survey with two PSOs will be conducted each day to monitor the Level B zone. Alternatives to the aerial survey are presented in text below.

For geohazard surveys when the sub-bottom profiler is being used, PSOs will be stationed on the survey vessel.. PSOs will implement the following mitigation measures.

3.1.5.1 Clearing the Exclusion Zone

Prior to the start of daily seismic, use of sub-bottom profiler, or when activities have been stopped for longer than a 30 minute period, the PSOs will clear the EZ for a period of 30 minutes. Clearing the EZ means no marine mammals have been observed within the EZ for that 30-minute period. If any marine mammals have been observed within the EZ, ramp up cannot start until the marine mammal has left the EZ or has not been observed for a 30-minute period.

3.1.5.2 Power Down Procedure

A power down procedure involves reducing the number of airguns in use, which reduces the EZ or SZ radius. In contrast, a shut down procedure occurs when all airgun activity is suspended immediately. During a power down, a mitigation airgun is operated. Operation of the mitigation gun allows the size of the EZ to decrease to the size of the SZ for marine mammals other than beluga whales. If a marine mammal is detected outside the safety radius (either SZ or EZ) but is likely to enter that zone, the airguns may be powered down before the animal is within the safety radius, as an alternative to a complete shutdown. Likewise, if a marine mammal is already within the SZ when first detected, the airguns will be powered down if this is a reasonable alternative to an immediate shutdown. If a marine mammal is already within the EZ when first detected, the airguns will be shut down immediately.

Following a power down, airgun activity will not resume until the marine mammal has cleared the SZ. The animal will be considered to have cleared the SZ if it:

- Is visually observed to have left the SZ, or
- Has not been seen within the SZ for 15 min in the case of pinnipeds, sea otters, and harbor porpoise, or
- Has not been seen within the SZ for 30 min in the case of cetaceans.

3.1.5.3 Shut Down Procedure

A shut down occurs when all airgun or sub-bottom profiler's activity is suspended. The operating airguns or profiler will be shut down completely if a marine mammal approaches the EZ. The shut down procedure will be accomplished within several seconds (of a "one shot" period) of the determination that a marine mammal is either in or about to enter the EZ.

Following a shut down, airgun or sub-bottom profiler activity will not resume until the marine mammal has cleared the EZ. The animal will be considered to have cleared the EZ if it:

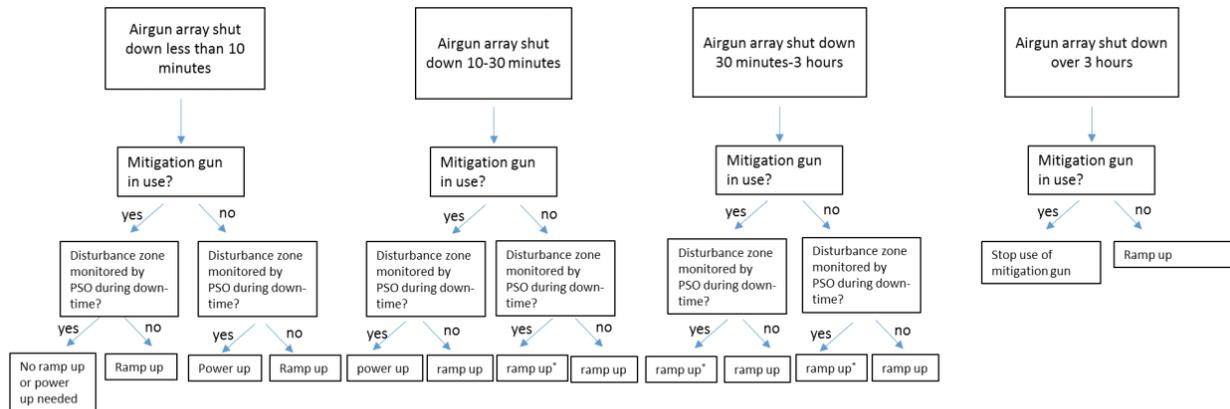
- Is visually observed to have left the EZ, or
- Has not been seen within the EZ for 15 min in the case of pinnipeds, sea otters, and harbor porpoise, or
- Has not been seen within the EZ for 30 min in the case of cetaceans.

