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

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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 135 days. The exact timing of the project is dependant upon rig availability, but would occur in the summer operating season between April 15 and October 31, 2016. BlueCrest intends to use the Spartan 151 drill rig or a similar 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 either the U.S. Fish and Wildlife Service (FWS) or the National Marine Fisheries Service (NMFS), depending on the species involved. MMPA identifies 14 specific items that must be addressed when applying for an IHA, which allow FWS/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 State 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 sea otters (*Enhydra lutris*), which are under the jurisdiction of the FWS. Marine mammals that are under the jurisdiction of NMFS 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. 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°53'13.0"	W 151°52'58.0"	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

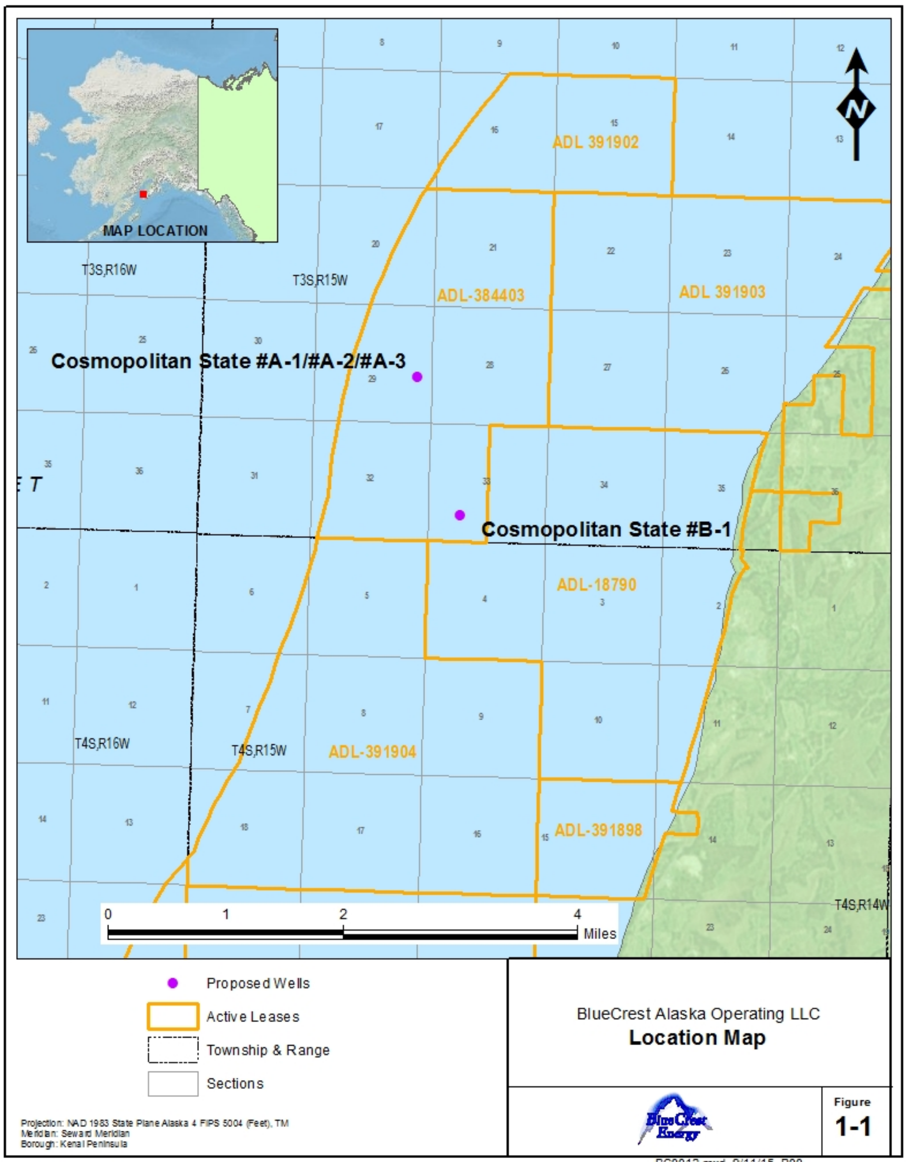

Figure 1-1. Locations of the proposed Cosmopolitan State lease well sites.

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 during the April 15 to October 31, 2016 drilling season. 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 45 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) or similar rig. 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 or during plug and abandonment (P&A).

1.2.3. Rig Mobilization

The *Spartan 151* is likey to be moored at Port Graham over the winter of 2015/2016 where it will undergo maintenance and winterization. The intention is to move the drill rig to the Cosmopolitan State #B-1 well site at some point after April 15, a distance of about 50 km (31 mi). It is possible that the *Spartan 151* may be scheduled for a different spring project, and then later moved to the Cosmopolitan State well site, possibly from upper Cook Inlet located approximately 100 km (62 mi) north of Cosmopolitan State #B-1. Tows from either location would likely be accomplished within a 48-hour (hr) period. Any subsequent move 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 handling, 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 45 days to complete, including up to 15 days of well testing, or about 135 days to complete the full program within a 165-day work window.

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 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.

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 Sea Otters

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

1. Towing of the jack-up drill rig to and between the Cosmopolitan well sites,
2. Impact hammering of the drive pipe at the well prior to drilling, and
3. 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 and FWS 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. Helicopters will be used to transport personnel on and off the drill rig, but any noise related impacts to sea otters will be avoided by maintaining 300- to 450-m (1,000- to 1,500-ft) flight altitudes. FWS has determined that Level B disturbance harassment of sea otters can occur when the animals are exposed to underwater noise exceeding 160 dB re 1 μPa-m [rms], regardless of whether the noise is continuous or impulsive. Towing, pipe driving, and VSP are the only planned operations expected to produce underwater noise exceeding 160 dB re 1 μPa-m (rms), and are the subjects of this application.

