

The Pebble Project and McNeil River Brown Bears

By

Lowell H. Suring
Principal Wildlife Ecologist
Northern Ecologic L.L.C.
10685 County Road A
Suring, Wisconsin 54174

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Lowell H. Suring, Northern Ecologic L.L.C., 10685 County Road A, Suring, Wisconsin 54174, USA

Executive Summary

Introduction

McNeil River supports the world's largest congregation of brown bears (*Ursus arctos*). Recognizing this, the Alaska State Legislature established the McNeil River State Game Sanctuary, the McNeil River State Game Refuge (Refuge), and the Kamishak Special Use Area to provide permanent protection for brown bears and opportunities for wildlife viewing (among other uses). Southwest Alaska residents and visitors were estimated to spend nearly \$145,000,000 (2019 dollars) annually to view wildlife and generated more than an additional \$133,000,000 in associated annual economic activity. Much of the wildlife viewing activity in southwest Alaska is centered on observing brown bears.

Pebble Limited Partnership is proposing to develop the Pebble copper-gold-molybdenum porphyry deposit as a surface mine in Southwest Alaska. In 2018, applications were submitted to the U.S. Army Corps of Engineers for development of the Pebble Mine (Project); including one alternative that would place a road and a natural gas pipeline closer than 76 – 91 m (250 – 300 ft) and an industrial port facility within 3.2 km (2 mi) of the northern border of the Refuge. This document reviews the potential impacts on brown bears of the proposed road, natural gas pipeline, and road corridor from the south ferry terminal on Iliamna Lake to the port facility on Kamishak Bay and the port facility.

Issues

Comments from the public during the scoping process for the Project included concern regarding wildlife, with specific emphasis on brown bears including the effects of noise, potential for brown bear mortality due to defense of life or property (DLP), and food-conditioning of brown bears. Other issues include the effects of the Project on denning behavior and habitat, and the effect of Project roads on brown bear behavior and habitat. Additionally, there are issues with the overall analysis of impact in the Draft Environmental Impact Statement (DEIS), discussion of cumulative effects, presentation of mitigation practices, and adequacy of base-line studies.

- The DEIS provides very little evaluation of the potential impact of noise generated by the project on brown bears. This needs to be better addressed.
- Food-conditioned brown bears are likely to occur with implementation of the Project. As a result, brown bears have increased vulnerability to mortality through DLP kills. To mitigate the potential of human-brown bear encounters, roads developed for this project should avoid high quality habitats for brown bears. Additional mitigation measures relative to use of project roads should follow those implemented for the Greens Creek Mine in Southeast Alaska.
- The most direct and most effective approach to dealing with food-conditioned brown bears is to have agency personnel kill them. To avoid these situations it will be necessary

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to have in-depth training on food-handling for all Project personnel so they understand and appreciate the seriousness of preventing food-conditioning in brown bears.

- Discussion of brown bear den sites within the area that may be affected by the Project was limited to a description of the findings of an aerial survey of den locations. With the potential for increased human activities in this area as a result of resource extraction and human access associated with the Project, gaining a fuller understanding of specific denning requirements will be essential for developing future management actions that do not jeopardize the brown bear population.
- Management of human access associated with roads will help to reduce mortalities of brown bears adjacent to roads. However, it does not address mortalities of brown bears resulting from collisions with Project vehicles on the road or the fragmentation of habitat due to the reluctance of brown bears to cross the road when it is in service. To maintain movement patterns of brown bears in the area, it will be necessary to describe movement corridors for brown bears, identify probable locations for brown bears to cross the road, and facilitate crossing activity.
- Generally, there was not an analysis of the impact of the issues related to brown bears that completely addressed the factors of analysis used to evaluate environmental consequences (i.e., magnitude or intensity, duration, geographic extent). *Magnitude* or *intensity* of the potential effects associated with these issues was not addressed for brown bears. Magnitude of effect would be best described for brown bears as estimated changes in distribution, population density, and demographic factors. None of those were specifically addressed. *Duration* of the effect of most issues was generally adequately addressed (i.e., the effect would last the life of the project). Analysis of the *Geographic extent* of the effect was problematic in that brown bears are a landscape species and the analysis area for effects on terrestrial mammals (including brown bears) resulting from actions within the transportation corridor and at the port was limited to a 4.8-km (3-mi) radius.
- A comprehensive analysis of the cumulative effects on brown bears would certainly include the combination of changes to the brown bears' environment that are caused by Project actions in combination with other past, present, and future human actions. What is included in the DEIS under cumulative effects analysis for brown bears is a series of unrelated statements mostly associated with potential impacts of spills and unplanned releases of materials that may contaminate the environment. A more in-depth analysis is needed that evaluates changes in quality of habitat for brown bears as a result of habitat modification and the reduction in the effectiveness of that habitat as a result of disturbance and mortality.
- The risk of mortality to brown bears and ecological disruption associated with the Project is high. An integral part of managing the Project will be the development and full implementation of a comprehensive mitigation plan. Mitigation planning will provide the means and opportunity to integrate conservation of ecological processes into the design and implementation of the Project to reduce that risk. Therefore, it is critical that the complete mitigation plan be available for review and evaluation prior to approval of the Project.
- Base-line studies for brown bears should include a more comprehensive synthesis of the relevant literature, periodic population estimates within the project area, and

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determination of landscape-use patterns and use of those data to conduct analyses of habitat use in the project area.

Conclusions

Brown bears associated with the Project area are a resource that has high ecological, economic, and social value. Any impact on this resource through implementation of a large-scale mining project would have significant ramifications. The data and analysis provided in the Affected Environment and the Environmental Consequences sections of the DEIS are not adequate to fully understand and evaluate the effects of potential management alternatives on brown bear habitat and populations in this area.

In-depth studies of the ecological relationships of brown bears in the Project area are needed to provide information for conservation and management of these animals. Wildlife corridors and mitigation passages are critical to the conservation of brown bears in this area, especially in ensuring that landscape use patterns of brown bears are maintained. Also, upon initiation of the Project, a rigorous monitoring plan also needs to be implemented to evaluate the accuracy of effects analyses and the effectiveness of the mitigation strategy to ensure the continued wellbeing and likely survival of these brown bears.

Introduction

McNeil River

McNeil River, located in southwestern Alaska (Figure 1), supports the world's largest congregation of brown bears (*Ursus arctos*) (Griffin and Weiss 2019). In 2018 16–77 individual brown bears were observed per day at McNeil River falls throughout July. The Alaska State Legislature established the McNeil River State Game Sanctuary (Sanctuary) in 1967 to:

1. provide permanent protection for brown bears and other fish and wildlife populations and their habitats so that these resources may be preserved for scientific, aesthetic, and educational purposes;
2. manage human use and activities in a way that is compatible with the permanent protection of brown bears and enhance the unique bear-viewing opportunities within the Sanctuary; and
3. provide opportunities for wildlife viewing, fisheries enhancement, fishing, temporary safe anchorage, and other activities (AS 16.20.162(a)). Hunting, trapping, and mineral entry are prohibited in the sanctuary.

The Sanctuary was expanded and the adjoining McNeil River State Game Refuge (Refuge) was created in 1991 (Figure 1). The Refuge was created for purposes similar to those of the Sanctuary. However, black bear and small game hunting and trapping are allowed in the Refuge but hunting for brown bears is prohibited (AS 16.20.041). Additionally, human use in the Refuge is managed to maintain and enhance the unique brown bear-viewing opportunities within the adjoining Sanctuary. In 2018, the Alaska Department of Fish and Game (ADF&G) received 862 applications for McNeil River guided and standby bear-viewing permits (Griffin and Weiss 2019). Overall, 211 permits were issued and 187 permit holders visited the Sanctuary resulting in 1,173 visitor-use days and generating >\$96,000 in permit income for ADF&G. Clayton and Mendelsohn (1993) determined that visitors to the Sanctuary were willing to pay up to \$500 (2019 dollars) in fees to visit this site. Southwest Alaska residents and visitors were estimated to spend nearly \$145,000,000 (2019 dollars) annually to view wildlife (ECONorthwest 2014). These expenditures generated more than an additional \$133,000,000 in associated annual economic activity in southwest Alaska (ECONorthwest 2014). Much of the wildlife viewing activity in southwest Alaska is centered on observing brown bears (Matt and Suring 2018).

The Sanctuary and the Refuge are approximately 1,005 km² (388 mi²) in size (Griffin and Weiss 2019). These areas are included in a larger area of approximately 14,464 km² (5,585 mi²) that includes Katmai National Park and the Kamishak Special Use Area (Alaska Department of Natural Resources 1990) in which brown bears are protected from hunting. In 2018 the Pebble Limited Partnership submitted applications to the U.S. Army Corps of Engineers (ACOE) for development of the Pebble Mine in Bristol Bay; including one alternative that would place a road and a natural gas pipeline closer than 76 – 91 m (250 – 300 ft) and an industrial port facility within 3.2 km (2 mi) of the northern border of the Refuge. Policies within the Refuge and Sanctuary do not allow activities that would compromise the ecological integrity of the area (Schempf and Meehan 2008). This includes construction of new permanent roads, pipelines, utility lines, or docks, primarily to prevent disturbance to brown bears.

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While essentially all brown bears are managed at the population level, the brown bears at McNeil River are unique in that individual brown bears have specific importance to the continued success of the visitor experience that the Sanctuary provides.

Pebble Project

Pebble Limited Partnership is proposing to develop the Pebble copper-gold-molybdenum porphyry deposit (Pebble deposit) as a surface mine in Southwest Alaska near Iliamna Lake, approximately 322 km (200 mi) southwest of Anchorage and 97 km (60 mi) west of Cook Inlet (Figure 2). The closest communities are the villages of Iliamna, Newhalen, and Nondalton, each approximately 27 km (17 mi) from the Pebble deposit.

In 2018 the Pebble Limited Partnership submitted applications to the ACOE for development of the Pebble Mine in Bristol Bay. The preferred alternative for the Pebble Project comprises 4 primary elements: (1) the mine site at the Pebble deposit location; (2) 1 port site in Kamishak Bay in Cook Inlet and 2 ferry terminals in Iliamna Lake; (3) a road corridor connecting the mine site, ferry terminals and port; and (4) a natural gas pipeline connecting to existing infrastructure on the Kenai Peninsula (Figure 2) (The Pebble Partnership 2019a:2).

The proposed transportation corridor will connect the mine site to the proposed Amakdedori Port on Cook Inlet, and includes 2 main components: (1) a private, double lane road extending 48 km (30 mi) south from the mine site to a ferry terminal on the north shore of Iliamna Lake; and (2) a private, double-lane road extending 56 km (35 mi) southeast from the south ferry terminal to the Amakdedori Port on Kamishak Bay. The port site will be located north of the Amakdedori Creek outflow into Kamishak Bay on the western shore of Cook Inlet. The port site will include shore-based and marine facilities for the transfer, shipment, and temporary storage of concentrate, freight, and fuel for the Project. This alternative would place a road and natural gas pipeline closer than 76 – 91 m (250 – 300 ft) and an industrial port facility within 3.2 km (2 mi) of the northern border of the Refuge.

Objective

The primary objective of this document is to review the potential impacts of the proposed road, natural gas pipeline, and road corridor from the south ferry terminal on Iliamna Lake to the port facility on Kamishak Bay and the port facility on brown bears. Potential impacts on brown bears associated with the Sanctuary will be of particular interest. A secondary objective is to review general potential impacts of the whole Pebble Project on brown bears.

