

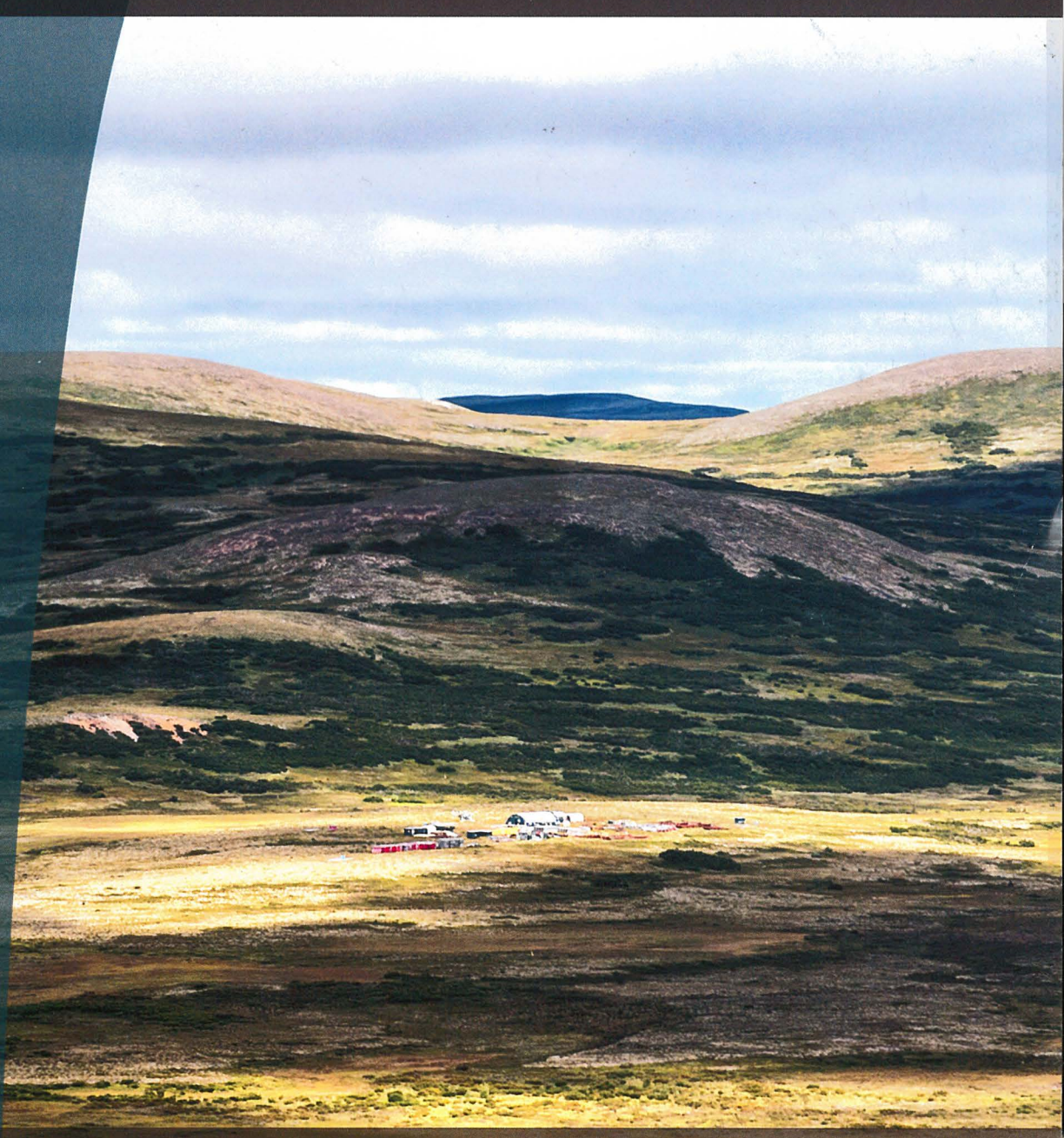
Volume 3:  
Chapter 4



US Army Corps  
of Engineers

# Pebble Project EIS

## Draft Environmental Impact Statement



February 2019

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**PEBBLE PROJECT**  
**DRAFT ENVIRONMENTAL IMPACT STATEMENT**  
**VOLUME 3: CHAPTER 4**  
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## 4.0 ENVIRONMENTAL CONSEQUENCES

### 4.1 INTRODUCTION

Chapter 4, Environmental Consequences, describes the potential impacts on the environmental resources addressed in Chapter 3, Affected Environment, that would occur under the No Action Alternative and the three action alternatives.

Chapter 4 sections discuss direct, indirect, and cumulative effects<sup>1</sup> for each resource described in Chapter 3, and for spills in Section 4.27, Spill Risk<sup>2</sup>, for each alternative.

#### 4.1.1 Impact Characterization

##### 4.1.1.1 Scope of Analysis

The Environmental Impact Statement (EIS) analysis area refers to the entire area of resource analysis that is specific to each resource discussed in Section 3.2 to Section 3.26<sup>3</sup>. Although the EIS analysis area can be delineated based on the physical footprint of the action alternatives, potential resource impacts are considered in a spatial context appropriate to each resource. The EIS analysis area is defined in each Chapter 3 and Chapter 4 section. See Section 3.1, Introduction to Affected Environment, for a detailed description of the scope of analysis for this EIS.