1.3.1. Rig Tow

The jack-up rig would be towed to the first well site (#B-1) during early spring or summer 2016. It is estimated that the tow will take about 48 hr to complete. Tows lasting less than a day will also occur between well sites. Any rig tow away from the final well site will fall under the responsibility of the rig owner or the next party to utilize the rig.

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. These continuous sounds have been measured at up to 171 dB re 1 μPa-m (rms) at 1-m source (Richardson *et al.* 1995), and they are generally emitted at dominant frequencies of well less than 5 kilohertz (kHz) (Miles *et al.* 1987, Richardson *et al.* 1995, Simmonds *et al.* 2004). Since it is currently unknown which tugs will be used to tow the rig on each tow (to and from the well site), and there are few sound signatures for tugs in general, it is assumed that noise exceeding 160 dB re 1 μPa-m (rms) extends 253 m (830 ft) from the operating tugs (based on a 171 dB re 1 μPa-m [rms] source; see Section 6.1.1). The tug's cavitating propellers do not exceed 180 dB re 1 μPa-m (rms) at 1-m source, thus they do not represent a Level A injury take concern.

1.3.2. 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 (12 days maximum), although actual noise generation (pounding) would occur only intermittently during this period.

1.3.3. 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 data provides 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 and presumably for sea otters. This application is not requesting authorization of these takes, termed Level A injury takes, but instead will implement mitigation measures to avoid these takes, including shutdown safety zones. However, the rig towing procedures to be used during BlueCrest's operation do not have the potential to acoustically injure marine mammals (see Section 6). Therefore, no shutdown safety zones will be established for this activity (but see Section 13 regarding monitoring of harassment zones). 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. These safety zones are conservative for sea otters given that injury take is not expected until noise levels reach 190 dB.

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 165-day operating time frame and completed by October 31, 2016. It is expected that the program will take 135 days to complete.

3. NUMBERS OF SEA OTTERS WITHIN THE ACTIVITY AREA

Gorbics and Bodkin (2001) determined that the sea otters found along the Kenai Peninsula are members of the unlisted Southcentral Alaska Stock. This stock extends from Cape Yakataga to the eastern shoreline of lower Cook Inlet, and includes Prince William Sound and the Kenai Peninsula coast as far north as Clam Gulch (Allen and Angliss 2014). (Sea otter populations found along the western shoreline of lower Cook Inlet, including Kamishak Bay, are part of the listed Southwest Alaska Stock.) The most recent population estimate (2000-2003) for the Southcentral Alaska Stock is 15,090 (Allen and Angliss 2014). While this stock was thought to be stabilizing by 2002 (Bodkin *et al.* 2002) after several decades of growth (Irons *et al.* 1988, Bodkin and Udevitz 1999), the Kachemak Bay population alone increased 26% annually between 2002 and 2008, with the most recent bay estimate at about 3,600 animals (Gill *et al.* 2009). However, until recently, only a very small fraction of these otters were recorded north of Anchor Point (Rugh *et al.* 2005, Gill *et al.* 2009, Doroff and Badajos 2010), especially during the winter (Hansen and Hubbard 1999, Larned 2006). Doroff and Badajos (2010) tracked 44 radio-tagged sea otters in Kachemak Bay for three years and did not find any of them to travel north of Anchor Point. Doroff and Badajos (2010) could not relocate 10 of the radio-tagged otters in August 2009 but these were subsequently relocated in September 2009. It is possible that these otters had moved north of Anchor Point (outside the study area) during August, only to return to Kachemak Bay in September.

In 2004 and 2005, Larned (2006) recorded sea otters during intensive (approximately 30% area coverage) winter (December to April) surveys for Steller's eiders between Anchor Point and Clam Gulch. The survey teams observed an average of less than 8 otters/survey month (9 months total). The highest estimate was

92 otters inhabiting about 300 square kilometers north of Anchor Point during December 2004. During June surveys for beluga whales conducted between 1993 and 2004, Rugh *et al.* (2005) recorded 2,111 sea otters in lower Cook Inlet, but virtually none north of Anchor Point (even though the length of the Kenai Peninsula was surveyed each year).

Recent (2013) marine mammal monitoring (for the Cosmopolitan State exploratory drilling program) conducted 5 km (3 mi) offshore of Cape Starichkof revealed that during July and August, relatively large numbers of sea otters can be found riding the tides between Anchor Point and some point well north of Cape Starichkof (Owl Ridge 2014). It is likely that this late summer phenomenon is a result of seasonal weather conditions that allow otters to safely ride the daily tides to foraging grounds outside Kachemak Bay.

In the fall of 2013 Owl Ridge collected systematic line-transect data for the Compolitan site (October to December; unpublished data) to assess the distribution and abundance of Steller's eider and sea otters. The pooled (three surveys – one per month) density estimate for sea otters was 2.6 sea otters per km^2.

Evans *et al.* (1997) calculated a correction factor of 2.38 for sea otters missed during aerial surveys conducted along the Aleutian Islands. Applying this correction factor (2.38) to sea otter densities derived from Larned (2006) of 1.0 otters/km^2 provides a density to 2.38 otters/km^2 an estimate very similar to the unpublished data collected by Owl Ridge.