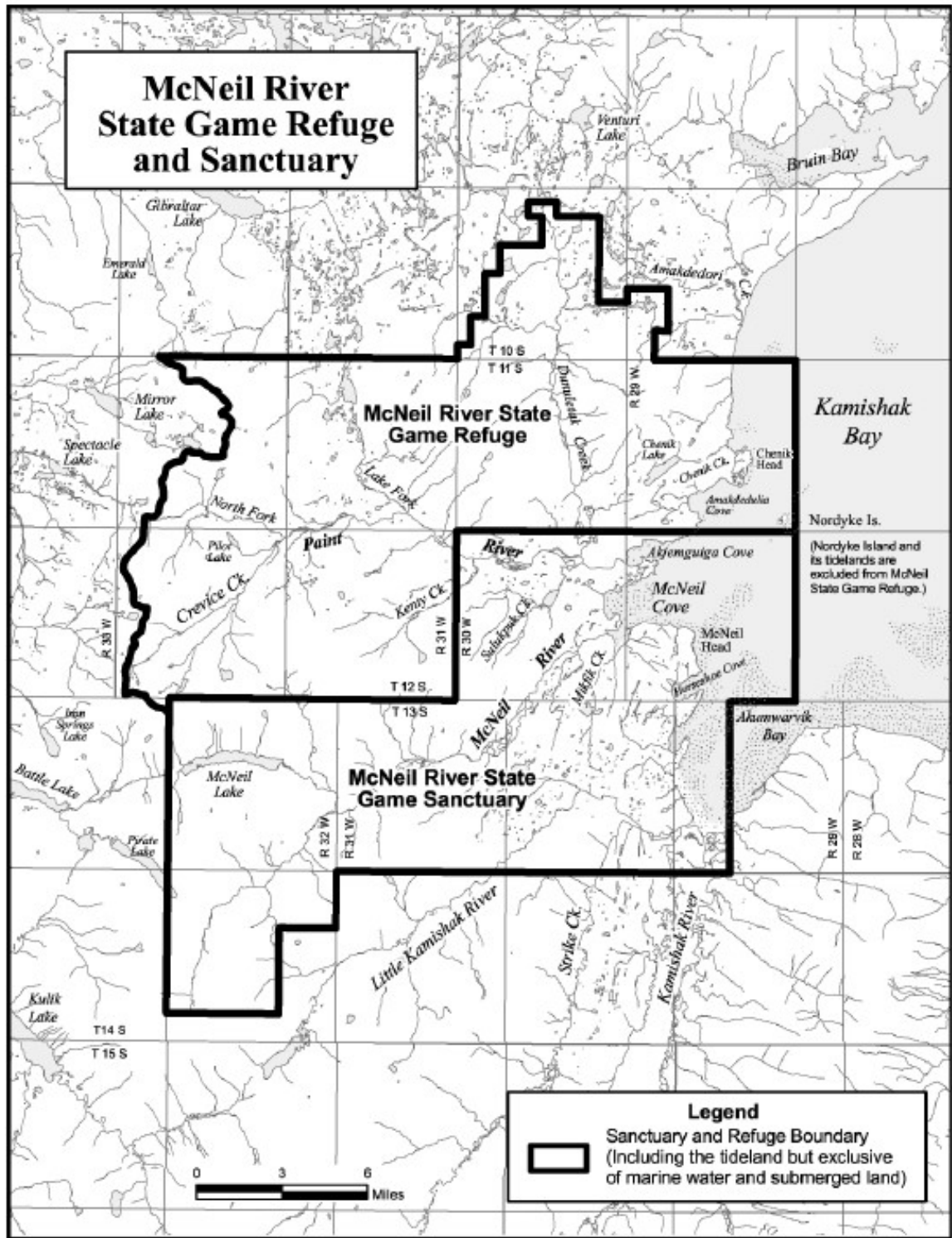


Figure 1. Location of the McNeil River State Game Sanctuary and McNeil River State Game Refuge in Southwest Alaska (from Schempf and Meehan 2008).

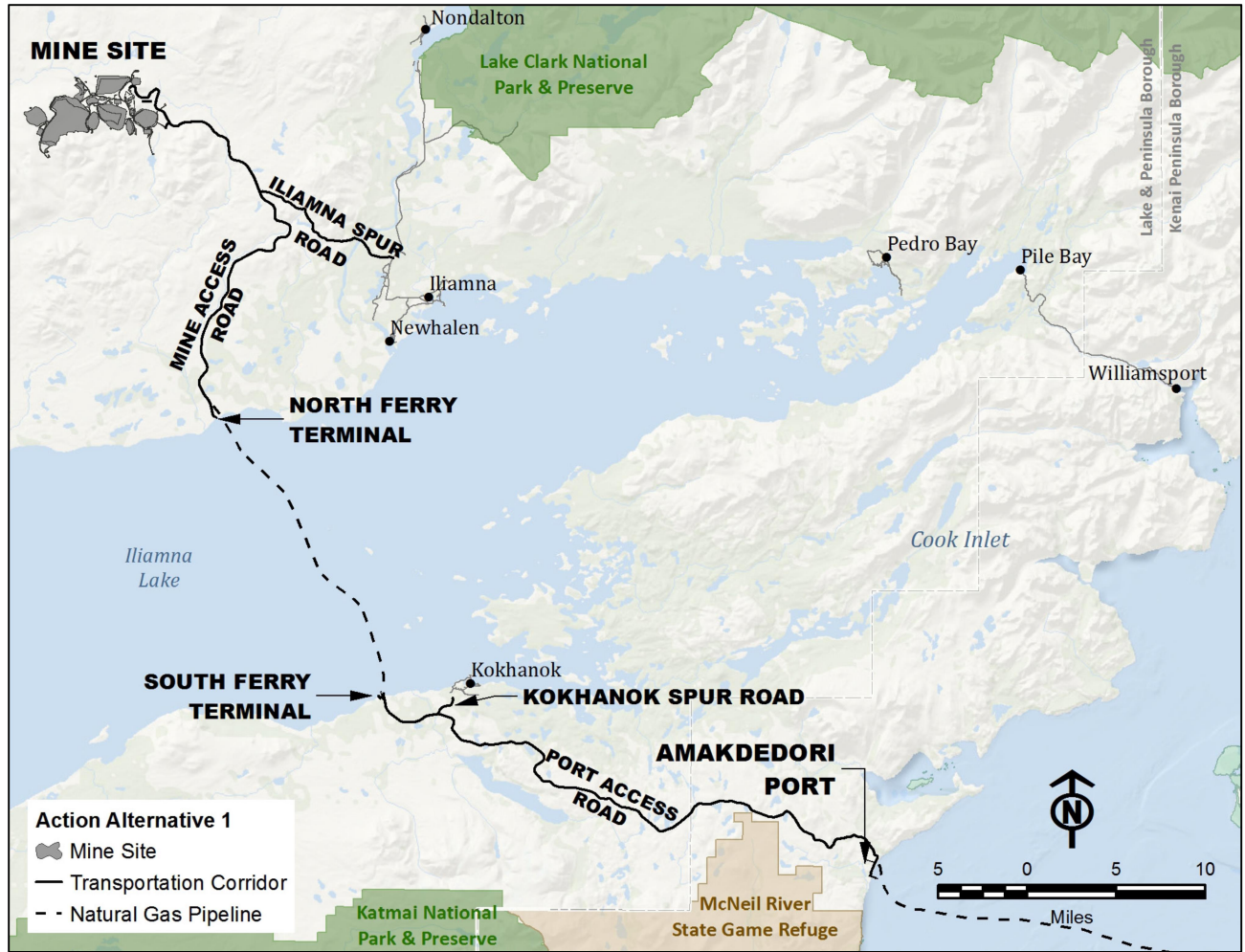


Figure 2. Overview of the preferred alternative for the Pebble Project (from The Pebble Partnership 2019b:2).

Evaluation of Potential Effects

Issue: Analysis of Impact

Scoping Comments

Comments from the public during the scoping process for the Project included the following regarding wildlife, with a specific emphasis on brown bears (The Pebble Partnership 2019c):

3.4.2.5 Noise

Consider noise in the water created by the proposed icebreaker ferry and the impacts to fish, *bears*, and other wildlife. (Page 11)

3.4.3.4 Wildlife and Non-Threatened and Endangered Birds and Mammals

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Analyze how noise levels from construction or large vessel traffic may deter bears from coming to McNeil River Falls, or could affect bear behavior and change or end the use of McNeil River by bears.

The proposed road and Amakdedori Port could change brown bear migration and result in brown bear mortalities.

Analyze impacts that habitat fragmentation from Amakdedori Port and the mine access road would have on bear movements.

Examine how increased contact between bears that use the McNeil River and humans could result in food conditioning of bears or direct bear mortality by humans. (Page 17)

3.4.4.1 Socioeconomic Impacts

Analyze impacts on the bear viewing industry near the proposed Amakdedori Port. (Page 19)

3.4.4.7 Recreation

Comments were received on impacts to recreation and tourism; recreational hunting and fishing usage near the mine, along river systems, and in transportation/pipeline corridor during construction and operation. This includes comments on disruption of recreational experiences (bear viewing, sport fishing).

Displacement of wildlife would impact the experience of people, throughout the proposed project area but would specifically impact the recreationists at McNeil State Game Refuge. (Page 24)

Response in the Draft Environmental Impact Statement (DEIS)

The DEIS acknowledged the issues raised in the scoping comments (summarized above) and, to an extent, described the potential impact of these issues on brown bears. But the DEIS did not completely address the *factors of analysis*.

Evaluation of Overall Analysis of Impact in the DEIS

Generally, there was not an analysis of the impact of the issues raised during the scoping process on brown bears that completely addressed the factors of analysis (4.1.1.2 Factors of Analysis – Page 4.1-1) used to evaluate environmental consequences (i.e., magnitude or intensity, duration, geographic extent). *Magnitude* or *intensity* of the potential effects associated with these issues was not addressed for brown bears. Magnitude of effect would be best described for brown bears as estimated changes in distribution, population density, and demographic factors. None of those were specifically addressed. *Duration* of the effect of most issues was generally adequately addressed (i.e., the effect would last the life of the project).

Analysis of the *Geographic extent* of the effect was problematic for brown bears in that the analysis area for effects on terrestrial mammals (including brown bears) resulting from actions within the transportation corridor and at the port was limited to a 4.8-km (3-mi) radius. Brown

bears are a landscape species because their habitat is not a specific vegetation type but rather an interspersed of various food resources and landscape features (Schoen 1990). The normal movements of brown bears are so extensive that a population's habitat must frequently be evaluated and managed on a landscape scale often exceeding 1,000s of km² (100s of mi²). Glenn and Miller (1980) described the movement of brown bears on the Alaska Peninsula and reported that brown bears moved greater distances per unit of time during spring than during other seasons of the year. Summer movements were restricted as brown bears concentrated along streams to feed on salmon. Dispersal away from streams began in late summer, eventually to den sites. The seasonal ranges of 30 adult females averaged 293 km² (113 mi²) (and those of 4 adult males averaged 262 km² [101 mi²]). The seasonal range of 5 subadult males and of 6 subadult females averaged 740 km² (286 mi²) and 224 km² (87 mi²), respectively. Collins et al. (2005) reported that 40 adult female brown bears in southwestern Alaska had home range sizes that ranged from 93-623 km² (36-240 mi²) (x = 356 km² [137 mi²]). Clearly, any potential negative effects to brown bears that may occur in the vicinity of project activities will have consequences for the brown bear population across a large area.

Limited information is available to describe movement of brown bears specifically associated with the Sanctuary and Refuge. The anecdotal evidence that is available indicates that brown bears that frequent the Sanctuary and Refuge move extensively, including within the transportation corridor and the vicinity of the port location (Figure 3).

Issue: Noise

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

4.19 NOISE

Scoping comments were received on impacts of noise pollution as a result of project construction and mining operations. Specifically, commenters requested that the EIS discuss noise impacts of blasting in the project area; describe the blasting methods that would be used; and consider noise in the water created by the proposed icebreaker ferry and the impacts to fish, *bears*, and other wildlife. (Page 4.19-1)

4.19.3.1 Mine Site

Although there are caribou, moose, *bear*, and other wildlife in the Bristol Bay Area Plan Management Unit Region 9 (ADNR 2013a) area that surrounds the mine site, there are no unique resources, or resources protected by legislation with respect to noise. Impacts from noise on terrestrial wildlife are addressed in Section 4.23, Wildlife Values. (Page 4.19-3)

4.23.2.2 Terrestrial Wildlife

Behavioral Disturbance

Noise

...*brown bears*, may not [adapt to noise], and may avoid areas or move away as people and equipment approach. (Page 4.23-13)

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The extent would include the project components and an avoidance buffer, which would likely vary depending on noise and activity levels. Because the area has a high density of bears (per Section 3.23, Wildlife Values) some individuals would experience disturbance, but impacts would not be expected to result in population-level impacts. (Page 4.23-18)

Evaluation of Analysis of Impact of Noise in the DEIS

The DEIS provides very little evaluation of the potential impact of noise generated by the project on brown bears. The limited discussion ranges from brown bears are not "... protected by legislation with respect to noise" to conjecture that brown bears may not adapt to noise but that would not result in "...population-level impacts"; statements made without any supporting evidence.