3.1.5.4 Ramp Up and Power Up Procedures

A “ramp up” procedure gradually increases airgun volume at a specified rate. Ramp up is used at the start of airgun operations, including after a power down, shut down, and after any period greater than 10 minutes in duration without airgun operations. NMFS normally requires that the rate of ramp up be no more than 6 dB per 5-minute period. Ramp up will begin with the smallest gun in the array that is being used for all airgun array configurations. During the ramp up, the EZ for the full airgun array will be maintained.

If the complete EZ has not been visible for at least 30 minutes prior to the start of operations, ramp up will not commence unless the mitigation gun has been operating during the interruption of seismic survey operations. This means that it will not be permissible to ramp up the 24-gun source from a complete shut down in thick fog or at other times when the outer part of the EZ is not visible. Ramp up of the airguns will not be initiated if a marine mammal is sighted within or near the EZ at any time.

The following information has been included from NMFS’ Biological Opinion to Lease Sale 244. Figure 5 shows a flow diagram indicating some seismic exploration mitigation measures under various scenarios described in mitigation measures 2c-2j in the NMFS Biological Opinion to Lease Sale 244.



* Under these conditions, the PSO's required 30-minute pre-airgun-use observation period would have already been met.

Figure 5. A flow diagram of suggested mitigation gun procedures in the NMFS Biological Opinion to Lease Sale 244.

3.1.5.5 Speed or Course Alteration

If a marine mammal is detected outside the EZ and, based on its position and relative motion, is likely to enter the EZ, the vessel's speed and/or direct course may, when practical and safe, be changed. This technique also minimizes the effect on the seismic program. This technique can be used in coordination with a power down procedure. The marine mammal activities and movements relative to the seismic and support vessels will be closely monitored to ensure that the marine mammal does not approach within the EZ. If the mammal appears likely to enter the EZ, further mitigative actions will be taken, i.e., either further course alterations, power down, or shut down of the airguns.

3.1.6 Water Jet Measures

A diver trained as a PSO will be present on the dive support vessel when divers are using the water jet. Prior to in-water use of the water jet, an EZ of 860 m around the DSV will be established. The water jet will be shut down if marine mammals are observed within the EZ.

3.1.7 Pingers

To avoid disturbance, the pinger would not be deployed if marine mammals have been observed within 135 m (443 ft) of the vessel by a trained observer.

3.2 MONITORING

3.2.1 Protected Species Observers

The Applicant will implement a robust monitoring and mitigation program for the protection of marine mammals using NMFS/USFWS-approved PSOs for LOA activities such as seismic and sub-bottom profilers. The use of water jets and pingers do not require the same level of monitoring (see text below). Marine mammal monitoring and mitigation methods have been designed to meet the requirements and objectives which will be specified in the ITRs promulgated by NMFS and USFWS. The Applicant recognizes some details of the monitoring and mitigation program may change upon receipt of the LOAs issued by NMFS and USFWS.

The specific objectives of the monitoring and mitigation program provide:

- the basis for real-time mitigation, as required by the various permits;
- the information needed to estimate the number of “takes” of marine mammals by harassment, which must be reported to NMFS and USFWS;
- data on the occurrence, distribution, and activities of marine mammals in the areas where the LOA activity was conducted; and,
- information to compare the distances, distributions, behaviors, and movements of marine mammals relative to the LOA activities