4. SEA OTTER STATUS AND DISTRIBUTION

As mentioned above, this IHA addresses potential acoustic impacts of 2016 drilling season at BlueCrest's Cosmopolitan State unit on the portion of the Southcentral Alaska stock of the northern sea otter that inhabits the eastern shoreline of lower Cook Inlet. This stock is classified as "non-strategic" as the level of direct human-caused mortality does not exceed the Potential Biological Removal (PBR), and it is neither listed as "depleted" under MMPA, nor as "threatened" or "endangered" under the Endangered Species Act (ESA). This population is largely confined to Kachemak Bay and south and east to Prince William Sound. Evidence suggests that few otters inhabit waters north of Anchor Point (Rugh *et al.* 2005, Larned 2006, Gill *et al.* 2009, Doroff and Badajos 2010), except during July and August, when some otters (presumably from Kachemak Bay) can be found riding currents north and south along the Kenai Peninsula (Owl Ridge 2014). Gill *et al.* (2009) did not survey north of Anchor Point, but did find large numbers of otters along their transect line closest to Anchor Point during August, but not during May or February. Doroff and Badajos (2010) tracked 44 radio-tagged sea otters for three years, and did not relocate any otters outside of Kachemak Bay other than a male that was subsistence harvested by a Ninilchik villager (although the exact location of harvest is unknown). However, 10 otters that were located in May, June, July, and September of 2009 were not located in August of that year, and may have been outside the Kachemak Bay study area. Thus, the primary concern with sea otters is where planned fall drilling activities might overlap with seasonally high otter use north of Anchor Point. For purposes of this IHA application, sea otter habitat is defined as the 60-km coastline between Anchor Point and Clam Gulch, and to 5 km offshore (300 km^2; Figure 4-1).

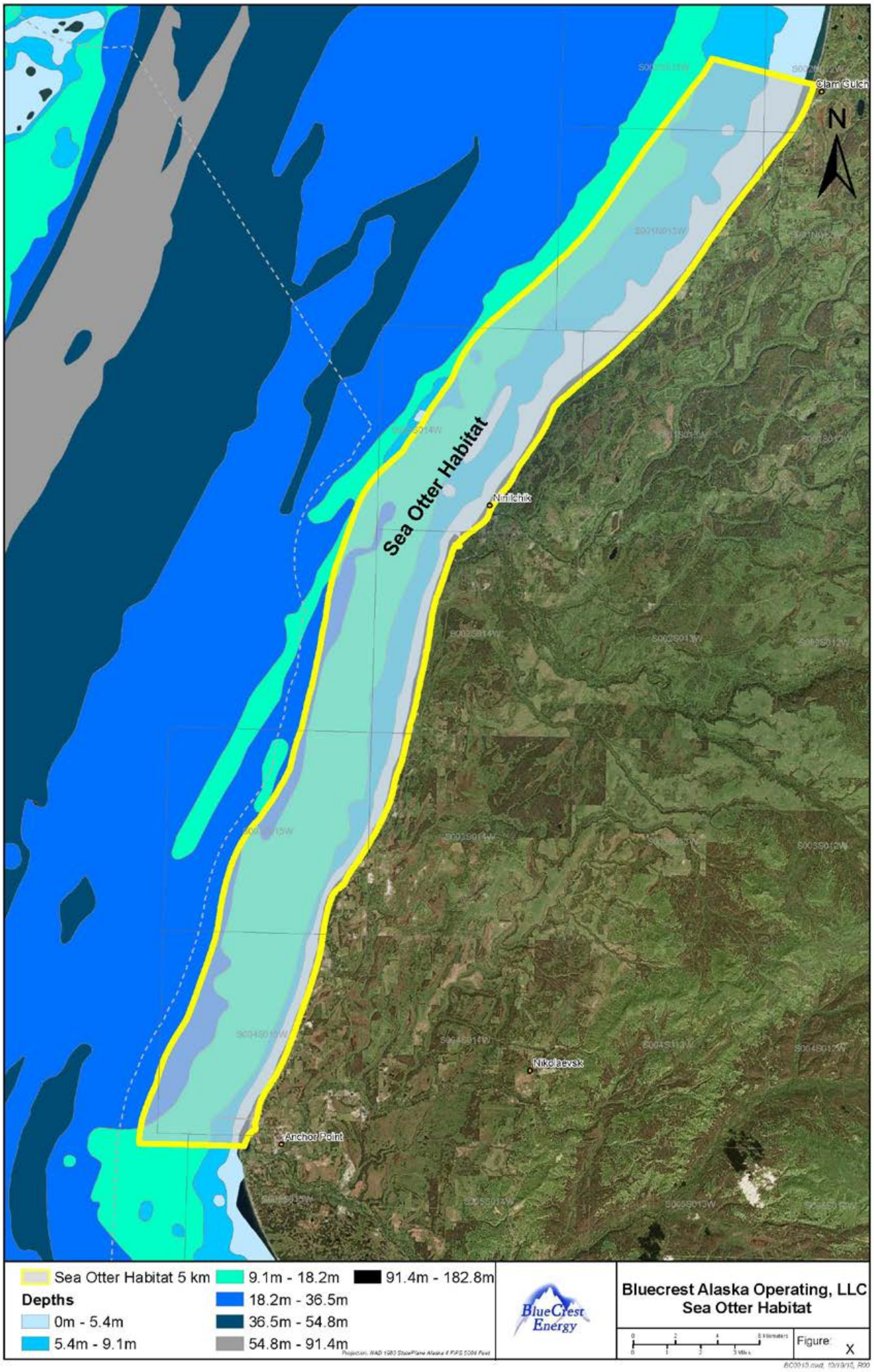

Figure 3-1: Sea Otter Habitat

5. TYPE OF INCIDENTAL TAKING AUTHORIZATION REQUESTED

The incidental take authorization requested is for Level B noise harassment (noise exceeding 160 dB re 1 μPa (rms)) associated with the oil and gas drilling activities. Actual Level B "takes" will depend upon the number of sea otters occurring within the 160 dB zone of influence (ZOI) at the time of impulsive noise activity. No Level A injury "takes" (noise exceeding 190 dB re 1 μPa [rms] for pinnipeds and presumably sea otters) are expected with the proposed mitigation measures (see Section 1.3 and Appendix B) in place.

