LOWER COOK INLET

2018 AIRBORNE GRAVITY AND MAGNETIC DATA SURVEY

ENVIRONMENTAL EVALUATION DOCUMENT

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Submitted December 28, 2017

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CONTENTS

FIGURES

TABLES

ACRONYMS

°C	Degrees Celsius
4MP	Marine Mammal Monitoring and Mitigation Plan
AAAQS	Alaska Ambient Air Quality Standards
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
AQCP	air quality control plan
AQCR	Air Quality Control Region
ASL	above ground level
ASL	above sea level
BIA	Biologically Important Areas
BOEM	Bureau of Ocean Energy Management
CAA	Clean Air Act
CFR	Code of Federal Regulations
CGG	CGG Multi-Physics
COA	corresponding onshore area
dB re 1 µPA rms	Decibels relative to 1 microPascal root mean square
dB	Decibel
DPS	distinct population segment
EED	Environmental Evaluation Document
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
ENP	Eastern North Pacific
ESA	Endangered Species Act
ft	Feet
Hilcorp	Hilcorp Alaska, LLC
Hz	Hertz
IHA	Incidental Harassment Authorization
In	inch(es)
kHz	kiloHertz
km	Kilometer
km^2	Square kilometer
m	Meter(s)
MMPA	Marine Mammal Protection Act
Mm/day	millimeter per day
Mph	miles per hour

N/A	Not available
NAAQS	National Ambient Air Quality Standards
NMFS	National Marine Fisheries Service
NMML	National Marine Mammal Laboratory
NOAA	National Oceanic and Atmospheric Administration
OCS	Outer Continental Shelf
PSD	Prevention of Significant Deterioration
SIP	State Implementation Plan
USFWS	U.S. Fish and Wildlife Service
WDPS	western DPS

1. INTRODUCTION

Hilcorp Alaska, LLC (Hilcorp) plans to collect airborne gravity and magnetic data in lower Cook Inlet, Alaska for approximately 2-3 weeks starting May 1, 2018. The survey area generally overlaps the Federal Outer Continental Shelf (OCS) waters of the Bureau of Ocean Energy Management (BOEM) Cook Inlet Planning Area in lower Cook Inlet, Alaska.

Hilcorp acquired 14 lease blocks in the BOEM OCS Lease Sale 244 held on June 21, 2017. The lower Cook Inlet geophysical program includes an aerial gravity and magnetic survey of all 14 lease blocks. Figure 1 shows the lease blocks (in yellow) and the aerial gravity/magnetic survey area (in red).

Hilcorp plans to hire CGG Multi-Physics (CGG), a well-known experienced potential fields contractor, to acquire and process airborne gravity and airborne magnetic data over the lower Cook Inlet, including Hilcorp's leased tracts and the Iniskin Peninsula. Data collection activities are passive measurements of the earth's gravitational and magnetic fields. The data are collected using a fixed-wing aircraft flying at low altitudes at approximately 152 m (500 feet [ft]) above sea level (ASL) or a rotor-wing aircraft flying at 91 to 152 m (300-500 ft) above ground level (AGL). The offshore areas will primarily be surveyed using the fixed-wing aircraft and the onshore areas will be surveyed using the rotor-wing aircraft. The total duration of the airborne data collection is expected to be two to three weeks.

This Environmental Evaluation Document (EED) was developed to provide information specific to resources that may be impacted as a result of the proposed airborne gravity and magnetic survey as outlined further in Section 2.

1.1 SURVEY DESIGN

Airborne gravity and magnetic data are collected to identify potential geologic structures which may contain oil and/or gas. Data are collected by flying a prescribed grid over the area(s) of interest. The survey grid is generally parallel to the coast at 23º. The length of the transects are approximately 100 kilometer (km) long spaced 500 meters (m) apart, and with tie lines at 5,000 m apart. Standard fixed wing and helicopter operational limitations apply and weather delays, flight ceilings, etc. are at the discretion of CGG.

Figure 2 shows an example of results from a gravity gradiometry and Figure 3 shows an example of results from a magnetic survey. The colors illustrate differences in intensity gravity or magnetic fields; red being the greatest intensity. The gravity field on the surface of the Earth is not uniformly the same everywhere varying with the distribution of the mass materials below. A gravity survey is an indirect (surface) means of calculating the density property of subsurface materials. The higher the gravity values (red), the denser the rock beneath. The aim of a magnetic survey is to investigate subsurface geology on the basis of the anomalies in the earth's magnetic field resulting from the magnetic properties of the underlying rock.

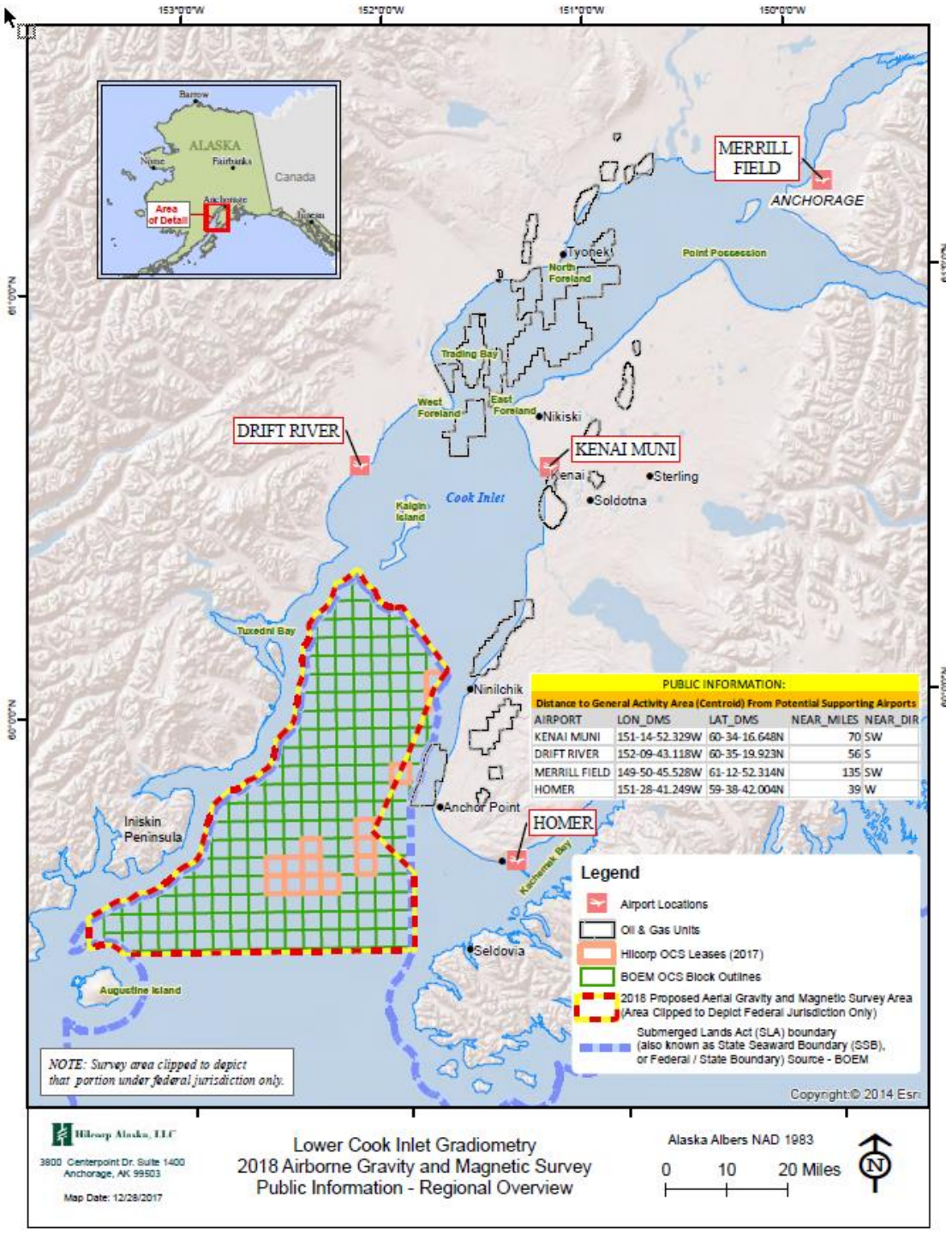

Figure 1 **Map of Project Area**

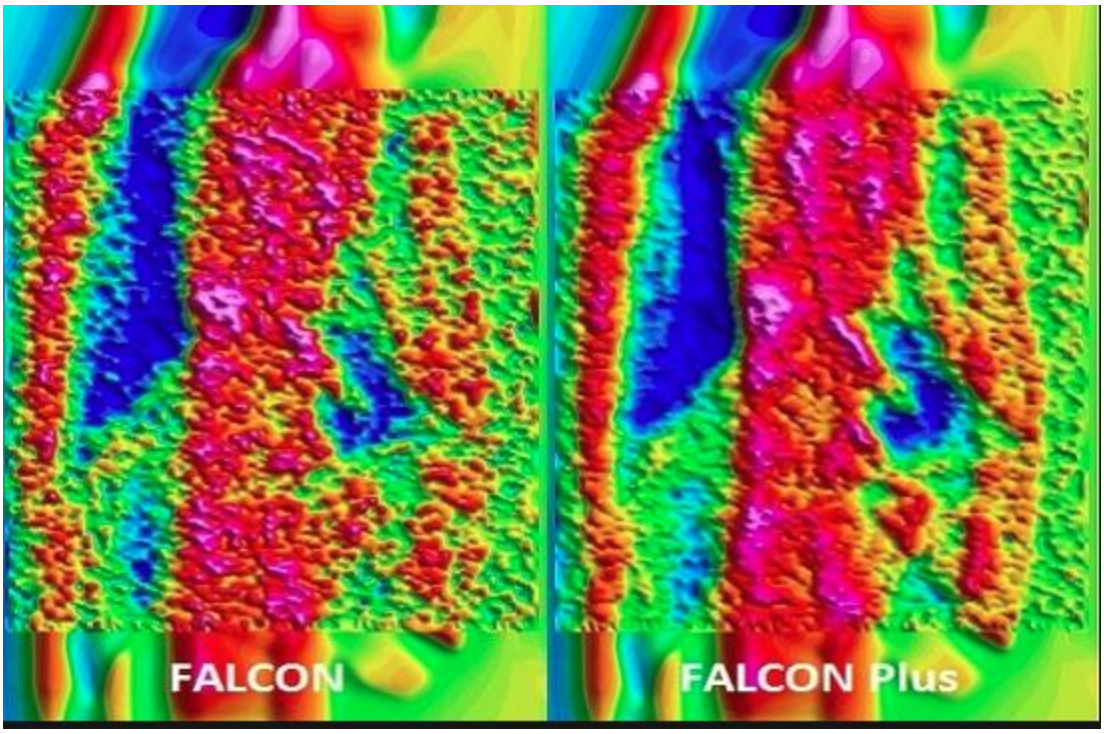

Figure 2. Example of Gravity Gradiometry Data Results.

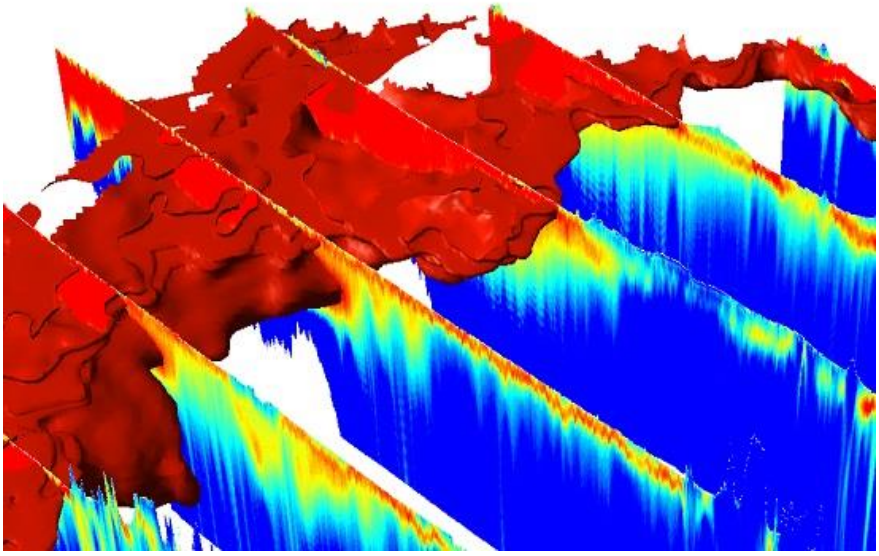

Figure 3. Example of Fixed Wing Magnetic Data Results.

1.2 AIRCRAFT

1.2.1 Fixed Wing

Fixed wing gravity and magnetic data would be acquired using a Basler BT-67 turboprop, a remanufactured and modified Douglas DC-3. A photo of the DC-3 is shown in Figure 4.

Figure 4 Fixed Wing Aircraft Used to Collect Gravity and Magnetic Data

1.2.2 Helicopter

Rotor-wing gravity and magnetic data would be acquired using a turbine powered helicopter flying similar to what is shown in Figure 5.

Figure 5 Rotor Wing Aircraft Used to Collect Gravity and Magnetic Data.

1.3 DATES, DURATION AND REGION OF ACTIVITY

The airborne gravity and magnetic survey is expected to take approximately two to three weeks. The preferred start date for this survey is May 1st because of the typical optimum weather conditions. The estimated acquisition time period for the gravity/magnetic survey is 14-21 days total, which includes a 30% weather delay contingency. The total length of the survey depends on the quality of data collection, as the goal is to complete the survey as efficiently as possible.

2. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This section describes potentially affected physical, biological, and social environments in the proposed project area and potential impacts to these environments associated with the Hilcorp's proposed 2018 airborne gravity and magnetic survey. Resource descriptions and potential impact analyses are based, in part, on information presented in various documents, including BOEM 2016 (Cook Inlet Planning Area Oil and Gas Lease Sale 244 Environmental Impact Statement [EIS]), BOEM 2012 (Outer Continental Shelf Oil and Gas Leasing Program: 2012-2017. Final Programmatic EIS), and Alaska Department of Natural Resources (ADNR) 2009 (Cook Inlet Arearwide Oil and Gas Lease Sale, Final Finding of the Director).

2.1 PHYSICAL ENVIRONMENT

2.1.1 Climate and Meteorology

The Lower Cook Inlet Project is physically located within the Arctic Climate Zone. This climatological zone is characterized by cold temperatures, low precipitation, consistent wind, and frequent winter storms (MMS 2007). Hourly surface meteorological data from the following four sources are used to characterize the climate and meteorology of the region for the project. Terrestrial areas bordering the Cook Inlet are classified as Dsc and Dfc under the Köppen-Geiger Climate Classification System (Peel, Finlayson, and McMahon, 2007). The Köppen-Geiger Climate Classification System delineates climate zones based on a combination of native vegetation, average annual and monthly temperatures and precipitation, and the seasonality of precipitation. Areas classified "Dsc" are those that exhibit cold climates, with a dry summer season. Areas classified "Dfc" have cold climates with no dry season and short, cool summers.

