Application for the Incidental Harassment Authorization for the Taking of Marine Mammals in Conjunction with the BlueCrest Alaska Operating LLC Activities at Cosmopolitan State Unit, Alaska, 2016

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Prepared for:

BlueCrest Alaska Operating LLC
3301 C Street, Suite 202
Anchorage, Alaska 99503

Prepared by:

Owl Ridge Natural Resource Consultants, Inc.
6407 Brayton Drive, Suite 204
Anchorage, Alaska 99507
T: 907.344.3448
F: 907.344.3445
www.owlridgenrc.com

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1. DESCRIPTION OF SPECIFIED ACTIVITY

BlueCrest Alaska Operating, LLC (BlueCrest) plans to conduct an oil and gas production drilling program in lower Cook Inlet on State of Alaska Oil and Gas Lease 384403 under the program name of Cosmopolitan State. The program includes drilling up to three wells with the total operation time of about 120 days. The exact timing of the project is dependant upon rig availability, but would occur in the summer operating season between July 1 and October 31, 2016. BlueCrest intends to use the *Spartan 151* jack-up drill rig.

This operation could acoustically harass local marine mammals, which is a form of take defined under the Marine Mammal Protection Act (MMPA) and it is subject to governance under MMPA. Incidental and unintentional harassment takes are permitted with the issuance of an Incidental Harassment Authorization (IHA) from the National Marine Fisheries Service (NMFS). MMPA identifies 14 specific items that must be addressed when applying for an IHA, which allow NMFS to fully evaluate whether the proposed actions remain incidental and unintentional. The 14 items are addressed below in this application, which addresses the 2016 drilling program.

There are four phases of the Cosmopolitan drilling program that could acoustically harass lower Cook Inlet marine mammals:

1. Towing of the jack-up drill rig to the Cosmopolitan State well site.
2. Impact hammering the drive pipe at the well prior to drilling.
3. Active exploratory drilling at the well site with associated generator noise.
4. Vertical Seismic Profiling (VSP) operations that may occur at the completion of drilling.

In addition, the rig will remain active with generators, pumps, and other standard equipment operating during and outside the above phases.

This IHA application addresses marine mammals under the jurisdiction of NMFS only, including Endangered Species Act (ESA)-listed species. Sea otters (*Enhydra lutris*) are under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and are addressed under a separate IHA application.

1.1. Overview of Activity

In 2013, BlueCrest, then in partnership with Buccaneer Energy, conducted exploratory oil and gas drilling at the Cosmopolitan State #A-1 well site (then called Cosmopolitan State #1). The well encountered multiple oil and gas zones within the Tyonek Formation, including gas zones capable of production in paying quantities. Beginning in spring 2016, BlueCrest intends to drill two more wells (Cosmopolitan State #A-2 and #A-3) to tap these identified gas layers for production. These directionally drilled wells have top holes located a few meters from the original Cosmopolitan State #A-1, and together would feed to a future single offshore platform. Both #A-2 and #A-3 may involve test drilling into oil layers. After testing, the oil horizons will be plugged and abandoned, while the gas zones will be suspended pending platform construction. A third well, #B-1, will be located approximately 1.7 kilometer (km) (1 mile [mi]) southeast of the other three wells. This well will be drilled into oil formations to collect geological

information. After testing, the oil horizons will be plugged and abandoned, while the gas zones will be suspended pending platform construction.

All four wells are located within Lease 384403 at the locations provided in Table 1-1 and on Figure 1-1.

Table 1-1. Locations of Cosmopolitan State well sites #A-1/#A-2/#A-3 and #B-1.

Well Name	Latitude	Longitude	Water Depth
Cosmopolitan State #A-1	N 59°53'13"	W 151°52'58"	23.8 m
Cosmopolitan State #A-2	N 59°53'13.1"	W 151°52'58.1"	23.8 m
Cosmopolitan State #A-3	N 59°53'13.2"	W 151°52'58.2"	23.8 m
Cosmopolitan State #B-1	N 59°52'12"	W 151°52'17"	20.7 m

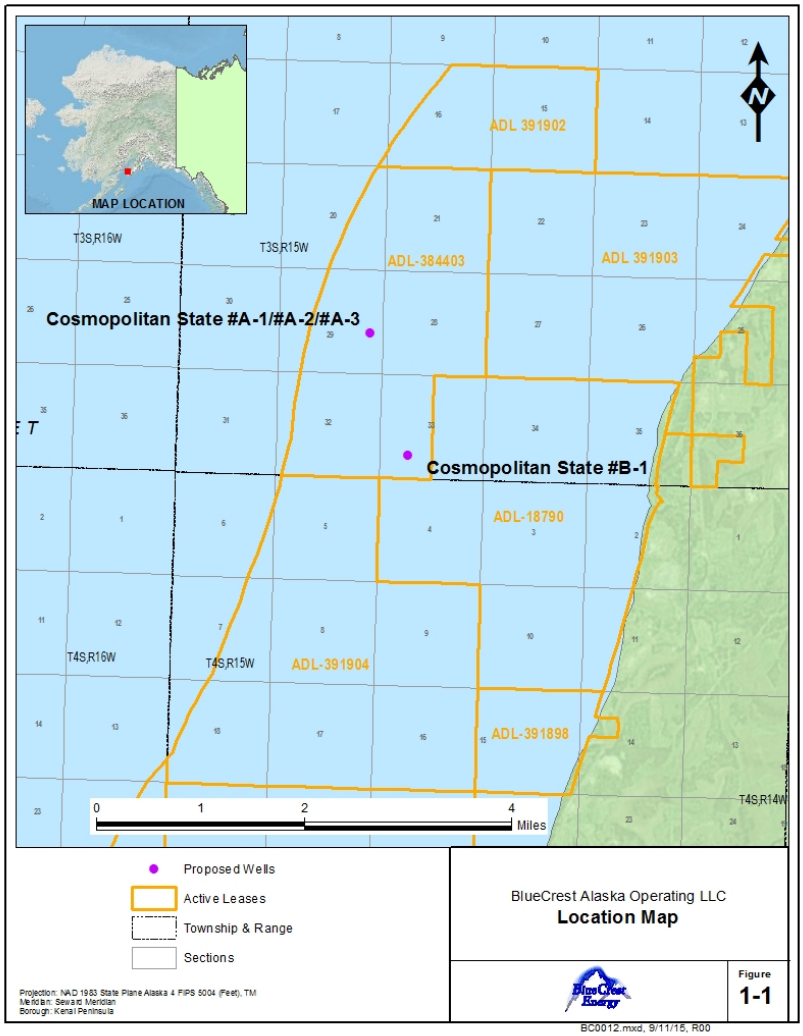

Figure 1-1. Locations of the proposed Cosmopolitan State lease well sites.

BlueCrest will use existing infrastructure and resources found on the Kenai Peninsula and south-central Alaska area whenever possible during the project. These resources include barge landings, private staging areas, airstrips, landfills, water supplies, heavy equipment, and personnel. Most on-shore activity will base from either Kenai or Homer. The phases of the operation and specifications of the equipment to be used are addressed individually below.

1.2. Project Details

1.2.1. Drilling Period

BlueCrest proposes to conduct the exploratory oil drilling program July 1 to October 31, 2016. Exact start date is currently unknown, and dependent on the scheduling availability of the proposed drill rig. It is expected that each well will take approximately 40 days to drill and test.

1.2.2. Drilling Rig

BlueCrest proposes to conduct its production and exploratory drilling using the *Spartan 151* drill rig (Figure 1-2). The *Spartan 151* is a 150 H class independent leg, cantilevered jack-up drill rig with a drilling depth capability of 7,620 meters (m) (25,000 feet [ft]), that can operate in maximum water depths up to 46 m (150 ft). The rig inventory can be found at http://www.spartanoffshore.com/PDF/rig151-inventory130515.pdf.

Figure 1-2. *Spartan 151* jack-up drill rig.

To maintain safety and work efficiency, the *Spartan 151* will be equipped with the following:

- Either a 5,000, 10,000, or 15,000 pounds per square inch (psi) blowout preventer (BOP) stack, for drilling in higher pressure formations found at greater depths in Cook Inlet;
- Sufficient variable deck load to accommodate the increased drilling loads and tubular for deeper drilling;
- Reduced draft characteristics to enable the rig to easily access shallow water locations;
- Riser tensioning system to adequately deal with the extreme tides/currents in up to 91-m (300-ft) water depth;
- Steel hull designed to withstand -10 degrees Celsius (°C) to eliminate the risk of steel failure during operations in Cook Inlet (*i.e.*, built for North Sea arctic conditions); and
- Ability to cantilever over existing platforms for working on development wells.

1.2.3. Rig Mobilization

The *Spartan 151* is currently moored at the Seward Marine Industrial Center directly across Resurrection Bay from the City of Seward. The intention is to move the drill rig to the Cosmopolitan State #B-1 well site in late June, a distance of about 314 kilometers (km; 195 miles [mi]). It is expected that this tow would be accomplished with 3 days. Any move post-project will be controlled by the owner of the drilling rig. The rig will be towed between locations by ocean-going tugs that are licensed to operate in Cook Inlet. Move plans will receive close scrutiny from the rig owner's tow master as well as the owner's insurers, and will be conducted in accordance with state and federal regulations. Rig moves will be conducted in a manner to minimize any potential risk regarding safety as well as cultural or environmental impact.

While under tow to the Cosmopolitan well sites, rig operations will be monitored by BlueCrest and the drilling contractor management. Very High Frequency radio, satellite, and cellular phone communication systems will be used while the rig is under tow. Helicopter transport will also be available. A description of helicopter operations is presented below. A certified marine surveyor will be monitoring during rig moves to ensure cadastral documentation of the rig and well locations and the final rig position at set-down.

1.2.4. Logistics Support and Oil Field Support Services

BlueCrest operations will be directed from the Anchorage BlueCrest office, and from an on-site field office located on the rig. Contractor and vendor facilities are located at Nikiski, Kenai, Homer, and Anchorage.

1.2.4.1. Oil Field Support Services

Table 1-2 presents a list of services, activities, equipment, and supplies that will be mobilized to the exploration drill site during drilling operations. The rig will be stocked with most of the drilling supplies required to complete a full summer program. Deliveries of remaining items, including crew transfers, will be performed by support vessels and helicopters. The majority of the oilfield support services contractors have offices, shops, and additional equipment located in Anchorage, Kenai, and Nikiski that will support

their remote field operations. The tugs used to mobilize the rig will be staged nearby at the OSK Dock in Kenai or at the Homer Dock in Homer for additional rig support and anchor-handling as needed.

Table 1-2. Identified exploration project support services, service activities, equipment, and supplies.

Drill Site Management Drilling	Drill Cuttings & Drill	Well Control BOP
Engineering / Technical Support	Fluids Disposal	Medical
Well Testing / Drill Stem Testing	Rig Camp Operations Catering	On-site EMT
Well Drilling	Housekeeping	1st Aid & General Medical
Casing	Drilling & Completion Operations	Equipment & Supplies
Plugging & Abandonment	Cementing Services, Directional /	Advanced Cardiac Life Support /
Drill Rig Crew	MWD / LWD	Trauma Life Support Equipment &
Rig Mobilization	Mud Logging, Service Packers	Supplies
Marine Surveyor	Completion Equipment, Casing	Marine Mammal Monitoring
Heavy Lift Vessel	Accessories	Certified Biologist / Marine
Oceangoing Tug Boats	Tubing and Perforating	Mammal Observers
Waste Management	Wireline and Slickline	Oil Spill Response Action
Dumpsters	Liner Hanging	Contractors (ODPCP)
Landfill	Drill Pipe Rental, Drilling Jars	Spill Technicians and Spill
Recycling	Fishing Services and Tubular	Prevention
Wastewater Treatment	Inspections	Fuel-Fluid Transfers

1.2.4.2. Helicopter Support

Helicopter logistics for project operations will include transportation for personnel, groceries, and supplies. Helicopter support will consist of a twin turbine Bell 212 (or equivalent) helicopter certified for instrument flight rules land and over water operations. Helicopter crews and support personnel will be housed in existing Kenai area facilities. The helicopter will be based at the Kenai Airport and/or Homer Airport to support rig crew changes and cargo handling. Fueling will take place at these facilities. No helicopter refueling will take place on the rig.

Helicopter flights to and from the rig are expected to average two per day. Flight routes will follow a direct route to and from the rig location, and flight heights will be maintained 300 to 450 m (1,000 to 1,500 ft) above ground level to avoid acoustical harassment of marine mammals (Richardson *et al.* 1995). The aircraft will be dedicated to the drilling operation and will be available for service 24 hr/day. A replacement aircraft will be available when major maintenance items are scheduled.

Rig crews, operator personnel, and third party personnel not already on the rig or in the Cook Inlet area will be flown to the Kenai Airport from Anchorage by scheduled commercial or chartered aircraft. Personnel will then be transported by helicopter to the rig. Personnel will be housed in an appropriate facility in the Homer or Kenai area in the event of inclement weather.

Alternate landing zones will be identified and available for diverted flights if weather prevents a helicopter landing at the Kenai Airport, such as the Nikiski OSK facility, Homer Airport, or the Hanson drill site helipad. Sufficient fuel will be carried on all flights under inclement weather conditions to return to the rig as an additional alternate destination. The rig will be provided with adequate instrumentation, communications, a helipad, and navigational aids to ensure all flight operations are conducted safely at all times.

1.2.4.3. Supply Vessel Support

Major supplies will be staged on-shore at the Kenai OSK Dock. Required supplies and equipment will be moved from the staging area by contracted supply vessels and loaded aboard the rig when the rig is established on a drilling location and will include fuel, drilling water, mud materials, cement, casing, and well service equipment. Supply vessels also will be outfitted with fire-fighting systems as part of fire prevention and control as required by Cook Inlet Spill Prevention and Response, Inc. (CISPRI).

The specific supply vessels have not been identified; however, typical offshore drilling support work vessels are of steel construction with strengthened hulls to provide the capability of working in extreme conditions.

1.2.4.4. Fuel

Rig equipment will use diesel fuel or electricity from generators. Personnel associated with fuel delivery, transfer, and handling will be knowledgeable of Industry Best Management Practices (BMP) related to fuel transfer and handing, drum labeling, secondary containment guidelines, and the use of liners/drip trays.

The jack-up rig will take on a maximum fuel load prior to operations to reduce fuel transfers during drilling. Commercial tank farms in the Nikiski or Kenai area will supply fuel transported by barge as needed. The rig barge master will be in charge of re-fueling and fluid transfers between the rig and fuel barge, and subsequent transfers between tanks on the rig.

1.2.5. Drilling Program and Well Operations

The drilling program for the well has been described in detail in the Plan of Operations filed with the Alaska Department of Natural Resources Division of Oil and Gas. The Plan of Operations presents information on the drilling mud program; casing design, formation evaluation program; cementing programs; and other engineering information.

After rig up/rig acceptance by BlueCrest, the wells will be spudded and drilled to bottom-hole depths of approximately 2,100 to 4,900 m (7,000 to 16,000 ft) depending on the well. It is expected that each well will take about 40 days to complete, including up to 15 days of well testing, or about 120 days to complete the full program.