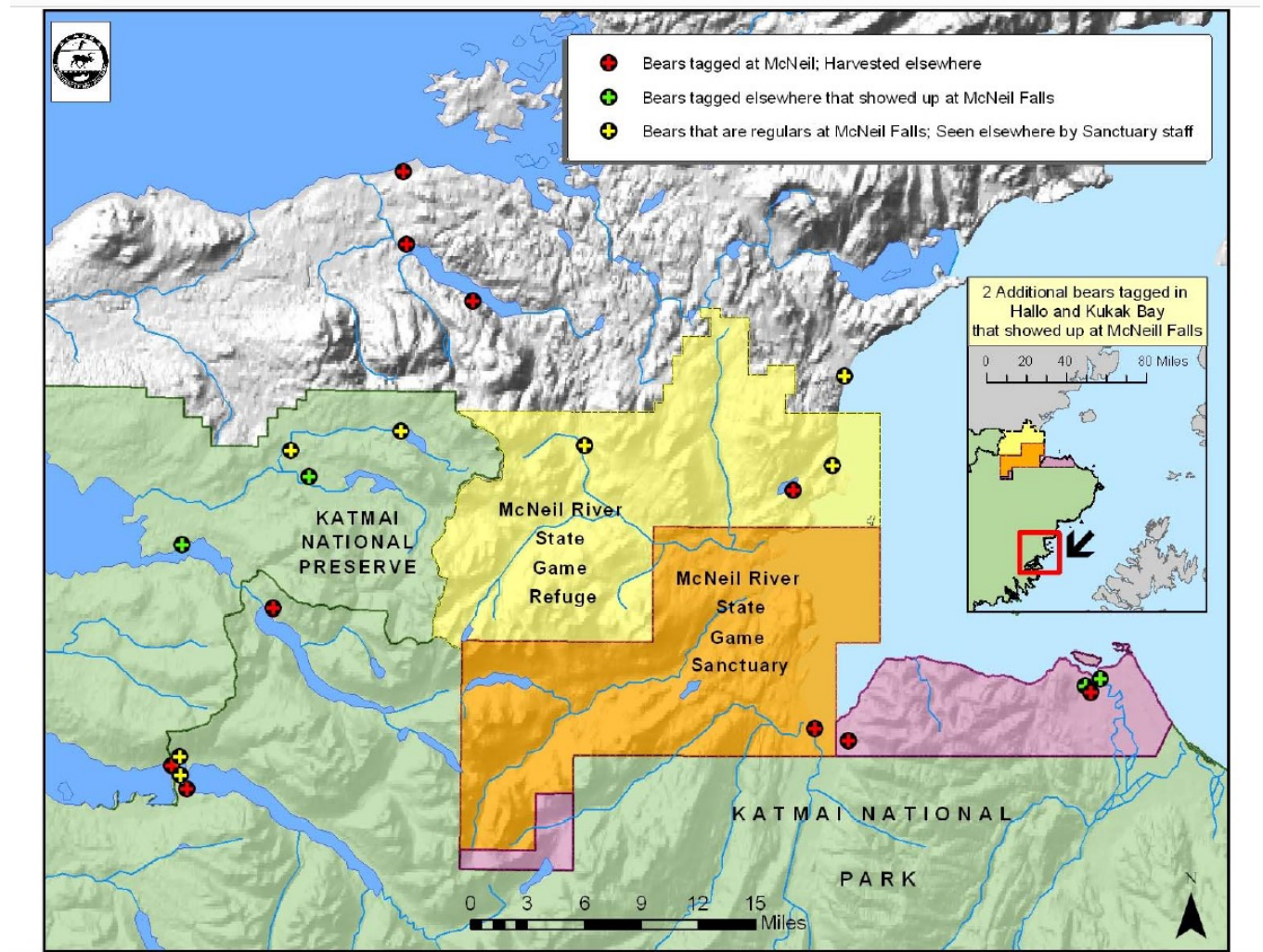


Figure 3. Movement of brown bears associated with the McNeil River State Game Sanctuary (from ADF&G).

Issue: Mortality of Brown Bears in Defense of Life or Property (DLP)

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

There would be a potential for bear mortality due to defense of life and property. Bears that become habituated and frequent the mine site, ferry terminals, Amakdedori port, or other project locations, may become a safety risk. Some of these bears may experience hazing and other negative human interactions, and then travel to areas such as Katmai National Park and Preserve and McNeil River State Game Refuge and Sanctuary. Bears that are negatively habituated to the project, or have become food conditioned, may become a danger to the public at bear viewing areas. Implementation of a WMP would be anticipated to minimize the potential for conflict between wildlife and humans.

Evaluation of Analysis of Impact of DLP Kills in the DEIS

Food-conditioned brown bears and habituated brown bears do have increased vulnerability to mortality through defense of life or property (DLP) kills. This is true for food-conditioned brown bears because they will approach people to seek food and habituated brown bears because they will tend to not avoid people during their normal daily activities. The majority of previously recorded DLP kills in Alaska resulted from interactions unrelated to food-conditioning (Miller and Chihuly 1987, Miller and Tutterrow 1999, Suring and Del Frate 2002). Increasing densities of roads and trails and high-quality habitats were associated with an increased likelihood that brown bears would be killed in DLP (Suring and Del Frate (2002). Roads and trails increase human access to brown bear habitats and facilitate the use of adjacent lands, increasing the likelihood of encounters between humans and brown bears. The increased infrastructure and increased human population associated with this project will likely result in increased encounters between people and brown bears, many of which may be habituated to humans based on their experience at McNeil River. These encounters may turn deadly for the brown bears because of perceived risk on the part of humans. To mitigate the potential of human-brown bear encounters, roads developed for this project should avoid high quality habitats for brown bears. Mitigation measures relative to use of project roads should follow those implemented for the Greens Creek Mine in Southeast Alaska (Schoen and Beier 1990):

- public access to roads should be prohibited and strictly enforced,
- project personnel should not be allowed to carry firearms while using project roads,
- project personnel should not be allowed off of the road bed except for project activities (i.e., they should not be allowed to use the road to access hunting and other recreation activities), and
- when roads are no longer necessary for project purposes, they should be permanently removed or made impassable to motorized vehicles.

Issue: Habituation and Food-conditioning

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

Bears that become habituated and frequent the mine site, ferry terminals, Amakdedori port, or other project locations, may become a safety risk. Some of these bears may experience hazing and other negative human interactions, and then travel to areas such as

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Katmai National Park and Preserve and McNeil River State Game Refuge and Sanctuary. Bears that are negatively habituated to the project, or have become food conditioned, may become a danger to the public at bear viewing areas. Implementation of a WMP would be anticipated to minimize the potential for conflict between wildlife and humans.

Evaluation of Analysis of Impact of Habituation and Food-conditioning in the DEIS

Habituation is a change in behavior that results in familiarity without adverse consequences (Aumiller and Matt 1994, Suring and Barber 2010). When brown bears are repeatedly exposed to a neutral situation, such as a person observing them from a close distance, they conserve energy by muting their reaction. Consequently, habituation often is assumed to have occurred when brown bears tolerate people at close distances and vice versa. A large population of highly habituated brown bears has occurred at the Sanctuary that perceive humans as neutral and not threatening and, therefore, less dangerous. As in other areas, habituated brown bears come closer to humans and exhibit fewer signs of stress than do nonhabituated brown bears (Herrero 1989). Highly habituated brown bears at the Sanctuary routinely approach humans to within 5-8 m (16-26 ft) before showing avoidance behavior (Aumiller and Matt 1994). A major point is that habituated brown bears do not pose a safety risk.

A large number of these habituated brown bears from the Sanctuary and Refuge are likely to occur in the vicinity of the Project's transportation corridor and Port site where they may encounter nonhabituated people who would perceive the brown bears as a threat. Mitigation measures will need to include in-depth training so that Project personnel will be able to interpret the behavior of brown bears and recognize when a threat is actually occurring. Also, possession and access to firearms will need to be restricted so that use of deadly force is not the first recourse to the presence of a brown bear. Training in, and access to, non-lethal aversion techniques, such as bear deterrent spray, will need to be implemented, with penalties for non-compliance. Bear deterrent spray is an effective tool for defusing brown bear-human conflict in a nonlethal manner (Smith et al. 2008). Widespread use of bear deterrent spray by Project personnel will promote human safety and conservation of brown bears while reliance on firearms would be less effective (Smith et al. 2012).

Habituation of brown bears to humans (as occurs within the Sanctuary and Refuge) will increase the probability of food-conditioning by brown bears that encounter Project personnel and facilities. Food-conditioning is a learned association of humans with available food (Herrero 1985, Mattson 1990). Positive conditioning of brown bears to human-provided food sources occurs when either or both of two circumstances exist:

- brown bears have fed on human-provided food,
- brown bears learn to associate humans and/or human development as potential sources of food (Gilbert 1989).

Herrero (1985) has documented that food-conditioned bears are more likely to seek food from people, to damage property, and to be killed than non-conditioned bears. Wilder et al. (2007) analyzed 171 bear-human incidents over 24 years in Lake Clark National Park and Preserve. They found that brown bears received food as a result of encounters with humans in 46% of the incidents, and that brown bears were killed in 23% of the incidents. Food-conditioned bears have been found to be 3 to 4 times more likely to be killed by humans than non-food conditioned

bears (Mattson et al. 1992). This is especially problematic because brown bears previously habituated to humans in the Sanctuary and Refuge that become food-conditioned on the Project site will return to the Sanctuary and be more aggressive towards people. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 25).

Unfortunately, the most direct and most effective approach to dealing with food-conditioned brown bears is to have agency personnel kill them (Witmer and Whittaker 2001). To avoid these situations it will be necessary to have in-depth training on food-handling for all Project personnel so they understand and appreciate the seriousness of preventing food-conditioning in brown bears. Also, organic waste should be disposed of daily through incineration that meets Alaska Department of Environmental Conservation standards for combustion residue (i.e., <5% unburned combustibles).

Also, whenever human-made items are in brown bear habitat they are susceptible to damage from brown bears. A brown bear will investigate, often by chewing, an item or structure that it has not previously encountered in that location (Herrero 1985). New signs and other structures are commonly damaged. Brown bears may also show interest in petroleum products, paint, and oils such as linseed (Katmai National Park and Preserve 2006). Precautions should be taken to exclude vehicles and construction and maintenance materials from brown bears (e.g., fenced storage areas).

Issue: Dens

Response to the Issues in the Draft Environmental Impact Statement (DEIS)

A series of three surveys for bears was conducted along the port access road in the spring and summer of 2018 (ABR 2018p, 2018k, 2018o). The first aerial surveys were conducted to locate bear dens within 0.6 mile of the port access road, and a separate corridor around the western end of Iliamna Lake. In total, the survey area was 151 square miles. Aerial surveys were flown from April 30 to May 1, 2018, and May 13-16, 2018, to assess den emergence. During these survey windows, snow was largely gone or patchy in the survey area, which limited the ability to track bears. Surveys located 64 bear dens throughout the survey area, but only a portion of these dens were in the survey area around the port access road. Specific to the port access road, dens were located in two main areas. Several dens were found from Gibraltar Lake west to Iliamna Lake, and the remaining were clustered near Cook Inlet north of Amakdedori Creek (Figure 3.23-12). Surveys documented a concentration of brown bear dens on each side of the port access road and around Amakdedori port (Figure 3.23-12). Several of the dens were close to the port access road, with the closest approximately 300 feet north of the road (ABR 2018p).

Results indicated that bear dens were located at lower elevations, steeper slopes, higher topographic positional indices, higher ruggedness, more north and west-facing aspects, and more often in shrubs (ABR 2018p). This indicates that bears in the Iliamna area are more likely to den in shrubby areas with steep slopes. A model was created to estimate density using the relative probability of detecting a bear den based on resource selection function analysis. The model predicted that the 151-square-mile survey area had an estimated density of 164 dens per 386 square miles (ABR 2018p).

Evaluation of Analysis of Impact to Dens in the DEIS

Discussion of brown bear den sites within the area that may be affected by the Project was limited to a description of the findings of an aerial survey of den locations (Prichard 2018). With the potential for increased human activities in this area as a result of resource extraction and human access associated with the Project, gaining a fuller understanding of specific denning requirements will be essential for developing future management actions that do not jeopardize the brown bear population (Mangipane et al. 2018).

Secure denning habitat is vital for future conservation of brown bear populations, as they are sensitive to den-site disturbance, which can result in lower reproductive success (Swenson et al. 1997) and reduced survival of dependent young (Linnell et al. 2000) following den abandonment. Adult male brown bears in Denali National Park and Preserve selected den sites in areas with abundant, high quality food available at den emergence (Libal et al. 2011). Risk of infanticide appeared to influence adult female den-site selection, with adult females selecting higher elevations and steeper slopes than adult males. So, den site selection can be complex within a population (Wilson and Schmidt 2015).

The work of Goldstein et al. (2010) indicated that brown bears on the Kenai Peninsula selected locations for den sites away from roads and trails. Schoen and Beier (1990) assessed the effect of the Green's Creek mine site development on Admiralty Island on denning bears. The mean distance brown bears denned from the mine site the first year of observation was 3.4 km (2.1 mi). They denned significantly farther from the mine site after construction was initiated (mean = 11.7 km [7.3 mi]). These results indicate that there is likely to be an influence on denning behavior of brown bear as a result of construction and operations in the Project area and that influence may negatively affect the brown bear population.

Findings from in-depth studies should be used to develop guidelines to minimize human–brown bear interactions and the potential impacts of land-use activities on occupied and potential denning habitat for brown bears (Pigeon et al. 2014). Preserving high-quality habitat for denning can be accomplished through planning and management because brown bears prefer and avoid specific landscape and land cover features when selecting dens.

Issue: Roads (and associated pipeline corridor)

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

In summary, the magnitude of impacts would include potential for avoidance of the mine site, the transportation corridor, and to a lesser extent, the ferry terminals and port. Because there are no established roads in the mine site, along the transportation corridor, and at Amakdedori port, the access roads, mine, port, and ferry terminals represent novel sources of disturbance to the landscape. The duration would last for the life of the project, and longer depending on how the roads are managed post-closure. The extent would include the project components and an avoidance buffer, which would likely vary depending on noise and activity levels. Because the area has a high density of bears (per Section 3.23, Wildlife Values) some individuals would experience disturbance, but impacts would not be expected to result in population-level impacts. (Page 4.23-18)

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Brown bears are common in the area along the port access road and Amakdedori port, especially along coastal plains in the early summer, and then along salmon-spawning streams later in the summer and fall. This was documented in 2018 along the port access road, with bears along the coast in the spring and early summer, and along salmon streams later in the summer. Therefore, bears move around in relation to seasonally available food resources. Bears would be expected to cross the port access road as part of their regular movement patterns, but may show initial caution, or avoidance. Because the road would be a novel item in the landscape, bears may be wary of crossing it initially. As detailed above under “Behavioral Disturbance,” brown bears in particular would likely avoid the transportation corridor during periods of high vehicular traffic. In terms of magnitude of the impact, the number of bears that may potentially suffer injury or mortality along the transportation corridor across the life of the project would likely fluctuate in relation to the location of resources, movement corridors, time of day, and season. (Page 4.23-21)

Evaluation of Analysis of Impact of Roads in the DEIS

The evidence is clear that motorized access into brown bear habitats can have significant negative consequences on brown bears (Proctor et al. 2018). Roads cause functional habitat loss, alter movement patterns, and can become ecological traps for wildlife (Northrup et al. 2012). Proctor et al. (2018) found that road construction impacted brown bears at the individual and population levels through effects on brown bears’ habitat use, home range selection, movements, population fragmentation, survival, and reproductive success that ultimately were reflected in population density, trend, and conservation status.