Climate in the Cook Inlet is influenced by the regulating effect of nearby ocean waters, and the seasonal distribution of sea ice. Locations under the predominant influence of the sea are characterized by relatively small seasonal temperature variability, with high humidity. Ambient temperatures in the Cook Inlet vary based on elevation, proximity to the coastline, and, to some extent, latitude, although the proposed project area is relatively small and is situated over a very narrow range of latitude, spanning approximately 59° to 60°N. Annual and seasonal average temperatures in Cook Inlet and surrounding coastal area are shown in Table 1. Temperatures are typically coldest in January and warmest in July, with freezing temperatures recorded every month of the year (NCDC, 2015).

Wind

Wind speeds and wind directions in the Cook Inlet vary by season and are influenced highly by extreme variability in local topography in the Cook Inlet area (Olsson and Liu, 2009; NCDC, 2015). Prevailing winds in Cook Inlet are from the south in summer months, and are otherwise from the north and northeast. Mean monthly wind speed in Kenai, which is located near the project area to the northeast, is lowest in August (7 knots) (8.1 miles per hour (mph)), and increases slightly through the following months to a maximum of 8 knots (9.2 mph) in June. Extreme maximum wind in Kenai of 62 knots (71.3 mph) in November may constitute a violent storm on the Beaufort Scale (National Oceanic and Atmospheric Administration [NOAA] 2015a). The extreme maximum wind in Homer located to the southeast of the project area has occurred in December when hurricane force winds of 68 knots (78.3 mph) were recorded.

Monthly winds in Homer average 1.2 mph in July, reach an average annual maximum in November of 24 knots (27.6 mph).

Table 1 Cook Inlet Meteorology

PARAMETER	TIME PERIOD	ALASKA LNG – NIKISKI, ALASKA[2]
Mean Temperature (°C)	Annual	4.3
Mean Temperature (°C)	January	-4.4
Mean Temperature (°C)	July	13.6
Maximum Temperature (°C)	Annual	28.4
Maximum Temperature (°C)	January	8.4
Maximum Temperature (°C)	July	20.2
Minimum Temperature (°C)	Annual	-17.9
Minimum Temperature (°C)	January	-17.9
Minimum Temperature (°C)	July	8.0
Maximum Daily Precipitation (mm/day)	Annual	37.9
Maximum Daily Precipitation (mm/day)	January	13.5
Maximum Daily Precipitation (mm/day)	July	18.5

Source: SLR. 2015 Annual Data Summary Report, Alaska LNG

When deep synoptic-scale low pressure systems interact with the varied terrain of Cook Inlet, fastmoving air in the lower level of the atmosphere can gust to 95 knots (109.3 mph). The wind may flow “down inlet” from the upper Cook Inlet while cross-channel east winds occur in the lower Cook Inlet causing convergent winds. Conversely, “up inlet” winds combine with cross-channel winds to produce divergent wind conditions. Mountain-gap winds create williwaws (sudden and violent blasts of wind descending from a mountainous coast to the sea), and waterspouts that can create hazardous conditions for mariners and aviators (MMS 2003). Mountain-gap winds are most prevalent in winter and can reach nearly 100 knots (115.1 mph).

Precipitation

The inlet experiences annual precipitation averaging 42 centimeters (16.6 in.) in the north to an annual average of approximately 2 m (78.0 in) in Kodiak. The inlet is a region of meteorological extremes due to the proximity of the Shelikof Strait and the Gulf of Alaska, which are subject to forceful marine extratropical cyclones. These storms move east along the Aleutian Islands from the western Pacific and are impeded by mountainous terrain, which causes dangerous wind conditions (NOAA, 2012). These conditions are possible in Cook Inlet due to the “maritime-continental gradient,” an area of transition from strictly marine climate characteristics (south and east coastal rainforests), and a continental climate (north and west to the Alaskan interior). In the north, precipitation is lowest in the spring and highest in August and September. In the south, precipitation is lighter than in the north, with least amounts falling in May through August, and much larger amounts than in the north falling in November through January. Snowfall typically occurs from October through April, but may occur as early as September and as late as May. The majority of snowfall occurs from November through February.

Storms

Storm-surge development is unlikely in most of lower Cook Inlet due to the rugged topography and steeply sloping seafloor (Wise, Comiskey, and Becker, 1981). However, the open-water stretch from Shelikof Strait to lower Cook Inlet can develop storm surges with west-southwest winds during the fall and winter when wind strength is sufficient, and many of the storms crossing the North Pacific end up crossing the Aleutian chain and move into the coastal area of the Gulf of Alaska. Storms with wind speeds >45 m/s (100.6 mph) are observed occasionally in mountainous coastal areas due to the change in atmospheric pressure between interior Alaska and the Gulf of Alaska. Wind speeds can be further increased as winds funnel through narrow mountain passes (BOEM 2012b). Severe weather events, such as floods, hail, high winds, and winter events such as heavy snow, ice storms, winter storms, and blizzards have been reported in the area surrounding Cook Inlet (NCDC, 2015).

Atmospheric stability is a measure of the atmosphere's tendency to encourage or deter vertical motion. Stability varies in the subarctic based on time of day, season, and land surface cover. Vertical stability has an effect on air quality conditions. Dispersion and vertical mixing of pollutants are enhanced in an unstable atmosphere, where pollutants rise and mix freely with otherwise unpolluted air, which decreases surface pollutant concentrations and impacts. Conversely, stable air enhances subsidence, or slow sinking air, which concentrates the pollutants and increases surface pollutant concentrations and impacts; this is referred to as inversion, and the highest elevation of the inversion is referred to as mixing height.

Cook Inlet exhibits frequent high winds and cloud cover, which cause a predominantly neutral atmospheric condition. The atmosphere is unstable 10% of the time, and stable the other 90% of the time (Doty, Wallace, and Holzworth, 1976). Mixing heights over land go through progressively larger diurnal and seasonal variations farther inland due to increased solar heating and surface cooling. Mixing heights are generally lowest around sunrise and highest in the afternoon, and, seasonally, mixing heights are typically highest in summer and lowest in winter. For coastal areas of Alaska, average mixing heights range from 1,000 to 1,400 m (3,280 to 4,590 ft). Mixing height over land reaches a maximum in the late afternoon, and reaches a minimum during clear, calm conditions at night in the winter when it can be close to zero (Wang and Wang, 2014).

2.1.2 Physical Oceanography, Bathymetry, and Geology

Cook Inlet is and approximately 210-mile long extension of the Gulf of Alaska (LGL 2000). It is characterized by its shallow depth, complex circulation associated with variability at tidal, seasonal, annual and interannual time scales, and extreme tides (Musgrave and Statscewich, 2006). In general, water depth increases from north to south, with average depths of 18.3m in the Upper Cook Inlet, 27.4 m in Central Cook Inlet, and 36.6m at the mouth of Cook Inlet (LGL 2000) as shown in Figure 6.

The Cook Inlet region has the fourth largest tidal range in the world, the circulation is dominated by tidally driven flows with current speeds of up to 300 cm s-1 (6 knots) (Musgrave and Statscewich, 2006). The general circulation pattern of lower and middle Cook Inlet is that denser, saltier water flows northward along the east shore and fresher, silty outflowing water flows southward along the west shore (Burbank 1977; .Wapora Inc. 1979 in LGL 2000).

The amount of sea ice in Cook Inlet varies annually and may consist of pack ice, shorefast ice, stamukhi (layered ice cakes formed by stacking of ice floes on shorefast ice over multiple high tides), and estuarine/river ice. Sea ice is most prevalent in the Cook Inlet OCS area during winter. It typically begins to form in October or November, reaches maximum extent in February, and recedes as it melts in March to April. Tidal action and tidal currents often shatter sea ice in Cook Inlet to the extent that there is seldom uniform cover. (BOEM 2016).

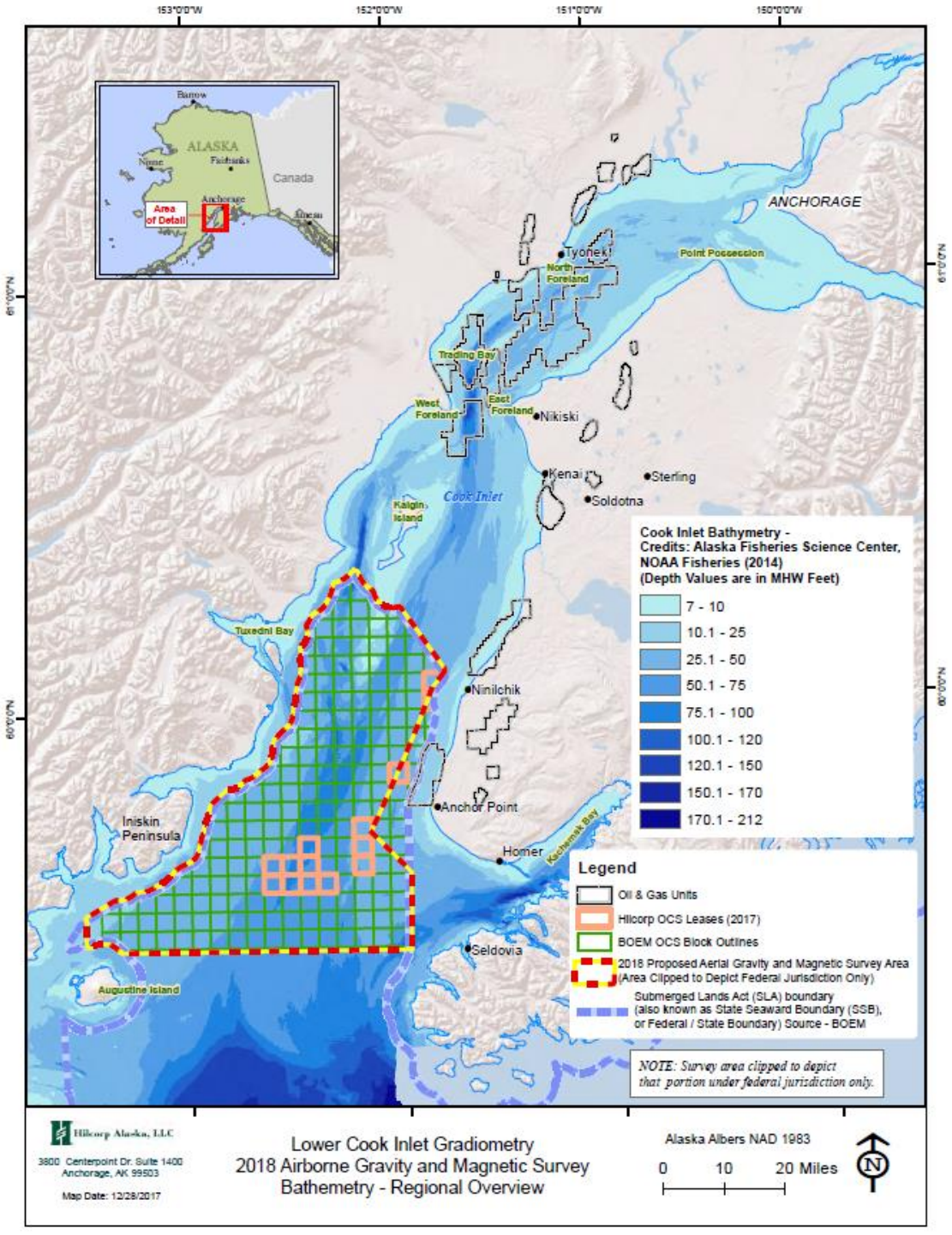

Figure 6 **Cook Inlet Bathymetry**

The airborne gravity and magnetic survey is proposed for in May 2018 using fixed wing aircraft and helicopter. No impacts to oceanography, bathymetric, or geology are expected as part of the proposed project. No impacts to the survey are expected as a result of oceanographic or geologic hazards.

2.1.3 Air Quality

The nation's air quality is regulated under the Clean Air Act (CAA), as amended. The State of Alaska, EPA, and BOEM implement air quality programs in Alaska that are designed to carry out the goals of the CAA over land and water. The Alaska Department of Environmental Conservation (ADEC) is responsible for administering the state's air programs where they have jurisdiction on state land and on waters within the state seaward boundary (SSB) extending three nautical miles offshore. In areas over the outer continental shelf (OCS) for the Cook Inlet region under Lease Sale 244, EPA maintains jurisdiction to control air pollution from OCS sources located within 25 nm of the SSB (CAA Sec. 328(a) and 43 U.S.C. 7627). Within this area of water, EPA must attain and maintain Federal and State ambient air quality standards and comply with the provisions of Sec. 328 of the CAA (42 U.S.C.7627). Further, such requirements must be the same as would be applicable if the source were located in the corresponding onshore area (COA) (40 CFR 55.2), and must include State and local air quality requirements.

The CAA requires the EPA to set National Ambient Air Quality Standards (NAAQS). The NAAQS set limits, or criteria, for ambient air concentrations of six "criteria" pollutants. The NAAQS reflect the concentrations of criteria pollutants that are the legal definition of healthy outside (ambient) air. EPA has identified two types of NAAQS. Primary standards have been set to protect public health with attention given to protecting sensitive populations such as the elderly, children, or asthmatics. Secondary standards focus on public welfare protection and include items such as reducing visibility impairment and preventing damage to crops, livestock, and vegetation. The six EPA NAAQS are called the criteria pollutants and are listed below (EPA 2017):

- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Particulate Matter ($PM_{2.5}$ and PM_{10})
- Sulfur Dioxide (SO_2)
- Ozone (O_3)
- Lead

The ADEC is responsible for ensuring that regulations are enforced within state boundaries to maintain ambient air quality standards and is the primary agency responsible for implementing the state's air quality control plan (AQCP). The State of Alaska's AQCP is approved by EPA and is included within the State Implementation Plan (SIP) for Alaska that addresses the requirements of the CAA. The AQCP, including the SIP, has been adopted by reference into Title 18, Chapter 50 of the Alaska Administrative Code (AAC).

Under the 2017 (AAC) (as amended), the ADEC has established its own ambient air quality standards and does not adopt the NAAQS by reference, nor does it identify separate primary and secondary standards. Therefore, the standards established in the AAC are presumed to be primary. The State of Alaska has adopted the NAAQS under the EPA-approved SIP as Alaska Ambient Air Quality Standards (AAAQS) for the six criteria pollutants and has established state ambient standards for two other air pollutants, reduced sulfur compounds and ammonia.