1.2.5.1. Blowout Prevention Program and Equipment

All operating procedures on the rig, whether automated or controlled by company or contractor personnel, are specifically designed to prevent a loss of well control. The primary method of well control utilizes the hydrostatic pressure exerted by a column of drilling mud of sufficient density to prevent an undesired flow of formation fluid into the well bore. In the unlikely event that primary control is lost, surface BOP equipment would be used for secondary control. BlueCrest will use a 10,000 or 15,000 pounds per square inch (psi) BOP stack due to the higher pressure formations known to exist in Cook Inlet.

1.2.5.2. Well Plugging and Abandonment (P&A)

When planned and permitted operations are completed, the well will be suspended according to Alaska Oil and Gas Conservation Commission (AOGCC) regulations. The well string is sealed and cemented

with mechanical plugging devices to prevent the movement of any reservoir fluids between various strata. The well casing will be landed in a mudline hanger. There will be caps covering each of the casing strings and then a cover cap over the mudline hanger. The P&A procedures would be presented to AOGCC prior to beginning operations.

1.2.5.3. Waste Management Program

The on-site Health, Safety, and Environmental Advisor will supervise drilling waste, solid waste, and wastewater, and will be responsible for authorized discharge and proper manifesting for transport and off-site disposal.

1.2.5.4. Drilling Fluids and Cuttings

Drilling wastes include drilling fluids, known as mud, rock cuttings, and formation waters. Drilling wastes (non-hydrocarbon) will be discharged to the Cook Inlet under an approved Alaska Pollution Discharge Elimination System (APDES) general permit or sent to an approved waste disposal facility. Drilling wastes (hydrocarbon) will be delivered to an onshore permitted location for disposal. BlueCrest will follow BMP and all stipulations of the applicable permits for this activity. Fluids and cutting management does not produce any noise signature to the marine environment that is not already included in other activities provided herein.

1.3. Project Components of Relevance to Acoustical Harassment of Marine Mammals

The project components with a potential for harassment of marine mammals include:

1. Impact hammering of the drive pipe at the well prior to drilling, and
2. VSP operations that may occur at the completion of drilling.

For these activities the primary impact of concern is the effect the noise generated by these operations could have on local marine mammals. Underwater noise associated with drilling and rig operation has already been determined by NMFS in prior consultations to have little effect on marine mammals (based on Marine Acoustics, Inc.'s [2011] acoustical testing of the *Spartan 151* while drilling), thus is not addressed further in this application. Towing generates continuous cavitation noise; therefore, continuous noise criteria developed by NMFS can apply (*i.e.*, Level B disturbance harassment with exposure to sound levels >120 dB re 1 μPa-m [rms]). However, NMFS (Dale Youngkin, pers. comm.) has rule that rig tow activities for this project do not rise to the level of take and, thus, no take authorizations are requested. Helicopters will be used to transport personnel on and off the drill rig, but any noise related impacts to marine mammals will be avoided by maintaining 300- to 450-m (1,000- to 1,500-ft) flight altitudes. The conductor pipe driving and VSP are impulsive noise activities. For them the Level B disturbance exposure to sound levels >160 dB re 1 μPa-m (rms) applies, and take is addressed relative to noise levels exceeding 160 dB.

1.3.1. Drive Pipe Placement

A drive pipe is a relatively short, large-diameter pipe driven into the sediment prior to the drilling of oil wells. The drive pipe also serves to support the initial sedimentary part of the well, preventing the looser

surface layer from collapsing and obstructing the wellbore. Drive pipes are usually installed using pile driving techniques. (Drive pipe is often synonymous to the term conductor pipe, although a 50.8-cm [20-in] conductor pipe will be drilled [not hammered] inside the drive pipe, and is used to transport or "conduct" drillhead cuttings to the surface. There are no noise concerns associated with the conductor pipe drilling.) BlueCrest proposes to drive approximately 60 m (200 ft below mudline) of 76.2-cm (30-in) pipe at each wells site prior to drilling using a Delmar D62-22 impact hammer. This hammer has impact weight of 6,200 kilograms (kg) (13,640 pounds [lbs]) and reaches a maximum impact energy of 224 kilonewton-m (165,215 ft-lbs) at a drop height of 3.6 m (12 ft). Illingworth & Rodkin (2014) measured the noise from a hammer operating from the *Endeavour* in 2013 and found noise levels exceeding 160 dB re 1µPa (rms) out to 1.63 km (1 mi; disturbance zone), 180 dB re 1µPa (rms) to 170 m (560 ft; cetacean injury zone), and 190 dB re 1µPa (rms) to 55 m (180 ft; pinniped injury zone).

The drive pipe driving event is expected to last one to three days at each well site, although actual noise generation (pounding) would occur only intermittently during this period.

1.3.2. Vertical Seismic Profiling

Data on geological strata depth collected during initial seismic surveys at the surface can only be inferred. However, once a well is drilled, accurate follow-up seismic data can be collected by placing a receiver at known depths in the borehole and shooting a seismic airgun at the surface near the borehole. These data provide not only high resolution images of the geological layers penetrated by the borehole, but can be used to accurately correlate (or correct) these original surface seismic data. The procedure is known as vertical seismic profiling, or VSP.

BlueCrest intends to conduct VSP operations at the end of drilling each well using an array of airguns with total volumes of between 600 and 880 cubic inches (in^3). The actual size of the airgun array will not be determined until the final well depth is known. The VSP operation is expected to last less than two days at each well site. Illingworth & Rodkin (2014) measured noise levels associated with VSP (using a 750 in^3 airgun array) conducted at Cosmopolitan State #A-1 in 2013. The results indicated that the 190 dB radius (Level A take threshold for pinnipeds) from source was 120 m (394 ft), the 180 dB radius (the Level A take threshold for cetaceans) was 240 m (787 ft), and the 160 dB radius (Level B disturbance take threshold) was 2.47 km (1.54 mi).

1.4. Maintaining Safe Radii

Acoustical injury to marine mammals can occur if received noise levels exceed 180 dB re 1 µPa (rms) for whales or 190 dB re 1 µPa (rms) for pinnipeds. This application is not requesting authorization of these takes, termed Level A injury takes, but instead will implement mitigation measures to avoid these takes. The pipe driving and VSP operations do generate impulsive noises exceeding 180 dB re 1 µPa (rms). Based on the estimated distances to the 180 dB isopleth addressed above, a 170-m (560-ft) shutdown safety zone will be established and monitored during pipe driving, while a 240-m (787-ft) shutdown safety zone will be monitored during VSP operations.

2. DATES, DURATION, AND SPECIFIC GEOGRAPHICAL REGION

The request for incidental harassment authorization is for the 2016 drilling season at BlueCrest's Cosmopolitan State unit in lower Cook Inlet. Exploratory drilling will be conducted within a 120-day operating time frame and completed by October 31, 2016. It is expected that the program will take the full 120 days to complete.

3. SPECIES AND NUMBERS OF MARINE MAMMALS

The cetaceans and pinnipeds most likely to be found in the vicinity of the Cosmopolitan State activity area is best reflected in the data collected during marine mammal monitoring at Cosmopolitan State #A-1 during the summer of 2013 (Owl Ridge 2014). Between May and August (112 days), 1 beluga whale (*Delphinapterus leucas*), 48 humpback whales (*Megaptera novaeangliae*), 104 harbor porpoise (*Phocoena phocoena*), 72 harbor seals (*Phoca vitulina*), 32 minke whales (*Balaenoptera acutorostra*), 19 Dall's porpoise (*Phocoenoides dalli*), 12 gray whales (*Eschrichtius robustus*), 7 Steller sea lions (*Eumetopias jubatus*), and 2 killer whales (*Orcinus orca*) were recorded. Any of these species could be expected to be encountered in during the 2015 operations. The stock populations for the marine mammals found in Cook Inlet are shown in Table 3-1.

Table 3-1. Cetaceans and pinnipeds in the Cook Inlet project area.

Species	Stock Estimate[1]	Comment
Humpback Whale (*Megaptera novaeangliae*)	10,103	Central North Pacific Stock, ESA-listed as Endangered
Minke Whale (*Balaenoptera acutorostra*)	1,233[2]	Alaska Stock
Gray Whale (*Eschrichtius robustus*)	20,990[3]	Eastern North Pacific Stock
Beluga Whale (*Delphinapterus leucas*)	340	Cook Inlet Stock, ESA-listed as Endangered
Killer Whale (*Orcinus orca*)	2,347	Alaska Resident Stock
Killer Whale (*Orcinus orca*)	587	Alaska Transient Stock
Harbor Porpoise (*Phocoena phocoena*)	31,046	Gulf of Alaska Stock
Dall's Porpoise *(Phocoenoides dalli*)	83,400	Alaska Stock
Harbor Seal (*Phoca vitulina*)	22,900	Cook Inlet/Shelikof Stock
Steller Sea Lion (*Eumetopias jubatus*)	55,422	Western U.S. Stock

[1] Allen and Angliss (2015)
[2] Zerbini et al. (2006)
[3] Carretta et al. (2015)

4. AFFECTED SPECIES STATUS AND DISTRIBUTION

4.1. Humpback Whale (*Megaptera novaeangliae*)

Although there is considerable distributional overlap in the humpback whale stocks that use Alaskan waters, the whales seasonally found in lower Cook Inlet are probably of the Central North Pacific stock.

Listed as endangered under the ESA, this stock has recently been estimated at 10,103 individuals (Allen and Angliss 2015). The Central North Pacific stock winters in Hawaii and summers from British Columbia to the Aleutian Islands (Calambokidis *et al.* 1997), including Cook Inlet.

In the North Pacific, humpback whales feed primarily on krill (especially euphausiids) and small schooling fishes including Pacific herring (*Clupea pallasi*), Pacific sand lance (*Ammodytes hexapterus*), capelin (*Mallotus villosus*), and eulachon (*Thaleicthys pacificus*) (Clapham 2002). Based on both fecal samples and isotope analysis, Witteveen et al. (2011) found humpback whales near Kodiak Island feed largely on euphausiids, capelin, Pacific sand lance, and juvenile walleye pollock (*Theragra chalcogramma*). The diet of humpback whales feeding in Kachemak Bay and near Anchor Point is unknown, but Cook Inlet seabird and forage fish studies (Piatt and Roseneau 1997) found large concentrations of sand lance in this region.

Within Cook Inlet, humpback whales are largely confined to the lower Inlet. They have been regularly seen near Kachemak Bay during the summer months (Rugh *et al.* 2005a), and there is a whale-watching venture in Homer capitalizing on this seasonal event. There are anecdotal observations of humpback whales as far north as Anchor Point, but very few records to the latitude of the Cosmopolitan State lease area (Barbara Mahoney, NMFS, pers. comm.). It was because of a lack of records for the area that humpback whales were not addressed in the April 25, 2013 Letter of Concurrence from NMFS. However, 29 sightings of 48 humpback whales were recorded by marine mammal observers during the 2013 marine mammal monitoring program at Cosmopolitan State well site #A-1 (Owl Ridge 2014), although nearly all these animals were observed at a distance well south of the well site, many records were repeat sightings of the same animals, and none were recorded inside an active harassment zone. Nevertheless, the number of humpback whales occasionally summering north of Anchor Point appears to me more than originally thought and thus they are included in this application.

4.2. Minke Whale (*Balaenoptera acutorostra*)

Minke whales are the smallest of the rorqual group of baleen whales reaching lengths of up to 11 m (35 ft). They are also the most common species of baleen whales. There are no minke whale population estimates for the North Pacific. However, Zerbini *et al.* (2006) did estimate the coastal population between Kenai Fjords and the Aleutian Islands at 1,233 animals. Minke whales have a very catholic diet feeding on preferred prey items most abundant at a given time and location (Leatherwood and Reeves 1983). In the southern hemisphere, minkes feed largely on krill, while in the North Pacific they feed on schooling fish such as herring, sandlance, and walleye pollock (Reeves et al. 2002). There is no dietary information specific to Alaska although anecdotal observations of minke whales feeding on shoaling fish off Anchor Point have been reported to NMFS (Brad Smith, pers. comm.).

During Cook Inlet-wide aerial surveys conducted from 1993 to 2004, minke whales were encountered only twice (1998, 1999), both times off Anchor Point approximately 30 km (19 mi) northwest of Homer. A minke whale was also reported off Cape Starichkof in late fall 2011 (A. Holmes, pers. comm.) and January 2013 (E. Fernandez and C. Hesselbach, pers. comm.), suggesting this location is regularly used by minke whales, including during the winter. More importantly, 42 minke whales were recorded at Cosmopolitan #A-1 between May and August 2013 in patterns suggesting the presence of a small, yet conspicuous summer population (at least) within the Cosmopolitan State unit, although all but three

whales were recorded over 300 m (984 ft) from the active drill rig. There are no records north of Cape Starichkof.

4.3. Gray Whale (*Eschrichtius robustus*)

Each spring, the Eastern North Pacific stock of gray whale migrates 8,000 km (5,000 mi) northward from breeding lagoons in Baja California to feeding grounds in the Bering and Chukchi seas, reversing their travel in the fall (Rice and Wolman 1971). Their migration route is for the most part coastal until they reach the feeding grounds. A small portion of whales do not annually complete the full circuit, as some can be found in summer feeding along the Oregon, Washington, British Columbia, and Alaskan coasts (Rice *et al.* 1984, Moore *et al.* 2007).

Gray whales typically do not feed during their northward migration through Alaskan waters until they reach the Chukchi Sea where they spend the summer feeding mostly on ampeliscid amphipods, a benthic crustacean (Rice and Wolman 1971, Highsmith and Coyle 1992, Nelson *et al.* 1994). However, small groups of whales may opportunistically feed along route (Nerini 1984), with some groups actually becoming "resident" at areas of high localized prey densities (Calambokidis *et al.* 2004). One "resident" group, known as the Kodiak group, has been observed year-round at Ugak Bay (Kodiak Island) feeding on dense populations of hooded shrimp or cumaceans (Diastylidae), a benthic crustacean (Moore *et al.* 2007). The seven groups of gray whales recorded at the Cosmopolitan State lease site in 2013 (Owl Ridge 2014), mostly in July, may have been repeated sightings of the same one or two small groups, suggesting seasonal foraging use of the Anchor Point area by a few whales. There is no information regarding the diet of gray whales using lower Cook Inlet, but available prey could be similar to that found at Ugak Bay.

By the 1960s, human exploitation reduced this stock down to an estimated "few thousand" animals (Jones and Swartz 2002). However, by the late 1980s, the stock was appearing to reach carrying capacity and estimated to be at 26,600 animals (Jones and Swartz 2002). By 2002, that stock had been reduced to about 16,000 animals, especially following unusually high mortality events in 1999 and 2000 (Allen and Angliss 2015). The stock has continued to grow since then and is currently estimated at 20,990 animals (Carretta *et al*. 2015).

Most gray whales migrate past the mouth of Cook Inlet to and from northern feeding grounds. However, small numbers of summering gray whales have been noted by fishermen near Kachemak Bay and north of Anchor Point. Further, summer gray whales were recorded a dozen times offshore of Cape Starichkof by marine mammal observers monitoring BlueCrest's Cosmopolitan State #A-1 drilling program between May and August 2013; however, none of this animals closely approached the drilling operations and most were observed well south of the well site.