PSOs will be on watch during all daylight periods for project-specific activities. The observer(s) will watch for marine mammals from the best available vantage point on the vessel or station. Ideally this vantage point is an elevated stable platform from which the PSO has an unobstructed 360° view of the water. The PSOs will scan systematically with the naked eye and with binoculars. When a mammal sighting is made, the following information about the sighting will be carefully and accurately recorded:

- Species, group size, age/size/sex categories (if determinable), behavior when first sighted and after initial sighting, heading (if consistent), bearing and distance from the PSO, apparent reaction to activities (e.g., none, avoidance, approach, paralleling, etc.), closest point of approach, and behavioral pace.
- Time, location, speed, activity of the vessel, sea state, ice cover, visibility, and sun glare.
- The positions of other vessel(s) in the vicinity of the PSO location.
- The vessel’s position, speed, water depth, sea state, ice cover, visibility, and sun glare will also be recorded at the start and end of each observation watch, every 30 minutes during a watch, and whenever there is a change in any of those variables.

An electronic database or paper form will be used to record and collate data obtained from visual observations. The PSOs will enter the data into the data entry program installed on field laptops. The program automates the data entry process, reduces data entry errors, and maximizes PSO time spent looking at the water.

3.2.2 Seismic Survey Monitoring Methods

The seismic survey involves one source vessel, one support vessel, and one chase vessel. The source vessel will tow the airgun array and the streamers. The support vessel will provide general support for the source vessel, including supplies, crew changes, etc. The chase vessel will monitor the in-water equipment and maintain a security perimeter around the streamers.

After discussions with the project operations team and NMFS/USFWS, we determined that four PSOs will be stationed on the source vessel with two on watch during daylight hours, and three PSOs will be on either the support vessel or the chase vessel. Additionally, two PSOs will provide aerial survey support. This section suggests routine aerial survey methods as well as potential options for survey coverage when aerial flights are restricted due to weather or other limiting factors.

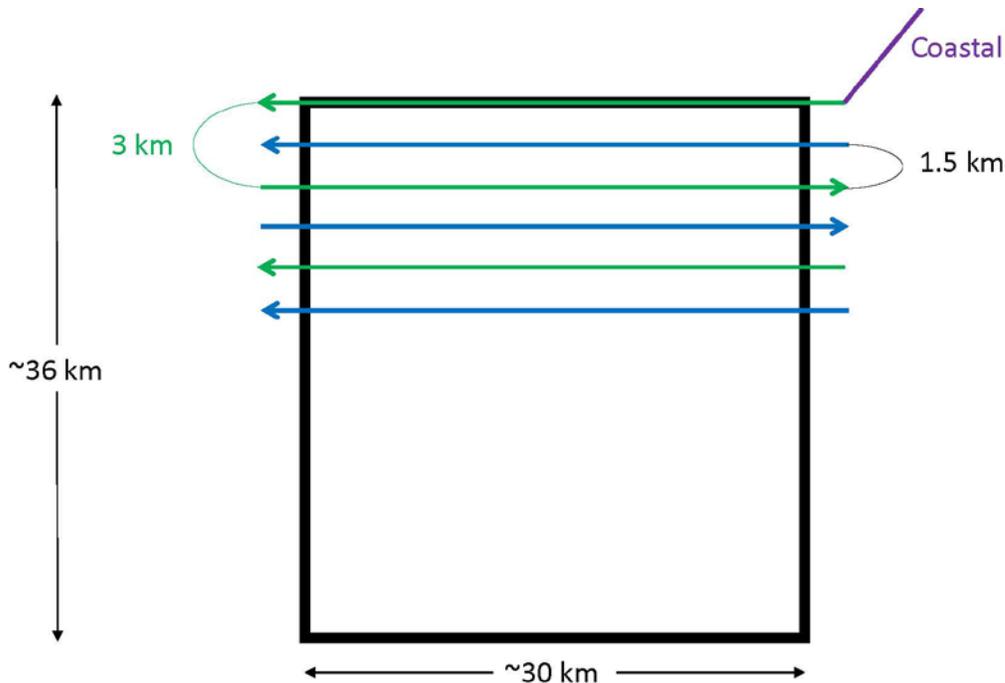
NMFS conducted annual aerial surveys in Cook Inlet, Alaska for beluga whales from 1993 to 2012, and began biennial surveys in 2014. Surveys were flown in a fixed-wing, high-wing aircraft at a target altitude of 244 m (800 ft) and speed of 185 km/hr (100 kts). Coastal surveys were conducted approximately 1.4 km from the shoreline or exposed mudflats, as beluga sightings more than 3 km from the coast are infrequent.