However, many of the negative effects of roads are likely to be a function of the human use of roads, not the road itself. Suring et al (2006) showed that relative probability of use by female brown bears on the Kenai Peninsula declined as road densities increased. Other work showed that on the Kenai Peninsula the probability of brown bears being killed in defense of life or property increased as the density of roads increased (Suring and Del Frate 2002). Schoen and Beier (1990) evaluated the immediate effect of road construction on Admiralty Island on brown bears. Prior to road construction they counted 57 day beds within 60 m (200 ft) of either side of Zink Creek. A year after road construction along the creek, they counted 17 day beds in the same area. Because they tend to use large areas, large carnivores like bears are particularly susceptible to the effects of roads (Gucinski et al. 2001). Road construction and use has substantially reduced habitat effectiveness for brown bears in other areas (Boulanger and Stenhouse 2014). The analysis of Boulanger and Stenhouse (2014) demonstrated that road density affects both the direct demography and trend of bear populations and also introduces additional risk into reproduction and recruitment.

Access management, the limiting of road access, is often suggested as a means to reduce mortalities but requires detailed knowledge of the response of brown bears to road traffic (Northrup et al. 2012). Some habitat value may be maintained near roads if traffic and firearms are restricted during resource extraction and roads are closed to all use (including all-terrain vehicles) after resource extraction has been completed (Boone and Hunter 1996, Wielgus et al. 2002, Wielgus and Vernier 2003).

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Motorized access management—where roads are fully closed or restricted to the motorized public but may remain accessible to short-term industry use—is an effective mitigation and should be integrated into land use and wildlife management activities, particularly where brown bear conservation is a priority (Proctor et al. 2018).

Access management will help to reduce mortalities of brown bears adjacent to roads. However, it does not address mortalities of brown bears resulting from collisions with Project vehicles on the road (as experienced at the Green’s Creek mine on Admiralty Island [USDA Forest Service 2003]) or the fragmentation of habitat due to the reluctance of brown bears to cross the road when it is in service. Specifically, roads may form a barrier to movement (Proctor et al. 2005, 2012, 2015) or contribute to direct mortality from collisions with vehicles (Collins and Kays 2011). Northrup et al. (2012) reported that brown bears avoided crossing roads receiving >20 vehicles per 24 h period. The Project road is scheduled to have a truck density of 79 vehicles per 24 h period (1 vehicle every 18.5 minutes). This density does not include maintenance vehicles and administrative traffic. To maintain movement patterns of brown bears in the area, it will be necessary to describe movement corridors for brown bears, identify probable locations for brown bears to cross the road, and facilitate crossing activity (e.g., Suring et al. 2017). Exclusion fencing and wildlife overpasses and underpasses have been successfully used to facilitate the safe movement of animals across roads (Corlatti et al. 2008, Beckmann et al. 2012, Ford et al. 2017).

Issue: Cumulative Effects

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

- *Bears* may change their foraging areas and have increased mortality from new roads and mortality from defense of life and property. (Page 4.23-43)
- Iniskin Bay has a large seasonal concentration of *brown bears* at the end of the bay, which would be directly impacted. (Page 4.23-45)
- Larger terrestrial mammals such as *bears (Ursus species)*...are unlikely to be impacted by a terrestrial diesel spill because it is unlikely they would be in the immediate vicinity during the spill, and are likely to vacate the area during active spill cleanup. For terrestrial mammals that might be exposed, numbers of individuals are expected to be small, with no population-level effects. (Page 4.27-15)
- Most terrestrial species do not use the marine-terrestrial interface extensively, although some large mammals, such as *brown bears (Ursus arctos)* and other mammal species, may occasionally forage along exposed tidal flats in Kamishak Bay. In Kamishak Bay, there is a small area of razor clam (*Siliqua species*) beds at the mouth of Amakdedori Creek (GeoEngineers 2018), but the rest of Kamishak Bay does not support extensive razor clam beds (NOAA 2002), and therefore it is not a major clamming area for *bears*. (Page 4.27-22)
- If a concentrate spill occurs and enters flowing water, concentrate would be carried rapidly downstream and dispersed. Leaching of metals from concentrate would likely require years to decades (see “Fate and Behavior of Spilled Concrete” section, above). Additionally, copper does not bioaccumulate (EPA 2014), and therefore does not pose a consumption risk to *bears (Ursus species)*, gray wolves (*Canis lupus*), and other terrestrial wildlife *that consume salmon*. (Page 4.27-46)

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- Any impacts to fish populations, detailed in the fish section below, would directly impact terrestrial species that prey on fish, such as *brown bears (Ursus arctos)* and gray wolves (*Canis lupus*). (Page 4.27-87)
- There are a few scattered *bear dens* on slopes above the SFK, which would not be directly impacted. The area does not appear to concentrate moose or caribou, although the occasional *brown bear* has been detected in the area. (Page 4.27-106)
- Because fish are an important part of the food chain for terrestrial mammals such as *brown bears*, wolves, and others, impacts to fish populations may result in impacts to these species. Impacts may include altered foraging locations (if fish levels are reduced) and potential for increased competition and decreased fitness through increased energy expenditure to find resources. (Page 4.27-122)
- Species such as river otters and *bears* can bioaccumulate mercury from fish (Mann et al. 2011 in Sánchez-Bayo et al. 2011). (Page 4.27-123)

Evaluation of Analysis of Cumulative Effects in the DEIS

An analysis of the cumulative effects on brown bears would certainly include the combination of changes to the brown bears' environment that are caused by Project actions in combination with other past, present, and future human actions. What is included in the DEIS under cumulative effects analysis for brown bears is a series of unrelated statements mostly associated with potential impacts of spills and unplanned releases of materials that may contaminate the environment.

Johnson et al. (2005:4) provided a synopsis of the potential individual effects that may cumulatively impact a population of brown bears:

- The construction of facilities, such as roads, trails, or buildings, and increased presence of humans, beyond some threshold, will result in a direct loss of habitats, or indirectly, following avoidance behavior of affected brown bears.
- Human facilities, especially roads, trails, pipelines and other linear developments, also can fragment and isolate habitats.
- In addition to a loss or reduction in the effectiveness of habitats, disturbance may result in response behaviors with negative social or physiological consequences.
- Disruption of breeding or rearing activities can reduce fecundity and recruitment.
- The nutritional or hormonal costs of avoiding or responding to a disturbance may have cumulative and important implications for individual fitness and population productivity.
- More directly, human access can increase mortality through non-monitored and controlled hunting, vehicle collisions, or the removal or destruction of problem brown bears.

Suring et al. (1998) developed a model to analyze the effects of cumulative actions on brown bears on the Kenai Peninsula that incorporated many of these factors. Their model evaluated changes in quality of habitat for brown bears as a result of habitat modification (habitat submodel) and the reduction in the effectiveness of that habitat as a result of disturbance and mortality (human activities submodel). A similar analysis is needed for the Project to document and make clear the cumulative impacts all aspects of this Project will have on brown bears. The

ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 35).

Issue: Mitigation

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

A Wildlife Management Plan (WMP) would be developed for the project prior to commencement of construction, and the project would use BMPs for wildlife management. The WMP would describe the equipment, methodology, training, and assessment techniques that would be used to minimize the potential for wildlife interaction with project activities, and to minimize impacts to wildlife in the project area. (Page 5-8)

Evaluation of Mitigation in the DEIS

The Pebble Limited Partnership has the opportunity to address the conservation of brown bears using 2 separate conservation strategies: (1) preservation and protection of existing source habitats and secure areas to impede habitat degradation and ecological disruption; and (2) mitigation of sites where risk of mortality and ecological disruption is high and manageable (Nielsen et al. 2006). It is apparent that risk of mortality and ecological disruption associated with the Project is high and that an integral part of managing the Project will be the development and full implementation of a comprehensive mitigation plan.

Wildlife corridors and mitigation passages will play a critical role in ensuring that landscape patterns are maintained (Clevenger et al. 2002). Mitigation planning will provide the means and opportunity to integrate conservation of ecological processes into the design and implementation of the Project. Therefore, it is critical that the complete mitigation plan be available for review and evaluation prior to approval of the Project. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 8).

Issue: Base-line Studies on Brown Bears

Response to the Issue in the Draft Environmental Impact Statement (DEIS)

The base-line studies on brown bears performed by ABR (ABR, Inc. Environmental Research & Services 2011) for the project were summarized in the section of the DEIS on Affected Environment. (Page 3.23-19)

The stated objectives for the base-line studies were to:

- Provide adequate baseline information needed for the affected environment portion of National Environmental Policy (NEPA) documents.
 - This included assessing the seasonal distribution and abundance of brown bears through field surveys in the mine area and initial transportation corridor to provide background for impact analyses.
- Characterize the distribution and abundance of brown bears (ABR, Inc. Environmental Research & Services 2011:16.2-1).

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- This included determining distribution and abundance at biologically important times of the year, including estimates of population densities of brown bears.

Evaluation of Base-line Studies on Brown Bears in the DEIS

Habitat-value assessments were prepared for brown bear (ABR, Inc. Environmental Research & Services 2011:16.1-13 – 16.1-34). The assessment was based on sightings made during superficial aerial surveys (i.e., convenience surveys of Anderson 2001) and limited reviews of the scientific literature. The aerial surveys conducted to describe the distribution and habitat used by brown bears had serious limitations, many of which were acknowledged by the investigators (e.g., difficult observability, nonrepresentative sample [ABR, Inc. Environmental Research & Services 2011:16.1-8]). The description of habitat use by brown bears, as reported in the literature, is adequate, but limited (i.e., all relevant Alaska-based studies are not included and recent work from other areas is often missing) (ABR, Inc. Environmental Research & Services 2011:16.1-16 – 16.1-21). As a result, the habitat-value assessments for brown bears in the vicinity of the Pebble Mine Project provide a limited view of the use and values of habitats.

A population estimate was conducted for brown bears in May 2009 following procedures published and implemented by ADF&G (Becker and Quang 2009, Becker 2010). The methodology for these population estimates followed those developed by the ADF&G and is considered to be scientifically sound.

Considering the above, the following recommendations are made:

- Supplement current literature reviews on habitat-use patterns of brown bears with a more thorough examination of the available literature, including more recent literature.
- Prepare a more comprehensive synthesis of the literature to better establish the biological foundation for statements made in the literature reviews relative to habitat use in the project area.
- Complete periodic (e.g., every 3 years) population estimates for brown bears within the project area, using methods previously used, up to the point when development of the mine begins. Ensure that data collection is robust enough to limit variability in the data and to result in estimates with high confidence of accuracy. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 10).
- Collect data on landscape-use patterns by brown bears and use those data to conduct analyses of habitat use in the project area (e.g., Resource Selection Functions [Ciarniello et al. 2007]). Data-based descriptions of habitat use by brown bears within the project area are currently not available and would provide an essential basis for evaluation of the effects of proposed mine development on brown bears. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Numbers 8, 18, 25, and 27).

Conclusions

Brown bears associated with McNeil River Falls, Katmai National Park and Preserve, and Lake Clark National Park and Preserve are a resource that has high ecological, economic, and social value in Alaska, the Nation, and throughout the world (e.g. Walker and Aumiller 1993). Any impact on this resource through implementation of a large-scale mining project would have significant ramifications. The data and analysis provided in the Affected Environment and the Environmental Consequences sections of the DEIS are not adequate to fully understand and evaluate the effects of potential management alternatives on brown bear habitat and populations in this area.

Other major mine-development projects in Alaska (e.g., Greens Creek [Schoen and Beier 1990], Red Dog [Ballard et al. 1993]) and elsewhere (Johnson et al. 2005) were preceded by in-depth studies of the ecological relationships of brown bears in the project areas to provide information for conservation and management. Similar analyses on brown bears of habitat use patterns, denning ecology, movement patterns, and demographics (e.g., cub production, litter size, cub survival, adult survival, age of weaning, estimated age of first reproduction, inter birth interval, population size, sex and age ratios, annual natural mortality rate) should be completed prior to initiation of this Project. This will provide adequate base-line data to inform analyses of effects of the Project on brown bears which will, in turn, lead to development of a comprehensive mitigation strategy. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 19).

Wildlife corridors and mitigation passages are critical to the conservation of brown bears, especially in ensuring that landscape use patterns of brown bears are maintained. Mitigation planning prior to project design will provide the means and opportunity to integrate ecological processes into the design and implementation of the Project. The ADF&G concurred with this finding in their comments on the Preliminary DEIS (ADF&G Conservation Comment Number 8). Also, upon initiation of the Project, a rigorous monitoring plan also needs to be implemented to evaluate the accuracy of effects analyses and the effectiveness of the mitigation strategy to ensure the continued wellbeing and likely survival of these brown bears.