4.4. Beluga Whale (*Delphinapterus leucas*)

The Cook Inlet beluga whale Distinct Population Stock (DPS) is a small geographically isolated population that is separated from other beluga populations by the Alaska Peninsula. The population is genetically (mtDNA) distinct from other Alaska populations suggesting the Peninsula is an effective barrier to genetic exchange (O'Corry-Crowe et al. 1997) and that these whales may have been separated from other stocks at least since the last ice age. Laidre *et al.* (2000) examined data from more than 20

marine mammal surveys conducted in the northern Gulf of Alaska and found that sightings of belugas outside Cook Inlet were exceedingly rare, and these were composed of a few stragglers from the Cook Inlet DPS observed at Kodiak Island, Prince William Sound, and Yakutat Bay. Several marine mammal surveys specific to Cook Inlet (Laidre *et al.* 2000, Speckman and Piatt 2000), including those that concentrated on beluga whales (Rugh *et al.* 2000, 2005a), clearly indicate that this stock largely confines itself to Cook Inlet. There is no indication that these whales make forays into the Bering Sea where they might intermix with other Alaskan stocks.

The Cook Inlet beluga DPS was originally estimated at 1,300 whales in 1979 (Calkins 1989) and has been the focus of management concerns since experiencing a dramatic decline in the 1990s. Between 1994 and 1998 the stock declined 47% and this decline is attributed to overharvesting by subsistence hunting. Subsistence hunting was estimated to then have annually removed 10-15% of the population. Only five belugas have been harvested since 1999, yet the population has continued to decline (Allen and Angliss 2015), with the most recent estimate at 340 animals (Shelden *et al.* 2015). The NMFS listed the population as "depleted" in 2000 as a consequence of the decline, and as "endangered" under the ESA in 2008 when the population failed to recover following a moratorium on subsistence harvest. In April 2011, the NMFS designated critical habitat for the beluga under the ESA (Figure 4-1).

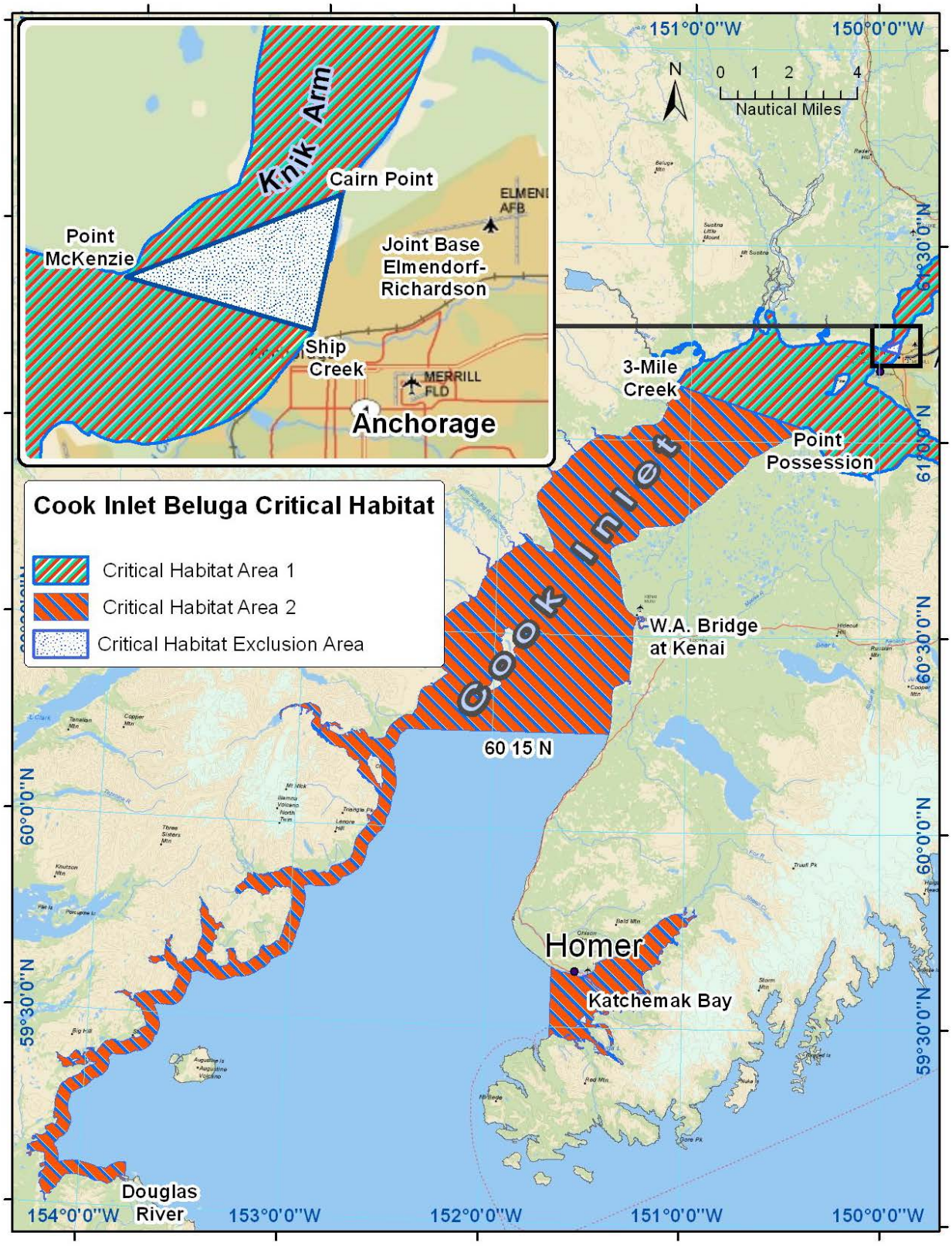

Figure 4-1. Cook Inlet beluga whale designated critical habitat.

Prior to the decline, this DPS was believed to range throughout Cook Inlet and occasionally into Prince William Sound and Yakutat (Nemeth *et al.* 2007). However the range has contracted coincident with the population reduction (Speckman and Piatt 2000). 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 and salmon (*Oncorhynchus* spp.) (Moore *et al.* 2000). Critical Habitat Area 1 reflects this summer distribution (Figure 4-1). During the winter, beluga whales concentrate in deeper waters in the mid-inlet to Kalgin Island, and in the shallow waters along the west shore of Cook Inlet to Kamishak Bay (Critical Habitat Area 2; Figure 4-1). Some whales may also winter in and near Kachemak Bay.

The Cosmopolitan State lease does not fall within beluga whale critical habitat. Based on Goetz *et al.* (2012) beluga whale densities both along the wet-route from Port Graham and at the well site are very low (<0.01 whales/km^2). In the past, beluga whales have been observed in Kachemak Bay, which presumably could have traveled between the bay and upper Cook Inlet following a route past the current location of the Cosmopolitan State lease. However, reported observations since 1975 show most whale activity in Kachemak Bay occurred prior to 2000, and there have been no sightings in the bay since 2007 (Barbara Mahoney, NMFS, pers. comm.). However, in 2013 a single beluga was sighted a few kilometers from Cosmopolitan State well site #A-1 (Owl Ridge 2014).

4.5. Killer Whale (*Orcinus orca*)

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 (Allen and Angliss 2015). The resident stock is estimated at 2,084 animals and occurs from Southeast Alaska to the Bering Sea (Allen and Angliss 2015). Resident whales feed exclusively on fish and are genetically distinct from transient whales (Saulitis *et al.* 2000). The transient whales feed primarily on marine mammals (Saulitis *et al.* 2000). The transient population inhabiting the Gulf of Alaska shares mitochondrial DNA haplotypes with whales found along the Aleutian Islands and the Bering Sea suggesting a common stock, although there appears to be some subpopulation genetic structuring occurring to suggest the gene flow between groups is limited (see Allen and Angliss 2015). For the three regions combined, the transient population has been estimated at 552 animals (Allen and Angliss 2015).

Killer whales are occasionally observed in lower Cook Inlet, especially near Homer and Port Graham (Shelden *et al.* 2003, Rugh *et al.* 2005a). A concentration of sightings near Homer and inside Kachemak Bay may represent high use, or high observer-effort given most records are from a whale-watching venture based in Homer. 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). Prior to the 1980s, killer whale sightings in upper Cook Inlet were rare. 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). These sporadic ventures of transient whales into beluga summering grounds have been implicated as a possible contributor to decline of Cook Inlet belugas in the 1990s, although the number of confirmed mortalities from killer whales is small (Shelden *et al.* 2003). Eighteen killer whales were recorded during the May to August 2013 marine

mammal monitoring activities at Cosmopolitan State #A-1 (Owl Ridge 2014). Which stock these whales belonged to was undetermined.

4.6. Harbor Porpoise (*Phocoena phocoena*)

Harbor porpoise are small (1.5 m [5 ft] length), relatively inconspicuous toothed whales. The Gulf of Alaska Stock is distributed from Cape Suckling to Unimak Pass and was most recently estimated at 31,046 animals (Allen and Angliss 2015). They are found primarily in coastal waters less than 100 m (328 ft) deep (Hobbs and Waite 2010) where they feed on Pacific herring, other schooling fishes, and cephalopods. The diet of harbor porpoise within Cook Inlet is unknown, although seasonal distribution patterns of porpoise (Shelden et al. 2014) coincident with eulachon, longfin smelt (*Spirinchus thaleichthys*), capelin, herring, and salmon concentrations (Moulton 1997) suggest these fish are important prey items for Cook Inlet harbor porpoise.

Although they have been frequently observed during aerial surveys in Cook Inlet, most sightings were of single animals, and were concentrated at Chinitna and Tuxedni bays on the west side of lower Cook Inlet (Rugh *et al.* 2005). Dahlheim *et al.* (2000) estimated the 1991 Cook Inlet-wide population at only 136 animals. However, harbor porpoise were the most commonly observed marine mammal (excluding sea otters) recorded at Cosmopolitan State #A-1 during monitoring of marine mammal activities between May and August 2013. At least 154 harbor porpoise were recorded, but only 12 were observed inside 260 m (853 ft) of the drill rig.

4.7. Dall's Porpoise (*Phocoenoides dalli*)

Dall's porpoise are widely distributed throughout the North Pacific Ocean including Alaska, although they are not found in upper Cook Inlet and the shallower waters of the Bering, Chukchi, and Beaufort Seas (Allen and Angliss 2015). Compared to harbor porpoise, Dall's porpoise prefer the deep offshore and shelf slope waters where they feed largely on mesopelagic fish and squid, but also herring in more nearshore waters (Jefferson 2002). There is no diet information specific to Cook Inlet.

The Alaskan population has been estimated at 83,400 animals (Allen and Angliss 2015), making it one of the more common cetaceans in the state. Dall's porpoise have been observed in lower Cook Inlet, including Kachemak Bay and near Anchor Point, but sightings there are rare. During 112 days of monitoring during the Cosmopolitan State #1 drilling operation between May and August 2013, 19 Dall's porpoise were recorded (all during August), but none in close proximity (less than 260 m [853 ft]) of the drill rig.

4.8. Harbor Seal (*Phoca vitulina*)

At over 150,000 animals state-wide (Allen and Angliss 2015), harbor seals are one of the more common marine mammal species in Alaskan waters. They are most commonly seen hauled out at tidal flats and rocky areas. Harbor seals feed largely on schooling fish such a walleye pollock, Pacific cod (*Gadus macrocephalus*), salmon (*Onchorhynchus* spp.), Pacific herring, eulachon (*Thaleichthys pacificus*), and squid. Although harbor seals may make seasonal movements in response to prey, they are resident to Alaska and do not migrate.

The Cook Inlet/Shelikof Stock, ranging from approximately Anchorage down along the south side of the Alaska Peninsula to Unimak Pass, has been recently estimated at a stable 22,900 (Allen and Angliss 2015). They concentrate at river mouths and embayments of lower Cook Inlet, including the Fox River mouth in Kachemak Bay (Rugh *et al.* 2005). Montgomery *et al.* (2007) recorded more than 200 haulout sites in lower Cook Inlet alone. However, only a few dozen 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). 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 SAE's (with Apache) 2012 Cook Inlet seismic program. Montgomery *et al.* (2007) also found seals elsewhere in Cook Inlet to move in response to local steelhead (*Oncorhynchus mykiss*) and salmon runs. During the marine mammal monitoring associated with 2013 drilling activities at Cosmopolitan State, 77 harbor seals were recorded. Their inquisitive nature probably accounts for the observation that 18 of these seals were observed within 260 m (853 ft) of the active drill rig.

4.9. Steller Sea Lion (*Eumetopias jubatus*)

The Western Stock of the Steller sea lion is defined as all populations west of longitude 144°W to the western end of the Aleutian Islands. The most recent estimate for this stock is 55,422 animals (Allen and Angliss 2015), considerably less than the estimated 140,000 animals in the 1950s (Merrick *et al.* 1987). Because of this dramatic decline, the stock was listed as threatened under ESA in 1990, and was relisted as endangered in 1997. Critical habitat was designated in 1993, and is defined as a 20-nautical-mi (nm) radius around all major rookeries and haulout sites.

Steller sea lions inhabit lower Cook Inlet, especially in the vicinity of Shaw Island and Elizabeth Island (Nagahut Rocks) haulout sites (Rugh *et al.* 2005a), but are rarely seen in upper Cook Inlet (Nemeth *et al.* 2007). Of the 42 Steller sea lion groups recorded during Cook Inlet aerial surveys between 1993 and 2004, none were recorded north of Anchor Point and only one in the vicinity of Kachemak Bay (Rugh *et al.* 2005a). Marine mammal observers associated with Buccaneer/BlueCrest's 2013 drilling project off Cape Starichkof did observe seven Steller sea lions (Owl Ridge 2014).

The 20-nm buffer was established based on telemetry data that indicated these sea lions concentrated their summer foraging effort within this distance of rookeries and haul outs. Most of Cook Inlet may not provide adequate foraging conditions for sea lions for establishing a major haul out presence. Steller sea lions feed largely on walleye pollock, salmon, and arrowtooth flounder (*Atheresthes stomias*) during the summer, and walleye pollock and Pacific cod during the winter (Sinclair and Zeppelin 2002), none of which, except for salmon, are found in abundance in Cook Inlet (Nemeth *et al.* 2007).

Small numbers of Steller sea lions are likely to be encountered during BlueCrest's planned operations in 2015 based on the observations of sea lions made at the lease site in 2013 (Owl Ridge 2014).

5. TYPE OF INCIDENTAL TAKING AUTHORIZATION REQUESTED

The incidental take authorization requested is for Level B noise harassment associated with the exploratory oil and gas drilling activity. Actual Level B exposures will depend upon numbers of marine

mammals occurring within the 160 dB zone of influence (ZOI or area ensonified) at the time of impulsive noise activity (conductor pipe driving and VSP). No Level A injury exposures (noise exceeding 180 dB re 1 µPa [rms] for cetaceans and 190 dB re 1 µPa [rms] for pinnipeds) are expected with the proposed mitigation measures (see Section 1.3 and Appendix I) in place.