6. SEA OTTER TAKE ESTIMATES

6.1. Basis for Estimating Numbers of Sea Otters 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 criteria for (impulsive) acoustical harassment under MMPA (NMFS 2005). Exposure to sound levels greater than 190 dB re 1 μPa may lead to acoustical injury including temporary loss in hearing sensitivity and permanent hearing damage in sea otters. These values are the MMPA Level A injury criterion. IHAs do not authorize Level A "take".

Estimated numbers of sea otters that could be exposed to Level B noise levels from towing was determined by multiplying the maximum seasonal density of sea otters by the total area that will be ensonified by greater than 160 dB re 1 μPa (rms). For conductor pipe driving and VSP, the number of exposures was determined by multiplying the area that could be ensonified in a day multiplied by the number of days, then multiplied by sea otter density.

There is no estimate of potential Level A "takes", as this will be avoided through mitigation (establishment of shutdown safety zones; see Section 1.3 and Appendix B).

6.1.1. Ensonified Area - Rig Tow

The jack-up rig would be towed to the Cosmopolitan State well site coming from either Port Graham, a travel distance of about 50 km (31 mi), or from upper Cook Inlet approximately 100 km (62 mi) north of Cosmopolitan State (Figure 6-1). After drilling is complete, the rig will be released and moved away from the well sites to a location of the owner's discretion.

The jack-up rig could be towed multiple times during 2016, but only the tow from Port Graham or upper Cook Inlet to Cosmopolitan State #2, and between Cosmopolitan State #2 and #1, are addressed in this IHA application. It is estimated that the longer tows (to and from the Cosmopolitan State leases) will take two days to complete, while tows between Cosmopolitan well sites will take but a few hours. The rig will be wet-towed by two or three ocean-going tugs licensed to operate in Cook Inlet. Tugs generate their loudest sounds while towing due to propeller cavitation. These continuous sounds have been measured at up to 171 dB re 1 μPa-m (rms) at source (broadband), and are generally emitted at dominant frequencies of less than 5 kHz (Miles et al. 1987, Richardson et al. 1995, Simmonds et al. 2004).

For the most part, the dominant noise frequencies from propeller cavitation are significantly less than the dominant hearing frequencies for pinnipeds (10 to 30 kHz) and toothed whales (12 to >100 kHz), but within the hearing range of otters in general (Wartzok and Ketten 1999). Also, because it is currently unknown which tug or tugs will be used to tow the rig, and there are few sound signatures for tugs in general, the potential area that could be ensonified by disturbancelevel noise is calculated based on an assumed 171 dB re 1 μPa-m source. Using Collins et al.'s (2007) 18.4 Log(R) – 0.00188R spreading model determine from hydroacoustic surveys in Cook Inlet, the distance to the 160 dB isopleth would be at 253 meters (830 feet). Therefore, while towing, the operating tug would ensonify a strip 0.51 km (0.31 mi) wide. The ensonified area of the route was determined by multiplying route length by the ensonified strip width, which equates to 253 m multiplied by 2. Subsequently, the ZOI for the route from Port Graham to well site #B-1 is 25.3 km^2, for the route from upper Cook Inlet to #B-1 is 50.6 km^2, and for the route between #B-1 and #A-2 is 0.84 km^2. Rig movement between well site #A-2 and #A-3 is only a few meters and represents a ZOI of 0.40 km^2.

As can be seen from Figure 6-1 only a small fraction of the entire tow route will occur within sea otter habitat (6 km from upper Cook Inlet and 10 km from Port Graham). In fact, depending on the route of the tow it is expected that no more the 10 km of the entire (regardless of direction) track will occur within the expected otter habitat (5 km from shore) and represents a ZOI of 5.1 km^2.