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Appendix

References in Pebble Project DEIS to Brown Bears

002 Executive Summary

3.1.2 Expected Effects (Environmental Consequences) of Alternatives

3.1.2.1 Socioeconomics

Scoping comments focused on the economic feasibility of the project, beneficial impacts of additional employment opportunities, economic impacts to recreation and commercial fisheries, impacts on the use of Iliamna Lake for sport fishing and recreation, *impacts on the bear viewing industry near the Amakdedori Port*, economic benefits to the State of Alaska, and how risks to the environment could outweigh short-term benefits.

008 Sec3.2_Lands_Ownership_Mgmt_Use

3.2.2 Land Management

3.2.2.1 State Management

Kenai Area Plan

The Kenai Area Plan divides the Cook Inlet area into 12 regions with management units. Amakdedori port and Diamond Point port would be located in Region 12, and parts of the natural gas pipeline component for all alternatives would be in Region 7 and Region 12. State-owned lands in these regions are identified to be retained in public ownership and managed for multiple uses. *The area around Amakdedori port is managed as habitat for bear spring feeding*, moose, Dolly Varden, Arctic char, ducks, and geese. Cook Inlet waters at Amakdedori are managed for recreation. At Diamond Point, the project facilities would be on lands that are private or owned by Native Corporations, but state lands and waters are designated in the plan for habitat and recreation. The plan has management guidelines for the development of transportation and utilities, which include cultural surveys, and protection of hydrologic systems and roads near wetlands. The plan also provides guidelines for waterfront development for soil erosion and fuel storage (ADNR 2001).

011 Sec3.5_Recreation

3.5.1 Recreation Management

3.5.1.1 State Lands

Alaska Department of Fish and Game

McNeil River State Game Refuge and Sanctuary

The McNeil River State Game Sanctuary (MRSGS) and Refuge (MRSGR) are located immediately south of the Amakdedori port site and port access road. They extend north and east from Katmai National Park and Preserve, to the shores of Kamishak Bay. The refuge portion is located north of the sanctuary. The MRSGS hosts visitor facilities (campground, visitor support

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buildings, trails) and *a brown bear viewing program*, which primarily occurs at McNeil River, Mikfik Creek, and along the coast. The MRSGR does not have any developed visitor facilities and is located north of the MRSGS. *Most bear-viewing activities within the refuge occur near Chenik Creek. Guided bear viewing and private visitor bear viewing occurs during the month of July.* The boundary of the refuge portion would be within 1 mile of the Alternative 1 transportation corridor (250 feet at its nearest point) and 2 miles from Amakdedori port. It would be more than 10 miles from Alternative 2 or 3 components. The McNeil River State Game Refuge and Sanctuary were established for the purpose of preserving wildlife habitats and unique brown bear concentrations. The 2008 Management Plan includes policies that support low intensity recreational uses such as information and education, camping, boating, hunting, trapping, fishing, hiking, photography, and wildlife viewing (ADF&G 2008a). The MRSGS is closed to all hunting and trapping, *while the MRSGR is closed to brown bear hunting*, but open to other hunting and trapping. Fishing is allowed in portions of the refuge and sanctuary.

Alaska Department of Natural Resources

Kenai Area Plan

The eastern end of the Alternative 1 transportation corridor and a portion of the Amakdedori port would be located in Unit 19 – Bruin Bay Uplands, which is designated Habitat. *This unit contains habitat for brown bear (spring feeding), moose, Dolly Varden/Arctic char, seabird nesting, ducks and geese, and herring spawning.* (Page 3.5-4)

The Diamond Point port under Alternatives 2 and 3 would be located within Region 12 Unit 587 – Iniskin Peninsula and Bay Tidelands and Unit 522A (described above). The Iniskin Bay lightering location would also be located in Unit 587, which is designated Habitat. This unit contains habitat for waterfowl, harbor seals, Pacific herring spawning and migration, juvenile fish/shellfish rearing, anadromous fish, and *bears*. Commercial fishing occurs in this unit and there may be potential requests for mooring buoys for ships to use during log loading (ADNR 2001). There is likely recreational fishing and wildlife viewing use within Unit 587. (Page 3.5-5)

3.5.1.2 Federal Lands

National Park Service

Katmai National Park and Preserve

The purpose of Katmai National Park and Preserve is “to protect, study, and interpret active volcanism surrounding the Valley of Ten Thousand Smokes, extensive coastal resources, habitats supporting a high concentration of salmon and *brown bears*, and an ongoing story of humans integrated with a dynamic subarctic ecosystem” (NPS 2009d). (Page 3.5-6)

Sport Hunting and Trapping

Hunting, primarily for moose, caribou, and bear, is a major recreation activity in the region (Kevin Waring and Associates 2011b). Much of the region is open to sport hunting, except Lake Clark National Park, Katmai National Park, and McNeil River State Game Sanctuary. However, hunting and trapping are allowed by the NPS and State of Alaska in the Lake Clark National Preserve, Katmai National Preserve, and McNeil River State Game Refuge (*excluding brown*

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bears in the refuge) (ADF&G 2018e; NPS 2017g, 2018a). Hunting and trapping are also allowed in the Alagnak Wild River and on certain islands in the Alaska Maritime NWR (NPS 2016a; USFWS 2014a). State lands are open to hunting unless otherwise restricted by the ADF&G, which manages hunting in Alaska. Hunting on private property, including on village corporation lands and Native allotments, requires landowner permission.

The NPS and State of Alaska cooperatively manage wildlife resources in the three regional NPS units (Lake Clark, Katmai, Alagnak Wild River), and hunters in these units must follow current state and federal hunting regulations and must have all required licenses and permits (NPS 2016a, 2017g, 2018a). The Lake Clark National Preserve is divided into three authorized hunting guide areas and there are currently two concessioners authorized to guide sport hunters in these areas and Alaska residents may hunt without a guide (NPS 2017g). There are also two concessioners authorized to guide sport hunters at Katmai National Preserve (NPS 2018a). *The McNeil River State Game Refuge is open to hunting and trapping of species except brown bears (ADF&G 2018e).*

The region is in Game Management Units (GMUs) 9 (most of the region), 17B (western portion of EIS analysis area), and 15C (Kenai Peninsula). The EIS analysis area is specifically in GMUs 9B, 17B, and 15C. *The species hunted in GMU 9 include brown bear, caribou, Dall sheep, moose, wolf, and wolverine. Species hunted in GMU 17B include black bear, brown bear, emperor goose, moose, wolf, and wolverine. Species hunted in GMU 15 include black bear, brown bear, caribou, Dall sheep, moose, mountain goat, wolf, and wolverine. In Alaska, nonresidents who hunt for brown bear, mountain goat, and Dall sheep need to be personally accompanied by a licensed hunting guide or an Alaska resident 19 years or older who is a close relative.* Though numbers of hunters by GMU are not available, Table 3.5-1 below shows 2017 harvest information by animal species and GMU (ADF&G 2018-RFI 089). (Page 3.5-8)

Wildlife and Nature Viewing

Bear viewing is especially popular at Lake Clark and Katmai national parks, and McNeil State Game Refuge and Sanctuary. Popular locations for *bear viewing* at Lake Clark National Park and Preserve include Chinitna Bay, Crescent Lake, Silver Salmon Creek, Shelter Creek, and Tuxedni Bay (NPS 2017c). Katmai has many food-rich areas *where bears tend to congregate*, such as Brooks Camp, in the preserve, and along the Cook Inlet coast. *Bears can be found in the Katmai backcountry* (NPS 2018a).

McNeil State Game Refuge and Sanctuary was designated a wildlife sanctuary in 1967 to protect the world's largest concentration of wild brown bears. McNeil River Falls are located about a mile from the mouth of McNeil River; the falls slow the movement of salmon heading upstream to spawning grounds, causing salmon to congregate. Large numbers of brown bears can be seen at McNeil State Game Refuge and Sanctuary in early July through mid-August (ADF&G 2018b).

Though *bear viewing opportunities are world-class within the region*, opportunities for viewing other wildlife species are also available at all of the recreation areas within the region.

Often these activities are combined with activities such as *bear viewing*. (Page 3.5-10)

3.5.2.4 Recreation Settings

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Apart from a few developed sites previously described, the regional public recreation areas generally provide a primitive, remote recreation setting where solitude is common and there are no lights or sounds from human development. In popular areas (*primarily popular bear viewing locations*), the few developed sites such as Lake Camp and Brooks Camp, and areas closer to villages/towns, the recreation setting may include views of limited human development and other visitors, though the setting is still primarily remote and primitive.

Visitor use at Lake Clark National Park and Preserve has been increasing over the last 10 years to almost 17,000 visitor use days, with the number of visitor use days increasing dramatically for *bear viewing*...(Page 3.5-13)

The Long Range Interpretive Plan for Katmai National Park and Preserve notes that most of the park's visitors participate in two primary activities: *bear viewing* and sport fishing; there are virtually no drop-in visitors due to the effort needed to reach the park (NPS 2009a).

The number of *bear-viewing visitors* at McNeil River Camp was an average of 178 people per year between 2008 and 2017. The number of *bear-viewing visitors* at McNeil River Camp is capped at 257 visitors per year. In 2017, there were 1,092 user days (i.e., the participation in a recreational activity at a given resource during a 24-hour period by one person) associated with *the bear-viewing program* at McNeil River Camp in McNeil State Game Refuge and Sanctuary, and another 513 user days reported by guides or the public using the Kamishak River and Chenik Creek areas of the refuge and sanctuary, primarily for fishing and *bear viewing* (ADF&G 2018a). The annual visitation to the Kamishak River and Chenik Lake areas likely varies due to the number of commercial transporter permits issued and used at each of these areas each year. There are no visitation estimates available for the Alagnak Wild River, Alaska Maritime NWR, or state lands/park sites. (Page 3.5-14)

3.5.3 Recreational Use at Project Components

3.5.3.3 Amakdedori Port

Scoping comments mentioned *local bear hunting use at the port site*. There is no existing estimate of recreational use at the port site, though there is some boating use on the Cook Inlet. Due to the large size of the inlet and other nearby locations with known fishing and wildlife viewing opportunities, there is probably low use of the port site itself for recreation other than *some local bear hunting use*. (Page 3.5-15)

3.5.3.6 Diamond Point Port

There are also opportunities for wildlife viewing in Iliamna Bay as there are large colonies of seabirds at the mouth of the bay *as well as brown bears*, moose, and shorebirds in the area (ADNR 2001).

3.5.3.7 Alternatives 2 and 3 Natural Gas Pipeline Corridor

Ursus Cove is a *known bear hunting location* (H&H Alaskan Outfitters 2018)...(Page 3.5-16)

013 Sec3.7_Cultural_Resources

3.7.3.2 Transportation Corridor

Interview-Identified Cultural Resources

Community subsistence data show harvest areas for plants, moose, caribou, *brown bear*, and other resources supporting the nearby villages, such as Iliamna, Kokhanok, Igiugig, and Newhalen. (Page 3.7-9)

015 Sec3.9_Subistence

3.9.3.3 Pedro Bay

They observed that moose were being adversely affected by increased populations of wolves and *bears* (Fall et al. 2006). (Page 3.9-17)

3.9.3.4 Nondalton

Use areas for caribou, moose, black bear, and *brown bear* hunting were from the headwaters of the Mulchatna River and towards the Koktuli River system (Fall et al. 2006). (Page 3.9-20)

3.9.3.6 Kokhanok

The lands to the south of Kokhanok are overlapping use areas for caribou, moose, *bear*, fish, waterfowl, upland birds, berries, and plants. (Page 3.9-26)

017 Sec3.11_Aesthetics

3.11.4.2 EIS Analysis Area

Mine Site

Visitors are flown into surrounding parks and other destinations over the proposed project area to access *bear viewing locations along the coastline*, in the estuaries and up the stream corridors and over the glaciers of Four Peaks Mountain. (Page 3.11-9)

Transportation Corridors

The McNeil River State Game Refuge is located in the EIS analysis area for the Alternative 1 port access road and Amakdedori port. As described in Section 3.5, Recreation, the McNeil State Game Refuge and Sanctuary is a premier destination for *bear viewing and is home to one of the largest congregations of brown bears in Alaska. Large numbers of brown bears come to McNeil River to feed on sockeye, chum, and coho salmon. Brown bears are present in the McNeil State Game Refuge and Sanctuary throughout the year, and congregate at McNeil River late May through the end of August. The Alaska Department of Fish and Game (ADF&G) operates a visitor bear viewing program at McNeil River from early June through late August. Smaller numbers of brown bears congregate at Chenik Creek in Chenik Lagoon during late June through late July, depending on the timing of the sockeye run. Guided bear viewing and private visitor bear viewing occurs during the month of July (ADF&G 2018b).* (Page 3.11-10)

028 Sec3.22_Wetlands_Aquatic_Sites

3.22.4 Other Waters Functions and Values

Rivers/Streams

Aquatic and riparian habitats also have high value for bird and mammal species including harlequin duck, bald eagle (*Haliaeetus leucocephalus*), arctic tern, river otter, brown bear (*Ursus arctos*), and beaver. (Page 3.22-10)

029 Sec3.23_Wildlife_Values

3.23 WILDLIFE VALUES

Large Mammals

A general bear (*Ursus species*) survey in 2009 and moose (*Alces alces*) survey in 2010 were designed to estimate the density of those species, while additional aerial surveys were intended to gather distribution, relative abundance, and general patterns of use of the EIS analysis area. (Page 3.23-13)

- Aerial line-transect surveys to estimate the density of bears in the Iliamna Lake region.
- Aerial surveys of brown bears (*Ursus arctos*) along salmon-spawning streams, and an examination of brown bear and gray wolf (*Canis lupus*) dens in and around the mine survey area.