The EPA designates areas considered to have air quality as good as or better than the NAAQS as attainment areas. Areas in which air quality does not meet the NAAQS are designated by EPA as nonattainment areas. The project is located on the OCS with the nearest COA in the Cook Inlet Interstate Air Quality Control Region (AQCR) that is classified as a Class II region, that is in attainment or unclassifiable with the NAAQS. The Cook Inlet AQCR includes

all of the Greater Anchorage Area Borough, the Kenai Peninsula Borough, and the Matanuska-Susitna Borough. Thus, the EPA regulations applicable to the COA refer to the attainment status of the Cook Inlet AQCR and are also relevant to the proposed project. The closest non-attainment area is a portion of the Fairbanks and North Pole urban area, which is classified as a nonattainment area under the NAAQS $PM_{2.5}$ standard, located approximately adjacent to the proposed Lease Sale Area the project area.

The CAA establishes a number of permitting programs that the State of Alaska and EPA implement depending on the jurisdictional geographic location of the stationary source. Permits are issued under these programs and are divided into Title I construction and minor air permits and Title V operating permits. The Title I permit program regulates air emissions associated with construction of new or modified major sources. Under Article 3 of 18 AAC 50, the State of Alaska issues construction permits under the Prevention of Significant Deterioration (PSD) regulations codified in Title 40 CFR Section 52.21. These regulations apply to major new air pollutant emission sources or major modifications of existing air pollutant emission sources within an attainment or unclassified area. The PSD regulations provide standards that limit the total increase in ambient air pollution levels above established baseline levels for NO_2, PM_{10}, $PM_{2.5}$, and SO_2. These limits are most stringent in Class I areas. The nearest PSD Class I area is the Tuxedni National Wildlife Refuge, neighboring the project area.

The Title I air permitting program for Alaska also includes a minor source program under 18 AAC 50, Article 5 that is designed to regulate those smaller sources of emissions that are not subject to a Title I major source construction permit. The State of Alaska Title V air permitting program is designed to standardize air quality permits and the permitting process for major sources of emissions by containing all requirements in one permit document. It requires that the source submit periodic reports identifying the extent to which it has complied with those obligations. Title V operating permits are issued to air pollution sources after the source has begun to operate.

Title I and Title V permits are legally binding documents that include applicable requirements for demonstrating compliance with emission limits and standards. Monitoring, record keeping, and reporting provisions are also included within air permits that ensure sources follow the assumptions provided under a permit application and maintain compliance with all applicable elements of the CAA including the NAAQS and AAAQS. Under 40 CFR 55, EPA is required to implement the air quality requirements of the COA for the OCS in the Lower Cook Inlet Region, which include the ADEC air quality requirements of 18 AAC 50.

The gravity and magnetic survey will be performed from aircraft flying over a large geographic area and will occur during a relatively short period. Any impacts to air quality are associated with combustion emissions from engines associated with propelling aircraft. These emissions will be well dispersed over the area and will have a short intensity during the project. Therefore, the impacts to air quality associated with the project are considered to have a negligible impact.

2.1.4 Water Quality

The water quality of lower Cook Inlet generally is good, with water quality meeting Alaska Water Quality Standards criteria for marine uses. Turbulence, associated mainly with tidal currents, and winds, result in strong vertical mixing. While contaminants have been reported, many are attributed to erosion of the local soils, rocks, and ores. Concentrations of hydrocarbons are comparable to background hydrocarbons in other coastal Alaska waters. (BOEM 2016).

The gravity and magnetic survey will be performed from aircraft and therefore does not include any impacts to the seabed which could result in disturbance of sediment. No impacts to water quality are expected as part of the proposed project.

2.1.5 Acoustic Environment

Both natural and anthropogenic activities contribute to the acoustic environment of Cook Inlet. The dominant natural sound sources are typically physical mechanisms from wind and wave activity at or near the ocean surface, geological noise from earthquakes and volcanic activity, and noise from sea ice movement (BOEM 2016). Cook Inlet is a high-energy, dynamic environment with large tides, strong currents, natural seismic activity, and seasonal sea ice cover, which contributes to a generally high noise environment when compared to open ocean habitats. Biological noise, sounds created by animals, such as marine mammals, crustaceans, and fish can generate noise that effectively changes the dominant characteristics of an acoustic environment. (BOEM 2016).

Anthropogenic sound sources in Cook Inlet include noise from vessel traffic (Cook Inlet has several active ports and harbors, as well as commercial and recreational fishing activities, and an on-water tourism industry) aircraft (sea planes and traffic at airports with runways near coastal waters of Cook Inlet), and oil and gas activities (BOEM 2016). Other sources of anthropogenic noise include ships using dynamic positioning, dredging, and pile driving. Table 2 provides a summary of sounds in Cook Inlet.

Table 2 Summary of Received Sound Levels, the Distance to the Noise and the Frequency of Various Noise Sources in Cook Inlet.

SOURCE	RECEIVED LEVEL (DB RE 1 µPA)	DISTANCE	FREQUENCY (KHZ)
AMBIENT NOISE[1]			
Mouth of Little Susitna River	100	-	-
Between Fire Island and the mouth of Susitna River	113	-	-
Birchwood (Knik Arm outside action area)	95	-	-
Mouth of Eagle River (Knik Arm outside action area)	118	-	-
North of Point Possession	120	-	-
Anchorage Airport	105	-	-
Joint Base Elmendorf-Richardson	119	-	-
Port of Anchorage	113	-	-
VESSEL NOISE[1]			
Cargo-freight – Northern Lights (docked)	126	100-400 m	Generally < 1 kHz
Cargo-bulk carrier – Emerald Bulker (with 2 tugs)	134	>200 m	
Tug – Leo (pushing gravel barge Katie II)	149	100 m	
Small boat – Boston Whaler (drive by)	138	13 m	
Small rubber boat - Avon (drive by)	142	8.5 m	
AIRCRAFT NOISE[1]			

Anchorage Airport	118.4 ± 5.7[2]	-	Generally < 2 kHz
Joint Base Elmendorf-Richardson	128.0 ± 9.0	-	
DC-10	124[3]	-	
Landing Military Jet	134	-	
OIL AND GAS DRILLING NOISE[1]			
Phillip A Oil Platform	119 3	1.2 km	< 10 kHz

Source:
[1]Blackewell and Greene 2002
[2]Mean and standard deviation
[3]Maximum values

2.1.5.1 Aircraft Noise from the Proposed Survey

The airborne gravity and magnetic data will be collected by flying a prescribed grid over the area(s) of interest at an altitude of 500 ft. ASL by the fixed wing aircraft and 300 - 500 AGL over the Iniskin Peninsula by the rotor wing aircraft.

Helicopters and fixed-wing aircraft generate noise from their engines, airframe, and propellers. The dominant tones for both types of aircraft generally are <500 Hertz (Hz) (Richardson et al. 1995). Richardson et al. 1995 reported that received sound levels in water from aircraft flying at an altitude of 152 m (approximately 500 ft) were 109 dB re 1 µPa for a Bell 212 helicopter, 101 dB re 1 µPa for a small fixed-wing aircraft, 107 dB re 1 µPa for a twin otter, and 124 dB re 1 µPa for a P-3 Orion. Data on received sound levels of the DC-3 are not available, but are expected to be between the twin otter and P-3 Orion.

Penetration of aircraft noise into the water is greatest directly below the aircraft; at angles >13° from vertical, much of the sound is reflected and does not penetrate (Richardson et al. 1995). Duration of underwater sound from passing aircraft is much shorter in water than air; for example, a helicopter passing at an altitude of 152 m (approximately 500 ft), audible in air for 4 minutes, may be detectable underwater for 38 seconds at 3 m (10 ft) depth, and 11 seconds at 18 m (59 ft) depth (Richardson et al. 1995).

2.1.5.2 Aircraft Noise from the Proposed Survey

The effects of the proposed project on the acoustic environment will depend upon the sound source, timing, propagation, environmental conditions. As described in Section 1.1 of this EED, the survey will be conducted by flying transects over the survey area during a 3-week long period. Impacts to the acoustic environment, particularly the underwater acoustic environment, will be transient, occurring only during the survey program. The survey is expected not to have any long-term effect on the Cook Inlet acoustic environment.

2.2 BIOLOGICAL ENVIRONMENT

2.2.1 Invertebrates and Lower Trophic Organisms

Invertebrates occupy multiple habitat types from the intertidal zone to the deep sea. Invertebrates can occupy benthic (bottom) or pelagic (water column) habitats. Benthic invertebrates include predators, scavengers, scrapers, suspension (filter) feeders, and deposit feeders, which consume surface or subsurface sediment organic matter. Pelagic invertebrates may drift with the current (zooplankton) or actively swim.

The invertebrates found in Cook Inlet are composed of a mix of oceanic and coastal species. Benthic invertebrates are important as prey for other species in Cook Inlet such as crabs, flatfishes, and cod. There are differences in the composition of benthic species in Cook Inlet as a result of differences in ice formation, substrate type, and tidal zone. (BOEM 2012)

The gravity and magnetic survey will be performed from aircraft and therefore does not include any impacts to the areas within Cook Inlet where lower tropic organisms are located (i.e., marine waters). No impacts to lower trophic organisms are expected as part of the proposed project.

2.2.2 Fish and Shellfish

Fish and shellfish are important components of the food web in Cook Inlet as well as being important for subsistence and the commercial economy (both commercial fishing and recreational/tourism markets). Various species of fish and shellfish are present in Cook Inlet. Fish species that can be found in Cook Inlet include pelagic fish, (e.g., smelt, Pacific herring, Hooligan, and capelin), all five species of Pacific salmon (i.e., Chinook (King), Coho (Silver), Pink, Chum, and Sockeye (Red) Salmon), Dolly Varden, and various groundfish (Pacific cod, Pacific halibut, sablefish). Shellfish species found in Cook Inlet include various species of crab, shrimp, scallop, and clam. (BOEM 2016).

2.2.2.1 Essential Fish Habitat

NMFS is required to designate and conserve Essential Fish Habitat (EFH) for species managed under an existing Fishery Management Plan under the Magnuson-Stevens Fishery Conservation and Management Act of 1976. The term "essential fish habitat" means those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity (16 USC 1801-1884). This includes aquatic habitat where fish spawn, breed, feed, or grow to maturity. A number of fish and shellfish have designated EFH in the lower Cook Inlet as provided in Table 3.

Table 3 Essential Fish Habitat in Project Area

TYPE	SPECIES	DEVELOPMENT LEVEL
Groundfish	Arrowtooth Flounder	Late Juvenile & Mature
Groundfish	Pacific Cod	Late Juvenile, Mature
Groundfish	Rock Sole	Late Juvenile, Mature
Groundfish	Sculpin	Late Juvenile, Mature
Groundfish	Skate	Mature
Groundfish	Walleye Pollock	Late Juvenile, Mature
Salmon	Chinook Salmon	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Chum Salmon	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Coho Salmon	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Pink Salmon	Marine Immature, Maturing Adults, Marine Juvenile
Salmon	Sockeye Salmon	Marine Immature, Maturing Adults, Marine Juvenile
Scallops	Weathervane Scallop	Late Juvenile, Mature

Source: NMFS 2017a

The proposed survey will be performed from aircraft and therefore does not include any impacts to marine waters or disturbance of the seafloor where fish and shellfish are located. No impacts to fish and shellfish due to aircraft

noise introduced into the underwater environment ae expected due to the transient nature of the program (approximately 3 weeks) and the limited penetration of aircraft noise into the water.

2.2.3 Marine Mammals

The following sections are limited to those marine mammals that would generally be within the project area. The marine mammal species known to occur in the Hilcorp geophysical project area are listed in Table 4 and described below.

Table 4 Marine Mammals in Project Area

SPECIES	CONSERVATION STATUS	STOCK	MINIMUM POPULATION ESTIMATE
Humpback whale (*Megaptera novaeangliae*)	ESA – Endangered	Western North Pacific Stock	865[1]
Minke whale (*Balaenoptera acutorostrata*)	ESA – Not Listed	Alaska Stock	1,233[2]
Gray whale (*Eschrichtius robustus*)	ESA – Not Listed	Eastern Pacific Stock	20,125[3]
Beluga whale (*Delphinapterus leucas*)	ESA – Endangered	Cook Inlet Stock	328[4]
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Resident Stock	2,347[1]
Killer whale (*Orcinus orca*)	ESA – Not Listed	Alaska Transient Stock	587[1]
Harbor porpoise (*Phocoena phocoena*)	ESA – Not Listed	Gulf of Alaska Stock	31,046[1]
Dall's porpoise (*Phocoenoides dalli*)	ESA – Not Listed	Alaska Stock	83,400[1]
Harbor seal (*Phoca vitulina*)	ESA – Not Listed	Cook Inlet/Shelikof Stock	27,386[1,5]
Steller sea lion (*Eumetopias jubatus*)	ESA – Endangered	Western U.S. Stock	50,983[1,5]
Northern sea otter ((*Enhydra lutris kenyoni)*	ESA – Threatened	Southwest Alaska Stock	45,064[6]
	ESA – Not Listed	Southcentral Alaska Stock	18,327[7]

ESA = Endangered Species Act
[1]Muto et al. 2017
[2]Zerbini et al. 2006
[3]Allen and Angliss 2015
[4]Shelden et al. 2017
[5]NEST is the best estimate of pup and non-pup counts, which have not been corrected to account for animals at sea during abundance surveys
[6]USFWS 2014c
[7]USFWS 2014a

2.2.3.1 Humpack Whale

To date, three management units (populations) of humpback whales are recognized in the North Pacific, migrating between their respective summer/fall feeding areas and winter/spring calving and mating areas as follows (Baker et al. 1998; Calambokidis et al. 1997). Although there is considerable distributional overlap in the humpback whale stocks that use Alaska, the whales seasonally found in lower Cook Inlet are probably of the Central North Pacific stock (Muto et al. 2017). Listed as endangered under the Endangered Species Act (ESA), this stock has recently been estimated at 7,890 animals (Muto et al. 2017). The Central North Pacific stock winters in Hawaii and summers from British Columbia to the Aleutian Islands (Calambokidis et al. 1997), including Cook Inlet.

Humpback whales were listed as endangered under the ESA in 1973 (16 USC 1531 et seq.) due to the reduced population levels resulting from harvest pressure that occurred in the 20th Century (Perry et al. 1999; Rice 1978). Humpback whales are listed as depleted under the Marine Mammal Protection Act (MMPA) in 1973. In 1991, NMFS published a Final Recovery Plan for Humpback Whales (NMFS 1991).