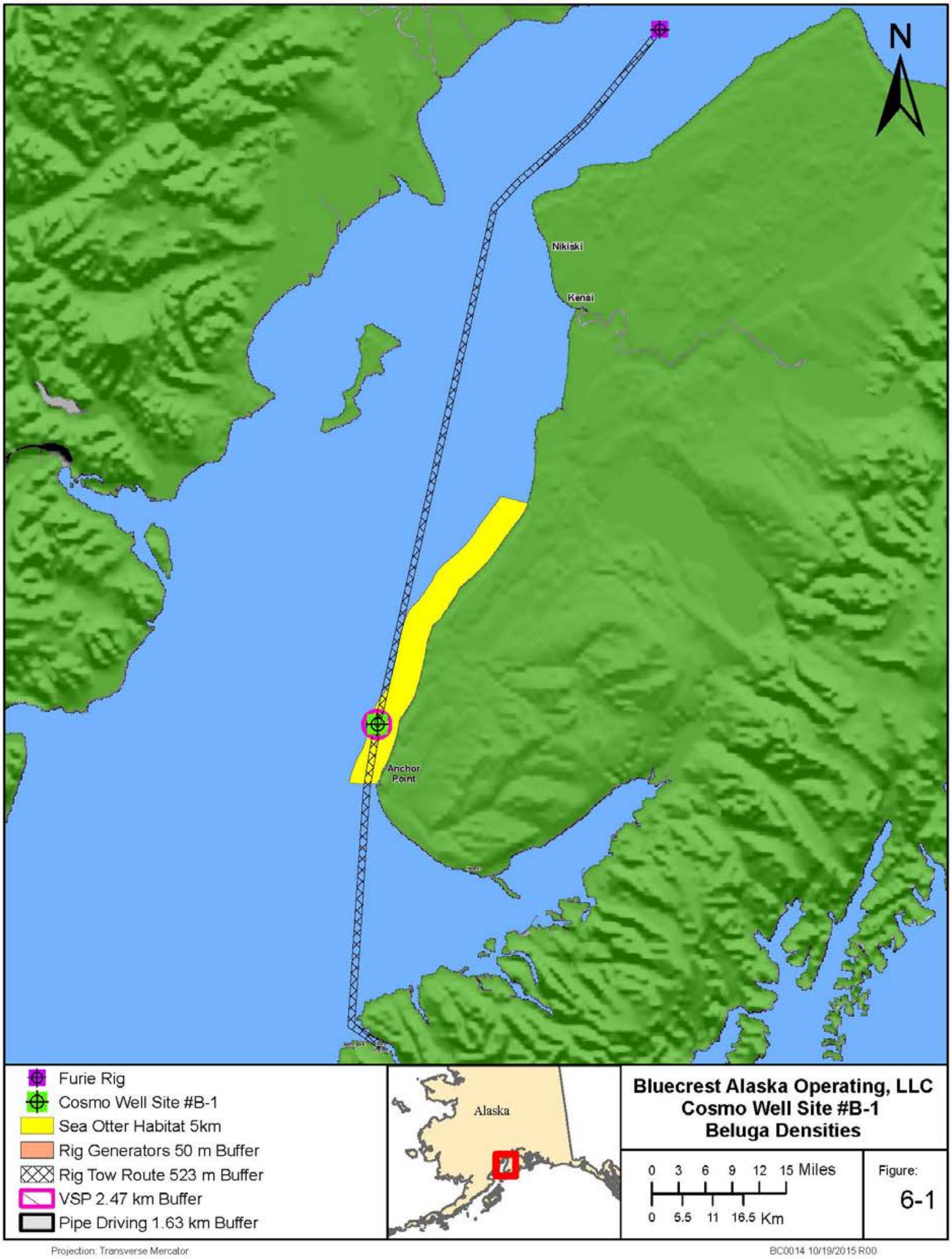

Figure 6-1: Tow routes for the jack up rig to Cosmopolitan #B-1

6.1.2. 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 (and presumably for sea otters) to extend to about 55 m (180 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).

6.1.3. Ensonified Area - Vertical Seismic Profiling

Illingworth & Rodkin (2014) measured noise levels associated with VSP (using a 750 in^3 airgun array) conducted at Cosmopolitan State #A-1 in 2013. Their results indicated that the 190 dB radius (Level A take threshold for pinnipeds and presumably sea otters) 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). Based on these results, the associated (160 dB) ZOI would be 19.2 km^2 (7.4 mi^2).

6.1.4. Sea Otter Densities

There are no published sea otter density estimates for the nearshore area along the Kenai Peninsula. Larned (2006) estimated from winter surveys for Steller's eider that there were 92 otters (December 2004) inhabiting the survey area – a 300-km^2 area north of Anchor Point. Larned (2006) also estimated that the expansion factor, or the ratio of the full survey area to the area actually sampled, was 3.27. Applied to the count data the estimated number of otters in the survey area north of Anchor Point was 300 animals, or 1.0/km^2. This estimate does not take into account missed animals; either because they were submerged or difficult to distinguish from the aerial platform (especially pups). Evans *et al.* (1997) calculated a correction factor of 2.38 for sea otters missed during aerial surveys conducted along the Aleutian Islands. Applying this correction factor (2.38) to the calculated density of 1.0 increases the estimated sea otter density to 2.38 otters/km^2. A fall 2013 survey (Owl Ridge unpublished data) of this region using line-transect methods and program DISTANCE produced a density estimate of 2.6 sea otters/km^2. It is therefore realistic to utilize the 2.38 density estimate in calculating estimated exposures.

6.2. Exposure Calculations

For purposes of this analysis, "potential exposure" was defined as a sea otter occurring within an active ZOI of a specific noise-generating activity. As discussed further below, this potential exposure does not necessarily constitute a Level B "take", especially if the otter remains above water and is not directly exposed to underwater noise. Thus, the calculated exposure values represent the number of otters that are in a position (within an active ZOI) of receiving harassment "take" noise levels should they dive during the encounter.

The estimated potential exposures of sea otters by BlueCrest's planned exploratory drilling project was determined using density estimates derived from Larned (2006) above as adjusted for missed animals (2.38/km^2). Potential exposures were derived by multiplying the maximum density (2.38 otters /km^2) by the ZOI for each activity and then by the estimated number of days the activity would occur. The rig tow is expected to last for about two to three days, the pipe driving about twelve days, and the VSP about three days. (However, pipe driving and VSP activity will only occur sporadically on any given day.) The exposure calculations can be found in Table 6-1.

Table 6-1. Estimated number of potential exposures during the 2016 drilling period.