3.2.3 Routine Aerial Survey Methods

We propose similar survey methodology, conditions permitting. A fixed-wing, high-wing aircraft will be flown at a target speed of 185 km/hr (100 kts) and a target altitude of 457 m (1,500 ft). The aircraft will depart Kenai and transit south to the project area, where survey effort will commence. A coastal transect offset approximately 1.4 km from the shoreline or exposed mudflats will be surveyed south to the Anchor Point area, where the aircraft will head offshore to the area of activity. The coastal transect will also be reflown *en route* to Kenai, after completing survey effort of the monitoring zone. The transit distance is estimated to be 106 km total and the coastal transect is estimated to be 106 km total.

The monitoring zone is approximately 36 km x 30 km, and we propose 25 transects spaced 1.5 km apart aligned in an east-west direction. The aircraft will survey 13 transects spaced 3 km apart traveling north to south. At the southern end of the monitoring zone, the aircraft will turn around and survey 12 transects spaced 3 km apart traveling south to north (Figure 6). Ferguson and Clarke (2013) estimated the effective strip width (ESW) for aerial detection of beluga whales to be 614 m. This was based on surveys conducted in an Aero Commander (used during Cook Inlet aerial beluga whale surveys) flown at a target speed of 204-259 km/hr (110-140 kts) and target altitude of 305 to 457 m (1,000-1,500 ft).

The transect length is ~1,000 km and flight duration will be ~6 hrs (survey and transit). Depending on the survey aircraft, a refuel may be necessary. Most small aircraft are capable of 4-5 hours of flight time. Transect spacing could be increased to 2 km or 3 km to reduce flight time to 5 or 4 hours, respectively. Beluga whale sighting rates have been consistently low in lower Cook Inlet (south of the Forelands), and increased transect spacing will likely still provide adequate coverage of the activity area. In areas of high narwhal abundance off of northwest Greenland, aerial survey transects were spaced 5.5 km apart (Heide-Jørgensen et al. 2010).



- Coastal transect will be flown to/from the prospect to/from the Forelands offset 1.4 km from the shoreline (or exposed mudflat)
- East-West Green transects spaced 3 km apart and flown north to south
- East-West Blue transects spaced 3 km apart and flown south to north
- 1.5 km spacing between Green and Blue transects

Figure 6. Monitoring zone with partial outline of survey transects spaced 1.5 km apart.

Option 1 – Aerial surveys at lower altitudes

When low ceilings prevent the aircraft from flying at 457 m (1,500 ft), we propose reducing the target altitude as necessary, within the range of 244-457 m (800-1,500 ft). The most conservative survey altitude available within aircraft safety parameters will be flown. Lower survey altitude, however, increases the likelihood of disturbance and potential takes.

Option 2 – Land-based observations

A go, no-go time will be established for aerial survey effort. If the aircraft is unable to survey, aerial PSOs could be mobilized from Kenai to a shore-based location near Anchor Point. Observations will be limited to coastal waters, and will not cover the monitoring zone. However, beluga whales are typically observed in nearshore waters rather than farther offshore.