In 2013, NMFS published a 90-day finding to identify the Central North Pacific population of Humpback whales as a distinct population segment (DPS) under the ESA and recommended that this DPS be delisted from the ESA based on population abundance (78 FR 53391). On September 8, 2016, NMFS revised the listing status of the humpback whale. NMFS divided the globally listed species into 14 DPSs, removing the current species listing and replacing it with four DPS as endangered (Cape Verde Islands/Northwest Africa, Western North Pacific, Central America, and Arabian Sea) and one DPS as threatened (Mexico). The remaining nine DPS did not warrant listing. Critical habitat for the three DPS found in U.S. waters (Western North Pacific, Central America, and Mexico) has not been determined (81 FR 62260).

The humpback whale is distributed worldwide in all ocean basins. In winter, most humpback whales occur in the subtropical and tropical waters of the northern and southern hemispheres. Humpback whales in the high latitudes of the North Pacific Ocean are seasonal migrants that feed on euphausiids and small schooling fishes (Muto et al. 2017). During the spring, these animals migrate north and spend the summer feeding in the prey-rich sub-polar waters of southern Alaska, British Columbia, and the southern Chukchi Sea. Individuals from the Western North Pacific (endangered), Hawaii (not listed under the ESA), and the Mexico (threatened) DPSs migrate to areas near and potentially in the action area; however, most of the individuals that migrate to the Cook Inlet area are likely from the Hawaii DPS and not the Western North Pacific or Mexico DPSs (NMFS 2017b).

In the summer, humpback whales are regularly present and feeding in the Cook Inlet region, including Shelikof Strait, Kodiak Island bays, and the Barren Islands, in addition to Gulf of Alaska regions adjacent to the southeast side of Kodiak Island (especially Albatross Banks), the Kenai and Alaska peninsulas, Elizabeth Island, as well as south of the Aleutian Islands. Humpbacks also may be present in some of these areas throughout autumn (Muto et al. 2017).

Humpback whales have been observed during marine mammal surveys conducted in Cook Inlet; however presence is largely confined to lower Cook Inlet. During SAE's 2015 seismic program, three humpback whales were observed in Cook Inlet; two near the Forelands and one in Kachemak Bay (Kendall et al. 2015). During NMFS Cook Inlet beluga whale aerial surveys from 2000-2016, there were 88 sightings of 191 estimated individual humpback whales in lower Cook Inlet (Shelden et al. 2017). They have been regularly seen near Kachemak Bay during the summer months (Rugh et al. 2005). There are observations of humpback whales as far north as Anchor Point, with recent summer observations extending to Cape Starichkof (Owl Ridge 2014). Although several humpback whale sightings occurred mid-inlet between Iniskin Peninsula and Kachemak Bay, most sightings occurred outside of the project area near Augustine, Barren, and Elizabeth Islands (Shelden et al. 2013, 2015, 2017).

Ferguson et al. (2015) has established Biologically Important Areas (BIAs) as part of the NOAA Cetacean Density and Distribution Mapping Working Group (CetMap) efforts. This information supplements the quantitative information on cetacean density, distribution, and occurrence by: 1) identifying areas where cetacean species or populations are known to concentrate for specific behaviors, or be range-limited, but for which there is not sufficient data for their importance to be reflected in the quantitative mapping effort; and 2) providing additional context within which to examine potential interactions between cetaceans and human activities. A 'Feeding Area' BIA for humpback whales in the Gulf of Alaska region encompasses the waters east of Kodiak Island (the Albatross and Portlock Banks), a target for historical commercial whalers based out of Port Hobron, Alaska (Ferguson et al. 2015; Reeves et al. 1985; Witteveen et al. 2007). This BIA also includes waters along the southeastern side of Shelikof Strait and in the bays

along the northwestern shore of Kodiak Island. The highest densities of humpback whales around the Kodiak Island BIA occur from July-August (Ferguson et al. 2015).

2.2.3.2 Minke Whale

Minke whales are most abundant in the Gulf of Alaska during summer and occupy localized feeding areas (Zerbini et al. 2006). Concentrations of minke whales have occurred along the north coast of Kodiak Island (and along the south coast of the Alaska Peninsula (Zerbini et al. 2006). The current estimate for minke whales between Kenai Fjords and the Aleutian Islands is 1,233 individuals (Zerbini et al. 2006). During shipboard surveys conducted in 2003, three minke whale sightings were made, all near the eastern extent of the survey from nearshore Prince William Sound to the shelf break (National Marine Mammal Laboratory [NMML] 2003).

Minke whales are a non-ESA listed cetacean uncommonly found in the Cook Inlet region. Minke whales are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA.

In the North Pacific, minke whales occur from the Bering and Chukchi seas south to near the Equator (Leatherwood et al. 1982). In the eastern North Pacific, minke whales are relatively common in the Bering and Chukchi seas and in the inshore waters of the Gulf of Alaska (Moore et al. 2002; Friday et al. 2013; Clarke et al. 2013).

Minke whales become scarce in the Gulf of Alaska in fall; most whales are thought to leave the region by October (Consiglieri et al. 1982). Minke whales are migratory in Alaska, but recently have been observed off Cape Starichkof and Anchor Point year-round (Muto et al. 2017).

During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered three times (1998, 1999, and 2006), both times off Anchor Point 16 miles northwest of Homer (Shelden et al. 2013, 2015, 2017). A minke whale was also reported off Cape Starichkof in 2011 (A. Holmes, pers. comm.) and 2013 (E. Fernandez and C. Hesselbach, pers. comm.), suggesting this location is regularly used by minke whales, including during the winter. Several minke whales were recorded off Cape Starichkof in early summer 2013 during exploratory drilling conducted (Owl Ridge 2014), suggesting this location is regularly used by minke whales year-round. During Apache's 2014 survey, a total of 2 minke whale groups (3 individuals) were observed during this time period, one sighting to the southeast of Kalgin Island and another sighting near Homer (Lomac-MacNair et al. 2014). SAE noted one minke whale near Tuxedni Bay in 2015 (Kendall et al., 2015). This species is unlikely to be seen in upper Cook Inlet but may be encountered in the mid and lower Inlet.

2.2.3.3 Killer Whale

Based on data regarding association patterns, acoustics, movements, and genetic differences, eight killer whale stocks are now recognized within the Pacific U.S. Exclusive Economic Zone. Two different stocks of killer whales inhabit the Cook Inlet region of Alaska: the Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock (Muto et al 2017).

The population estimate for the Alaska Resident Stock is estimated at 2,347 individuals, with a minimum population estimate of 2,084 (Muto et al. 2017). Though no official abundance estimate exists for this stock because of incomplete surveys of the range, a minimum population estimate for the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock was estimated to be 587 individuals (Muto et al. 2017).

The Alaska Resident Stock and the Gulf of Alaska, Aleutian Islands, Bering Sea Transient Stock of killer whales are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Muto et al. 2017).

Seasonal and year-round occurrence has been noted for killer whales throughout Alaska (Braham and Dahlheim 1982), where whales have been labeled as 'resident,' 'transient,' and 'offshore' type killer whales (Dahlheim et al. 2008; Ford et al. 2000). The killer whales using Cook Inlet are thought to be a mix of resident and transient individuals from two different stocks: the Alaska Resident Stock, and the Gulf of Alaska, Aleutian Islands, and Bering Sea Transient Stock (Allen and Angliss 2015). Although recent studies have documented movements of Alaska Resident killer whales from the Bering Sea into the Gulf of Alaska as far north as southern Kodiak Island, none of these whales have been photographed further north and east in the Gulf of Alaska where regular photo-identification studies have been conducted since 1984 (Muto et al. 2017).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Shelden et al. 2003; Rugh et al. 2005). The few whales that have been photographically identified in lower Cook Inlet belong to resident groups more commonly found in nearby Kenai Fjords and Prince William Sound (Shelden et al. 2003). The availability of these prey species largely determines the likeliest times for killer whales to be in the area. During aerial surveys conducted between 1993 and 2004, killer whales were observed on only three flights, all in the Kachemak and English Bay area (Rugh et al. 2005). However, anecdotal reports of killer whales feeding on belugas in upper Cook Inlet began increasing in the 1990s, possibly in response to declines in sea lion and harbor seal prey elsewhere (Shelden et al. 2003).

One killer group of two individuals whale was observed during the 2015 SAE seismic program near the North Foreland (Kendall et al. 2015). During NMFS aerial surveys, killer whales were observed in 1994 (Kamishak Bay), 1997 (Kachemak Bay), 2001 (Port Graham), 2005 (Iniskin Bay), 2010 (Elizabeth and Augustine Islands), and 2012 (Kachemak Bay; Shelden et al. 2013). Eleven killer whale strandings have been reported in Turnagain Arm, six in May 1991, and five in August 1993. Very few killer whales, if any, are expected to approach or be in the vicinity of the Project area.

2.2.3.4 Gray Whale

In 1994, the Eastern North Pacific (ENP) stock of gray whales was removed from the ESA in 1994 (59 FR 31094). The ENP is an estimated size of 20,990 animals, with an estimated minimum of 20,125 (Muto et al. 2017).

Gray whales have been reported feeding near Kodiak Island, in southeastern Alaska, and south along the Pacific Northwest (Allen and Angliss 2013). Because most gray whales migrating through the Gulf of Alaska region are thought to take a coastal route, BIA boundaries for the migratory corridor in this region were defined by the extent of the continental shelf (Ferguson et al. 2015).

Most gray whales calve and breed from late December to early February in protected waters along the western coast of Baja California, Mexico. In spring, the ENP stock of gray whales migrates approximately 8,000 km (5,000 miles) to feeding grounds in the Bering and Chukchi seas before returning to their wintering areas in the fall (Rice and Wolman 1971). Northward migration, primarily of individuals without calves, begins in February; some cow/calf pairs delay their departure from the calving area until well into April (Jones and Swartz 1984).

Gray whales approach the proposed Project Area in late March, April, May, and June, and leave again in November and December (Consiglieri et al. 1982; Rice and Wolman 1971) but migrate past the mouth of Cook Inlet to and from northern feeding grounds. Some gray whales do not migrate completely from Baja to the Chukchi Sea but instead feed in select coastal areas in the Pacific Northwest, including lower Cook Inlet (Moore et al. 2007).

Most of the population follows the outer coast of the Kodiak Archipelago from the Kenai Peninsula in spring or the Alaska Peninsula in fall (Consiglieri et al. 1982; Rice and Wolman 1971). Though most gray whales migrate past Cook

Inlet, small numbers have been noted by fishers near Kachemak Bay, and north of Anchor Point (BOEM 2015). During the NMFS aerial surveys, gray whales were observed in the month of June in 1994, 2000, 2001, 2005 and 2009 on the east side of Cook Inlet near Port Graham and Elizabeth Island but also on the west side near Kamishak Bay (Shelden et al. 2013). One gray whale was sighted as far north at the Beluga River. Additionally, summering gray whales were seen offshore of Cape Starichkof by marine mammal observers monitoring Buccaneer's Cosmopolitan drilling program in 2013 (Owl Ridge 2014). During Apache's 2012 seismic program, nine gray whales were observed in June and July (Lomac-MacNair et al. 2013). During Apache's seismic program in 2014, one gray whale was observed (Lomac-MacNair et al. 2014). During SAE's seismic survey in 2015, no gray whales were observed (Kendall et al. 2015).

2.2.3.5 Cook Inlet Beluga Whale

The Cook Inlet beluga whale DPS is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically distinct from other Alaska populations suggesting the Peninsula is an effective barrier to genetic exchange (O'Corry-Crowe et al. 1997).

The Cook Inlet beluga whale population is estimated to have declined from 1,300 animals in the 1970s (Calkins 1989) to about 340 animals in 2014 (Shelden et al. 2015). The current population estimate is 328 animals (Shelden et al. 2017). The precipitous decline documented in the mid-1990s was attributed to unsustainable subsistence practices by Alaska Native hunters (harvest of >50 whales per year) (Mahoney and Shelden 2000). In 2006, the subsistence hunting ceased to protect the species.

NMFS listed the population as depleted in 2000 because of the decline and as endangered under the ESA in 2008 when the population failed to recover following a moratorium on subsistence harvest (65 FR 34590). In April 2011, NMFS designated critical habitat for the beluga under the ESA (76 FR 20180). NMFS finalized the Conservation Plan for the Cook Inlet beluga in 2008 (NMFS 2008a). NMFS finalized the Recovery Plan for Cook Inlet beluga whales in 2016 (NMFS 2016a).

The Cook Inlet beluga stock remains within Cook Inlet throughout the year (Goetz et al. 2012). Two areas, consisting of 7,809 square kilometers (km^2) (3,016 square miles) of marine and estuarine environments considered essential for the species' survival and recovery were designated critical habitat. However, in recent years the range of the beluga whale has contracted to the upper reaches of Cook Inlet because of the decline in the population (Rugh et al. 2010). Area 1 of the Cook Inlet beluga whale critical habitat encompasses all marine waters of Cook Inlet north of a line connecting Point Possession (61.04°N, 150.37°W) and the mouth of Three Mile Creek (61.08.55°N, 151.04.40°W), including waters of the Susitna, Little Susitna, and Chickaloon Rivers below mean higher high water. This area provides important habitat during ice-free months, and is used intensively by Cook Inlet beluga between April and November (NMFS 2016a).

Since 1993, NMFS has conducted annual aerial surveys in June, July or August to document the distribution and abundance of beluga whales in Cook Inlet. The collective survey results show that beluga whales have been consistently found near or in river mouths along the northern shores of upper Cook Inlet (i.e., north of East and West Foreland). In particular, beluga whale groups are seen in the Susitna River Delta, Knik Arm, and along the shores of Chickaloon Bay. Small groups had also been recorded seen farther south in Kachemak Bay, Redoubt Bay (Big River), and Trading Bay (McArthur River) prior to 1996, but very rarely thereafter. Since the mid-1990s, most (96 to 100 percent) beluga whales in upper Cook Inlet have been concentrated in shallow areas near river mouths, no longer occurring in the central or southern portions of Cook Inlet (Hobbs et al. 2008). Based on these aerial surveys, the

concentration of beluga whales in the northernmost portion of Cook Inlet appears to be consistent from June to October (Rugh et al. 2000, 2004a, 2005, 2006, 2007).