	Tow	Conductor Pipe	VSP	Total
ZOI (km^2)	5.1	8.3	19.2	
Otter Density (No./km^2)	2.38	2.38	2.38	
Days	NA	12	3	
Potential Exposures	**12**	**238**	**138**	**388**

A mentioned above, an acoustical harassment take of a sea otter does not occur should the animal remain at the surface during the period it is found within the ZOI. During the 2013 drilling activities at Cosmopolitan State #1, only 52 of 356 recorded otters, or about 15%, actually dove underwater while within 260 m (853 ft) of the drill rig (most otters simply drifted past, and were often asleep). Thus, the exposure estimate of 388 found in Table 6-1 is conservative because it does not take into account that most otters are not expected to dive while drifting past the rig operations.

6.3. Take Authorization Request

The potential exposures for the 2016 drilling period, based on otter density, is estimated to be 388 sea otters (Table 6-1), or about 2.6% of the stock. Taking into account the 15% of the otters that are likely to dive while in the vicinity of the drill rig, the estimate number of exposures reduces to 58, or about 0.4% of the stock. However, because sea otter behavior is difficult to predict, the more conservative 388 sea otters potentially exposed is the requested authorization.

7. ANTICIPATED IMPACT OF THE ACTIVITY

7.1. Introduction

The proposed BlueCrest drilling operations that could impact local sea otters is impulsive acoustical harassment from the brief periods of conductor pipe driving and VSP activities. Disruptions are not likely to be significant enough to rise to the level of a "take" unless the sound source displaces a sea otter from an important feeding or breeding area for a prolonged period, and this project is unlikely to do so. Further, the continuous underwater noise generated by BlueCrest's proposed drilling operations would expose diving otters for only a couple of minutes at most, again questioning whether any disturbance is sufficient to cause "take" (see Section 7.5 below).

7.2. Behavioral Response

Previous work suggests that sea otters may be less responsive to impulsive underwater noise than some other marine mammals, such as mysticetes and odontocetes. Riedman (1983, 1984) monitored the behavior of sea otters along the California coast while they were exposed to a single 100-cubic-inch air gun and a 4,089-in^3 air gun array. No disturbance reactions were evident when the air gun array was as close as 0.9

km, while sea otters also did not respond noticeably to the single air gun. Sea otters spend a great deal of time at the surface feeding and grooming (Riedman 1983, 1984; Wolt et al. 2012). While at the surface, the potential noise exposure of sea otters would be much reduced by pressure-release and interference (Lloyd's mirror) effects at the surface (Greene and Richardson 1988; Richardson et al. 1995). Finally, the average dive time of a northern sea otter has been measured at only 85 seconds (Bodkin et al. 2004) to 149 seconds (Wolt et al. 2007), thereby limiting exposure during active continuous noise operations. It remains unclear whether both impulsive and continuous noise levels even rise to the level of harassment "take" at distances beyond 0.9 km, given the animal's poor underwater hearing ability and surface behavior, and for continuous noise at all given the time otters spend underwater is so infrequent and of shore duration compared other marine mammals.

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).

TTS could occur as a result of BlueCrests exploratory drilling operations, but there is no information on TTS impacts to sea otters, an animal that spends much time at the surface. The average dive time of a northern sea otter, the period the otter's ears would be underwater and exposed to underwater sounds, is only 85 seconds (Bodkin et al. 2004) to 149 seconds (Wolt et al. 2012). Wolt et al. (2012) found Prince William Sound sea otters to average 8.6 dives per feeding bout. Multiplied by the average dive time (149 seconds), the average total time a sea otter spends underwater during a feeding bout is about 21 minutes, or 12 to 18 percent of the time of a typical 2- to 3-hour slack-tide. Except for loud screams between pups and mothers (McShane et al. 1995), sea otters do not appear to communicate vocally, either at the surface or under water, and they do not use sound to detect prey. Thus, any TTS due to impulsive or seismic noise is unlikely to mask communication or reduce foraging efficiency. Finally, sea otters are unlikely to rely on sound to detect and avoid predators. For example, sea otters at the surface are not likely to hear killer whale (*Orcinus orca*) vocalizations.

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 also not an issue with sea otters and continuous noise sources. Sea otter exposure to underwater noises generated by vessels (propellers) or underwater pumps would be of very short duration because the average dive time of a northern sea otter is only 85 seconds (Bodkin et al. 2004) to 149 seconds (Wolt et al. 2012). Airborne exposure is also of little concern since pressure release and Lloyd's mirror-effect will reduce underwater noise transmitted to the air. Riedman's (1983, 1984) observations of sea otters lack of reaction to seismic noise was likely due largely to these transmission limits.

7.4. Masking

Masking occurs when louder noises interfere with marine mammal vocalizations or their ability to hear natural sounds in their environment (Richardson et al. 1995). These noise levels limit their ability to communicate and/or avoid predation or other natural hazards. However, as mentioned above, sea otters do not vocally communicate underwater (Ghoul and Reichmuth 2012) and masking due to exposure to underwater noise is not relevant.

Sea otters do communicate above water with the loud screams between separated mothers and pups of most importance (McShane et al. 1995). Ghoul and Reichmuth (2012) measured these vocalizations and found that the intensity of these calls ranged between 50 and 113 dB SPL re 20 μPa, and were loud enough that they can be heard by humans at distances exceeding 1 kilometer (McShane et al. 1995). Any potential masking effect from any noise entering the air from the impact hammer or VSP air gun would be brief (a strike or shot) and would likely disappear a few meter from the source.