6. TAKE ESTIMATES FOR MARINE MAMMALS

6.1. Basis for Estimating Numbers of Marine Mammals That Might Be "Taken by Harassment"

Exposure to impulsive sound levels greater than 160 dB re 1 µPa (rms) can elicit behavioral changes in marine mammals that might be detrimental to health and long-term survival where it disrupts normal behavioral routines, and is the Level B harassment criteria for acoustical disturbance under MMPA (NMFS 2005). Exposure to sound levels greater than 180 dB re 1 µPa (rms) for cetaceans and 190 dB re 1 µPa (rms) for pinnipeds can lead to physical injury including temporary loss in hearing sensitivity and permanent hearing damage. These values are the MMPA Level A injury criterion. However, only the impulsive noise sources (pipe driving and VSP) are likely to exceed 180 dB (see below). Shutdown safety zones will be established to avoid Level A injury take (see Section 1.4).

The estimate of the numbers of each species of marine mammals that could be acoustically harassed by pipe driving and VSP activities was determined by by multiplying the animal density by the total area ensonified each day of activity by the total number of days the activity would occur.

6.1.1. Ensonified Area – Pipe Driving

The Delmar D62-22 diesel impact hammer proposed to be used by BlueCrest to drive the 76.2-cm (30-in) conductor pipe was previously acoustically measured by Illingworth & Rodkin (2014) during drilling operations at Cosmopolitan State #A-1. They found that sound exceeding Level A noise limits for pinnipeds to extend to about 55 m (180 ft), and Level A impacts to cetaceans to about 170 m (560 ft). Level B disturbance levels extended to just less than 1.63 km (1.0 mi). The associated ZOI (area ensonified by noise greater than 160 dB) is 8.3 km^2 (3.1 mi^2).

6.1.2. Ensonified Area - Vertical Seismic Profiling

Illingworth and Rodkin (2014) measured noise levels during VSP operations associated with post-drilling operations at the Cosmopolitan State #A-1 site in lower Cook Inlet during July 2013. The results indicated that the 720-in^3 airgun array used during the operation produced noise levels exceeding 160 dB re 1 µPa out to a distance of approximately 2.47 km (1.54 mi). Based on these results, the associated ZOI would be 19.2 km^2 (7.4 mi^2).

6.1.3. Marine Mammal Densities

Density estimates were derived for harbor porpoises, killer whales, harbor seals, and Steller sea lions as described below in Section 6.1.5.1 and shown in Table 6-1. The beluga whale exposure estimates where calculated using density estimates from Goetz *et al.* (2012) as described in Section 6.1.5.2. Because of

their low numbers, there are no available Cook Inlet density estimates for the other marine mammals that occasionally inhabit Cook Inlet north of Anchor Point.

6.1.3.1. Humpback Whale, Harbor Porpoise, Killer Whale, Harbor Seal, and Steller Sea Lion

Density estimates were calculated for the five species of marine mammals using aerial survey data collected by NMFS in Cook Inlet between 2005 and 2014 compiled by Shelden *et al.* (2013, 2015). To estimate the average raw densities of marine mammals, the total number of animals for each species observed over the 9-year survey period was divided by the total area (65,889 km^2) surveyed over the 9 years. The aerial survey marine mammal sightings, survey effort (area), and derived densities are provided in Table 6-1.

Table 6-1. Raw density estimates for Cook Inlet marine mammals based on NMFS aerial surveys 2005-2014.

Species	No. of Animals	Area (km^2)	Mean Raw Density (no./km^2)
Humpback Whale	70	56,130	**0.0012**
Harbor Porpoise	234	56,130	**0.0042**
Killer Whale	47	56,130	**0.0008**
Harbor Seal	15,545	56,130	**0.2769**
Steller Sea Lion	510	56,130	**0.0091**

These raw densities were not corrected for animals missed during the aerial surveys as no accurate correction factors are currently available for these species. However, observer error was limited as the NMFS surveyors often circled marine mammal groups in order to get an accurate count of group size. The harbor seal densities, however, are probably biased upwards given that a large number of the animals recorded were of large groups hauled out at river mouths, and do not represent the distribution in the offshore waters where the seismic activity will actually occur.

6.1.3.2. Beluga Whale

Beluga whale densities were based on previous modeling. Goetz *et al.* (2012) modeled aerial survey data collected by the NMFS between 1993 and 2008, and developed specific beluga summer densities for each 1-km cell of Cook Inlet. The results provide a more precise estimate of beluga density at a given location than simply multiplying all aerial observations by the total survey effort given the clumped distribution of beluga whales during the summer months. To develop a density estimate associated with the location of each of BlueCrest's planned activities, the ensonified area associated with each activity was overlain on a map of the Goetz *et al.* density cells, the cells falling mostly within each ensonified area quantified, and the average cell density calculated.

The quantified results are found in Table 6-1, and show that throughout the proposed activity areas the beluga densities are very low.

Table 6-1. Mean raw densities of beluga whales with activity action areas based on the Goetz *et al.*'s (2012) Cook Inlet beluga whale distribution modeling.

Activity	Number of Cells	Mean Density (no./km^2)	Density Range (no./km^2)
Pipe Driving	8	0.000344	0.000200 - 0.000562
VSP	19	0.000346	0.000136 - 0.000755

6.1.3.3. Minke Whales, Gray Whales, and Dall's Porpoise

Too few minke whales, gray whales, and Dall's porpoise were recorded during NMFS aerial surveys to calculate reliable density estimates. However, all three species were recorded at Cosmopolitan State in 2013 (Owl Ridge 2014), and are expected to be encountered in 2015. Thus, exposure estimates for these species are not empirically derived but estimated based on observations during the 2013 operations and average group size.

6.1.4. Activity Duration

The pipe driving is expected to occur intermittently over a three-day period (at each well), the VSP about two days (at each well).

6.2. Exposure Calculations

For pipe driving and VSP activities, the potential number of exposures was estimated by multiplying the animal density (Table 6-1) by the ZOI (area ensonified by impulsive noise greater than 160 dB re 1 µPa (rms)) for each activity by the number of days the activity will occur. The resulting exposure calculations for each given activity are found in Tables 6-2 and 6-3.

Table 6-2. Number of marine mammals potentially exposed to underwater sound pressure levels exceeding 160 dB during the proposed pipe driving activities.

Species	Mean Density (no./km^2)	ZOI (km^2)	Days	Mean Exposures
Beluga Whale	0.00034	8.3	9	0.1
Humpback Whale	0.0012	8.3	9	0.1
Harbor Porpoise	0.0042	8.3	9	0.3
Killer Whale	0.0008	8.3	9	0.1
Harbor Seal	0.2769	8.3	9	20.7
Steller Sea Lion	0.0091	8.3	9	0.7

Table 6-3. Number of marine mammals potentially exposed to underwater sound pressure levels exceeding 160 dB during the proposed VSP activities.

Species	Mean Density (no./km^2)	ZOI (km^2)	Days	Mean Exposures
Beluga Whale	0.00034	19.2	6	0.1
Humpback Whale	0.0012	19.2	6	0.1
Harbor Porpoise	0.0042	19.2	6	0.5
Killer Whale	0.0008	19.2	6	0.1

Harbor Seal	0.2769	19.2	6	31.9
Steller Sea Lion	0.0091	19.2	6	1.0

The total number of marine mammals potentially exposed by harassment level noise from all operations combined is displayed in Table 6-4.

Table 6-4. Total number marine mammals potentially exposed to harassment noise levels.

Species	Pipe Driving	VSP	Total Exposures
Beluga Whale	0.1	0.1	**0.2**
Humpback Whale	0.1	0.1	**0.2**
Harbor Porpoise	0.3	0.5	**0.8**
Killer Whale	0.1	0.1	**0.2**
Harbor Seal	20.7	31.9	**52.6**
Steller Sea Lion	0.7	1.0	**1.7**

As the values in Table 6-4 show, the number of beluga whales, humpback whales, harbor porpoise, and killer whales is less than 1, while number of Steller sea lion exposures is about 2 animals, respectively. The estimated harbor seal numbers are much higher due to the higher density estimate for this species.

Based on the marine mammal monitoring effort that occurred at Cosmopolitan State #A-1 in 2013 (Owl Ridge 2014), these values in Table 6-4 appear low regarding harbor porpoise and killer whales and high regarding harbor seals. During the 2013 monitoring, 152 harbor porpoise were observed within about 2 km (1.2 mi). If we assume that the 1,999 hr of observation effort in 2013 equates to about 83 days (24-hr periods), then we can assume that about 2 harbor porpoise were recorded for every 24 hr of monitoring effort in 2013. Consequently, it is reasonable to assume that the 15 total days of activity associated with pipe driving and VSP combined could expose approximately 30 harbor porpoise. Following this same logic, the 17 killer whales, 77 harbor seals, and 7 Steller sea lions that were observed within about 2 km (1.2 mi) in 2013, would equate to an expectation of about 3 killer whale, 14 harbor seals, and 1 Steller sea lion occurring within 2 km (1.2 mi) of the rig during the planned 15 total days of pipe driving and VSP activity.

One beluga whale was observed during the 2013 monitoring study, but at a distance well beyond 3 km (1.8 mi). The estimated exposures based on both the Goetz modeling (0.3 whales) and from the observation of the one whale in 2013 are similar. This low exposure estimate, combined with shut down procedures to be implemented for listed species during pipe driving and VSP activities, zero beluga takes are expected, but a small number of takes are requested just to cover the unexpected.

During 2013, 42 minke whales, 5 gray whales, and 19 Dall's porpoise were observed with 2 km (1.2 mi) of the rig. Based on these numbers, and the 1,999 hr of observation effort, if can be roughly assumed that 8 minke whales, 1 gray whale, and 3 Dall's porpoise could be observed during the combined 15 total days of pipe driving and VSP activity (without mitigation), although exposure would be less than 1 animal for all given that actual noise activity would occur during only a fraction of the period.

Table 6-5 provides a summary of the number of marine mammals that could potentially be exposed to harassment level noise during BlueCrest's proposed 2015 drilling program based on the qualitative analysis of the NMFS aerial survey data, and the number of take authorizations requested for each species. The take requests have been adjust relative to the estimated exposures to better reflect the results of the 2013 monitoring (Owl Ridge 2014), and taking into account imperfect viewing conditions during the monitoring effort, average group sizes, species-specific avoidance or attraction behaviors, and inherent variability in annual marine mammal distributions.

Table 6-5. The estimated exposures and requested take of marine mammals.

Species	Estimated Exposures	Take Authorization Request
Humpback Whale	<1	15
Gray Whale	<1	5
Minke Whale	<1	5
Beluga Whale	<1	5
Killer Whale	<1	15
Harbor Porpoise	<1	15
Dall's Porpoise	<1	25
Harbor Seal	53	53
Steller Sea Lion	2	25

7. ANTICIPATED IMPACT OF THE ACTIVITY

7.1. Introduction

The primary potential impact of the proposed BlueCrest drilling operations to local marine mammals is acoustical harassment from the short-term conductor pipe driving and VSP operations, both impulsive noise sources. The operating drill rig (drilling table, generators, etc.) and the rig tow (propeller cavitation from towing tug boats) are expected to have much less impact potential because the activities are short in duration and received levels are well below injurious levels. A summary of what is known about behavioral responses to noise stimuli by the marine mammals that inhabit the Cook Inlet project area follows. Both the estimated and requested incidental harassment take as a percentage of the marine mammal stock is very small or negligible in all cases (Table 7-1). Thus, the population level impacts of BlueCrest's proposed lower Cook Inlet activities on marine mammals is small to discountable.

Table 7-1. Requested "take" as percentage of the stock.

Species	Stock Estimate	Requested Take	Percent Population
Humpback Whale	10,103	15	0.15%
Gray Whale	20,990	5	0.02%

Minke Whale	1,233	5	0.41%
Beluga Whale	340	5	1.47%
Killer Whale Alaska Resident	2,347	15	0.64%
Killer Whale Alaska Transient	587	15	2.56%
Dall's Porpoise	83,400	25	0.03%
Harbor Porpoise	31,046	15	0.05%
Harbor Seal	22,900	53	0.23%
Steller Sea Lion	55,422	25	0.05%

Abundance sources: Allen and Angliss (2015), Carretta *et al.* (2013), Zerbini (2006)

Acoustical injury is possible where received sound levels exceed 180 dB re 1 µPa (cetaceans) or 190 dB re 1 µPa (pinnipeds), but this potential impact will not occur given that the continuous noise sources do not exceed these values, and shutdown safety zones will be established during impulsive noise activities.

Other direct impacts to species could occur from an oil spill or pollution discharge event. The consequences and likelihood of these impacts are also addressed in the following subsections.

7.2. Behavioral Response

7.2.1. Large Baleen Whales

Humpback whales, gray whales, and other large baleen whales such as bowhead whales (*Eubalaena mysticetus*), have shown strong overt reactions to impulsive noises, such as seismic operations, at received levels between 160 and 173 dB re 1 µPa (rms) (Richardson *et al.* 1986, 1999; Ljungblad *et al.* 1988; Miller *et al.* 1999, 2005; McCauley *et al.* 2000). Baleen whales also seem to be sensitive to continuous noise (Richardson and Malme 1993), often detouring around drilling activity when received levels are as low as 119 dB re 1 µPa (rms) (Malme *et al.* 1983, Richardson *et al.* 1985, 1990). However, the seismic noise associated with BlueCrest's operations is limited to two days of VSP activity that involves a small airgun array (@750 in^3) with a radius to the 160 dB threshold of only 2.47 km (1.54 mi), and this activity will be shut down at the approach of any listed species to this harassment zone. Further, MAI (2011) hydroacoustically tested the *Spartan 151* and found that underwater drilling noise associated with this jack up drill rig was below ambient, and generator noise exceeding 120 dB extended only 50 m. Based on Owl Ridge's (2014) observations and the mitigation measures to be in place, no large baleen whale is expected to be exposed to harassment level noise from BlueCrest's planned operations.

Ship strike of marine mammals during tow is not an issue of major concern. Most strikes of marine mammals occur when vessels are traveling at speeds between 24 and 44 km/hr (13 and 24 knots [kt]) (http://www.nmfs.noaa.gov/pr/pdfs/shipstrike/ss_speed.pdf), well above the 1.9- to 7.4-km/hr (1- to 4-kt) drill rig tow speed expected. However, ship cavitation noise, or mere presence, can result in behavioral changes by baleen whales. Humpback whales in particular have been studied relative to reactions to cruise ships and tankers with results showing a general avoidance reaction at distances from 2 to 4 km (1.2 to 2.5 mi; Baker *et al.* 1982, 1983), and no reaction at distances to 800 m (2,625 ft) when the whales were feeding (Watkins *et al.* 1981, Krieger and Wing 1986). Also, humpback whales have been especially responsive to fast moving vessels (Richardson *et al.* 1995), and often react with aerial behaviors such as breaching or tail/flipper slapping (Jurasz and Jurasz 1979). However, temporarily disturbed whales often remain in the area despite the presence of vessels (Baker *et al.* 1988, 1992). Between 1999 and 2003, the

California stranding network reported only four serious injuries or mortalities of gray whales caused by ship strikes, and only one reported in Alaska (Allen and Angliss 2015). The estimated annual mortality to gray whales in the U.S. from ship strikes is 1.5 animals (Allen and Angliss 2015).