Though Cook Inlet beluga whales can be found throughout the inlet at any time of year, generally, they spend the ice-free months in the upper Cook Inlet, shifting into the middle and lower Inlet in winter (Hobbs et al. 2005). In 1999, one beluga whale was tagged with a satellite transmitter, and its movements were recorded from June through September of that year. Since 1999, 18 beluga whales in upper Cook Inlet have been captured and fitted with satellite tags to provide information on their movements during late summer, fall, winter, and spring. Using location data from satellite-tagged Cook Inlet belugas, Ezer et al. (2013) found most tagged whales were in the lower to middle inlet (70 to 100% of tagged whales) during January through March, near the Susitna River Delta from April to July (60 to 90% of tagged whales) and in the Knik and Turnagain Arms from August to December.

During the spring and summer, beluga whales are generally concentrated near the warmer waters of river mouths where prey availability is high and predator occurrence is low (Moore et al. 2000). Beluga whales in Cook Inlet are believed to mostly calve between mid-May and mid-July, and concurrently breed between late spring and early summer (NMFS 2016a), primarily in upper Cook Inlet. Movement was correlated with the peak discharge of seven major rivers emptying into Cook Inlet. Boat-based surveys from 2005 to the present (McGuire and Stephens 2017), and initial results from passive acoustic monitoring across the entire inlet (Castellote et al. 2016) also support seasonal patterns observed with other methods, and other surveys confirm Cook Inlet belugas near the Kenai River during summer months (McGuire and Stephens 2017).

During the summer and fall, beluga whales are concentrated near the Susitna River mouth, Knik Arm, Turnagain Arm, and Chickaloon Bay (Nemeth et al. 2007) where they feed on migrating eulachon (*Thaleichthys pacificus*) and salmon (*Onchorhyncus spp.*) (Moore et al. 2000). Data from tagged whales (14 tags between July and March 2000 through 2003) show beluga whales use upper Cook Inlet intensively between summer and late autumn (Hobbs et al. 2005).

As late as October, beluga whales tagged with satellite transmitters continued to use Knik Arm and Turnagain Arm and Chickaloon Bay, but some ranged into lower Cook Inlet south to Chinitna Bay, Tuxedni Bay, and Trading Bay (McArthur River) in the fall (Hobbs et al. 2005). Data from NMFS aerial surveys, opportunistic sighting reports, and satellite-tagged beluga whales confirm they are more widely dispersed throughout Cook Inlet during the winter months (November-April), with animals found between Kalgin Island and Point Possession. In November, beluga whales moved between Knik Arm, Turnagain Arm, and Chickaloon Bay, similar to patterns observed in September (Hobbs et al. 2005). By December, beluga whales were distributed throughout the upper to mid-inlet. From January into March, they moved as far south as Kalgin Island and slightly beyond in central offshore waters. Beluga whales also made occasional excursions into Knik Arm and Turnagain Arm in February and March despite ice cover greater than 90 percent (Hobbs et al. 2005).

During Apache's seismic test program in 2011 along the west coast of Redoubt Bay, lower Cook Inlet, a total of 33 beluga whales were sighted during the survey (Lomac-MacNair et al. 2013). During Apache's 2012 seismic program in mid-inlet, a total of 151 sightings of approximately 1,463 estimated individual beluga whales were observed (Lomac-MacNair et al. 2013). During SAE's 2015 seismic program, a total of eight sightings of approximately 33 estimated individual beluga whales were visually observed during this time period and there were two acoustic detections of beluga whales (Kendall et al. 2015).

2.2.3.6 Harbor Porpoise

In Alaskan waters, three stocks of harbor porpoises are currently recognized for management purposes: Southeast Alaska, Gulf of Alaska, and Bering Sea Stocks (Muto et al. 2017). Porpoises found in Cook Inlet belong to the Gulf of Alaska Stock which are distributed from Cape Suckling to Unimak Pass and most recently was estimated to number 31,046 individuals (Muto et al. 2017). They are one of the three marine mammals (the other two being belugas and harbor seals) regularly seen throughout Cook Inlet (Nemeth et al. 2007), especially during spring eulachon and summer salmon runs.

Harbor porpoises are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Muto et al. 2017).

Harbor porpoises primarily frequent the coastal waters of the Gulf of Alaska and Southeast Alaska (Dahlheim et al. 2000, 2008), typically occurring in waters less than 100 m deep (Hobbs and Waite 2010). The range of the Gulf of Alaska stock includes the entire Cook Inlet, Shelikof Strait, and the Gulf of Alaska. Harbor porpoises have been reported in lower Cook Inlet from Cape Douglas to the West Foreland, Kachemak Bay, and offshore (Rugh et al. 2005). Although they have been frequently observed during aerial surveys in Cook Inlet (Shelden et al. 2014), most sightings are of single animals, and are concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh et al. 2005) and in the upper inlet.

The occurrence of larger numbers of porpoise in the lower Cook Inlet may be driven by greater availability of preferred prey and possibly less competition with beluga whales, as belugas move into upper inlet waters to forage on Pacific salmon, *Oncorhynchus spp*., during the summer months (Shelden et al. 2014).

The harbor porpoise frequently has been observed during summer aerial surveys of Cook Inlet, with most sightings of individuals concentrated at Chinitna and Tuxedni Bays on the west side of lower Cook Inlet; Rugh et al. 2005). Mating probably occurs from June or July to October, with peak calving in May and June (as cited in Consiglieri et al. 1982). Small numbers of harbor porpoises have been consistently reported in the upper Cook Inlet between April and October, except for a recent survey that recorded higher numbers than typical. NMFS aerial surveys have identified many harbor porpoise sightings throughout Cook Inlet: 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2004, 2005, 2007, 2008, 2009, 2010, 2011, 2012, 2014, and 2016. During Apache's 2012 seismic program, 137 sightings (190 individuals) were observed between May and August (Lomac-MacNair et al. 2012). Lomac-MacNair et al. 2015 identified 77 groups of harbor porpoise totaling 13 individuals during Apache's 2014 seismic survey, both from vessels and aircraft, during the month of May. During SAE's 2015 seismic survey, 52 sightings (65 individuals) were observed north of the Forelands (Kendall et al. 2015).

Recent passive acoustic research in Cook Inlet by Alaska Department of Fish and Game (ADF&G) and NMML have indicated that harbor porpoises occur more frequently than expected, particularly in the West Foreland area in the spring (Castellote et al. 2016), although overall numbers are still unknown at this time. Because harbor porpoises have been observed throughout Cook Inlet during the summer months, including mid-inlet waters, they represent one species that could be encountered during the proposed airborne gravity and magnetic survey in Cook Inlet.

2.2.3.7 Dall's Porpoise

Dall's porpoises are not designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Muto et al. 2017). The abundance estimate for the Alaska Stock of Dall's porpoise is 83,400 animals (Muto et al. 2017), making it one of the more abundant cetaceans in Alaskan waters.

Dall's porpoises are widely distributed throughout the North Pacific Ocean including preferring deep offshore and shelf-slopes, and deep oceanic waters (Muto et al. 2017). The Dall's porpoise range in Alaska extends into the southern portion of the project area. Dall's porpoises are present year-round throughout their entire range in the northeast including the Gulf of Alaska, and occasionally the Cook Inlet area (Morejohn 1979). This porpoise also has been observed in lower Cook Inlet, around Kachemak Bay, and rarely near Anchor Point (Owl Ridge 2014; BOEM 2015).

Throughout most of the eastern North Pacific they are present during all months of the year, although there may be seasonal onshore-offshore movements along the west coast of the continental U.S. and winter movements of populations out of areas with ice such as Prince William Sound (Muto et al. 2017). Dall's porpoises were observed (2 groups, 3 individuals) during Apache's 2014 seismic survey which occurred in the summer months (Lomac-MacNair et al. 2014). Dall's porpoises were observed during the month of June in 1997 (Iniskin Bay), 199 (Barren Island), and 2000 (Elizabeth Island, Kamishak Bay and Barren Island) (Shelden et al. 2013). Dall's porpoises have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point (Owl Ridge 2014). One Dall's porpoise was observed in August north of Nikiski in the middle of the Inlet during SAE's 2015 seismic program (Kendall et al. 2015).

2.2.3.8 Harbor Seal

No harbor seal stocks in Alaska are designated as depleted under the MMPA or listed as threatened or endangered under the ESA (Muto et al. 2017). Harbor seals are common in Alaskan waters with statewide abundance estimates at 152,602 animals (Muto et al. 2017). The Cook Inlet/Shelikof Stock, ranging from approximately Anchorage down along the south side of the Alaska Peninsula to Unimak Pass is estimated at a stable 27,386 (Muto et al. 2017).

In 2010, NMFS and their co-management partners, the Alaska Native Harbor Seal Commission, defined 12 separate stocks of harbor seals based largely on genetics. The harbor seal stocks present in or near the proposed Project Area include the Cook Inlet/Shelikof Stock. In 2006, the estimated abundance was 22,900 animals with a minimum population estimate of 21,896 (Muto et al. 2017).

Harbor seals occupy a wide variety of habitats in freshwater and saltwater in protected and exposed coastlines and range from Baja California north along the west coasts of Washington, Oregon, and California, British Columbia, and Southeast Alaska; west through the Gulf of Alaska, Prince William Sound, and the Aleutian Islands; and north in the Bering Sea to Cape Newenham and the Pribilof Islands. Harbor seals are found throughout the entire lower Cook Inlet coastline, hauling out on beaches, islands, mudflats, and at the mouths of rivers where they whelp and feed (Muto et al. 2017).

The major haulout sites for harbor seals are located in lower Cook Inlet. The presence of harbor seals in upper Cook Inlet is seasonal. In Cook Inlet, seal use of western habitats is greater than use of the eastern coastline (Boveng et al. 2012). NOAA has documented a strong seasonal pattern of more coastal and restricted spatial use during the spring and summer for breeding, pupping, and molting, and more wide-ranging seal movements within and outside of Cook Inlet during the winter months (Boveng et al. 2012). Large-scale patterns indicate a portion of harbor seals captured in Cook Inlet move out of the area in the fall, and into habitats within Shelikof Strait, Northern Kodiak Island, and coastal habitats of the Alaska Peninsula, and are most concentrated in Kachemak Bay, across Cook Inlet toward Iniskin and Iliamna Bays, and south through the Kamishak Bay, Cape Douglas and Shelikof Strait regions (Boveng et al. 2012).

A portion of the Cook Inlet seals move into the Gulf of Alaska and Shelikof Strait during the winter months (London et al. 2012). Seals move back into Cook Inlet as the breeding season approaches and their spatial use is more

concentrated around haul-out areas (Boveng et al. 2012; London et al. 2012). Some seals expand their use of the northern portion of Cook Inlet, however, in general, seals that were captured and tracked in the southern portion of Cook Inlet remained south of the Forelands (Boveng et al. 2012). Important harbor seal haul-out areas occur within Kamishak and Kachemak Bays and along the coast of the Kodiak Archipelago and the Alaska Peninsula. Chinitna Bay, Clearwater and Chinitna Creeks, Tuxedni Bay, Kamishak Bay, Oil Bay, Pomeroy and Iniskin Islands, and Augustine Island are also important spring-summer breeding and molting areas and known haul-outs sites. Small-scale patterns of movement within Cook Inlet also occur (Boveng et al. 2012). Montgomery et al. (2007) recorded over 200 haulout sites in lower Cook Inlet alone. However, only a few dozens to a couple hundred seals seasonally occur in upper Cook Inlet (Rugh et al. 2005), mostly at the mouth of the Susitna River where their numbers vary in concert with the spring eulachon and summer salmon runs (Nemeth et al. 2007; Boveng et al. 2012). The closest haulout sites to the project area are located on near anchor Point.

The Cook Inlet/Shelikof Stock is distributed from Anchorage into lower Cook Inlet during summer and from lower Cook Inlet through Shelikof Strait to Unimak Pass during winter (Boveng et al. 2012). Large numbers concentrate at the river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay, and several haul outs have been identified on the southern end of Kalgin Island in lower Cook Inlet (Rugh et al. 2005; Boveng et al. 2012). Montgomery et al. (2007) recorded over 200 haul-out sites in lower Cook Inlet alone.

NMFS aerial surveys have identified many harbor seals sightings throughout Cook Inlet: 1993, 1994, 1995, 1996, 1997, 1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2014, and 2016. During Apache's 2012 seismic program, harbor seals were observed in the project area from early May until the end of the seismic operations in late September (Lomac-MacNair et al. 2013). Also in 2012, up to 100 harbor seals were observed hauled out at the mouths of the Theodore and Lewis rivers during monitoring activity associated with Apache's 2012 Cook Inlet seismic program. During Apache's 2014 seismic program, 492 groups of harbor seals (613 individuals) were observed; this highest sighting rate of any marine mammal observed during the summer of 2014 (Lomac-MacNair et al. 2015). During SAE's 2015 seismic survey, 823 sightings (1,680 individuals) were observed north and between the Forelands (Kendall et al. 2015).

2.2.3.9 Steller Sea Lion

The western DPS (WDPS) stock of Steller sea lions most likely occurs in Cook Inlet (78 FR 66139). The center of abundance for the Western DPS is considered to extend from Kenai to Kiska Island (NMFS 2008a). The WDPS of the Steller sea lion is defined as all populations west of longitude 144°W to the western end of the Aleutian Islands. The range of the WDPS includes 38 rookeries and hundreds of haul out sites. Only the WDPS stock is addressed in this EED. The most recent comprehensive aerial photographic and land-based surveys of WDPS Steller sea lions in Alaska were conducted during the 2014 and 2015 breeding seasons (Fritz et al. 2015). Western Steller sea lion pup and non-pup counts in 2015 in Alaska were estimated to be 12,492 and 38,491, respectively (Fritz et al. 2015), which total 50,983 and is used as the minimum population estimate for the U.S. portion of the WDPS of Steller sea lions (Wade and Angliss 1997).

The WDPS of Steller sea lions is currently listed as endangered under the ESA (55 FR 49204) and designated as depleted under the MMPA. Critical habitat was designated on August 27, 1993 (58 FR 45269) south of the proposed project area in the Cook Inlet region. The critical habitat designation for the WDPS of Steller sea lions was determined to include a 37 km (20 nautical mile) buffer around all major haul outs and rookeries, and associated terrestrial, atmospheric, and aquatic zones, plus three large offshore foraging areas. NMFS also designated no entry zones around rookeries (50 CFR 223.202). Designated critical habitat is located outside Cook Inlet at Gore Point, Elizabeth Island, Perl Island and Chugach Island (NMFS 2008b).

The geographic center of Steller sea lion distribution is the Aleutian Islands and the Gulf of Alaska, although as the WDPS has declined, rookeries in the west became progressively smaller (NMFS 2008b). Steller sea lion habitat includes terrestrial sites for breeding and pupping (rookeries), resting (haul outs), and marine foraging areas. Nearly all rookeries are at sites inaccessible to terrestrial predators on remote rocks, islands, and reefs.