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.

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.).

8. ANTICIPATED IMPACTS ON SUBSISTENCE USES

The proposed drilling activities will occur near the marine subsistence areas used by the villages of Homer, Ninilchik, and Kenai. The MMPA permits Alaska Natives to harvest sea otters for subsistence purposes or for the purposes of creating authentic Native articles of handicrafts and clothing, provided this is accomplished in a non-wasteful manner. There are no harvest quotas for Cook Inlet sea otters, but dozens are taken there annually. Between 1989 and 2012 (24 years), villagers from Homer harvested 210 otters, while Kenai reported 100 and Ninilchik 18 otters harvested. In addition, native residents of Anchorage harvested 982 otters during this period, although the harvest locations are unknown (and Prince William Sound and Resurrection Bay are much closer to Anchorage than the Kenai Peninsula and Kachemak Bay). Upper Cook Inlet subsistence villages, such as Tyonek, have not reported otter harvest, largely because sea otters do not occur in upper Cook Inlet.

The impact of drilling operations at Cosmopolitan State is unlikely to impact the availability of sea otters for subsistence harvest in Cook Inlet. The impact of drilling operations is unlikely to affect any sea otter sufficient to render it unavailable for subsistence harvest in the future.

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.

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).

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). However, the lower inlet does support a wide variety of invertebrates and fish including Pacific halibut (*Hippoglossus stenolepis*), Dungeness crab (*Cancer magister*), tanner crab (*Chionecetes* spp.), pandalid shrimp (*Pandalus* spp., Pacific cod (*Gadus macrocephalus*), 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). Urchins (*Strongylocentrotus* spp.) and sea cucumbers (*Parashichopus californicus*), important otter prey, are also found in the shell debris communities. Razor clams (*Siliqua patula*) are found all along the beaches of the Kenai Peninsula.

Sea otters inhabiting Kachemak Bay feed primarily on mussels (41%), crabs (32%), and clams (12%) (Doroff *et al.* 2012). Sessile invertebrates, mussels and clams, were especially important during fall when they comprised 75-80% of the prey volume (Doroff *et al.* 2012). Thus, the nearshore habitats that support this species are of most importance to Cook Inlet sea otters.

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 0.8-ha (2-ac) footprint of the well 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]) 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 SEA OTTERS

Based on the conclusions of Section 9 above, no direct loss or modification of sea otter habitat is expected. Any impacts to prey resources are 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 sea otter 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 sea otter use where animals chose to avoid the higher noise levels. However, these impulsive noise sources would 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.

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 sea otters, 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 sea otter habitat are therefore insignificant (see Appendix II).

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 including sea otters. 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 and FWS 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 sea otters 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 sea otters, including any observed reactions to BlueCrest's proposed operations will be recorded and reported to FWS.

Further, to ensure that there will be no adverse effects resulting from the planned drilling activities, BlueCrest is currently coordinating with FWS, NMFS, 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 sea otter interactions with the BlueCrest operations deemed potentially harmful will be immediately reported to the FWS. Given the very low number of sea otters likely to be encountered during the Cook Inlet operations, especially considering the actions (such as timing) to be taken to avoid encounters, developing a research program would be impractical.

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APPENDIX I

Marine Mammal Monitoring and Mitigation Plan

Marine Mammal Monitoring and Mitigation Plan

BlueCrest Operating Alaska LLC

Cosmopolitan State Exploratory Drilling Program

January 2015

Prepared for

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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 135 days. The exact timing of the project is dependant upon rig availability, but would occur in the summer operating season between April 15 and October 31, 2016. BlueCrest intends to use the *Spartan 151* drill rig or a similar rig. This marine mammal monitoring and mitigation plan (4MP) addresses the drilling and associated activities at Cosmopolitan State.