A series of aerial strip-transect surveys were flown to coincide with seasonal timing to detect late-winter moose and caribou distribution, spring bear locations, caribou and moose calving, caribou post-calving, bear locations along salmon streams, caribou rut, and early winter moose and caribou distribution. (Page 3.23-14)

Brown Bear

Brown bears are widespread and common in the Bristol Bay and Cook Inlet drainages, primarily because of large salmon runs that provide an abundant source of protein. Brown bears are relatively common tundra inhabitants in the mine survey area (Figure 3.23-8) (ABR 2011a). Standardized surveys specifically for the mine site were conducted in 2009 by ABR and the ADF&G (Becker 2010). Aerial line-transect surveys flown in May 2009 used two similar analytical methods to determine the density of brown bears in the survey area surrounding the mine site, which included all of Iliamna Lake (which overlaps with the transportation and natural gas pipeline corridors). One analytical method (double-count method) resulted in a population density of 47.7 brown bears per 386 square miles (Becker 2010), and the second method (using the plane model) resulted in 58.3 brown bears per 386 square miles (ABR 2011a). Using the double-count method, the survey area supported approximately 412 brown bears. Per Becker (2010), the estimate of 47.7 brown bears per 386 square miles is similar to brown bear population estimates for other nearby areas. Surveys north of the Iliamna survey area around Lake Clark National Park and Preserve in 1999 and 2000 (Becker 2003; Butler 2007a) yielded estimates of 38.6 brown bears per 386 square miles, and to the south in GMU 9C (in spring 2005 and 2006), densities were estimated to be 78.4 brown bears per 386 square miles (Olson and Putera 2007). Overall, brown bears were not common in the mine site footprint itself, but were distributed throughout the mine survey area, primarily along streams and waterways.

The Pebble Project and Brown Bears

Helicopter surveys of salmon-spawning streams around the mine site on August 18 and 19, 2004 recorded 16 brown bears mainly 9 to 18 miles south and southeast of the mine site. Dense vegetation along streams limited visibility, and therefore the number of bears reported is likely under-estimated. The survey area included the NFK and SFK rivers, and the mine survey area south to Iliamna Lake and east to the Newhalen River (ABR 2011a). More-recent surveys of bear use at select salmon-spawning streams from July to September 2012 used time-lapse remote-sensor wildlife cameras positioned at one location in UTC (Figure 3.23-8). Overall, low bear activity was recorded (0.03 percent of useable photographs contained bears), with most activity in the late afternoon in July and August. No bears were recorded during September. Bears spent little time fishing at the location visible to the camera (ABR 2015a).

Surveys of bear dens and incidentally detected brown bear dens (during other biological surveys) from 2004 through 2006 indicated suitable denning habitat was common in the mine survey area, and dens were generally found in low-elevation wooded sites and high-elevation scree slopes. Brown bear dens were not found in the mine site footprint. (Page 3.23-19)

3.23.1.2 Transportation Corridor and Natural Gas Pipeline Corridor

Wildlife resources in the area are representative of the wildlife in the region, including *brown and black bears*, moose, and smaller terrestrial wildlife. (Page 3.23-23)

Terrestrial Mammals

There are no caribou herds in the immediate vicinity, and common terrestrial mammals on the Kenai Peninsula in this area include moose, *bears*, and smaller terrestrial vertebrates. (Page 3.23-30)

Large Mammals

Brown bear density estimates from the bear population survey in May 2009 ranged from 47.7 to 58.3 brown bears per 386 square miles (Becker 2010). The area covered by the survey included the southern portion of GMU 9B, plus a small section of the eastern part of GMU 17B. All but one of the black bear sightings occurred east of Nondalton and north of Kokhanok. Therefore, black bears appeared to be more closely tied to forested environments, with brown bears occurring in more open terrain and around salmon streams during periods of salmon spawning. Specific to areas outside the transportation and natural gas pipeline corridors, brown bears were concentrated around the northern portion of Katmai National Park and Preserve, south of Gibraltar Lake (Becker 2010) (Figure 3.23-12).

Surveys conducted by the NPS in May 2003 using an aerial line-transect double-count technique estimated that in GMU 9A, the brown bear density was 150 bears per 386 square miles, with a standard error of +/- 28 bears; and for black bears, the density was 85 +/- 20 bears per 386 square miles. This corresponds to a population of 703 +/- 134 brown bears and 413 +/- 62 black bears in GMU 9A (Olson and Putera 2007). No surveys were conducted in 2003 to determine a density estimate for GMU 9B. The aerial surveys by Becker (2010) included GMU 9B; therefore, in conjunction with the National Park Service survey in 2003 (Olson and Putera 2007) for GMU 9A, the entire transportation and natural gas pipeline corridors has been surveyed. Overall, brown bears were more common along the coast and around the southern part of Iliamna Lake,

with black bears more common to the east of Iliamna Lake and areas adjacent to Lake Clark National Park and Preserve. (Page 3.23-31)

Figure 3.23-12. BEAR OBSERVATIONS, DEN LOCATIONS, AND ILIAMNA LAKE SEAL HAUL-OUTS AROUND THE PORT ACCESS ROAD AND AMAKDEDORI PORT (Page 3.23-34)

A series of three surveys for bears was conducted along the port access road in the spring and summer of 2018 (ABR 2018p, 2018k, 2018o). The first aerial surveys were conducted to locate bear dens within 0.6 mile of the port access road, and a separate corridor around the western end of Iliamna Lake. In total, the survey area was 151 square miles. Aerial surveys were flown from April 30 to May 1, 2018, and May 13-16, 2018, to assess den emergence. During these survey windows, snow was largely gone or patchy in the survey area, which limited the ability to track bears. Surveys located 64 bear dens throughout the survey area, but only a portion of these dens were in the survey area around the port access road. Specific to the port access road, dens were located in two main areas. Several dens were found from Gibraltar Lake west to Iliamna Lake, and the remaining were clustered near Cook Inlet north of Amakdedori Creek (Figure 3.23-12). Surveys documented a concentration of brown bear dens on each side of the port access road and around Amakdedori port (Figure 3.23-12). Several of the dens were close to the port access road, with the closest approximately 300 feet north of the road (ABR 2018p).

Results indicated that bear dens were located at lower elevations, steeper slopes, higher topographic positional indices, higher ruggedness, more north and west-facing aspects, and more often in shrubs (ABR 2018p). This indicates that bears in the Iliamna area are more likely to den in shrubby areas with steep slopes. A model was created to estimate density using the relative probability of detecting a bear den based on resource selection function analysis. The model predicted that the 151-square-mile survey area had an estimated density of 164 dens per 386 square miles (ABR 2018p). The second set of aerial surveys assessed the prevalence of bears using coastal sedge meadows or other areas along the coast of Cook Inlet. These surveys were conducted on May 20, 28, and July 2, 2018 (ABR 2018k). Bear observations were widely dispersed, and no concentration areas were observed (Figure 3.23-12). Only one brown bear was detected in the port access road analysis area on May 28, 2018. Brown bears were more abundant further north around Bruin Bay and Ursus Cove.

The third set of surveys was focused on bear use of salmon streams. Three surveys were conducted during July 14-15, August 16-18, and September 7-8, 2018 (ABR 2018o). During each survey, all streams and rivers in the ADF&G anadromous waters catalog within 3 miles of the transportation corridor outside of the mine site were surveyed. Two replicate surveys of the entire area were flown on each trip (ABR 2018o). Specific to the port access road, during the July survey, bears congregated at the mouth of Amakdedori Creek, with a few individuals along streams around Gibraltar Lake. During the August surveys, bears were primarily near the southern shore of Iliamna Lake, at the eastern end of Gibraltar Lake, fishing in the river flowing into Bruin Bay; and a few bears were upstream in Amakdedori Creek. During September surveys, bears were concentrated around the stream flowing into Bruin Bay, at the eastern end of Gibraltar Lake, along the westerns shore of Iliamna Lake, and around Kokhanok. These surveys of brown bear activity in the area around the port access road illustrate bear use of Amakdedori Creek, Gibraltar Lake, and other anadromous streams in the area (Figure 3.23-34). (Page 3.23-34)

In summary, the transportation and natural gas pipeline corridors contain more suitable caribou and brown bear habitat compared to habitat for moose and black bears. The port access road is in an area known for high brown bear densities, because it includes both coastal vegetation communities and salmon streams. (Page 3.23-35)

3.23.1.3 Amakdedori Port

Large Mammals

Large mammal species around the port are similar to those in the mine site and along the transportation and natural gas pipeline corridor, including caribou, *brown and black bear*, and moose.

Amakdedori port would be approximately 13 miles north of McNeil River Falls at McNeil River State Game Sanctuary, which is a world-famous brown bear viewing location, due to the world's largest concentration of wild brown bears (ADF&G 2018g). During bear surveys in May 2009 for the mine site, brown bears were common on the southern side of Iliamna Lake near Gibraltar Lake. Surveys for bears around salmon-spawning streams in summer 2018 documented brown bears fishing in Amakdedori Creek in July and August (ABR 2018o) (Figure 3.23-12). (Page 3.23-38)

3.23.2 Alternative 2 – North Road and Ferry with Downstream Dams

3.23.2.2 Terrestrial Mammals

Large Mammals

The transportation corridor survey area is in an area of transition between substantially higher coastal densities of brown bears and lower inland densities. Historical surveys have estimated 50 bears per 386 square miles in GMU 9B (excluding Lake Clark National Park and Preserve and Katmai National Park and Preserve lands) (Butler 2005). A more rigorous survey from May 1999 to 2000 estimated 38.6 brown bears per 386 square miles in GMU 9B North, including the area east of Iliamna Lake and Lake Clark National Park and Preserve (Becker 2003; Butler 2007a). The line-transect bear survey in May 2009 (Becker 2010), which encompassed the transportation corridor survey area (plus a large area around Iliamna Lake), resulted in two different brown bear estimates, based on different models; and ranged between 47.7 and 58.3 brown bears per 386 square miles.

Bear surveys around the eastern part of Iliamna Lake to Diamond Point and Iliamna and Iniskin bays between 2004 and 2007 documented high densities of brown bears, particularly along the Iniskin River and the end of Iniskin Bay (Figure 3.23-17; ABR 2011c). Brown bears were also detected around Cottonwood and Iliamna bays, but in lower numbers. Large aggregations of brown bears were observed in the sedge meadows and mudflats at the heads of Iniskin and Chinitna bays during spring and summer each year, with highest numbers in June (ABR 2011c). Brown bears shifted to salmon-spawning streams later in July and August, which are primarily in the eastern portion of the survey area (ABR 2011a). Little evidence was found for bears digging clams, with only one observation of this behavior in May 2006. Brown bears were observed fishing for salmon in Iniskin River, and Portage Creek in Iniskin Bay. Overall, brown bears were

concentrated foraging on vegetation early in the summer, and transitioned to salmon later in the summer and fall, following the season salmon runs in the area.

From July through September 2012, ABR conducted a study of bear activity using timelapse cameras placed near the location where the transportation corridor and natural gas pipeline would cross UTC, to capture bear activity along the stream. Overall, little bear use was recorded on photographs, but bear activity peaked from late July to early August. The highest level of activity occurred late in the evening. Despite the abundance of salmon in UTC, it did not appear that the location where the camera was placed was important to foraging bears during daylight and twilight hours (ABR 2015a). Additional cameras were placed along seven anadromous streams along the northern shore of Iliamna Lake, from Roadhouse Mountain to the Pile River. Bear use reflected salmon run timing, with the highest activity from late July to early August. Small, shallow streams with high numbers of spawning salmon were the preferred foraging areas. The highest level of activity occurred during early morning and late evening, but bears spent limited time fishing in the portions of the river in the camera's viewshed, according to the timelapse photography (ABR 2015a). (Page 3.23-54)

035 Sec4.3_SocioEcon

4.3 NEEDS AND WELFARE OF THE PEOPLE—SOCIOECONOMICS

Scoping comments related to socioeconomics focused on beneficial impacts of additional employment opportunities, adverse economic impacts to recreation and commercial fisheries, impacts on the use of Iliamna Lake for sport fishing and recreation, *impacts on the bear viewing industry near the Amakdedori port*, economic benefits to the state of Alaska, and how risks to the environment could outweigh short-term benefits. (Page 4.3-1)

037 Sec4.5_Recreation

4.5.2.2 Transportation Corridor

The project may also have low magnitude effects on incidental wildlife viewing along the transportation corridor; although the primary recreation use in most of the transportation corridor is likely from other activities, such as fishing. Movement and distribution of bears and other terrestrial mammals through the transportation corridor to the McNeil River State Game Refuge and Katmai National Park and Preserve may be disrupted; therefore, construction and operations activities in the south access corridor may have some indirect adverse impacts on incidental wildlife viewing in both of those recreation areas. These impacts would occur throughout the life of the project. See Section 4.23, Wildlife Values, for more information on impacts to bear movement and distribution. (Page 4.5-7)

4.5.2.3 Amakdedori Port

There is known *bear hunting* at the port site, which would be eliminated for the duration of the project due to port activities and noise. Hunters would be displaced to other nearby *bear hunting* locations, such as State lands further north. These impacts would be of low to medium magnitude, since opportunities for known recreational activities would be reduced, but to a limited geographic extent. Additionally, similar activities could be experienced in nearby

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locations. Impacts would be long-term, lasting for the duration of the project and they would be certain to occur if the port is permitted and built.