7.2.2. Minke Whales

Other than observations that minke whales are often seen at visual ranges from drilling vessels off Greenland (Kapel 1979), there is little information for this species specific to drilling and drilling related activities. Information on minke reactions to boats is varied. These whales have been observed to avoid boats when approached and approach boats when the boats are stationary (see Richardson *et al.* 1995). Relative to bigger ships, information is lacking. There is no information on effects from seismic operations.

7.2.3. Beluga Whales

Researchers have noted behavioral changes in captive beluga whales and other odontocetes when exposed to very loud impulsive sound similar to seismic airguns (Finneran *et al.* 2000, 2002), and field observations in the Beaufort Sea reported evidence of belugas avoiding large array seismic operations (Miller *et al.* 2005). Further, Romano *et al.* (2004) exposed a captive beluga whale to airgun noise levels and found that the whale produced stress-level hormones with increasing sound pressure levels, and some hormone levels remained high as long as an hour after exposure (but these hormone levels were far less than those produced during beluga whale chase and capture events). Although the above observations occurred during beluga exposure to sound pressure levels above those that would be produced by the much smaller airgun arrays proposed to be used by BlueCrest during VSP activity, they do demonstrate that beluga are susceptible to noise-induced stress and may avoid high noise levels as result, leading to limited use of the available habitat.

7.2.4. Harbor Porpoise

Harbor porpoise are naturally shy and tend to move away from boats and ships. Reaction to boats can be strong when within 400 m (1,312 ft) (Polacheck and Thorpe 1990) out to 1.5 km (0.93 mi) (Barlow 1988, Palka 1993). There is little information on harbor porpoise reaction to drilling activities, but they probably show tolerance to noise levels similar to other odontocetes given their effective hearing is above frequencies characterizing drilling sounds. However, Lucke *et al.* (2009) recently exposed harbor porpoise and found that a temporary threshold shift (TTS) was induced at sound pressure levels of about 200 dB re 1 µPa (peak-peak) and harbor porpoises showed behavioral aversion to impulsive sounds as low as 174 dB re 1 µPa (peak-peak), indicating a greater sensitivity to impulsive noise than beluga whales. Harbor porpoise are likely to avoid the planned pipe driving and VSP activities.

7.2.5. Killer Whale

There is very little information on killer whale reactions to drilling activity or ships other than studies on tour boat impacts to inland stocks of Washington and British Columbia. Presumably, the frequencies of noise generated by drilling and rig tow are largely below the most sensitive hearing range of this odontocete. Killer whales are sensitive to loud impulsive noises as evidenced by the effective use of acoustical harassment devices to protect salmon pen fisheries (Morton and Symonds 2002).

7.2.6. Seals and Sea Lions

Pinnipeds in general appear somewhat tolerant of underwater industrial noises, partially because they can escape underwater pressure levels by exposing their head above the water surface, and they are less sensitive to lower frequency noises. In her review of the known effects of noise on marine mammals, Weilgart (2007) largely confined her discussion to cetaceans and only once mentioned a possible negative effect on pinnipeds. What few studies have been conducted have shown that seals and sea lions do not avoid drilling ships and platforms (*e.g.*, Gales 1982, McCarty 1982, Brueggeman *et al.* 1991). Richardson *et al.* (1990, 1991) found ringed and bearded seals to approach within at least 50 m (164 ft) of played back drilling rig sounds.

Most information on the reaction of seals and sea lions to boats relate to disturbance of hauled out animals. There is little information on the reaction of these pinnipeds to ships while in the water other than some anecdotal information that sea lions are often attracted to boats (Richardson *et al.* 1995).

7.3. Temporary Threshold Shift and Permanent Threshold Shift

Noise has the potential to induce temporary (TTS) or permanent (permanent threshold shift [PTS]) hearing loss (Weilgart 2007). The level of loss is dependent on sound frequency, intensity, and duration. Similar to masking, hearing loss reduces the ability for marine mammals to forage efficiently, maintain social cohesion, and avoid predators (Weilgart 2007). For example, Todd *et al.* (1996) found an unusual increase in fatal fishing gear entanglement of humpback whales to coincide with blasting activities, suggesting hearing damage from the blasting may have compromised the ability for the whales to use sound to passively detect the nets. Experiments with captive bottlenose dolphins and beluga whales found that short duration impulsive sounds can cause TTS (Finneran *et al.* 2002). Southall *et al.* (2007) recommended 224 dB re 1 μPa (peak) as the behavioral disturbance criteria for mid-frequency cetaceans such as beluga based on Finneran *et al.*'s (2002) study results suggesting that his is the threshold for TTS onset for belugas.

In general, pinnipeds are tolerant of high noise levels (Richardson *et al.* 1995), and have the ability to escape underwater noises for short periods by keeping their head above water. Sound exposures that elicit TTS have been studied in harbor seals and sea lions (Southall *et al.* 2007). Studies on non-impulsive noise exposures have shown that harbor seals are likely to experience TTS at lower exposure levels than sea lions (Kastak *et al.* 1999, 2005). Harbor seals experienced TTS at 25-minute (min) exposure to sound pressure levels as low as 153 dB re 1 μPa. Only one study (Finneran *et al.* 2003) has measured pinniped TTS-onset from impulsive noises, and found no measurable TTS in California sea lions following exposures up to 183 dB re 1 μPa (peak-peak).

TTS effects from pipe driving and VSP will be avoided by shutting down for any marine mammal approaching the Level A injury zone, shutting down for any listed species (or large whale) approaching the Level B harassment zone, "clearing" zones of marine mammals prior to start up, and ramping up.

PTS occurs when continuous noise exposure causes hairs within the inner ear system to die. This can occur due to moderate durations of very loud noise levels, or long-term continuous exposure of moderate noise levels. However, PTS is not an issue with impulsive seismic noise, and continuous noise from the cavitation of boat propellers are of short term for a given location since the vessels are either constantly

moving, or idle and not producing noise. Further, drilling noise levels are expected to be below ambient, and general rig noise of harassment concern extends only 50 m (164 ft) from the drill rig.

7.4. Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or ability to hear natural sounds in their environment (Richardson *et al.* 1995), which limit their ability to communicate or avoid predation or other natural hazards. Masking is of special concern for mysticetes that vocalize at low frequencies over long distances, as their communication frequencies overlap with anthropomorphic noises such as shipping traffic. Some baleen whales have adjusted their communication frequencies, intensity, and call rate to limit masking effects. For example, McDonald *et al.* (2009) found that California blue whales (*Balaenoptera musculus*) have shifted their call frequencies downward by 31% since the 1960s, possibly in an attempt to communicate at frequencies below masking shipping noise frequencies. Melcon *et al.* (2012) found blue whales to increase their call rates in the presence of shipping noise, but to significantly decrease call rates when exposed to mid-frequency sonar. Also, Di Iorio and Clark (2010) found blue whales to communicate more often in the presence of seismic surveys, which they attributed to compensating for an increase in ambient noise levels. Fin whales (*Balaenoptera physalus*) have reduced their calling rate in response to boat noise (Watkins 1986), and were thought to stop singing altogether for weeks in response to seismic surveys (International Whaling Commission 2007).

Low frequency noise associated with rig towing is unlikely to create masking issues for odontocetes and pinnipeds as these animals effectively hear and communicate at much higher frequencies. The impulsive noises associated with conductor pipe driving and VSP are both sporadic and short-term, limiting masking effects to a few hours at a time at most. Masking from low frequency noise sources is more a concern for baleen whales. However, the species of baleen whales of concern – humpback, gray, and minke whales – are found in lower Cook Inlet in relatively low numbers, and when present rarely approached the Cosmopolitan State drilling operations (Owl Ridge 2014).

7.5. Oil Spills and Pollution Discharges

Oil spills are an inherent risk in oil drilling operations. To limit this risk and to mitigate any impacts in the unlikely event of a spill, BlueCrest has an approved Oil Discharge Prevention and Contingency Plan (ODPCP), which covers operations in Cook Inlet during the April 15 to October 31 open water period. NMFS reviewed the previous ODPCP covering the Cosmopolitan State project (prepared by Buccaneer Alaska Operations, LLC) during the ESA consultation process for Cosmopolitan State leases and resolved that with the implementation of the plan, the potential impacts to beluga whales, and by extension other marine mammals, were discountable. Relevant detail from the plan modified from the previous Biological Assessment (BA) prepared for these drilling activities at Cosmopolitan State is found in Appendix II. Copies of both the ODPCP and the previous BA have been provided to NMFS for review in association with this application.

The drill rig *Spartan 151* is currently operating under the Alaska Pollutant Discharge Elimination System (APDES) general permit AKG-31-5100 for wastewater discharges. This permit authorizes discharges from oil and gas extraction facilities engaged in exploration under the Offshore and Coastal Subcategories of the Oil and Gas Extraction Point Source Category (40 CFR Part 435). The authorized discharges include: drilling fluids and drill cuttings, deck drainage, blowout preventer fluid, boiler blow down, fire

control system test water, uncontaminated ballast water, bilge water, excess cement slurry, mud cuttings cement at sea floor, and completion fluids. Areas prohibited from discharge in the Cook Inlet are 10-m (33-ft) isobaths, 5-m (16-ft) isobaths, and other geographic area restrictions (AKG-31-5021.I.C.).

NMFS reviewed the Revised Biological Evaluation, prepared by the Environmental Protection Agency (EPA), for the Cook Inlet National Pollutant Discharge Elimination System (NPDES). In a letter dated October 13, 2006, NMFS concurred with the EPA's determination that the reissuance of the NPDES permit is not likely to adversely affect Steller sea lions. NMFS did not agree or disagree with the same determination for Cook Inlet beluga whales, but requested future analysis on potential bioaccumulation effects. However, NMFS' concerns were directed towards waters in Critical Habitat Area 1 approximately 160 km (100 mi) north of the Cosmopolitan State well. During the ESA consultation process for the BlueCrest leases, NMFS concluded that significant adverse effects from discharge are unlikely and that any harm, injury, or harassment to beluga whales, and by extension other marine mammals, is unlikely to occur, and is therefore, discountable.

8. ANTICIPATED IMPACTS ON SUBSISTENCE USES

The proposed drilling activities will occur near the marine subsistence area used by the villages of Homer, Ninilchik, and Kenai, although the well site location is not recognized as subsistence use area *per se* given it is located approximately 22 km (14 mi; Ninilchik) to 81 km (50 mi; Kenai) from the villages. None of these villages traditionally harvested beluga whales, and Steller sea lions generally do not occur this far north into Cook Inlet. Between 1992 and 2008, only two sea lions were reported harvested by Kenai hunters and none reported from the other villages (Wolfe *et al.* 2009. Sea lions are more commonly harvested by villages well south of the well site, such as Seldovia, Port Graham, and Nanwalek (Merrill and Orpheim 2013). The only marine mammal under NMFS jurisdiction that is regularly harvested by local villages is the harbor seal. Between 1992 and 2008, Alaskan natives from the Cook Inlet villages of Homer and Kenai annually took (harvested plus struck and lost) an average of 14 to 15 harbor seals (there is no subsistence data for Ninilchik) (Wolfe *et al.* 2009). Many of these seals were taken incidental to other activities such as boat-based moose hunting across the inlet (Fall *et al.* 1984).

The impact of drilling operations at Cosmopolitan State is unlikely to affect harbor seal populations sufficient to render them unavailable for subsistence harvest in the future, especially given that drilling operation impacts are unlikely to reach to areas where harbor seal harvest traditionally occurs.

Oil spill trajectory scenarios developed in preparation of the ODPCP indicate that potential spills would travel south through the central channel of the inlet away from shoreline subsistence harvest areas. Further information can be found in the approved ODPCP provided to NMFS.

9. ANTICIPATED IMPACTS ON HABITAT

The Cosmopolitan State #B-1 well site is located in lower Cook Inlet. Cook Inlet is a large subarctic estuary roughly 300 km (186 mi) in length and averaging 96 km (60 mi) in width. It extends from the city of Anchorage at its northern end and flows into the Gulf of Alaska at its southernmost. For descriptive

purposes, Cook Inlet is separated into unique upper and lower sections, divided at the East and West Forelands, where the opposing peninsulas create a natural waistline in the length of the waterway, measuring approximately 16 km (10 mi) across (Mulherin *et al.* 2001).

Lower Cook Inlet extends from the Forelands southwest to the inlet mouth demarked by an approximate line between Cape Douglas and English Bay. Water circulation in lower Cook Inlet is dominated by the Alaska Coastal Current (ACC) that flows northward along the shores of the Kenai Peninsula until it is turned westward and mixed by the combined influences of freshwater input from upper Cook Inlet, wind, topography, tidal surges, and the coriolis effect (Field and Walker 2003, Mineral Management Service 1996). Upwelling by the ACC brings nutrient-rich waters to lower Cook Inlet and contributes to a biologically rich and productive ecology (Sambrotto and Lorenzen 1986). Tidal currents average 1.0 to 1.5 m/second (2 to 3 kt) and are rotary in that they do not completely go slack before rotating around into an opposite direction (Gatto 1976, Mulherin *et al.* 2001). Depths in the central portion of lower Cook Inlet are 60 to 80 m (197 to 262 ft) and decrease steadily toward the shores (Muench *et al.* 1981). Bottom sediments in the lower inlet are coarse gravel and sand that grade to finer sand and mud toward the south (Bouma 1978).

Coarser substrate support a wide variety of invertebrates and fish including Pacific halibut (*Hippoglossus stenolepis*), Dungeness crab (*Metacarcinus magister*), tanner crab (*Chionoecetes bairdi*), pandalid shrimp (*Pandalus* spp.), Pacific cod, and rock sole (*Lepidopsetta bilineata*), while the soft-bottom sand and silt communities are dominated by polychaetes, bivalves and other flatfish (Field and Walker 2003). Sea urchins (*Strongylocentrotus* spp.) and red sea cucumbers (*Parastichopus californicus*) are important otter prey and are found in shell debris communities. Razor clams (*Siliqua patula*) are found all along the beaches of the Kenai Peninsula. In general, the lower Cook Inlet marine invertebrate community is of low abundance, dominated by polychaetes, until reaching the mouth of the inlet (Saupe *et al.* 2005). Overall, the lower Cook Inlet marine ecosystem is fed by midwater communities of phytoplankton and zooplankton, with the latter composed mostly of copepods, and barnacle and crab larvae (Damkaer 1977, English 1980).

The potential direct habitat impact by the BlueCrest drilling operation is limited to the actual drill-rig footprint defined as the area occupied and enclosed by the drill-rig legs. This area was calculated as 0.22 hectares (ha) (0.54 ac) during the land use permitting process. The collective 0.66-ha (1.62-ac) footprint of the three wells represents a very small fraction of the 18,950-km^2 (7,300-mi^2) Cook Inlet surface area. Potential damage to the Cook Inlet benthic community will be limited, however, to the actual surface area of the three spud cans (collective total of 442 m^2 [4,755 ft^2] at each well site, and 1,326 m^2 [14,265 ft^2] for all three well sites) that form the "foot" of each leg. Given the high tidal energy at the well site locations, drilling footprints are not expected to support benthic communities equivalent to shallow lower energy sites found in nearshore waters where harbor seals mostly feed.