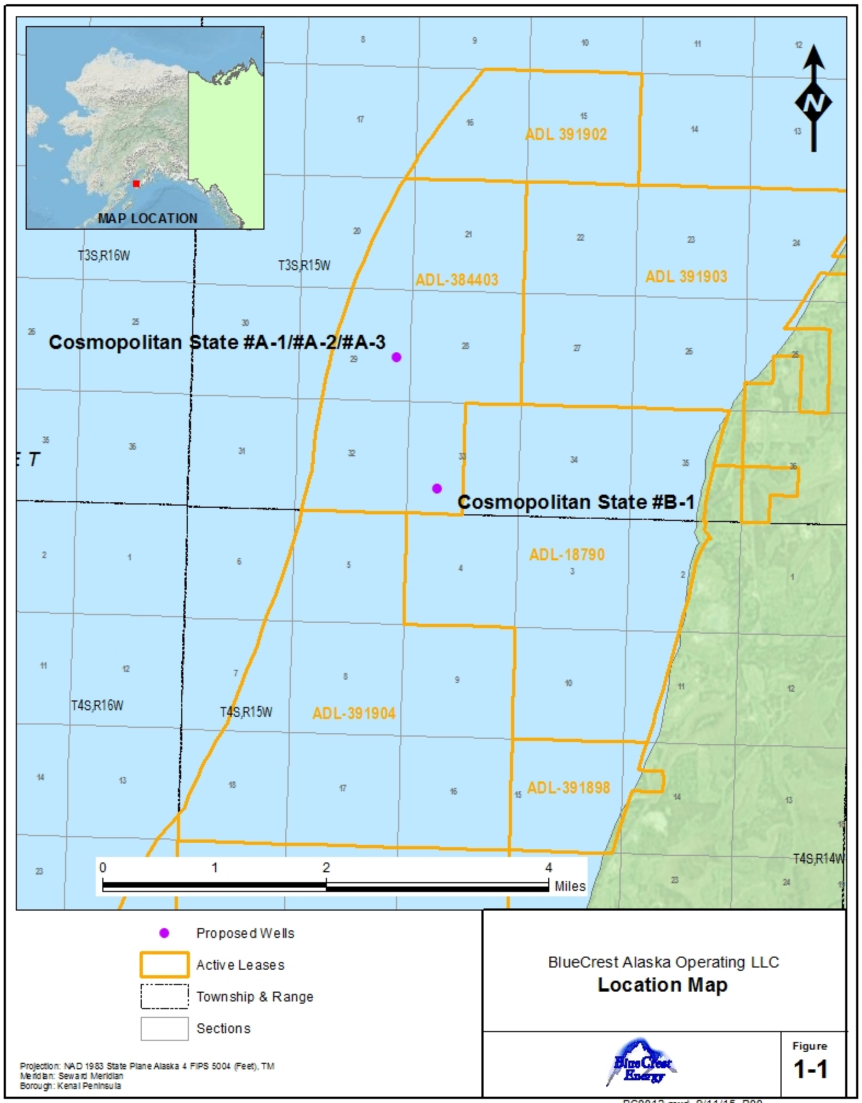

FIGURE 1-1. PROPOSED PROJECT AREA FOR BLUECREST'S 2014 EXPLORATORY DRILLING PROGRAM

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.

All of these operations, except drilling, emit 1-m source noise levels exceeding 160 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, and 160 dB not at all. 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 any activity that generates noise that could potentially harass marine mammals, 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 that doesn't generate harassment level noise.

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. Still, because it is currently unknown which tugs will be used to tow the rig on each tow (to and from the well site), and there are few sound signatures for tugs in general, it is assumed that noise exceeding 120 dB dB re 1 μPa-m (rms) extends 523 m (1,716 ft) from the operating tugs (based on a 171 dB re 1 μPa-m (rms) source). The tug's cavitating propellers do not exceed 180 dB re 1 μPa-m (rms) at 1-m source, thus they do not represent a Level A injury take concern.

3.1.1. 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).

3.1.2. 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.

3.1.3. 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. Drill Rig Tow

The wet-towing of the drill rig to the well site would occur in early summer 2015 with the rig moved from its current location at Port Graham to Cosmopolitan State #B-1.

The expected source levels from tugs during wet-tow operations are expected to be well less than 180 dB, thus there are no Level A injury concerns relative to noise. The estimated distance to the 120-dB isopleth (the Level B harassment threshold), assuming a 171 dB re 1µPa source (Richardson *et al.* 1995) and using Collins *et al.*'s (2007) 18.4 Log r spreading model determined from Cook Inlet, is 523 m (1,712 ft).

Because the ocean tugs will be under tow while they are generating noises of concern they will be traveling at very slow speeds (1 to 5 knots) providing sufficient time for marine mammals to move from the vicinity and avoid any possible injury take due to collision or noises exceeding injury thresholds. Altering courses or speeds to avoid harassment takes will be conducted when feasible, but completely shutting engines down would represent a major (and perhaps illegal) safety concern given the inherent hazards of towing at sea, thus, while marine mammals will be monitored, no safety shutdowns will occur, however, marine mammal monitoring will occur during all tow events.

4.2. 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.

4.3. Rig Operation

Hydroacoustic tests were conducted by MAI (2011) on the *Spartan 151* in 2011. The results indicated that the lattice legs of the drill rig were preventing significant noise from entering the water column. MAI (2011) found that underwater noise levels associated with drilling did not exceed ambient, while the large power generators onboard the rig produced noise that exceeded 120 dB only out about 50 m. Noise associated with drilling and general operation of the drill rig is of little concern to marine mammals.

4.4. 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.

4.5. Summary of Monitoring Zones

- Wet-tow – 523 m (1,716 ft), no shutdown, only avoidance.
- 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. Drill Rig Tow

The initial rig tow from Port Graham to Cosmopolitan #B-1 is expected to last less than 12 hr. A single observer will monitor for marine mammals during the tow. If the rig is towed from an upper Cook Inlet location, and is expected to last more than 12 hr (which it is), then two observers, working alternate shifts, will be used.

5.1.2. 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.

5.1.3. 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

The wet-tow will most likely occur during the summer when Alaska days are long. However, because there are no injury-take concerns with the wet-tows, and only a very low potential for acoustical harassment, no special considerations will be made to monitor during poor visibility conditions. 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 exploratory drilling and 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 FWS within a few days of completing each of the three activities (rig tow, pipe driving, and VSP). The monthly report will contain and summarize the following information as appropriate:

- Dates, times, locations, heading, speed, 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 vessel, 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 seismic activity (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 seismic activity (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 and FWS 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 or FWS to incorporate observation data into the next Authorization. The report will summarize all activities and monitoring conducted during rig towing, pipe driving, and VSP operations. The Technical Report will include the following:

- Summaries of monitoring effort (*e.g.*, total hours, total distances, 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, FWS, 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).

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, FWS, and the NMFS Alaska Stranding Hotline and/or by email to the Alaska Regional Stranding Coordinators, within 24 hr of the discovery. BlueCrest would provide photographs or video footage (if available) or other documentation of the stranded animal sighting to NMFS, FWS, 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 August 29, 2012, which covers operations in the upper Cook Inlet from April 15 to October 31.

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.