In addition, project-related noise and activities during construction, operations, and closure at Amakdedori port would adversely affect the recreational experiences of visitors within visual and auditory distance of the port site due to the change from a quiet, undeveloped area to a developed site with visible facilities, generators, and in-water facilities. The extent of the impact would be within visual and auditory distance of the port. For the duration of the project, the adverse effects would displace visitors preferring a quiet, undisturbed recreation setting, or who participate in recreation opportunities such as wildlife viewing, hunting, and fishing, which typically require a quiet, undisturbed recreation setting. Magnitude of impacts would be higher during summer months during the peak visitation period of McNeil River State Game Refuge and the Alaska Maritime National Wildlife Refuge. The likelihood of the impact occurring would be definite if the port is permitted and built.

Overall, because recreational use of the Amakdedori port site is estimated to be low, project related wildlife and fish displacement, noise, and activities would have low magnitude impacts from displacement of the few users of the area for wildlife viewing, hunting, and fishing uses to other nearby shoreline areas.

The port site, including construction, operations, and closure activities, would be visible from the Cook Inlet shoreline area further north of the port, but visibility would decrease with distance out to about 10 miles. The port would be visible from some portions of the McNeil River State Game Refuge and Alaska Maritime National Wildlife Refuge islands, and may be visible from flights over the site to regional recreation destinations such as Katmai National Park and Preserve, or towns farther west such as King Salmon or Naknek. The port site would be visible from the Chenik Creek area of the McNeil River State Game Refuge and would affect views from this recreation area. However, the port would not be visible from McNeil River Camp (see Appendix K4.11), the main recreation area in the McNeil River State Game Sanctuary, and would therefore not affect views from this recreation site, though vessel traffic may be evident and may intermittently affect the recreation setting at the camp during project construction and operations. The port would not be visible from Augustine Island, but may affect views from Cook Inlet shoreline areas surrounding the port. Impacts to night sky affecting visibility of stars and could affect a small portion of McNeil River State Game Refuge (about 2 percent).

These impacts on views would be long term and certain to occur if the port is permitted and built. On-water sightseeing and/or wildlife viewing may occur in these locations, but recreational use of McNeil River State Game Refuge shoreline areas is limited by permit numbers. Construction, operations, and closure at Amakdedori port could adversely affect the recreational experience for visitors participating in sightseeing or wildlife viewing opportunities in these surrounding areas, by causing a change in the recreational setting to a more developed and less remote, primitive area. Impacts however would be of low magnitude due to low number of visitors.

The project would not result in changes in access to McNeil River State Game Refuge or Sanctuary. Visitors fly in to the sanctuary, where the main recreational use areas are located. McNeil River Camp, the main access point to the sanctuary and refuge, is located 12 miles south of the Amakdedori port site. (Page 4.5-9)

4.5.3 Alternative 2 – North Road and Ferry with Downstream Dams

4.5.3.2 Transportation Corridor

There are *opportunities for hunting bear* and moose in and adjacent to the transportation corridor. Magnitude of impacts on sport hunting opportunities and experiences from project related noise and activities would be similar to those described above for the mine site under Alternative 1 and geographic extent of impacts would be slightly less. (Page 4.5-11)

However, *the movement and distribution of bears* and other marine and terrestrial mammals throughout the transportation corridor may be disrupted by project activities over the long-term. Thus, construction and operations activities may have some indirect adverse impacts on wildlife viewing, including viewing of the Iliamna Lake harbor seals, in the transportation corridor. These impacts would occur if Alternative 2 is chosen, permitted, and built. See Section 4.23, Wildlife Values, for more information on impacts to wildlife movement and distribution. (Page 4.5-12)

4.5.3.4 Natural Gas Pipeline

Ursus Cove is a known *bear hunting location* (H&H Alaskan Outfitters 2018)... (Page 4.5-14)

4.5.4 Alternative 3 – North Road Only

Movement and distribution of bears and other terrestrial mammals through the corridor may be disrupted, thus construction and operations activities may have some adverse impacts on wildlife viewing along the transportation corridor. These impacts would be long term and would occur if Alternative 3 is permitted and built. See Section 4.23, Wildlife Values, for more information on *impacts to bear movement and distribution*. (Page 4.5-16)

4.19 NOISE

Scoping comments were received on impacts of noise pollution as a result of project construction and mining operations. Specifically, commenters requested that the EIS discuss noise impacts of blasting in the project area; describe the blasting methods that would be used; and consider noise in the water created by the proposed icebreaker ferry and the impacts to fish, *bears*, and other wildlife. (Page 4.19-1)

4.19.3 Alternative 1 – Applicant’s Proposed Alternative

4.19.3.1 Mine Site

Although there are caribou, moose, *bear*, and other wildlife in the Bristol Bay Area Plan Management Unit Region 9 (ADNR 2013a) area that surrounds the mine site, there are no unique resources, or resources protected by legislation with respect to noise. Impacts from noise on terrestrial wildlife are addressed in Section 4.23, Wildlife Values. (Page 4.19-3)

055 Sec4.23_Wildlife_Values

4.23 WILDLIFE VALUES

Scoping comments were received related to potential impacts to wildlife Specific comments related to *bears* included concerns for human safety from bears that move between Amakdedori port and *McNeil River State Game Refuge and Sanctuary*; that the proposed road and Amakdedori port and the mine access roads could change *brown bear* (*Ursus arctos*) migration and result in brown bear habitat fragmentation and mortalities; and bears could become food conditioned, resulting in bear mortality. (Page 4.23-3)

4.23.2.2 Terrestrial Wildlife

Behavioral Disturbance

Noise

...*brown bears*, may not [adapt to noise], and may avoid areas or move away as people and equipment approach. (Page 4.23-13)

Waste Management and Disposal

Some species, such as *bears* and red foxes (*Vulpes vulpes*) that become habituated to food resources may become a nuisance and safety hazard. Although the landfill would be operated according to permit conditions (if issued), the WMP would detail additional measures, should food-conditioned wildlife become a problem. (Page 4.23-14)

Behavioral Avoidance

For species with large home ranges, or species that travel seasonally between winter and summer ranges, such as caribou, moose, *brown* and black *bears* (*Ursus americanus*), and gray wolves, a barrier to movement could fragment and decrease the size of preferred habitat. Traffic on the access road during the operations phase would be subject to speed restrictions; but in terms of duration, would last for the life of the project and potentially longer. As detailed in Chapter 2, Alternatives, roads would remain as long as needed for long-term post-closure water treatment and monitoring. The specific fate of the access roads post-long-term closure is undetermined. Because the access roads would be constructed in an area with no previously established roads, this would result in a new visual and auditory source of disturbance. The level of truck traffic would be one truck passing approximately every 18.5 minutes.

Some species are particularly sensitive at certain times of year (e.g., caribou calving in spring, *bear* and wolf *denning in winter*, and moose rutting in fall). (Page 4.23-14)

Bear

Brown and black bears may experience a range of potential impacts from the project. This includes loss of habitat due to land conversion, increased mortality from vehicular collisions and defense of life and property, and behavioral changes based on avoidance of humans. Because brown bears are common around all components of the project (see Section 3.23, Wildlife Values, for specific bear densities), and black bears only occur at a low density in the area, this impacts section focuses primarily on impacts to brown bears.

Brown bears have been shown to avoid roads regardless of traffic volume (McLellan and Shackleton 1988), and may avoid mine facilities. McLellan and Shackleton found that most

The Pebble Project and Brown Bears

bears used habitat within 328 feet of roads less than expected, resulting in additional habitat loss. They found that roads and adjacent areas were used more at night and were avoided during the day. Additionally, yearlings and females with cubs used habitats near roads more than other bears, likely because roads were avoided by adult male bears. However, some brown bears at a coal mine in Alberta, Canada have appeared to adapt to disturbance from the mine (Cristescu et al. 2016). Based on the study, female brown bears with cubs appeared most adaptable to mining disturbance (their home ranges overlapped with areas of active mining), while male brown bears appeared to leave the area during active mining. This study concluded that active mining influenced the incidence of encounters between male bears and females with cubs, which may increase the likelihood of cubs' survival while active mining would be taking place. Once mining stopped and the area was restored, male bears appeared to return to the area, and females indicated some flight response (Cristescu et al. 2016).

In Denali National Park between 1996 and 1997, a study was conducted that compared brown bear, caribou, and moose densities in proximity to the gravel road in the park with backcountry areas (Yost and Wright 2001). Overall, brown bear and caribou distributions indicated no pattern of traffic avoidance, while moose distribution suggested possible traffic avoidance (confounded by preferred forage farther from the road).

Roads can also cause functional habitat loss if bears avoid them due to proximity to nearby resources (preferred foraging areas such as salmon streams, and denning locations). Although roads can cause habitat avoidance, alter movement patterns, and become ecological traps, many of the negative effects of roads are related to human use of roads, and not the roads themselves (Northrup et al. 2012). In a study in Alberta, Canada, Northrup et al. (2012) found that traffic patterns caused a clear behavioral shift in brown bears, with increased use of areas near roads and movement across roads during the night, when traffic was low. Typically, brown bears in areas of low human population are most active during the day, with no daily pattern of road use (Boyce et al. 2010); Northrup et al. (2012) found that vehicular activity shifted these patterns. Bears selected areas near roads traveled by fewer than 20 vehicles per day, and were more likely to cross these roads, avoiding roads receiving modest traffic (i.e., 20 to 100 vehicles per day). They strongly avoided high-use roads (i.e., more than 100 vehicles per day) at all times. As detailed previously, the magnitude of truck traffic on the transportation corridor roads would be expected to be approximately one truck passing in either direction every 18.5 minutes (including at night) during operations, and therefore, bears may avoid crossing the mine access road, especially during daytime hours.

In terms of extent, bear movement patterns around the mine site, along the transportation corridor, at the ferry terminals, and at Amakdedori port would be impacted by the project. The magnitude of the effect would be that some age and gender groups of bears may avoid the mine site, specifically during operations (such as adult male bears), and others may be less affected or become habituated to mine site disturbance. Vehicular traffic along the transportation corridor (in particular the port access road) would be anticipated to alter movement patterns, because there are currently no roads in the majority of the transportation corridor. Some bears may avoid the transportation corridor or shift their movement patterns during periods of increased vehicular use. Additionally, aircraft disturbance at Amakdedori port during construction of the port access road would likely cause bears to move away from the area. Because bears were detected fishing

in Amakdedori Creek, they may be disturbed by construction and operation of the port and vacate the area. The WMP would detail specific parameters to prevent disturbance to bears.

In summary, the magnitude of impacts would include potential for avoidance of the mine site, the transportation corridor, and to a lesser extent, the ferry terminals and port. Because there are no established roads in the mine site, along the transportation corridor, and at Amakdedori port, the access roads, mine, port, and ferry terminals represent novel sources of disturbance to the landscape. The duration would last for the life of the project, and longer depending on how the roads are managed post-closure. The extent would include the project components and an avoidance buffer, which would likely vary depending on noise and activity levels. Because the area has a high density of bears (per Section 3.23, Wildlife Values) some individuals would experience disturbance, but impacts would not be expected to result in population-level impacts. (Page 4.23-18)

Injury and Mortality

The WMP would outline ways to reduce the potential for wildlife mortality along the road; however, varying weather and seasonal conditions would likely cause periods of increased mortality for some species (such as increased moose mortality during winter months, and *reduced bear mortality during hibernation*). The duration of these impacts would be long term, lasting through the life of the project. (Page 4.23-19)

Bear

Across the species' range, one factor causing reduction in brown bear populations has been the availability of human access into brown bear habitat by roads built for resource extraction (Boulanger and Stenhouse 2014). One study in Alberta, Canada by Boulanger and Stenhouse (2014) attempted to estimate the direct demographic impact of roads on survival rates, reproductive rates, and other demographic parameters for brown bears. They found that sex and age class survival was related to road density, with sub-adult bears being most vulnerable to road-based mortality. Additionally, females with young of the year and/or yearling cubs had lower survival rates compared to females with 2-year-olds or no cubs (Boulanger and Stenhouse 2014).

The port access road would be located in an area with high brown bear densities, and occurs directly north of Katmai National Park and Preserve and McNeil River State Game Refuge and Sanctuary. In terms of magnitude and extent, these areas have the highest documented concentration of wild brown bears in the world, and include popular bear-viewing locations (ADF&G 2018b). According to Alaska Department of Fish and Game (ADF&G), no one has ever been injured by a bear at McNeil River, and no bears have been killed by visitors who felt threatened since the permit program to access the sanctuary was initiated (ADF&G 2018b). Amakdedori port and the port access road would be located approximately 13 miles north of McNeil River Falls.