Steller sea lions inhabit lower Cook Inlet, especially near Shaw Island and Elizabeth Island (Nagahut Rocks) haulout sites (Rugh et al. 2005), but are rarely seen in upper Cook Inlet (Nemeth et al. 2007). Steller sea lions occur in Cook Inlet but south of Anchor Point around the offshore islands and along the west coast of the upper inlet in the bays (Chinitna Bay, Iniskin Bay, etc.) (Rugh et al. 2005). Portions of the southern reaches of the lower inlet are designated as critical habitat, including a 20-nautical mile buffer around all major haul out sites and rookeries. Rookeries and haulout sites in lower Cook Inlet include those near the mouth of the inlet, which are far south of the project area. It is unlikely that any Steller sea lion would be in the project area during operations.

Steller sea lions feed largely on walleye pollock (*Theragra chalcogramma*), salmon (*Onchorhyncus spp*.), and arrowtooth flounder (*Atheresthes stomias*) during the summer, and walleye pollock and Pacific cod (*Gadus macrocephalus*) during the winter (Sinclair and Zeppelin 2002), none which, except for salmon, are found in abundance in upper Cook Inlet (Nemeth et al. 2007).

Steller sea lions can travel considerable distances (Baba et al. 2000). Steller sea lions are not known to migrate annually, but individuals may widely disperse outside of the breeding season (late-May to early-July; Jemison et al. 2013; Allen and Angliss 2014). Most adult Steller sea lions inhabit rookeries during the breeding season (late May to early July); some juveniles and non-breeding adults occur at or near rookeries during the breeding season, but most are on haul outs. Adult males may disperse widely after the breeding season and during fall and winter, many sea lions increase use of haul outs, especially terrestrial sites but also on sea ice in the Bering Sea (NMFS 2008b).

Steller sea lions have been observed during marine mammal surveys conducted in Cook Inlet. In 2012, during Apache's 3D Seismic surveys, there were three sightings of approximately four individuals in upper Cook Inlet (Lomac-MacNair et al. 2013). Marine mammal observers associated with Buccaneer's drilling project off Cape Starichkof observed seven Steller sea lions during the summer of 2013 (Owl Ridge 2014). During SAE's 3D Seismic Program in 2015, four Steller sea lions were observed in Cook Inlet. One sighting occurred between the West and East Forelands, one near Nikiski and one northeast of the North Foreland in the center of Cook Inlet (Kendall et al. 2015). During NMFS Cook Inlet beluga whale aerial surveys from 2000-2016, there were 39 sightings of 769 estimated individual Steller sea lions in lower Cook Inlet (Shelden et al. 2017). Sightings of large congregations of Steller sea lions during NMFS aerial surveys occurred outside the action area, on land in the mouth of Cook Inlet (e.g., Elizabeth and Shaw Islands).

2.2.3.10 Northern Sea Otter

The northern sea otter is the smallest marine mammal species, and a member of the weasel family (*Mustelidae*) (USFWS 2005). They are the only marine mammals who do not rely on blubber for insulation; sea otters' dense waterproof undercoats contain more follicles per square in than any other mammal, and keep air bubbles trapped close to their bodies for heat retention (ADF&G 2008). Sea otters forage in nearshore waters at depths of around 40 m. They spend approximately 40% of their daily activity foraging, and primarily feed on benthic invertebrates, including; mussels, crabs, urchins, sea cucumbers, and clams. Red sea cucumbers (*Parastichopus californicus*) and sea urchins (*Strogylocentrotus* spp.), found among shell debris, are also important otter prey.

Two distinct stocks of northern sea otters occur in lower Cook Inlet; the Southwest Alaska Stock and the Southcentral Alaska Stock. The Southwest Alaska Stock is listed as threatened under the ESA, and ranges along the western shore of lower Cook Inlet, and throughout Alaska Peninsula and Bristol Bay coasts, as well as the Aleutian, Barren, Kodiak, and Pribilof Islands (USFWS 2014a). The non-listed Southcentral Alaska Stock extends from Cape Yakataga to the eastern shoreline of lower Cook Inlet, including Prince William Sound, Kachemak Bay, and the Kenai Peninsula coast (Gorbics and Bodkin 2001; Allen and Angliss 2014; USFWS 2014a). The Hilcorp proposed airborne gravity and magnetic survey is centrally located over the lower Cook Inlet, therefore both/either stock(s) of otters may be encountered.

Northern sea otters are non-migratory and occur year-round throughout lower Cook Inlet in nearshore coastal waters, typically within 40 m of depth to maintain consistent access to benthic foraging habitat (Garshelis 1987; Reidman and Estes 1990). Although individuals can cover long distances (> 100 km), movement is generally restricted by geography, energy requirements, and social behavior, and individuals tend to remain within a home range of < 30 km^2 (Reidman and Estes 1990; Garshelis and Garshelis 1984). Sea otter movement is also affected by tidal and wind patterns, and inclement weather. Storm conditions often cause otters to seek shelter in protected bays, inlets, or lees; however, in calmer conditions otters may be sighted farther from the shore (Lensink 1962; Kenyon 1969). If transiting though open water, otters may be seen rafting together (Schneider 1976).

Population densities between the Kenai and Alaska peninsulas have generally been reported as low, potentially due to the 100 km stretch of open water between the two peninsulas, with water depths around 100 m (Bodkin and Udevitz 1999; USFWS 2005

The Hilcorp geophysical project area is situated in central lower Cook Inlet, and also predominantly within transects categorized as low otter density by Bodkin et al. (2003b). Based on otter habitat preferences, it is unlikely that the proposed work will encounter many otters due to its location outside nearshore ranges.

The Hilcorp planned project area falls within the Bodkin et al. (2003b) “low density” transect area (water 40-100 m deep), in which only one otter was sighted during the 70 total hours of survey time. Most of the surveys were conducted between May 22 and June 6, 2002.

2.2.3.11 General Effects of Noise on Marine Mammals

Marine mammals use hearing and sound transmission to perform vital life functions. Introducing sound into their environment could be disruptive to those behaviors. Sound (hearing and vocalization/ echolocation) serves four primary functions for marine mammals, including: 1) providing information about their environment, 2) communication, 3) prey detection, and 4) predator detection. The distances to which noise is audible depends upon source levels, frequency, ambient noise levels, the propagation characteristics of the environment, and sensitivity of the receptor (Richardson et al. 1995).

The effects of sounds from anthropogenic sound sources on marine mammals might include one or more of the following: tolerance, masking of natural sounds, behavioral disturbance, and temporary or permanent hearing impairment, or non-auditory physical effects (Richardson et al. 1995). In assessing potential effects of noise, Richardson et al. (1995) has suggested four criteria for defining zones of influence. These zones are described below from greatest influence to least:

Zone of hearing loss, discomfort, or injury – the area within which the received sound level is potentially high enough to cause discomfort or tissue damage to auditory or other systems. This includes temporary loss in hearing or loss in hearing at specific frequencies or deafness. Non-auditory physiological effects or injuries that theoretically

might occur in marine mammals exposed to strong underwater sound include stress, neurological effects, bubble formation, resonance effects, and other types of organ or tissue damage.

Zone of masking – the area within which the noise may interfere with detection of other sounds, including communication calls, prey sounds, or other environmental sounds.

Zone of responsiveness – the area within which the animal reacts behaviorally or physiologically. The behavioral responses of marine mammals to sound is dependent upon a number of factors, including: 1) acoustic characteristics the noise source of interest; 2) physical and behavioral state of animals at time of exposure; 3) ambient acoustic and ecological characteristics of the environment; and 4) context of the sound (e.g., whether it sounds similar to a predator) (Richardson et al. 1995; Southall et al. 2007). However, temporary behavioral effects are often simply evidence that an animal has heard a sound and may not indicate lasting consequence for exposed individuals (Southall et al. 2007).

Zone of audibility – the area within which the marine mammal might hear the noise. Marine mammals as a group have functional hearing ranges of 10 Hz to 180 kiloHertz (kHz), with best thresholds near 40 dB (Ketten 1998; Kastak et al. 2005; Southall et al. 2007); northern sea otters have a functional hearing range of 60 Hz to 39kHz, with highest sensitivity between 2 and 16 kHz (NMFS 2016b; Ghoul and Reichmuth 2011. There are no applicable criteria for the zone of audibility due to difficulties in human ability to determine the audibility of a particular noise for a particular species.

2.2.3.12 Potential Effects of Aircraft Sound on Marine Mammals

The airborne gravity and magnetic data will be collected by flying a prescribed grid over the area(s) of interest at an altitude of approximately 330-500 ft. ASL by the fixed wing aircraft and approximately 300-500 ft AGL over the Iniskin Peninsula by the rotor wing aircraft. Noise generated by aircraft proposed for the survey is discussed in Section 2.1.5.1 of this EED.

Marine mammal response to aircraft noise varies with aircraft type, altitude and flight pattern. Visual cues are likely involved with the marine mammal reactions to aircraft presence. The following sections summarize cetacean and pinniped responses to noise associated with aircraft (Richardson et al. 1995).

Cetaceans

Responses to aircraft by cetaceans are less documented than pinnipeds. Richardson et al. (1995) suggests this could indicate that airborne noise has a greater affect on pinnipeds hauled out on land or ice than on cetaceans in-water. Responses to aircraft by odontocetes and mysticetes are similar and include a change in behavior, diving, slapping the water with flukes or flippers, and swimming away or turning away from the aircrafts flight direction. Belugas did not show a reaction to an aircraft flying at 500 m; however, dove for longer periods of time, had shorter surface intervals and occasionally swam away when the aircraft was at 150-200 m. Foraging belugas were documented as less reactive in the presence of an aircraft, than lone whales which dove when an aircraft was at 500 m. Some humpback whales have shown a response to an aircraft at 305 m, while other whales have shown no response to an aircraft at 152 m. Whales are less reactive in larger feeding or social groups and more reactive in confined waters or with calves. Reactions by cetaceans are likely influenced by group size and behavioral activity (reviewed in Richardson et al. 1995).

Pinnipeds

Reactions to aircraft noise and/or sight of the aircraft by pinnipeds hauled out on land or ice include increased vigilance and/or rushing into the water. The presence of aircraft can also trigger stampedes causing increase pup mortality due to crushing or pup abandonment. Responses from pinnipeds in-water to aircraft presence may include diving. Pinnipeds react more if the aircraft flies at low altitudes, passes directly overhead or there are changes in aircraft sound. Helicopters may have more of an effect on pinnipeds reactions; however, more studies on sound pressure levels are needed (reviewed in Richardson et al. 1995).

2.2.3.13 Measures to Mitigate Impacts to Marine Mammals

Hilcorp proposes to modify the flight path or altitude to mitigate impacts to marine mammals associated with the airborne gravity/electromagnetic survey:

- Modify flight altitude from 500 ft ASL to over 1,000 ft ASL of the in the event a congregation of marine mammals is observed by the pilot or sensor operators onboard the aircraft.
- Modify flight path to avoid flying directly over congregations of marine mammals in the event a congregation of marine mammals is observed by the pilot or sensor operators onboard the aircraft.

A congregation is defined as more than 10 seals hauled out on land, more than 5 beluga whales. Because of the sensitive nature of the data collection methods (i.e., requires security clearance), Hilcorp is not able to place a PSO onboard the aircraft. Further, the aircraft does not have windows on the side for appropriate viewing for a PSO. Therefore, Hilcorp will train the pilots and sensor operators on the aircraft on marine mammal viewing. For previous projects, the applicant and PSO contractor held a pre-field PSO training seminar. The agenda typically includes: training on the data collection software, overview of the IHA stipulations, marine mammal identification for the project area, safety expectations, and general vessel preparation. The pilots for the gravity/magnetic survey will be included in this training. The aircraft will be in contact with a lead PSO in Anchorage to report sightings.

Due to the temporary nature of the airborne gravity and magnetic survey, and the mitigation measures proposed, impacts to marine mammals are expected to be limited.

2.2.4 Birds

Over 450 species of birds are found in Alaska, most of which can be found in the Cook Inlet area, either as residents or migrating through. These include passerines, raptors, seabirds, waterfowl, and shorebirds (ADNR 2009). Cook Inlet provides an important resting and staging area for migrating birds, as well as breeding and nesting habitat for over 100 species of marine and coastal birds (waterfowl, shorebirds, and seabirds).

Birds migrating to and from breeding areas along the Pacific Flyway may be present in the Cook Inlet area. Large numbers of waterfowl and shorebirds use Cook Inlet coastal areas as stop-over area. During migrations, large numbers of birds arrive typically in early May and depart in mid-to-late May. Bird density is lower in summer since most shorebirds and waterfowl continue to summer nesting grounds. Bird densities increase during the fall migration, however they are approximately half those during the spring migration. (BOEM 2016).

The lower Cook Inlet is important for seabirds due to the shallow coastal areas that support high densities of forage fish. Seabirds tend to nest in colonies on islands and bluffs. Important nesting sites in the Cook Inlet area include Chisik Island and Duck Island, located near Tuxedni Channel; Gull Island, located in Kachemak Bay outside

the lease sale area; and Barren Islands and Shuyak Island. About 5,000 seabirds use Duck Island, including about 3,000 horned puffins, and more than 16,000 use Gull Island. (ADNR, 2009)

Table 5 provides a description of birds occurring near lower Cook Inlet. More detailed information may be found in the Cook Inlet Planning Area Oil and Gas Lease Sale 244 Final EIS (BOEM 2016).