Acoustical affects to prey resources are also limited. Christian *et al.* (2004) studied seismic energy impacts on male snow crabs (*Chionoecetes* sp.) and found no significant increases in physiological stress due to exposure. No acoustical impact studies have been conducted to date on the above fish species, but studies have been conducted on Atlantic cod (*Gadus morhua*) and sardine (family Clupeidae). Davis *et al.* (1998) cited various studies which found little effect to Atlantic cod eggs, larvae, and fry when received levels were 222 dB. What effects were found were to larval fish within about 5 m (16.4 ft), and from air

guns with volumes between 3,000 and 4,000 in^3. Alternatively, effects to sardine were greatest on eggs and 2-day larvae, and were greatest at 0.5 m (1.64 ft) - again confined to 5 m (16.4 ft). Further, Greenlaw *et al.* (1988) found no evidence of gross histological damage to eggs and larvae of northern anchovy (*Engraulis mordax*) exposed to seismic air guns, and concluded that noticeable effects would result only from multiple, close exposures. Based on these results, impulsive conductor pipe driving and VSP could acoustically impact local marine communities, but only out to about 2 or 3 m (6 to 9 ft) at most. From an ecological community standpoint, these impacts are considered minor.

Overall, rig placement and acoustical effects on prey resources will have a minor effect at most on the marine mammal habitat within the seismic survey area. Some prey resources might be temporarily displaced, but no long-term effects are unexpected.

10. ANTICIPATED EFFECTS OF HABITAT IMPACTS ON MARINE MAMMALS

Based on the conclusions of Section 9 above, no direct loss or modification of marine mammal habitat is expected. Any impacts to prey resources is considered minor or negligible, and no long-term effects would occur. However, potential damage to local benthic resources from the drill rig legs and anchors will be assessed with side-scan sonar (at a high resolution 500 kHz, or beyond marine mammal hearing ranges) after the drill rig leaves the well site to confirm the extent, if any, of the damage.

Some aspects of the drilling operation, especially the pipe driving and VSP, will temporarily increase noise levels in the underwater acoustical environment, possibly limiting the availability of the habitat for marine mammal use where animals chose to avoid the higher noise levels. However, these impulsive noise sources last only two to three days, and their maximum acoustical footprint (area ensonified by sound levels exceeding 160 dB) is only 19.2 km^2 (4,744 ac) (from VSP), equating to only 0.09% of the 20,943 km^2 (8,086 mi^2) area defining Cook Inlet. Acoustical impacts from the rig tow would last but a few minutes, and the ensonified area associated from the operation of the drill rig is too small (0.0078 km^2 or 1.9 ac) to be of acoustical concern.

Oil spill risks are reduced and mitigated with the implementation of the ODPCP that will be used in the unlikely event of a spill. The ADEC previously approved an ODPCP for the Cosmopolitan State Project. Based on their review during ESA consultation process, NMFS concluded that oil spill risks to local marine mammals were negligible (see Appendix II).

With oil and gas platforms presently operating in Cook Inlet, there is concern for continuous exposure to potentially toxic heavy metals and metalloids (*i.e.*, mercury, lead, cadmium, copper, zinc, and arsenic) that are associated with oil and gas development and production. These elements occur naturally in the earth's crust and the oceans, but many also have anthropogenic origins from local sources of pollution or from contamination from atmospheric distribution. North American beluga whales, for example, were analyzed for heavy metals and other elements. Cadmium, mercury, selenium, vanadium, and silver were generally lower in the livers of Cook Inlet animals than in the other beluga whale stocks, while copper was higher (Becker *et al.* 2001). Hepatic methyl mercury levels were similar to those reported for other beluga whales (Becker *et al.* 2001). Similar work on heavy metals has not been done for Cook Inlet

harbor seals, but because discharge by BlueCrest of drilling muds, cuttings, or sanitary wastes from their rig will meet the conditions of the Cook Inlet pollution discharge permit, no impacts to water quality are expected, and any effects to harbor seal habitat are therefore insignificant (see Appendix II). Studies have been conducted on persistent organochlorine concentrations in Alaskan harbor seals (Papa and Becker 1998), which showed that Prince William Sound harbor seals had much lower loads of polychlorinated biphenyls, DDT/DDE, and chlordane compared to seals inhabiting the Oregon and Washington coasts, reflective of differences in human development between the areas.

11. MITIGATION MEASURES

Compared to non-jack-up drill rigs, the use of the jack-up drilling rig *Spartan 151* will mitigate potential noise impacts. With their lattice leg structure, jack-up rigs have less surface contact with the water and, therefore, convey less noise from the drilling table and generators into the underwater environment. Sound source verifications conducted by MAI (2011) confirmed that underwater drilling and generator noises produced by the *Spartan 151* are near ambient.

Shutdown safety zones will be established and monitored during pipe driving and VSP activities. Shut downs will be implemented to avoid injury take to all marine mammals and, as possible, harassment take of listed species (belugas, humpback whales, and Steller sea lions). Reducing and mitigating potential acoustical impacts to local marine mammals is further addressed in the Marine Mammal Monitoring and Mitigation Plan found in Appendix I.

In the unlikely event of an oil spill, BlueCrest will be working with CISPRI, which is certified as a U.S. Coast Guard oil spill removal organization and State of Alaska Primary Response Action Contractor serving the Cook Inlet region of Alaska. BlueCrest will follow the procedures as outlined in CISPRI's Technical Manual, Wildlife Tactics. Most procedures discussed in the CISPRI Technical Manual are associated with responses for either waterfowl or marine mammals. CISPRI will dedicate personnel and equipment as appropriate in support of wildlife during a spill. The Planning Chief will work to implement a Wildlife Plan addressing those species anticipated to be at risk and needing protection. The protocols are described in further detail in the ODPCP.

12. ARCTIC PLAN OF COOPERATION

The proposed activity does not occur in or near a traditional Arctic subsistence hunting area, and the Cosmopolitan State lease is located south of 60°N, the latitude NMFS regulations consider Arctic waters. Thus, a Plan of Cooperation is not required. However, potential impacts to local Cook Inlet subsistence harvest are addressed in Section 8, and coordination with local subsistence users is addressed in Section 14.

13. MONITORING AND REPORTING

Monitoring and reporting potential acoustical impacts to local marine mammals are fully addressed in the Marine Mammal Monitoring and Mitigation Plan attached as Appendix I.

14. SUGGESTED MEANS OF COORDINATION

Potential impacts of exploratory drilling operations noise on marine mammals have been studied, with the results used to establish the noise criteria for evaluating "take" and to support shutting down operations as necessary to avoid Level A injury "take". However, all observations of marine mammals, including any observed reactions to BlueCrest's proposed operations will be recorded and reported to NMFS.

Further, to ensure that there will be no adverse effects resulting from the planned drilling activities, BlueCrest is currently coordinating with NMFS, USFWS, Bureau of Safety and Environmental Enforcement, the U.S. Army Corps of Engineers, the State of Alaska, and other state and federal agencies in the assessment of all measures that can be taken to eliminate or minimize any impacts from planned activities. In 2013, BlueCrest, through its Buccaneer partner at the time, reached out to and coordinated with numerous communities including the cities and villages of Homer, Port Graham, Kenai, Seldovia, Soldotna, and Ninilchik, as well as Kenai Peninsula Borough, Cook Inlet Region, Inc., Cook Inlet Keeper, United Cook Inlet Drift Association, and the Chugach Alaska Services. BlueCrest is currently in the process of a follow-up coordination with the same entities.

Any observed marine mammal interactions with the BlueCrest operations deemed potentially harmful will be immediately reported to the Anchorage Office of NMFS (Ms. Barbara Mahoney).

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APPENDIX I

Marine Mammal Monitoring and Mitigation Plan

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Marine Mammal Monitoring and Mitigation Plan

BlueCrest Operating Alaska LLC

Cosmopolitan State Exploratory Drilling Program

April 2016

Prepared for

BlueCrest Operating Alaska LLC
953 Echo Lane, Suite 420
Houston, Texas 77024

Prepared by

Owl Ridge Natural Resource Consultants
6407 Brayton Drive, Suite 204
Anchorage, Alaska 99507

1. Introduction

BlueCrest Alaska Operating, LLC (BlueCrest) plans to conduct an oil and gas production drilling program in lower Cook Inlet on State of Alaska Oil and Gas Lease 384403 under the program name of Cosmopolitan State. The program includes drilling up to three wells with the total operation time of about 120 days. The exact timing of the project is dependant upon rig availability, but would occur in the summer operating season between July 1 and October 31, 2016. BlueCrest intends to use the *Spartan 151* drill rig. This marine mammal monitoring and mitigation plan (4MP) addresses the drilling and associated activities at Cosmopolitan State.

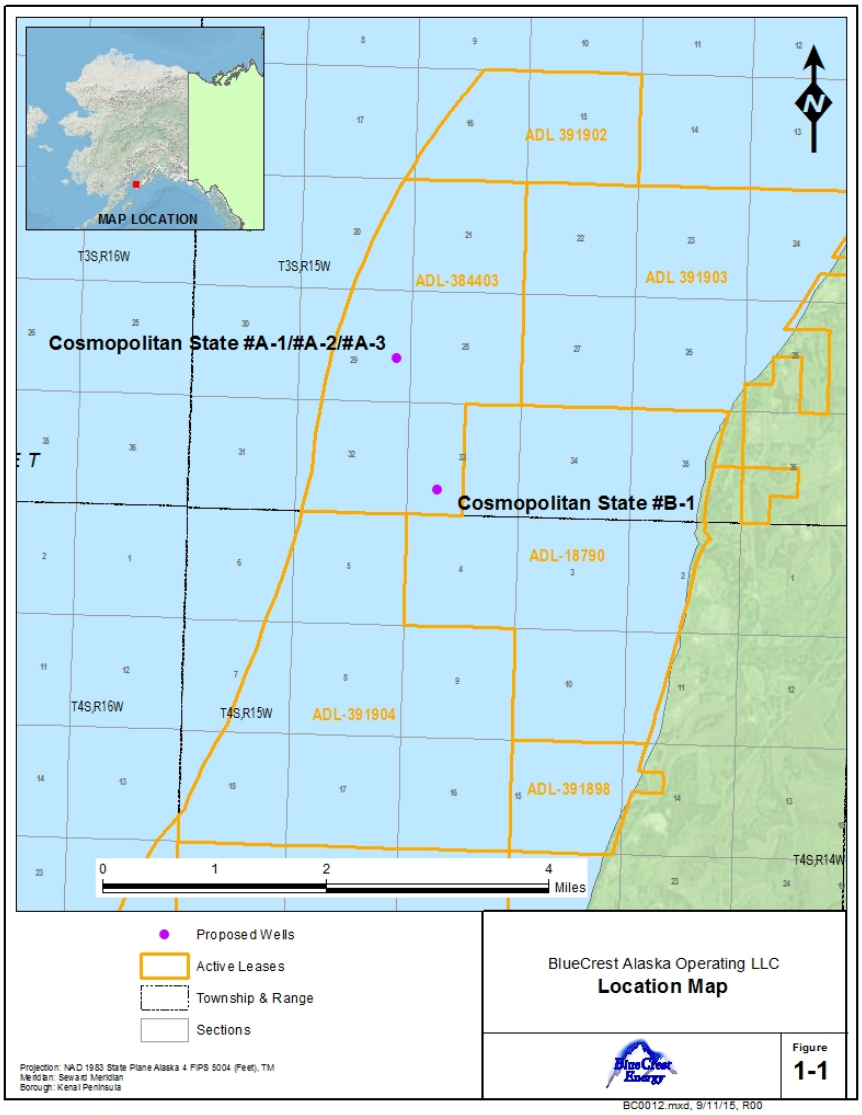

FIGURE 1-1. PROPOSED PROJECT AREA FOR BLUECREST'S 2014 EXPLORATORY DRILLING PROGRAM

Several species of marine mammals inhabit Cook Inlet, any of which could be acoustically harassed by the proposed exploratory drilling activities. Of particular concern is the Cook Inlet beluga whale (*Delphinapterus leucas*), a listed species which summers in upper Cook Inlet and ventures to lower Cook Inlet during the winter. However, the Cosmopolitan State lease area does not fall within Cook Inlet beluga whale critical habitat, thus belugas are less of a concern here. Only one was observed in 2013 (Owl Ridge 2014).

Other marine mammals that have been found in the vicinity of the Cosmopolitan State unit include the harbor seal (*Phoca vitulina*), Steller sea lion (*Eumetopias jubatus*), harbor porpoise (*Phocoena phocoena*), humpback whale (*Megaptera novaeangliae*), minke whale (*Balaenoptera acutorostrata*), gray whale (*Eschrichtius robustus*), and sea otter (*Enhydra lutris*). Killer whales (*Orcinus orca*) may occasionally venture into lower Cook Inlet in search of marine mammal prey.

This 4MP is designed to monitor and mitigate for all marine mammals regardless of status or agency jurisdiction. The primary concern is the harassing levels of underwater noise produced by the drilling program operations. For impulsive noise sources such as vertical seismic profiling (VSP) or impact hammering, the Level B harassment take threshold is 160 dB re 1µPa-m (rms) while for continuous noise sources such as propeller cavitation, rig operations, or drilling the threshold is 120 dB re 1µPa-m (rms). For sea otters, the 160 dB re 1µPa-m (rms) threshold applies to both impulsive and continuous noise.

For all noise sources the Level A injury take thresholds are 190 dB re 1µPa-m (rms) for pinnipeds and sea otters and 180 dB re 1µPa-m (rms) for cetaceans, although continuous noise sources associated with drilling activities rarely exceed 180 dB re 1µPa-m (rms).

Noise sources from the proposed drilling operations vary greatly with frequency, and not all local marine mammals can effectively hear all noise sources. Pinnipeds (harbor seals and sea lions) and odontocetes (toothed whales such as belugas, harbor porpoise, and killer whales) are high frequency marine mammals with most sensitive hearing ranges of 10 to 30 kHz for pinnipeds and 12 to 100 kHz for odontocetes (Wartzok and Ketten 1999). Mysticetes (baleen whales such as humpback and minke whales) are low frequency cetaceans with effective hearing between 0.5 and 5 kHz. Thus, odontocetes and pinnipeds would not effectively hear low frequency drilling and cavitation noise, while mysticetes would. Sea otters do not communicate underwater, and there is little evidence on how effectively they can hear underwater as well.

2. Exploration Program and Drilling Operations

There are four activities proposed to occur well site of relative importance to acoustical harassment:

1. Wet-tow mobilization of the rig to the well site
2. Driving of pipe
3. Exploratory drilling
4. VSP

In addition, the rig will remain active at the location with generators, pumps, and other standard equipment operating continuously.