Brown bears are common in the area along the port access road and Amakdedori port, especially along coastal plains in the early summer, and then along salmon-spawning streams later in the summer and fall. This was documented in 2018 along the port access road, with bears along the coast in the spring and early summer, and along salmon streams later in the summer. Therefore,

The Pebble Project and Brown Bears

bears move around in relation to seasonally available food resources. Bears would be expected to cross the port access road as part of their regular movement patterns, but may show initial caution, or avoidance. Because the road would be a novel item in the landscape, bears may be wary of crossing it initially. As detailed above under “Behavioral Disturbance,” brown bears in particular would likely avoid the transportation corridor during periods of high vehicular traffic. In terms of magnitude of the impact, the number of bears that may potentially suffer injury or mortality along the transportation corridor across the life of the project would likely fluctuate in relation to the location of resources, movement corridors, time of day, and season.

There would be a potential for bear mortality due to defense of life and property. Bears that become habituated and frequent the mine site, ferry terminals, Amakdedori port, or other project locations, may become a safety risk. Some of these bears may experience hazing and other negative human interactions, and then travel to areas such as Katmai National Park and Preserve and McNeil River State Game Refuge and Sanctuary. Bears that are negatively habituated to the project, or have become food conditioned, may become a danger to the public at bear viewing areas. Implementation of a WMP would be anticipated to minimize the potential for conflict between wildlife and humans. There would be also a potential for increased hunting pressure from increased accessibility to areas, especially along the transportation corridor. The project would have a no hunting, fishing, or gathering policy for non-local employees to minimize competition for local resources.

In summary, the magnitude of impacts would be expected to be that individual bears may be killed along the access roads and during defense of life and property, or from other negative human interactions. The duration would last for the life of the project, and potentially longer, depending on the long-term management of the access roads. The extent would include all project components, but could extend into adjacent areas if negatively habituated bears move into public bear viewing areas. There would be a likelihood of occurrence because bears may be injured or killed along the transportation corridor, and there would be a potential for a food-conditioned bear to become a safety hazard. (Page 4.23-21)

Habitat Changes

Some of the large mammal species such as caribou, moose, bears, and gray wolves occupy the habitat in the mine site at varying densities and at different times of the year. In terms of the duration of effects, a large portion of this habitat would be revegetated once the project would be completed, and the species would be anticipated to return over time as the vegetation and habitat mature to conditions suitable for each species. (Page 4.23-22)

Bear

In terms of magnitude and extent of impacts, the direct loss of approximately 9,317 acres of habitat from construction and operations of the project (including the mine site, Amakdedori port, ferry terminals, and transportation and natural gas pipeline corridors) would be expected to displace bears that use the habitat for foraging, denning, and as part of their home range. There would be additional habitat around mine components that would be indirectly removed by avoidance due to behavioral disturbance. Avoidance areas may include salmon spawning streams and preferred denning habitat (such as near Amakdedori port), and other locations of seasonal food sources. Bears that experience habitat loss (either directly or indirectly) would be

anticipated to use the surrounding habitat, although they may encounter increased competition with other bears. Brown bears are distributed throughout the landscape and are seasonally concentrated around resources such as high-quality vegetation sources (sedges, grasses, berry sources) and salmon-spawning streams. In particular, brown bears may avoid locations or alter foraging patterns where the transportation corridor crosses anadromous streams. Habitat loss may also result if some bears are hesitant to cross mine access roads, in particular the port access road. The port access road may inhibit movement patterns, and cause bears to seek out other locations for foraging and denning. As mentioned above under Behavioral Disturbance, brown bears have been shown to avoid habitat within 328 feet of roads, resulting in additional habitat loss (McLellan and Shackleton 1988). Based on the location of highest bear density, a 328-foot-radius buffer around the port access road, south ferry terminal, and Amakdedori port would result in an additional 3,680 acres of habitat loss through avoidance. In terms of impact magnitude and duration, a large portion of the project would be restored following closure of the mine; therefore, the actual amount of permanent habitat loss would be less.

In summary, the magnitude of habitat loss may reach 13,000 acres (9,317 acres of direct impacts plus 3,680 acres of habitat that would be avoided along the port access road). There may be additional habitat avoidance around the mine site, mine access road, and north ferry terminal. The indirect habitat loss through avoidance may include loss of foraging and denning locations, and may result in increased interspecific competition. The duration would last for the life of the project and longer, because the pit lake would represent a permanent loss of habitat. The extent would include all of the mine components, and in particular, the port access road. Given the high density of brown bears in the area, impacts would be expected to occur if the project is permitted and constructed. (Page 4.23-24)

4.23.2.4 Variants Impact Analysis

Kokhanok East Ferry Terminal Variant

In terms of magnitude, this would reduce impacts to wildlife species (such as *brown bears*) around Gibraltar Lake and along Gibraltar Creek because the port access road would lead north to Kokhanok and avoid Gibraltar Lake. (Page 4.23-30)

4.23.3 Alternative 2 – North Road and Ferry with Downstream Dams

4.23.3.2 Terrestrial Wildlife

In terms of magnitude and extent, impacts to moose, *brown* and black *bears*, gray wolves, and other terrestrial wildlife would be primarily related to behavioral disturbance (through increased noise, vehicular traffic, and human interaction), injury and mortality, and loss of habitat (both directly through vegetation removal, and avoidance of areas near the transportation and natural gas pipeline corridors). (Page 4.23-33)

Behavioral Disturbance

Moose have been known to avoid roads by up to 1,000 feet, and *bears would be anticipated to alter feeding patterns in salmon-spawning streams adjacent to the transportation and natural gas pipeline corridors*. Traffic volumes, at 39 round-trip truck trips per 24-hour day (one vehicle every 18.5 minutes) would be anticipated to temporarily disturb wildlife while vehicles are

passing. The magnitude of the visual and noise disturbance from passing vehicles would be reduced due to the forest habitat that most of the transportation corridor passes through. The extent of behavioral disturbance to wildlife would be an impact on individuals along the transportation corridor. Some species may avoid the transportation corridor, especially where it overlaps with favored foraging areas, such as along salmon streams. As detailed in Section 3.23, Wildlife Values, wildlife cameras were placed along seven anadromous streams along the northern shore of Iliamna Lake, from Roadhouse Mountain to the Pile River (ABR 2015a). *Bear use reflected salmon run timing, with the highest activity from late July to early August. Small, shallow streams with high numbers of spawning salmon were the preferred foraging areas. The highest level of activity occurred during early morning and late evening, but bears spent little time fishing in the portions of the river in the camera's viewshed, according to the timelapse photography (ABR 2015a). Conversely, this finding may not fully represent the extent of bear use at these locations throughout the year, but provides a snapshot of activity levels during one summer.* The duration of behavioral disturbance impacts would extend for the life of the project, and the extent would include all project components. It would be likely that behavioral impacts would occur to some species and individuals, especially those that would not be accustomed to vehicular traffic apart from occasional use of the Williamsport-Pile Bay Road. (Page 4.23-34)

Injury and Mortality

Moose, *bears*, wolves, and smaller terrestrial wildlife that cross the road have a potential to collide with truck traffic, which would entail a truck passing by approximately every 18.5 minutes. (Page 4.23-34)

Habitat Changes

If Alternative 2 is selected, permitted, and constructed, impacts from loss and avoidance of habitat would be expected for a range of terrestrial species such as moose, *bears*, wolves, and smaller terrestrial wildlife. (Page 4.23-35)

Table 4.23-3: Summary of Key Issues for Wildlife Resources

Injury and mortality	Potential for <i>bears</i> to be killed in defense of life and property. (all alternatives)
	may increase collisions for wildlife species (such as <i>brown bears</i>) (all alternatives and variants) (Page 4.23-39)

4.23.6 Cumulative Effects

4.23.6.1 Past, Present, and Reasonably Foreseeable Actions

Terrestrial Wildlife and Birds

Bears may change their foraging areas and have increased mortality from new roads and mortality from defense of life and property. (Page 4.23-43)

4.23.6.3 Alternative 1 – Applicant's Proposed Alternative

Pebble Mine Expanded Development Scenario

Iniskin Bay has a large seasonal concentration of *brown bears* at the end of the bay, which would be directly impacted. (Page 4.23-45)

059 Sec4.27_SpillRisk

4.27.1.2 Affected Environment of the Analysis Areas for the Bulk and Pyritic Tailings, and Untreated Contact Water Releases

Biological Resources

The area provides quality habitat for numerous terrestrial mammals, including moose, *brown* and black *bears*... (Page 4.27-3)

4.27.2.5 Diesel Spill Scenarios

Potential Impacts of a Diesel Spill from Tanker Truck Rollover

Wildlife

Larger terrestrial mammals such as *bears (Ursus species)*...are unlikely to be impacted by a terrestrial diesel spill because it is unlikely they would be in the immediate vicinity during the spill, and are likely to vacate the area during active spill cleanup. For terrestrial mammals that might be exposed, numbers of individuals are expected to be small, with no population-level effects. (Page 4.27-15)

Potential Impacts of a Diesel Spill from Marine Tug-Barge Allision (sic)

Wildlife

Most terrestrial species do not use the marine-terrestrial interface extensively, although some large mammals, such as *brown bears (Ursus arctos)* and other mammal species, may occasionally forage along exposed tidal flats in Kamishak Bay. In Kamishak Bay, there is a small area of razor clam (*Siliqua species*) beds at the mouth of Amakdedori Creek (GeoEngineers 2018), but the rest of Kamishak Bay does not support extensive razor clam beds (NOAA 2002), and therefore it is not a major clamming area for *bears*. (Page 4.27-22)

Potential Impacts of a Concentrate Spill from Truck Rollover

Wildlife

If a concentrate spill occurs and enters flowing water, concentrate would be carried rapidly downstream and dispersed. Leaching of metals from concentrate would likely require years to decades (see “Fate and Behavior of Spilled Concrete” section, above). Additionally, copper does not bioaccumulate (EPA 2014), and therefore does not pose a consumption risk to *bears (Ursus species)*, gray wolves (*Canis lupus*), and other terrestrial wildlife *that consume salmon*. (Page 4.27-46)

Potential Impacts of a Bulk Tailings Delivery Pipeline Rupture

Wildlife

Any impacts to fish populations, detailed in the fish section below, would directly impact terrestrial species that prey on fish, such as *brown bears (Ursus arctos)* and gray wolves (*Canis lupus*). (Page 4.27-87)

Potential Impacts of a Pyritic Tailings South Embankment Release into the SFK

Wildlife

There are a few scattered *bear dens* on slopes above the SFK, which would not be directly impacted. The area does not appear to concentrate moose or caribou, although the occasional *brown bear* has been detected in the area. (Page 4.27-106)

4.27.7.9 Potential Impacts of Contact Water Release from the Main WMP

Wildlife

Because fish are an important part of the food chain for terrestrial mammals such as *brown bears*, wolves, and others, impacts to fish populations may result in impacts to these species. Impacts may include altered foraging locations (if fish levels are reduced) and potential for increased competition and decreased fitness through increased energy expenditure to find resources. (Page 4.27-122)

Species such as river otters and *bears* can bioaccumulate mercury from fish (Mann et al. 2011 in Sánchez-Bayo et al. 2011). (Page 4.27-123)

060 Ch5_Mitigation

Table 5-2: Applicant's Proposed Mitigation Incorporated into the Project

Description of Measure

A Wildlife Management Plan (WMP) would be developed for the project prior to commencement of construction, and the project would use BMPs for wildlife management. The WMP would describe the equipment, methodology, training, and assessment techniques that would be used to minimize the potential for wildlife interaction with project activities, and to minimize impacts to wildlife in the project area. (Page 5-8)

065 AppA_ScopingReport

3.4.2.5 Noise

Consider noise in the water created by the proposed icebreaker ferry and the impacts to fish, *bears*, and other wildlife. (Page 11)

3.4.3.4 Wildlife and Non-Threatened and Endangered Birds and Mammals

Analyze how noise levels from construction or large vessel traffic may deter *bears* from coming to McNeil River Falls, or could affect bear behavior and change or end the use of McNeil River by bears.

The Pebble Project and Brown Bears

The proposed road and Amakdedori Port could change *brown bear migration and result in brown bear mortalities*.

Analyze impacts that habitat fragmentation from Amakdedori Port and the mine access road would have on *bear movements*.

Examine how increased contact between *bears that use the McNeil River* and humans could result in food conditioning of bears or direct bear mortality by humans. (Page 17)

3.4.4.1 Socioeconomic Impacts

Analyze impacts on the *bear viewing* industry near the proposed Amakdedori Port. (Page 19)

3.4.4.7 Recreation

Comments were received on impacts to recreation and tourism; recreational hunting and fishing usage near the mine, along river systems, and in transportation/pipeline corridor during construction and operation. This includes comments on disruption of recreational experiences (*bear viewing*, sport fishing).

Displacement of wildlife would impact the experience of people, throughout the proposed project area but would specifically impact the recreationists at *McNeil State Game Refuge*. (Page 24)

3.5.9 Research and Evaluation Needs

An extensive and thorough baseline study on *bear populations* including numbers, movement, diet, and feeding areas should be done. (Page 37)

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2. PROJECT SETTING

2.1. MINE SITE

2.1.2. Ecology

There are moderate densities of *brown bear*...(Page 15)

2.2. TRANSPORTATION CORRIDOR

2.2.2. Ecology

Brown bear density is somewhat higher in the transportation corridor, with densities increasing as the corridor approaches the coast. (Page 17)