Table 5 Birds Occurring in and Adjacent to the Cook Inlet Lease Sale 244

ECOLOGICAL GROUP	COMMON NAMES	DESCRIPTION
Landbirds	Perching Birds (e.g., warblers, sparrows, flycatchers, swallows, chickadees)	Passeriformes include several distinctly different life history strategies in the Cook Inlet area: large flocks of nocturnally-migrating songbirds pass through the area during migration (many staying locally to breed); many small songbirds (e.g., chickadee sp., redpoll) are common year- round residents; and larger corvids (northwestern crow and common raven) are important year-round scavengers and predators. Apodiformes are hummingbirds, with one species commonly breeding in the Cook Inlet area.
Landbirds	Belted kingfisher	Relatively small birds that plunge-dive for fish in sheltered waters, including coastal bays and marshes. Non-colonial birds that nest in burrows along earthen banks in the proposed Lease Sale Area, and are found there year-round (Walton, Gotthardt, and Fields, 2012).
Raptor and Owl	Falcons	Feed primarily on other birds captured in flight, including ducks. Some species are found year-round in the proposed Lease Sale Area. Territorial birds that nests along river bluffs and cliffs. Four species of falcons breed in Alaska, including gyrfalcon, peregrine falcon, American kestrel, and merlin. Merlin, a small falcon, is particularly common in Cook Inlet and found in the area year round.
Raptor and Owl	Hawks and Eagles (e.g., bald eagle, northern goshawk, osprey)	Bald eagle found in proposed Lease Sale Area year-round; preys on fish, ducks, small mammals, and carrion; territorial nester in trees close to the water; common bird in the Cook Inlet proposed Lease Sale Area year-round, with the highest nest densities occurring outside the proposed Lease Sale Area, in and along the southern shore of Kachemak Bay (ADNR, 2009a).
Raptor and Owl	Owls (e.g., great horned owl, great grey owl, northern hawk-owl, short-eared owl, and snowy owl)	Found in proposed Lease Sale Area year-round (except for short- eared owl); prey on small mammals, birds, and even fish; nest in forested areas (great horned owl, great grey owl, and northern hawk- owl), on open tundra (snowy owl), and in open country including marshes, muskegs, tundra, and prairies (short-eared owl).
Seabird	Jaegers	Three species of pelagic, gull-like birds, coming to land only to nest. Regularly occur in proposed Lease Sale Area during summer and during migration, and can be found over pelagic and coastal waters in winter. Feed by stealing from, scavenging, or directly preying on other birds and eggs.
Seabird	Gulls and Terns	Gregarious. Nest colonially on islands and rocky coasts in proposed Lease Sale Area; found in area year-round. Gulls omnivorous and opportunistic; terns plunge-dive small prey from water surface.
Seabird	Murres, Murrelets, Guillemots, Auklets and Puffins	Pelagic, coming to land only to nest colonially. Dive for fish and crustaceans; ungainly on land. Nest colonially on islands and coastal slopes in proposed Lease Sale Area; some species remain through the winter.
Seabird	Grebes	Waterbirds that breed on freshwater lakes and ponds during the summer and spend the rest of the year on coastal marine waters. Dives from surface for fish and aquatic invertebrates. Nest as isolated pair or in small colonies.
Seabird	Fulmars, Petrels, and Shearwaters	Highly pelagic and aerial species, coming to land only to nest. Found year-round in proposed Lease Sale Area. Feeds from water surface or using shallow dives.
Seabird	Storm-petrels	Small pelagic birds primarily found well offshore but come to land for nesting in cliffside burrows from April to June (Drummond and Leonard, 2009). Plucks food or

		skims oily fat from water surface. Colonial nesters. Found in proposed Lease Sale Area year-round.
Seabird	Cormorants	Waterbirds that sit and swim on the water and dive for fish. Nest colonially in proposed Lease Sale Area; found there year-round.
Waterfowl	Sea ducks, Ducks, Mergansers, Geese, and Swans	A large and diverse family using a variety of habitats including coastal ponds, bays, saltmarshes, rivers, and open ocean. Species feed by dabbling or diving; some have specialized diets. Found in proposed Lease Sale Area year-round.
Waterfowl	Loons	Somewhat large, territorially-breeding waterbirds that dive for fish. Leave water only to nest by late May. Present in proposed Lease Sale Area year-round. During fall migration, some loons congregate on large inland lakes before flying to coastal wintering areas. Loons, such as the common loon, are found on lakes throughout the Cook Inlet area during the summer, and they winter offshore and along the coast from the Aleutians to Baja California (ADNR, 2009a).
Waterfowl	Sandhill crane	Large, long-legged birds; breeds in salt marshes and feeds in agricultural fields in proposed Lease Sale Area. Occurs in small groups to groups of several hundred or more during migration. Feeds primarily on vegetation.
Shorebird	Plovers	Small shorebirds that nest in pairs on beaches and dunes in proposed Lease Sale Area. Pick small prey from intertidal zone. Found in proposed Lease Sale Area in summer and during migration.
Shorebird	Oystercatchers	Medium-sized shorebirds specialized for consuming mussels and other mollusks. Nest in pairs on islands. Nests in proposed Lease Sale Area and found there year-round.
Shorebird	Sandpipers, Turnstones, Godwits, Curlews, and Phalaropes	A diverse family of birds using a variety of habitats including beaches, dunes, mudflats, salt marshes, rocky coasts, and, most unusually, in the case of phalaropes, open water. Short-billed species pick prey from ground or water, while larger-billed species probe into mud or sand. Many species pass through during migration and a few breed in the proposed Lease Sale Area. Rock sandpiper remains in coastal areas through the winter, and red and red-necked phalaropes may be found in open water year-round.

Source: BOEM 2016

Two species of birds that are listed under the ESA may be present in the lower Cook Inlet region: the short-tailed albatross (*Pheobastria albatrus*) which is endangered and the Alaska breeding population of the Steller's eider (*Polysticta stelleri*) which is listed as threatened (BOEM 2016).

The short-tailed albatross is a long-winged pelagic seabird that spends most of its life at sea. It breeds on a limited number of islands in the North Pacific, with the largest breeding colony (greater than 70% of the breeding population) on Torishima Island, Japan. Non-breeding individuals, especially juveniles, are relatively frequent visitors to U.S. waters, however, these birds are not expected to occur in the Cook Inlet Planning Area. (BOEM 2016)

The Steller's eider is a sea duck that spends most of the year in nearshore marine waters. Steller's eiders nest in Arctic and subarctic tundra and feed by dabbling and diving. In Alaska they are primarily found nearshore marine waters. Critical habitat was designated in southwest Alaska, however no critical habitat has been designated near the lower Cook Inlet. (BOEM 2016)

2.2.4.1 Potential Effects on Birds

There is a potential to impact some birds for brief periods as a result of low-flying aircraft due to the timing of the airborne gravity and magnetic survey program during the spring migration (i.e., early May), however, impacts are expected to be temporary and limited.

2.3 SOCIOCULTURAL ENVIRONMENT

2.3.1 Fishing

Fishing is important in the lower Cook Inlet. Fishing is a major industry in Alaska, and there are robust personal use, sport fishing, and subsistence fisheries in Cook Inlet.

2.3.1.1 Commercial Fishing

All five species of Pacific salmon, Pacific herring, and smelt are commercially harvested in the Cook Inlet Area. Numerous groundfish species are also commercially harvested in directed fisheries including Pacific cod, sablefish, lingcod, and pelagic shelf rockfish (primarily black rockfish). Other groundfish species commercially harvested as bycatch to other directed groundfish and halibut fisheries include walleye pollock, skate, and a variety of rockfish species. Shellfish species commercially harvested in the Cook Inlet Area are octopus, which may be retained as bycatch to other directed fisheries, and razor clams. Historically, the area supported crab, littleneck clam, and shrimp fisheries, but these fisheries are currently closed while stocks rebuild. These varied resources are assessed and managed by. (ADF&G 2017a)

Cook Inlet hosts several commercial fisheries; all of which require permits. The commercial fisheries in Cook Inlet are divided into two distinct management areas: the Upper Cook Inlet Management Area and the Lower Cook Inlet Management Area (ADF&G 2017b, c). The Upper Cook Inlet Management Area is not within the proposed airborne gravity and magnetic survey program area.

The Lower Cook Inlet Management Area, which is located within the proposed airborne gravity and magnetic survey area, is comprised of all waters west of the longitude of Cape Fairfield, north of the latitude of Cape Douglas, and south of the latitude of Anchor Point (ADF&G 2017 c). All five species of pacific salmon are present in lower Cook Inlet; however, chum and sockeye are the most economically valuable (ADF&G 2017 c). Over the past three decades, fishery enhancement has played a major role in salmon production in lower Cook Inlet, potentially providing upward of 90 % of the harvest. In addition to a salmon commercial fishery, lower Cook Inlet provides opportunity for groundfish and scallop harvest (ADF&G 2017 c). Historically, lower Cook Inlet supported herring, crab and shrimp fisheries, but these fisheries are closed to allow for the stocks to rebuild (ADF&G 2017c). The estimated commercial salmon harvest for 2016 was 434,311 salmon (based on fish ticket data) including 919 Chinook, 260,465 sockeye, 1,632 coho, 97,144 pink, and 74,151 chum (ADF&G 2016d). The harvest was comprised of 234,363 (53.9 %) commercial common property fishery fish and 199,948 (46.1%) hatchery cost recovery fish (ADF&G 2016d). Estimated groundfish harvest (round weight in pounds) in Cook Inlet for 2017 is described in Table 6.

Table 6 2017 Commercial Harvest Estimates of Groundfish in the Cook Inlet

SPECIES	HARVEST (ROUND WEIGHT IN POUNDS)
Lingcod	3,437

Pacific cod (Parallel Season)	1,609,146
Pacific cod (State waters season)	1,636,864
Rockfish	57,871
Sable fish	19,096
Total	**3,326,414**

Source: ADF&G 2017c

There are three commercial fishing associations that are active regarding activities in Cook Inlet. The Kenai Peninsula Fishermen's Association and the United Cook Inlet Drift Association are focused on activities in Cook Inlet. The United Fishermen of Alaska is a state-wide organization that typically does not get involved in local issues (e.g. Cook Inlet) unless the local organization has requested it and had taken a position on the project/issue.

2.3.1.2 Personal Use Fisheries

In Alaska, "Personal use" is a regulatory category of fishery defined as "the taking, fishing for, or possession of finfish, shellfish, or other fishery resources, by Alaska residents for personal use and not for sale or barter." Personal use fishing is open to Alaskan residents only, and you must have a valid resident Sport Fishing License to participate in personal use fisheries. Personal Use fisheries in the Cook Inlet include those provided in Table 7.

Table 7 Personal Use Fisheries in Cook Inlet

NAME	DESCRIPTION	LOCATION AND TIMING
Kenai River Salmon Fisheries	Personal use dipnet fishery focused on sockeye salmon. Since 2003, Alaskans harvest between 130,000 and 540,000 sockeye salmon annually in this fishery.	Late June through July in the marine waters of Cook Inlet just off the mouth of the Kenai River.
Kasilof River Salmon Fishery	Personal use fisheries are allowed only at the mouth of the Kasilof, which is approximately 180 highway miles south of Anchorage. There are both dipnet and gillnet personal use salmon fisheries allowed on the Kasilof River.	Kasilof River personal use salmon dipnetting is open June 25 through August 7 at the mouth of the Kasilof River.
Fish Creek Salmon Fishery	Fish Creek drains Big Lake, which is located approximately 60 highway miles north of Anchorage, and empties into Knik Arm. Fish Creek crosses Knik Goose Bay Road at mile 16. The Fish Creek personal use salmon fishery may be opened for personal use dipnet fishery by Emergency Order only, and only if the Department projects that the escapement of sockeye salmon into Fish Creek will be above 35,000 fish	Personal use dipnet fishery may open July 15 through July 31 at Fish Creek.

NAME	DESCRIPTION	LOCATION AND TIMING
Cook Inlet Clam Fishery	The most popular fishery for clams in Cook Inlet is the fishery for Razor Clams on the beaches between Homer and Kenai. Clammers take almost a million clams a year from this popular fishery. The "table quality" of the clam is generally considered best in early summer, just prior to the July-August spawning. On the northern beaches, razor clam beds are exposed on any minus tide. However, tides of -2.0 feet or lower are suggested.	Clamming is open year round in the salt waters of Cook Inlet. However, most digging occurs from April through September. The most popular clamming locations are the beaches between Homer and Kenai.
China Poot Bay Salmon Fishery	China Poot is enhanced with sockeye salmon by the Cook Inlet Aquaculture Association, paid for by commercial fishers. Those that escape the commercial nets are available to harvest by personal use dipnetters.	China Poot Bay is located approximately 4 miles southeast of the Homer Spit, across Kachemak Bay. There is no road access to China Poot Bay. Sockeye salmon generally return to China Poot Creek by July 1, and the typical peak is between July 18 and July 31.
Kachemak Bay Salmon Gillnet Fishery	This fishery traditionally targeted wild stocks of Kachemak Bay coho salmon. In the early 1980s, however, increasing numbers of hatchery-produced coho contributed to catches in the fishery. The "Personal Use Coho Salmon Fishery Management Plan," directs the Department to close the fishery when an estimated 1,000 to 2,000 coho salmon are harvested. Prior year fisheries have been short. In 2002, the fishery closed after 72 hours of fishing time, with only 122 permits issued. In 2001, the fishery lasted 96 hours with 154 permits issued. Because of recent efforts by the Division of Sport Fish to begin stocking early-run coho into the Homer Spit Fishing Hole, these additional fish are once again expected to result in the rather rapid achievement of the GHR.	This fishery takes place on the beaches of Kachemak Bay near the community of Homer, about 235 highway miles south of Anchorage. Under 5 AAC 77.549 "Personal Use Coho Salmon Fishery Management Plan," ADF&G is directed to open this fishery from August 16 through September 15, from 6:00 a.m. Monday until 6:00 a.m. Wednesday and from 6:00 a.m. Thursday until 6:00 a.m. Saturday. The short duration of the fishery means that most coho are caught on the first and second openings.
Cook Inlet Herring and Hooligan Fisheries	Hooligan may be taken by dipnet or by drift gillnet. Dipnets may be used in any waters, fresh or salt. Hooligan runs are highly erratic in terms of when they begin to return. Typically, hooligan are in the Southcentral Alaska rivers by the second week of May. Herring may be taken with dipnets or gillnets, except that gillnets may not be used in Turnagain Arm east of a line from Point Possession to point Campbell. Herring are highly erratic in terms of when they begin to return. Typically, herring are in nearshore Southcentral Alaska salt waters by the second week of May. There are no bag or possession limits for herring or hooligan.	Hooligan may be taken in salt waters from April 1 through May 31 and in fresh waters from April 1 through June 15. Herring may be taken in Cook Inlet north of Anchor Point from April 1 through May 31 and in Cook Inlet south of Anchor Point, including Resurrection Bay, and in the North Gulf Coast, year-round.

Note: there are a number of additional personal use fisheries allowed in different areas of Southcentral and Southwestern Alaska for salmon, Dolly Varden, shellfish, herring, suckers and whitefish
Source: ADF&G 2017e - http://www.adfg.alaska.gov/index.cfm?adfg=PersonalUseByAreaSouthcentral.main

2.3.1.3 Sport Fisheries

Sport fisheries in the lower Cook Inlet are managed by the ADF&G as the Lower Cook Inlet Management Area. There are a number of salt and freshwater sport fishing opportunities in the management area as outlined in Table 8. These include:

- Halibut fishing in Kachemak Bay, Cook Inlet and the North Gulf Coast
- Trolling for king salmon occurs year round in these waters too.
- Fishing for king, pink, and silver salmon, Dolly Varden and steelhead trout in streams, many of which are road accessible streams.