During previous Endangered Species Act (ESA) consultations (culminating in a Letter of Concurrence [LOC] from James Balsiger to Buccaneer Alaska Operations, LLC [the joint operator with BlueCrest during the 2013 drilling at Cosmopolitan State #A-1) dated April 25, 2013,) with the National Marine Fisheries Service (NMFS) it was determined that while all of the above have the potential to disturb Cook Inlet marine mammals, the pipe driving, and the VSP operations, all impulsive noises, have the greater potential to disturb Cook Inlet marine mammals. All of these operations emit 1-m source noise levels exceeding 200 dB re 1 μPa-m (root mean square). Based on available literature, the continuous noise from cavitating tug propellers during the rig tows and the actual drilling occur at frequencies below the effective hearing range of toothed cetaceans (such as belugas) and pinnipeds, and at relatively low energy levels relative to the impulsive noise sources. Hydroacoustical tests conducted by MAI (2011) in 2011 revealed that *Spartan 151* underwater noise levels from drilling were below ambient, and generator noises exceeded 120 dB only to about 50 m. Other well site survey noise sources, such as post-drilling side-scan sonar, will occur at relatively high energy levels, but their frequencies (>200 kHz) are well beyond the effective hearing range of marine mammals (thus, post-drilling sonar surveys are not addressed further).

The mitigation and monitoring measures that are planned to be implemented in association with BlueCrest's planned drilling and associated activities in Cook Inlet are described in the subsequent sections that follow. The focus of the plan is to deploy marine mammal observers in association with pipe driving and VSP, and to shut down noise-generating operations at the approach of any marine mammal to the associated Level A take threshold, and any listed species at the approach of the harassment zone. Observers would not be used during any activity for which take has not been requested.

3. Generated Noise Levels

3.1. Drill Rig Tow

The rig will be wet-towed by two or three ocean-going tugs licensed to operate in the Cook Inlet. Tugs generate their loudest sounds while towing due to the propeller cavitations. While these continuous sounds have been measured at up to 171 dB re 1 μPa-m (rms) at 1-m source (Richardson *et al.* 1995), they are generally emitted at dominant frequencies of less than 5 kilohertz (kHz) (Miles *et al.* 1987, Richardson *et al.* 1995, Simmonds *et al.* 2004). Thus, the dominant noise frequencies from propeller cavitation are significantly less than the dominant hearing frequencies for pinnipeds and odontocetes. Further, NMFS (Dale Youngkin, pers. comm.) is decided that rig towing does not rise to the level of take, and does not require take estimates or monitoring.

3.2. Conductor/Drive Pipe Driving

A drive pipe is a relatively short, large-diameter pipe driven into the sediment prior to the drilling of oil wells. This section of tubing serves to support the initial sedimentary part of the well, preventing the looser surface layer from collapsing and obstructing the wellbore. The pipe also facilitates the return of cuttings from the drill head. Drive pipes are usually installed using drilling, pile driving, or a combination of these techniques. In offshore wells, the conductor drive pipe is also used as a foundation for the surface diverter; a 20-in conductor pipe is normally drilled through the drive pipe and supports the wellhead. BlueCrest proposes to drive approximately 60 m (200 ft below mudline) of 76.2-cm (30-in) pipe at Cosmopolitan State #B-1 prior to drilling using a Delmar D62-22 impact hammer. This hammer has

impact weight of 6,200 kg (13,640 pounds) and reaches a maximum impact energy of 224 kilonewton-m (165,215 ft-pounds) at a drop height of 3.6 m (12 ft). Illingworth & Rodkin (2014) measured the hammer noise operating from the *Endeavour* in 2013 and found noise levels exceeding 160 dB re 1µPa (rms) out to 1.63 km (1 mile; disturbance zone), 180 dB re 1µPa (rms) to 170 m (560 ft), and 190 dB re 1µPa (rms) to 55 m (180 ft; injury zone).

3.3. Exploratory Drilling

BlueCrest proposes to use the jack-up drilling rig *Spartan 151* for the Cosmopolitan State program. Because the drilling platform and other noise-generating equipment is located above the sea's surface, and there is very little surface contact with the water compared to drill ships and semi-submersible drill rigs, lattice-legged jack-up drill rigs are relatively quiet (Richardson *et al.* 1995, Spence *et al.* 2007). The *Spartan 151* was hydroacoustically measured by Marine Acoustics, Inc. (2011) while operating in 2011. The survey results showed that continuous noise levels exceeding 120 dB re 1µPa extended out only 50 m (164 ft), and that this noise was largely associated with the diesel engines used as hotel power generators.

3.4. Vertical Seismic Profiling

Data on geological strata depth collected during initial seismic surveys at the surface can only be inferred. However, once a well is drilled, accurate follow-up seismic data can be collected by placing a receiver at known depths in the borehole and shooting a seismic airgun at the surface near the borehole. This gathered data provides not only high resolution images of the geological layers penetrated by the borehole, but can be used to accurately correlate (or correct) the original surface seismic data. The procedure is known as vertical seismic profiling, or VSP, and can include seismic shots adjacent to the well hole, or 1-mile walkaway surveys in four cardinal directions.

BlueCrest intends to conduct VSP operations at the end of drilling each well using an array of airguns with total volumes of between 600 and 880 in^3. Each VSP operation is expected to last less than one or two days. Illingworth & Rodkin (2014) measured noise levels associated with VSP conducted at Cosmopolitan State #A-1 in 2013. The results indicated that the 190 dB radius (Level A take threshold) from source was 75 m (246 ft), the 180 dB re 1µPa (rms) radius at 240 m (787 ft), and the 160 dB radius (Level B disturbance take threshold) at 2.47 km (1.54 mi).

4. Mitigation Measures

4.1. Drive Pipe Driving

Soon after the drill rig is positioned on the well head, the conductor pipe will be driven as the first stage of the drilling operation. At least two marine mammal observers (one operating at a time) will be stationed aboard the rig during this two to three day operation monitoring a 1.6-km (1-mi) shutdown safety zone. The impact hammer operator will be notified to shutdown hammering operations at the approach of a marine mammal to the safety zone. Also, a ramp up of the hammering will begin at the start of each hammering session. The ramp-up procedure, detailed in Appendix A, involves initially starting with three soft strikes, 30 seconds apart. This delayed-strike start alerts marine mammals of the pending

hammering activity and provides them time to vacate the area. Monitoring will occur during all hammering sessions.

4.2. VSP Operations

As with the conductor pipe driving, marine mammal observers will be redeployed during the VSP operations to monitor a shutdown safety zone. Initially, the zone was estimated at 2-km (1.24-mi), based on use of a 600-in^3 airgun array. However, Illingworth & Rodkin (2014) measured noise levels during VSP operations associated with BlueCrest post-drilling operations at the Cosmopolitan State #B-1 site during July 2013. The results indicated that for the 720-in^3 airgun array used during the operation produced noise levels exceeding 160 dB re 1 µPa out to a distance of approximately 2.47 km (1.54 mi). All future VSP monitoring will involve a 2.5-km (1.55-mi) shutdown zone. The airgun operator will be notified to shut down firing of the guns at the approach of a marine mammal to the safety zone. Also, a "soft start" ramp up of the guns will begin at the start of each airgun session.

4.3. Summary of Monitoring Zones

- Impact pipe driving – 1.63 km (1.0 mi).
- Vertical seismic profiling (VSP) – 2.5 km (1.55 mi).

5. Marine Mammal Observers

5.1. Number of Observers

5.1.1. Pipe Driving

Pipe driving is expected to take two to three days to complete. Two marine mammal observers, working alternate shifts, will be stationed aboard the drill rig during all pipe driving activities at the well. The observers will operate from a station as close to the well head as safely possible.

5.1.2. VSP Operations

As with the pipe driving, two observers will monitor all VSP activities. Monitoring during zero-offset VSP will be conducted by two marine mammal observers operating from the drill rig. During walk-away VSP operations, an additional two marine mammal observers will monitor from the seismic source vessel.

5.2. Observer Qualifications

Only trained marine mammal observers will be used during this project. All observers will either have previous experience monitoring for marine mammals, or will go through a rigorous marine mammal monitoring training course. Less experience observers will be paired with veterans. Observers will also be provided with field guides, instructional handbooks, and a contacts list to assist in assuring data are collected effectively and accurately.

6. Monitoring Methodology

6.1. Monitoring at Night and in Poor Visibility

Pipe driving and VSP activities will be limited to daylight hours, and when sea conditions are light; therefore, when marine mammal observation conditions will be generally good. There are no take concerns with rig towing, exploratory drilling, or general rig operation.

6.2. Field Equipment

Standard marine mammal observing field equipment will be used including reticule binoculars (10x42), big-eye binoculars (30x), inclinometers, and range-finders. Because rig-towing, pipe driving, and VSP will be limited to daylight hours, no special equipment such as night scopes or FLIRS will be needed.

6.3. Field Data Recording

All location, weather, and marine mammal observation data will be recorded onto a standard field form. Field forms will be printed on Rite-in-the-Rain® paper, and attached to the daily report forms. Global positioning system and weather data will be collected at the beginning and end of a marine mammal monitoring period and at every half-hour in between. Position data will also be recorded at the change of an observer or the sighting of a marine mammal. Enough position data will be collected to eventually map an accurate charting of any vessel travel. Recorded marine mammal data will also include species, group size, behavior, and any apparent reactions to the project activities. Any behavior that could be construed as a take will also be recorded in the notes. (Because observers will be constantly moving about the rig observing from various unprotected vantage points without power sources, data will not be collected electronically.)

6.4. Field Reports

Daily field reports will be prepared that include daily activities, marine mammal monitoring efforts, and a record of the marine mammals, and their behaviors and reactions, recorded that day. The daily reports will be used to develop an annual 90-day report.

7. Reporting

7.1. Field Reports

Daily field reports will be prepared that include daily activities, marine mammal monitoring efforts, and a record of the marine mammals, and their behaviors and reactions, recorded that day. The daily reports will be used to develop an annual 90-day report.

7.2. Activity Reports

Activity reports will be submitted to NMFS within a few days of completing each of the two activities (pipe driving and VSP). The monthly report will contain and summarize the following information as appropriate:

- Dates, times, locations, weather, sea conditions (including Beaufort Sea state and wind force), and associated activities during all seismic operations and marine mammal sightings.

- Species, number, location, distance from the rig, and behavior of any sighted marine mammals, as well as associated seismic activity (number of power-downs and shutdowns), observed throughout all monitoring activities.
- An estimate of the number (by species) of: (i) pinnipeds that have been exposed to the pipe driving and VSP activities (based on visual observation) at received levels greater than or equal to 160 dB re 1 µPa (rms) and/or 190 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited; and (ii) cetaceans that have been exposed to the pipe driving and VSP activities (based on visual observation) at received levels greater than or equal to 160 dB re 1 µPa (rms) and/or 180 dB re 1 µPa (rms) with a discussion of any specific behaviors those individuals exhibited.
- A description of the implementation and effectiveness of the: (i) terms and conditions of the Biological Opinion's Incidental Take Statement; and (ii) mitigation measures of the IHA. For the Biological Opinion, the report shall confirm the implementation of each Term and Condition, as well as any conservation recommendations, and describe their effectiveness, for minimizing the adverse effects of the action on ESA-listed marine mammals.

7.3. 90-Day Technical Report

A report will be submitted to NMFS within 90 days after the end of the project or at least 60 days before the request for another Incidental Take Authorization for the next open water season to enable NMFS to incorporate observation data into the next Authorization. The report will summarize all activities and monitoring conducted during pipe driving and VSP operations. The Technical Report will include the following:

- Summaries of monitoring effort (*e.g.*, total hours and marine mammal distribution through the monitoring periods, accounting for sea state and other factors affecting visibility and detectability of marine mammals).
- Analyses of the effects of various factors influencing detectability of marine mammals (*e.g.*, sea state, number of observers, and fog/glare).
- Species composition, occurrence, and distribution of marine mammal sightings, including date, water depth, numbers, age/size/gender categories (if determinable), group sizes, and ice cover.
- Analyses of the effects of activities.
- Sighting rates of marine mammals during periods with and without active operations (and other variables that could affect detectability), such as: (i) initial sighting distances versus operation activity state; (ii) closest point of approach versus activity state; (iii) observed behaviors and types of movements versus activity state; (iv) numbers of sightings/individuals seen versus activity state; and (v) estimates of take by Level B harassment based on presence in the 160 dB harassment zone.

7.4. Notification of Injured or Dead Marine Mammals

In the unexpected event that the specified activity clearly causes the take of a marine mammal in a manner prohibited by the IHA (if issued), such as a serious injury or mortality (*e.g.*, ship-strike),

BlueCrest would immediately report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the Alaska Regional Stranding Coordinators. The report would include the following information:

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

With the exception of rig towing, activities would not resume until NMFS is able to review the circumstances of the prohibited take. NMFS would work with BlueCrest to determine what is necessary to minimize the likelihood of further prohibited take and ensure MMPA compliance. BlueCrest would not be able to resume their activities until notified by NMFS via letter, email, or telephone.

In the event that BlueCrest discovers an injured or dead marine mammal, and the lead PSO determines that the injury or death is not associated with or related to the activities authorized in the IHA (*e.g.*, previously wounded animal, carcass with moderate to advanced decomposition, or scavenger damage), BlueCrest would report the incident to the Chief of the Permits and Conservation Division, Office of Protected Resources, NMFS, and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators, within 24 hr of the discovery. SAE would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS and the Marine Mammal Stranding Network.

8. Sound Source Verification

Sound source verification (SSV) measurements have already been conducted for all noise generating activities planned at Cosmopolitan State by Illingworth & Rodkin (2014). Hydroacoustical testing of the *Spartan 151* was also conducted by MAI (2011).

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Appendix A – Ramp-up Procedures

The intent of ramp-up is to warn marine mammals pending seismic (in this case VSP) or hammering operations (in this case pipe driving) and to allow sufficient time for those animals to leave the immediate vicinity. Under normal conditions, animals sensitive to these activities are expected to move out of the area. For all seismic surveys and pipe/pile driving using an impact hammer, use the ramp-up procedures described below to allow marine mammals to depart the safety and harassment zones before operations begin.

Measures to conduct ramp-up procedures are as follows:

1. Visually monitor the safety zone and adjacent waters for the presence of marine mammals for at least 30 minutes before initiating ramp-up procedures. If none are detected, you may initiate ramp-up procedures.
2. For seismic, initiate ramp-up procedures by firing a single airgun. The preferred airgun to begin with should be the smallest airgun, in terms of energy output (dB) and volume (in^3).
3. Continue ramp-up by gradually activating additional airguns over a period of at least 30 minutes, but no longer than 40 minutes, until the desired operating level of the airgun array is obtained.
4. For impact hammering, "soft-start" technique shall be used at the beginning of each day's pipe/pile driving activities or if pipe/pile driving has ceased for more than one hour to allow any marine mammal that may be in the immediate area to leave before pile driving reaches full energy.
5. Begin impact hammering soft-start with an initial set of three strikes from the impact hammer at 40% energy, followed by a one minute waiting period, then two subsequent 3-strike sets.
6. Immediately shut down all airguns and hammers at any time a marine mammal is detected entering or within the safety zone. Recommencement of seismic and hammering operations will not begin until the exclusion zone has been visually inspected for at least 30 minutes to ensure the absence of marine mammals.