Option 3 – Additional vessel-based observations from a project vessel

If the aircraft is unable to survey, aerial PSOs could be mobilized from Kenai to the offshore project vessel (chase or support) without PSOs. This will be dependent on the vessel ceasing routine duties and being re-tasked with marine mammal monitoring and mitigation support. Additionally, this supplemental vessel-based PSO coverage will be limited in comparison to the typical area covered by aerial monitoring. PSOs on the source vessel will have an estimated monitoring radius of ~4.5 km around of the vessel. The Level

B harassment zone has been estimated to be 7.3 km. We propose directing the supplemental monitoring vessel to the northeast quadrant of the monitoring zone, where the vessel will travel ahead of the source vessel the on coastal side as opposed to the offshore side. The supplemental monitoring vessel will travel in a sawtooth pattern and focus monitoring effort on the Level B harassment zone not otherwise covered (the area outside of the 4.5 km radius covered by the source vessel PSOs out to ~ 7 km), as the source vessel operates.

Option 4 - Additional vessel-based observations on vessel of opportunity (contracted standby vessel)

Same as Option 3, however, a contracted vessel of opportunity will be deployed to act as the supplemental monitoring vessel, rather than re-tasking a project vessel (chase or support).

3.2.4 Geohazard Survey Monitoring Methods

When sub-bottom profilers are utilized as part of the geohazard surveys, NMFS/USFWS-approved PSOs will be stationed on the survey vessel. PSOs will implement similar monitoring strategies as those for the seismic survey.

3.2.5 Water Jet Monitoring Methods

A diver trained who has been specifically trained as a PSO will be present on the dive support vessel when divers are using the water jet to observe the SZ. Reporting will be on paper forms, as approved as part of the 5-year Letter of Concurrence (LOC) consultation.

3.2.6 Pingers

To avoid disturbance, the pinger would not be deployed if marine mammals have been observed within 135 m (443 ft) of the vessel by a trained observer. There are no further monitoring or reporting associated with this activity.

4.0 REPORTING

The results of PSO monitoring for the seismic and sub-bottom profiler activities, including estimates of exposure to key sound levels, will be presented in weekly, monthly, and 90-day reports. Reporting will address the requirements established by NMFS and USFWS in the LOAs. The technical report(s) will include the list below.

- Summaries of monitoring effort: total hours, total distances, and distribution of marine mammals throughout the study period compared to sea state, and other factors affecting visibility and detectability of marine mammals;
- Analyses of the effects of various factors influencing detectability of marine mammals: 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 (when discernable), group sizes, and ice cover;
- Analyses of the effects of seismic program:
 - Sighting rates of marine mammals during periods with and without project activities (and other variables that could affect detectability),
 - Initial sighting distances versus project activity,
 - Closest point of approach versus project activity,
 - Observed behaviors and types of movements versus project activity,

- Numbers of sightings/individuals seen versus project activity,
- Distribution around the vessels versus project activity,
- Summary of implemented mitigation measures, and
- Estimates of “take by harassment”.

Reporting for the water jets will be in accordance with the LOC. No further reporting is required for the pingers.

5.0 REFERENCES

- Ferguson, M.C. and T.J. Clarke. 2013. Estimates of detection probability for BWASP Bowhead whale, Grey whale, and Beluga sightings collected from Twin Otter and Aero Commander Aircraft, 1989 to 2007 and 2008 to 2011.
- Heide-Jørgensen, M.P., K.L. Laidre, M.L. Burt, D.L. Borchers, T.A. Marques, R.G. Hansen, M. Rasmussen, and S. Fossette. 2010. Abundance of narwhals (*Monodon monoceros*) on the hunting grounds in Greenland. *Journal of Mammalogy*. 91. 1135-1151. 10.2307/40925720.
- Shelden, K. E. W., R. C. Hobbs, C. L. Sims, L. Vate Brattström, J. A. Mocklin, C. Boyd, and B. A. Mahoney. 2017. Aerial surveys of beluga whales (*Delphinapterus leucas*) in Cook Inlet, Alaska, June 2016. AFSC Processed Rep.2017-09, 62 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115.