- King and silver salmon are also stocked in a few terminal locations in Kachemak Bay, including the famous Nick Dudiak Fishing Lagoon on the Homer Spit.
- Harvesting razor clams from beaches in Cook Inlet
- Harvesting hardshell clams on the south side of Kachemak Bay.
- Remote fishing opportunities for all five species of salmon from Homer to streams in Kachemak Bay, the North Gulf Coast, and West Cook Inlet.

The sport fisheries in the Lower Cook Inlet Management Area are primarily accessed along the Sterling Highway. Homer is the largest community in the area but other small communities such as Ninilchik and Anchor Point are located along the Sterling Highway. These communities have many services available including: motels, bed and breakfasts, restaurants, private and public camping, boat launches, and parking areas. Daily air charter services are available from Anchorage to Homer. Access to remote fisheries is possible via boat, water taxi, and small plane charters.

Table 8 Sport Fisheries in Lower Cook Inlet

NAME	DESCRIPTION
Saltwater Salmon Fisheries	
Saltwater King Salmon Fisheries	In the Lower Cook Inlet Management area, saltwater king salmon fishing occurs year-round the nearshore waters of Kachemak Bay and east Cook Inlet. The sport fishery targets a mixture of Chinook salmon stocks. Mature (spawning) king salmon are caught April through August in the summer fishery while "feeder" (immature) king salmon are caught year-round.
Feeder King Salmon	This small troll fishery is primarily accessed by boat from the Homer or Seldovia harbors. Although feeder king salmon are present year-round, spring and fall are typically when anglers are most successful. Feeder king salmon are caught along the south shore of Kachemak Bay from Point Pogibshi east to Chugachik Island and the shoreline from Homer north to Anchor Point.
Spawner King Salmon	From April through August, when spawner king salmon are returning Cook Inlet streams, anglers often target them in the Cook Inlet waters from Bluff Point north to Deep Creek. Access to the area occurs from private tractor launches at Deep Creek and Anchor Point, the Homer harbor, and some anglers launch small skiffs from the beach at Whiskey Gulch. Anglers find their best success fishing close to shore in waters less than 40 feet deep. Additional spawner king salmon are available at one of the three king salmon enhancement fisheries in Kachemak Bay.
Enhanced (i.e., stocked) Fisheries	
Enhanced Fisheries	King and silver salmon are stocked at terminal locations in Kachemak Bay to provide additional angling opportunities. These include the Nick Dudiak Fishing Lagoon on the Homer Spit, Seldovia Lagoon, and Halibut Cove Lagoon. Fishing for king salmon starts in mid-May, peaks in mid-June and ends by July. Silver salmon fishing occurs from about mid-July through mid-August.
Groundfish Fisheries	
Pacific Halibut	While sport fishing for Pacific halibut may occur February 1 through December 31 annually, most sport harvest occurs between May and early September when weather conditions are fairer. This marine fishery can be accessed out of the Homer Harbor, or the Anchor Point or Deep Creek tractor launch facilities.
Groundfish Fisheries	
Lingcod and Rockfish	The lingcod fishery occurs primarily along the outer coast around the Chugach Islands and around the Barren Islands, accessible through the Homer Harbor, or the Anchor Point or Deep Creek tractor launch facilities via charter or personal fishing vessels. Lingcod spawn December through March and males of the species fiercely guard the nests through June to prevent other fish and shellfish from eating the eggs, making them more vulnerable to harvest during this time. Therefore, lingcod are available for sport harvest from July 1 through December 31. Rockfish are often caught along the outer coast while lingcod fishing, jigging for halibut, or even while trolling for king salmon in Cook Inlet around kelp beds west of Seldovia or near Bluff Point. Rockfish may be kept year-round.

NAME	DESCRIPTION
Shellfish Fisheries	
Razor Clams	Pacific razor clams are found in exposed fine to medium grain sandy beaches along Cook Inlet beaches. Cook Inlet supports popular sport and personal use razor clam fisheries. The remote beaches on the west side of Cook Inlet are accessible by boat or plane and the east side beaches are accessed from the road system. In 2015 the fishery closed from the Kenai River south to the tip of the Homer Spit and remains closed at this time due to low populations of clams.
Hardshell Clams	Hardshell clams are found along the southern shore of Kachemak Bay from Bear Cove to Jakolof Bay. Access is by boat or water taxi. The most commonly harvested types of hardshell clams are Pacific littleneck (steamer) and butter clams. Blue mussels and cockles are also available. The islands in China Poot are popular with clammers looking for butter clams. Littleneck clams are found in most sub bays such as Jakolof and Tutka Bays, Sadie and Bear Coves.
Tanner Crab	Tanner crab live on the seafloor down to about 1,500 feet and anglers use pots to capture them. Most anglers lower a heavily baited crab pot down into 300-500 feet of water. Harvest of Tanner crab is restricted to males whose carapace width is 4.5" or longer from side to side. In order to grow, a Tanner crab must molt.
Freshwater Fisheries	
Roadside Freshwater Fisheries	In the Lower Cook Inlet Management Area, opportunities to fish for salmon and trout are found in four road accessible streams (Ninilchik and Anchor Rivers, Deep and Stariski Creeks). These streams are small coastal streams the feed into Cook Inlet. Sport fishing for king and coho salmon, steelhead trout and Dolly Varden are the most popular. The Ninilchik River and Deep Creek are located in the town of Ninilchik; Stariski Creek and the Anchor River are approximately located near Anchor Point. The Sterling Highway provides access to all four streams. Salmon fishing is only allowed in these streams from the mouth upstream approximately two miles and Stariski Creek is closed to king salmon fishing. Fishing for Steelhead trout and Dolly Varden upstream of the two mile marker is allowed from August 1 through October 31. These streams are closed from November 1 through June 30 except for a few weekends in late May and June.

Source: ADF&G 2017

2.3.1.4 Potential Effects on Fisheries

While some fisheries take place as early as April, most fisheries extend into summer. Due to the survey being performed from aircraft and the limited timeframe of the proposed survey (approximately 2-3 weeks starting May 1, 2018), there is little potential to impact commercial, sport, and personal fisheries. No observable impacts to fish harvests are expected.

2.3.2 Subsistence Activities

The Alaska National Interest Lands Conservation Act defines subsistence use as:

> "The customary and traditional uses by rural Alaska residents of wild, renewable resources for direct personal or family consumption as food, shelter, fuel, clothing, tools, or transportation; for the making and selling of handicraft articles out of nonedible byproducts of fish and wildlife resources taken for personal or family consumption; for barter, or sharing for personal or family consumption; and for customary trade." (16 U.S.C. 3113).

2.3.2.1 Subsistence Use of Marine Mammals

Many of the communities adjacent in the Cook Inlet area participate in subsistence. The subsistence way of life is a continuation of centuries-old traditional patterns. Subsistence resources provide special foods for religious and

social occasions. The sharing, trading, and bartering of subsistence foods structures relationships among communities, while the giving of such foods helps maintain ties with family members elsewhere in Alaska. (BOEM 2016)

Subsistence fishing generally takes place in spring and summer; moose hunting typically occurs in fall and is typically combined with fishing and gathering activities. Federal marine mammal regulations allow Alaska Natives to hunt marine mammals including harbor seals and sea otter. There was a subsistence hunt of Cook Inlet beluga whales until 2005, but there has been no subsistence harvest allowed since 2006 due to the decline in the Cook Inlet beluga population. (BOEM 2016)

Provisions were included in the MMPA for the development of cooperative agreements between the federal government and Alaska Native organizations to conserve marine mammals and provide for the co-management of subsistence use by Alaska Natives. Under Section 119 of the MMPA, NMFS and USFWS can enter into government-to-government agreements with tribally authorized Alaska Native organizations. These cooperative agreements address the co-management of subsistence use of marine mammals in Alaska.

Co-management agreements entered into by NMFS and USFWS address beluga whales, bowhead whales, Steller sea lions, northern fur seals, harbor seals, bearded seals, ringed seals, spotted seals, ribbon seals, sea otters, polar bears and Pacific walrus. Co-management groups for species found in Cook Inlet are provided in Table 9.

Table 9 Marine Mammal Co-Management Groups

NAME	INTEREST
Alaska Native Harbor Seal Commission	The Alaska Native Harbor Seal Commission is a nonprofit tribal consortium comprised of Alaska Native communities within the harbor seal habitat range. The overall goal of the commission is to strengthen and increase the role of Alaska Natives in resource management and decisions affecting the harbor seals and their uses. The Commission helps foster this through our co-management agreement for data analysis, population monitoring and harvest assessment. Interests include harbor seal populations and subsistence hunt. NOAA's National Marine Fisheries Service and the Alaska Native Harbor Seal Commission have agreed to share management of harbor seals in Alaska through an accord that ensures the seal populations are conserved and subsistence harvest needs are met. Note: facebook site was active as of August 2016, but website does not currently appear to be active.
Alaska Sea Otter and Steller Sea Lion Commission	The mission of The Alaska Sea Otter and Steller Sea Lion Commission is to: develop and protect Alaska Natives' rights in Sea Otter and Steller Sea Lion customary and traditional uses through co-management, conservation, research, education and artistic development. Interests include Sea otter and Steller sea lion populations and subsistence hunt. NOAA's National Marine Fisheries Service website (http://www.nmfs.noaa.gov/stories/2012/10/10_23_12alaska_co_management.html) states that there is an existing co-management agreement for Steller sea lions and that they currently are working with the Alaska Sea Otter and Steller Sea Lion Commission.

Note: the Cook Inlet Marine Mammal Council, co-management group for Cook Inlet beluga whales, was disbanded in 2012. The Alaska Beluga Whale Commission is the co-management group for the Western Alaska beluga whale population.

2.3.2.2 Subsistence Fisheries

All Alaska residents are eligible to participate in state subsistence fisheries; rural residents are eligible to participate in federal subsistence fisheries. While personal use fishing requires a valid Resident Sport Fishing License, subsistence fishing does not (ADF&G 2017a). There are several subsistence salmon fisheries in Cook Inlet. The closest fisheries to Cook Inlet's major population centers include the Tyonek Fishery on the west side of Cook Inlet and the Seldovia fishery in Kachemak Bay. Halibut may also be caught as well by residents of rural communities through the Federal subsistence halibut program. Other subsistence fisheries include herring, bottomfish, and shellfish which are described below. Additional fisheries that occur outside the nonsubsistence use areas include whitefish in the Tyone River, as well as several locations for Dolly Varden and smelt. A list of subsistence fisheries in Cook Inlet are provided in Table 10

Table 10 Subsistence Fisheries in Cook Inlet

NAME	TYPE OF FISHERY	INTEREST
Salmon	State of Alaska	Salmon may be harvested for subsistence by obtaining a permit from the Division of Commercial fisheries for the Port Chatham, and Windy Bay subdistricts, and from the Division of Sport Fish in Palmer for the Yentna fish wheel fishery. Permits for the Tyonek, Seldovia, Port Graham, and Nanwalek subsistence salmon fisheries may be obtained from the Division of Subsistence or a local vendor.
Salmon	Federal	For residents of Hope, Cooper Landing, and Ninilchik a federal subsistence fishery is also available. See https://www.doi.gov/subsistence for more details.
Name	Type of Fishery	Interest
Herring	State of Alaska	Herring are found in Cook Inlet and may be harvested using gillnets outside the non-subsistence use area. Gillnets used to take herring may not exceed 50 feet in length and two in in mesh size.
Halibut	Federal	The National Marine Fisheries Service administers the subsistence halibut program under Federal regulations for residents of rural Alaska communities. To obtain a Subsistence Halibut Registration Certificate see the contact information at http://www.fakr.noaa.gov/ram/subsistence/halibut.htm.
Bottomfish	State of Alaska	Subsistence fishing for bottomfish (e.g., ling cod and rockfish) in Cook Inlet, especially in Lower Cook Inlet is authorized as long as the harvest takes place outside the non-subsistence use area, which in Cook Inlet includes State of Alaska waters. Both lingcod and rockfish may be harvested in Cook Inlet using a single hand troll, single hand-held line, or single longline, none of which may have more than five hooks attached to it. Both lingcod and rockfish may also be kept if they are harvested incidentally in another subsistence finfish fishery such as salmon.
Shellfish	State of Alaska	Clams may be taken year round in Cook Inlet and include up to 1000 littleneck clams and 700 butter clams. The other shellfish subsistence fishery is Tanner crab which may be taken with pots, ring nets, dip nets, diving gear, hand lines, or by hand. See subsistence shellfish fishery regulations for more specific details.

Source: ADF&G 2017g

2.3.2.3 Potential Effects on Subsistence Activities

The proposed survey will be performed from aircraft for a limited timeframe. There is the potential to impact local marine mammals for brief periods during operations; however, disruptions are expected to be limited. No impacts to fish and shellfish due to aircraft noise is expected. Due to the limited impacts to subsistence species, no observable impacts to subsistence harvest are expected.

2.3.3 Recreation and Tourism

Recreation and tourism are important areas of economic activity in Cook Inlet and the two are closely linked. Recreational based tourism is also important to Alaska's economy. Popular wildland recreational activities include fishing, hunting, hiking, skiing, bird watching, snowmobiling, off-road vehicle riding, wildlife viewing, recreational mining, mountaineering, whitewater rafting, spelunking, dog mushing, ocean kayaking, and power boating (BOEM 2016). Many visitors to Alaska travel by cruise ship or take day cruises.

Impacts to recreation and tourism experiences and visual and scenic resources occur when the public enjoyment of a particular resource or viewshed is adversely affected by an activity or action that conflicts with individuals' desired or expected conditions. There is a potential that tourists or recreational users could be affected by noise from low flying aircraft from the proposed airborne gravity and magnetic survey. However, due to the limited timeframe of the proposed activities, and the timing early in the cruise season (CLAA 2017), impacts to recreation and tourism is expected to be negligible.

2.3.4 Environmental Justice

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations (59 FR 7629), requires each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

A number of communities near the proposed airborne gravity and magnetic survey meet the definition of minority populations. In general these communities have a higher population of Alaska Natives than in the Kenai Peninsula Borough as a whole. The percentage of minority populations in the communities of Port Graham, Seldovia, Nanwalek, Ninilchik, Chignik Bay, Chignik Lagoon, Chignik Lake, Perryville, Ivanof Bay, Akhiok, Karluk, Larsen Bay, Old Harbor, Ouzinkie, Port Lions, and Tyonek, these communities qualify as environmental justice communities based on their racial/ethnic minority composition. (BOEM 2016)

Due to the type and location of activities, the environmental justice impacts are likely to be those effects on subsistence resources and the opportunity to access them, as addressed in Section 2.3.2.

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