Initial seismic and hammering starts will not begin during periods of poor visibility (e.g., night, fog, wind). Any shut-down due to a marine mammals sighting within the safety zone must be followed by a 30-minute all-clear period and then a standard, full ramp-up. Any shut-down for other reasons resulting in the cessation of the sound source for a period greater than 30 minutes, must also be followed by full ramp-up procedures. In recognition of occasional, short periods of the cessation of airgun firing or hammering for a variety of reasons, periods of airgun silence not exceeding 30 minutes in duration will not require ramp-up for the resumption of seismic or hammering operations if: (1) visual surveys are continued diligently throughout the silent period (requiring daylight and reasonable sighting conditions), and (2) no marine mammals are observed in the safety zone.

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APPENDIX II

Oil Spill and Pollution Discharge Prevention and Mitigation Measures

Oil Spill and Pollution Discharge Prevention and Mitigation Measures

[Modified from the Biological Assessment prepared as part of the 2014/2015 Cosmopolitan State ESA consultation.]

1. Oil Spills

A potential effect of the proposed natural gas exploration activities is an oil spill. As with any oil and gas operation, effects from any large oil spill (more than 1,000 bbl. [42,000 gallons]) represents a major concern. Although the likelihood of a spill is remote, if it were to occur, a spill could have the potential to create long term, if not permanent, damage to the environmental resources in Cook Inlet. BlueCrest has prepared an Oil Discharge Prevention and Contingency Plan (ODPCP) that will be used in the unlikely event of a spill. Alaska's Department of Environmental Conservation (ADEC) approved BlueCrest's (through Buccaneer, its partner at the time) ODPCP on November 13, 2015, which covers operations in the upper Cook Inlet from April 15 to October 31, and does not expire until November 13, 2020.

If a spill were to occur, it could adversely affect harbor porpoises and harbor seals, both directly and indirectly. Drilling will be conducted during the summer, and potentially fall, which are the seasons with the mildest temperature, weather, and sea condition (open water season when open pack ice conditions are less than 10% concentration) for this region. BlueCrest considered these environmental conditions when selecting the jack-up rig, equipment placement, and operations, to minimize the possibility of oil discharge.

BlueCrest (through Buccaneer) conducted extensive modeling in its ODPCP to determine oil spill migration if a spill occurred. The trajectory of oil would be dependent on wind speed, direction, and ocean currents at the time of and directly after the spill. Tidal fluctuations in the main body of Cook Inlet regularly reach 7.6 m (25 ft) and exhibit currents in excess of 5 knots (6 mph) at full tidal flow (NOAA 2008). If a spill were to occur, real time data would be required to assess the trajectory of the released oil.

The ODPCP identifies measures to be taken in the event of an oil spill. Wildlife protection strategies may entail, in order of priority:

- Containment and control to limit the spread and area influenced by the spill;
- Hazing of birds and mammals to prevent them from entering the spill area; and
- Capture and relocation of wildlife at direct threat.

BlueCrest will be working with Cook Inlet Spill Prevention and Response, Inc. (CISPRI), which is certified as a U.S. Coast Guard oil spill removal organization and State of Alaska Primary Response Action Contractor serving the Cook Inlet region of Alaska. BlueCrest will follow the procedures as outlined in CISPRI's Technical Manual, Wildlife Tactics. Most procedures discussed in the CISPRI Technical Manual are associated with responses for either waterfowl or marine mammals. CISPRI will dedicate personnel and equipment as appropriate in support of wildlife during a spill. The Planning Section Chief will work to implement a Wildlife Plan addressing those species anticipated to be at risk and needing protection.

1.1. Cetaceans

The effects of oil spills on cetaceans such as harbor porpoises are generally unknown; however, some generalizations can be made regarding impacts from oil on individual whales based on present knowledge and from data collected on spills in similar regions, such as the *Exxon Valdez* oil spill in Prince William Sound, Alaska. Although cetaceans are capable of detecting oil, they do not seem to avoid the oil (Geraci 1990). Harbor porpoises swimming through an oil spill could be affected in several ways: skin contact with the oil; ingestion of oil; respiratory distress from hydrocarbon vapors; contaminated food sources; and displacement from feeding areas. Actual impacts would depend on the extent of duration of contact, and the characteristics (type and age) of the oil. Harbor porpoises could be affected by residual oil from a spill even if they were not present during the oil spill. However, the greatest potential threat to harbor porpoises from an oil spill is the inhalation of toxic vapors that concentrate above oil slicks as they surface to breath, and in extreme cases could result in sudden death (Geraci 1990). Geraci (1990) reviewed a number of studies pertaining to the physiologic and toxic impacts from oil on whales and concluded there was no definitive evidence that oil contamination had been responsible for the death of a cetacean. Cetaceans observed during the *Exxon Valdez* event made no effort to alter their behavior in the presence of oil (Harvey and Dahlheim 1994; Loughlin 1994). Dahlheim and Matkin (1994) concluded that because the highest recorded mortality rate of North Pacific killer whales occurred in 1989 and 1990, which coincided with the Exxon Valdez oil spill, there was a correlation between the loss of killer whales and the spill, but they could not identify a clear cause and effect relationship.

Any diminishment of feeding habitat during the summer months due to an oil spill could adversely affect the energy balance for harbor porpoises. The impacts from oil exposure to Cook Inlet harbor porpoises would also depend upon how many animals came into contact with oil. If oil found its way into nearshore feeding areas during summer months (*e.g.*, river mouths with eulachon runs), a significant proportion of the upper Cook Inlet population of harbor porpoise might be exposed. However, such a trajectory north into upper Cook Inlet summering feeding areas is very unlikely from the Cosmopolitan State well site.

1.2. Pinnipeds

Pinnipeds in general do not readily avoid oil (St. Aubin 1990), and mortality can occur, as evidenced by the estimated loss of 300 harbor seals from the *Exxon Valdez* spill. Pups seem to be the most vulnerable, either from the physical effects of heavy coatings of crude oil, or from the masking of identification odors preventing mothers from recognizing them. However, St. Aubin (1990), in his extensive investigation on oil effects on pinnipeds, stated “Pinnipeds show little behavioral or physiologic reactions to the noxious characteristics of oil”. Large scale pinniped mortality from oil has not been observed, and the thermal regulation impacts from oil fouling appear to be limited to fur seals (St. Aubin 1990). In controlled experiments, Kooyman *et al.* (1976) found oil to have little effect on the insulative value of sea lion pelts. Inhaling oil toxins can cause death, but not likely at the vapor concentrations found in a cold water oil spill (St. Aubin 1990).

1.3. Spill Prevention and Risk Analysis

Spill prevention is a primary goal for BlueCrest. BlueCrest has planned formal routine rig maintenance and surveillance checks as well as normal inspection and equipment checks to be conducted on the jack-up rig daily. The following steps will be in place to prevent oil from entering the water:

- Required inspections will follow standard operating procedures.
- Personnel working on the rig will be directed to report any unusual conditions to appropriate personnel.
- Oily equipment will be regularly wiped down with oil absorbent pads to collect free oil. Drips and small spillage from equipment will be controlled through use of drip pans and oil absorbent drop clothes.
- Oil absorbent materials used to contain oil spills or seeps will be collected and disposed of in sealed plastic bags or metal drums and closed containers.
- The platform surfaces will be kept clean of waste materials and loose debris on a daily basis.
- Remedial actions will be taken when visual inspections indicate deterioration of equipment (tanks) and/or their control systems.
- Following remedial work, and as appropriate, tests will be conducted to determine that the systems function correctly.

Drilling and completion fluids provide primary well control during drilling, work over, or completion operations. These fluids are designed to exert hydrostatic pressure on the wellbore that exceeds the pore pressures within the subsurface formations. This prevents undesired fluid flow into the wellbore. Surface mounted blow out preventer (BOP) equipment provides secondary well control. In the event that primary well control is lost, this surface equipment is used to contain the influx of formation fluid and then safely circulate it out of the wellbore.

The BOP is a large, specialized valve used to seal, control, and monitor oil and gas wells. BOPs come in variety of styles, sizes, and pressure ratings. For Cook Inlet, the BOP equipment used by BlueCrest will consist of:

- Three BOPs pressure safety levels of: 1) 5,000 pounds per square inch (psi) 2) 10,000 psi, and 3) 15,000 psi;
- A minimum of three 35-cm (cm) (13 5/8 in), 10,000 psi WP ram type preventers;
- One 35-cm (13 5/8 in) annular preventer;
- Choke and kill lines that provide circulating paths from/to the choke manifold;
- A two choke manifold that allows for safe circulation of well influxes out of the well bore; and
- A hydraulic control system with accumulator backup closing.

The wellhead, associated valves, and control systems provide blowout prevention during well production. These systems provide several layers of redundancy to ensure pressure containment is maintained. Well control planning is performed in accordance with Alaska Oil and Gas Conservation Commission (AOGCC) and Bureau of Safety and Environment Enforcement (BSEE) regulations. The operator's policies and recommended practices are, at a minimum, equivalent to BSEE regulations. BOP test drills are performed on a frequent basis to ensure the well will be shut in quickly and properly. BOP testing procedures will meet American Petroleum Institute Recommended Practice No. 53 and AOGCC specifications. The BOP tests will be conducted with a nonfreezing fluid when the ambient temperature

around the BOP stack is below 0° C (32° F). Tests will be conducted at least weekly and before drilling out the shoe of each casing string. The AOGCC will be contacted before each test is conducted, and will be on site during BOP tests unless an inspection waiver is approved.

In addition to the above water BOP system, a comparison of the Deep Water Horizon Gulf of Mexico incident to the Cook Inlet exploration indicates the following risk reductions for the BlueCrest exploration:

1.3.1. Deep Water Horizon

- Gulf of Mexico
- Water depth greater than 1,524 m (5,000 ft)
- Geological formation pressures unknown
- 80 km (50 miles) offshore
- Floating drill rig

1.3.2. BlueCrest Exploration Wells

- Cook Inlet
- Water depth less than 30 m (100 ft)
- Geological formation pressures established and well known
- Less than 16 km (10 miles) offshore
- Stationary drill rig anchored to the seabed

Significant drilling on the Outer Continental Shelf in Alaska, including parts of Cook Inlet, has not occurred since the early 1990s. During exploration in Alaska Outer Continental Shelf waters from 1982 to 1991, 52 exploratory wells were drilled with five spills greater than one oil barrel (bbl.; 42 gallons); the total spillage from these events was 45 bbl. (1,890 gallons) (MMS 1996). From these data, Minerals Management Service determined a spill rate of 11 spills per 100 wells with an average spill size of nine bbl. (378 gallons).

Major spills could be caused by failure of a storage tank or mud tank. These tanks are routinely tested for structural integrity, so the most likely cause of failure would be due to significant impact from on-site equipment. A spill of this type is not known to have occurred at an exploration site in Alaska and, with monitoring, is expected to have a very low probability of occurrence.

Oil spill risk in Cook Inlet is lessened to some degree with the advancement of drilling technologies and safety assurances; and because formation pressures are generally known and understood in this area with previous oil development. Offshore oil spill records in Cook Inlet during 1994-2011 show only three spills during oil exploration: two oil spills at the UNOCAL Dillon Platform in June 2011 (2 gallons) and December 2001 (3 gallons); and one oil spill at the UNOCAL Monopod Platform in January 2002 (one gallon) (ADNR 2011). During the same time, 71 spills occurred offshore in Cook Inlet during oil production. Most spills ranged between 0.0011 and 1 gallon (42 spills); with three spills larger than 200 gallons: 210 gallons in July 2001 (Cook Inlet Energy Stewart facility); 250 gallons in February 1998 (King Salmon Platform); and 504 gallons in October 1999 (UNOCAL Dillon Platform). All 71 crude oil

spills from the offshore platforms, both exploration and production, totaled less than 2,140 gallons. Based on historical data, most oil spills have been small.

During the 62 years of oil and gas exploration and development in Cook Inlet, there has not been a single oil well blowout, although there have been two incidents at gas wells, which makes it difficult to assign a precise risk factor to the possibility to such an event for Cook Inlet; but is thought to be an extremely low probability. There have been four natural gas blowouts in Cook Inlet since 1962.

Beluga whales are not expected to be near the exploration drilling rig, as they are distributed well north of these drill sites during the summer; and harbor porpoise and harbor seals are not regularly observed in this area. Therefore, in light of the small probability of a spill occurring; if a spill were to occur, the small probability for it to persist during the time when local marine mammals are expected to be in the area of the spilled oil; and the spill response measures required for this project, it is unlikely that these marine mammals would come into contact with oil. Significant adverse effects would only be expected if several of these low probability events occurred at the same time. As such, an oil spill presenting harm, injury, or harassment to Cook Inlet beluga whales, harbor porpoises, and harbor seals is extremely unlikely to occur, and is therefore, discountable.

1.4. Pollution Discharge

The drill rig *Spartan 151* is operating under the Alaska Pollutant Discharge Elimination System (APDES) general permit AKG-31-5021 for wastewater discharges (Alaska Department of Environmental Conservation [ADEC] 2012). This permit authorizes discharges from oil and gas extraction facilities engaged in exploration under the Offshore and Coastal Subcategories of the Oil and Gas Extraction Point Source Category (40 CFR Part 435).

Twelve effluents are authorized for discharge into Cook Inlet once ADEC discharge limits have been met. The authorized discharges include:

1. drilling fluids and drill cuttings;
2. deck drainage;
3. sanitary waste;
4. domestic waste;
5. blowout preventer fluid;
6. boiler blow down;
7. fire control system test water;
8. uncontaminated ballast water;
9. bilge water;
10. excess cement slurry;
11. mud cuttings cement at sea floor; and
12. completion fluids.

Areas prohibited from discharge in the Cook Inlet are 10-m (33-ft) isobaths, 5-m (16-ft) isobaths, and other geographic area restrictions (AKG-31-5021.I.C.).

The *Spartan 151* is also authorized under EPA's Vessel General Permit (VGP) for deck wash down and runoff, gray water, and gray water mixed with sewage discharges. The effluent limits and related requirements for these discharges in the VGP are to minimize or eliminate to the extent achievable using control measures (best management practices) (U.S. Environmental Protection Agency [EPA] 2011). The control measures must be technologically available and economically practicable and achievable in the light of best marine practices.

NMFS reviewed the Revised Biological Evaluation, prepared by the EPA, for the Cook Inlet National Pollutant Discharge Elimination System (NPDES). In their letter dated October 13, 2006, NMFS concurred with the EPA's determination that the reissuance of the NPDES permit is not likely to adversely affect Steller sea lions. NMFS did not agree or disagree with the same determination for Cook Inlet beluga whales, but requested future analysis on potential bioaccumulation effects. However, NMFS' concerns were directed towards waters in beluga Critical Habitat Area 1, north of the Cosmopolitan State #B-1 well site. It is not clear how NMFS might view the determination relative to upper Cook Inlet populations of harbor seals and harbor porpoise.

During the summer harbor porpoises and harbor seals are concentrated near river mouth feeding areas and haul outs (Boveng *et al.* 2012). Therefore, it is unlikely that harbor porpoises or harbor seals would be contacted by discharge effluent, especially given the authorized discharge limitations. Significant adverse effects from discharge are unlikely, any harm, injury, or harassment to local marine mammals is unlikely to occur, and is therefore, discountable.