The project area refers to the exact project footprint for each action alternative.

##### 4.1.1.2 Factors of Analysis

Adverse and beneficial effects of the project were evaluated and described for each of the resources. Each resource characterizes impacts in relation to four factors:

- **Magnitude or Intensity:** The intensity the impact would have, measured in terms of change or degree of change in a resource condition. Common characterizations are acres of impact, number of units of change, differences in levels of use, etc.
- **Duration:** How long the impact would be expected to occur or last, measured in length of time. Common characterizations are short-term, long-term, for the life of the project, etc.
- **Geographic extent:** Where the impact would be expected to occur geographically in the EIS analysis area.

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<sup>1</sup> Note that in this document, the terms “effect” and “impact” have the same meaning and are used interchangeably.

<sup>2</sup> As noted in Section 3.1, Introduction to Affected Environment, there is no corresponding spill risk section in Chapter 3 as spill risk would be considered an environmental consequence to the resources discussed in Section 3.2 through Section 3.26.

<sup>3</sup> Note that in Chapter 3 and Chapter 4, waters of the US (abbreviated as WOUS) as defined under the Clean Water Act (CWA) and determined to be jurisdictional under US Army Corps of Engineers (USACE) authority (see Appendix J for the Preliminary Jurisdictional Determination from USACE) are discussed collectively with wetlands and other waters; all WOUS, wetlands, or other waters are together termed “wetlands and other waters.” The term WOUS may appear in Chapter 3 and Chapter 4 under specific regulatory context.

- **Potential to occur (likelihood):** How probable or likely the impact would be. Common characterizations include likelihood of the impact were the project to be permitted, or probability of occurrence based on the results of analysis or modeling.

Each section in Chapter 4 describes analysis methodology, and includes explanations of how each factor applies to that resource. Note that analysis assumes normal operating conditions for the proposed project.

Project component values, such as road lengths and pad acreage, are approximations based on best available data. Due to differences in data processing systems (e.g., Geographic Information System [GIS]) and methodologies (e.g., number rounding), the values presented in the EIS may differ slightly from values presented in other project-related documents, such as permit drawings. These differences have been reviewed, and were determined to have no material consequence to the analysis, or to the overall permitting process.

**Project components** - The project is discussed in Chapter 3 and Chapter 4 by its four major components (mine site, transportation corridor, ports, and natural gas pipeline corridor for each alternative. See Section 3.1, Introduction to Affected Environment, for a brief description of project components. See Chapter 2, Alternatives, for detailed description of components.

**Project alternatives** - See Chapter 2, Alternatives, for detailed description of alternatives. Note that the three action alternatives in Chapter 3 and Chapter 4 are referred to as “Alternative 1,” “Alternative 2,” and “Alternative 3” without including the word “Action” in front of the alternative name as is done in Chapter 2, Appendix K2, and Appendix B.

**Project phases** - Impacts on some resources may vary depending on the phase of the proposed project. See Chapter 2, Alternatives, for detailed description of the proposed project phases. Chapter 4 includes analysis in the following phases:

- **Construction phase** - The period of construction of mine infrastructure prior to operations (4 years).
- **Operations phase** - The 20-year period of mine operations. Mining and milling operations would continue for the full 20-year operating life of the project.
- **Closure phase** - Activities occurring in the 20 years following the end of operations (for example, at closure year 15, pit backfilling would be completed; at closure year 20, the pyritic tailings storage facility (TSF) and water management ponds (WMPs) reclamation would be completed, and the pit lake would be at maximum level).
- **Post-closure phase** - The period of time after the 20-year closure phase (for example, at closure year 50, maximum tailings consolidation would be expected).

#### 4.1.1.3 Types of Effects Considered

The National Environmental Policy Act (NEPA) requires three types of impacts to be evaluated: direct, indirect, and cumulative effects.

Direct, indirect, and cumulative effects are analyzed in each of the Chapter 4 sections by the four factors of analysis.

#### **Direct and Indirect Effects**

Direct and indirect effects are defined as:

**Direct Effects** – Effects caused by the action and occurring at the same time and place (40 Code of Federal Regulations [CFR] Part 1508.8).

**Indirect Effects** – Effects that are “caused by an action and are later in time or farther removed, but are still reasonably likely. Indirect impacts may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems” (40 CFR Part 1508.8). Indirect effects are caused by the project, but do not occur at the same time or place as the direct effects.

### **Cumulative Effects**

Cumulative effects are described in each Chapter 4 section under a separate subheading near the end of each section.

Cumulative effects are interactive, synergistic, or additive effects that would result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions (RFFAs) regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR Part 1508.7). This includes incremental impacts of the proposed action or alternatives when added to other past, present, and RFFAs. Interactive effects may be either greater or less than the sum of the individual effects; therefore, the action’s contribution to the cumulative case could increase or decrease the net effects. Assessing the cumulative impacts from multiple projects/activities requires considering the impacts of their combined potential affected area and associated actions. It also requires a logical nexus with the potential effects of the proposed action. This means that the specific past, present or RFFA must have potential interactive, synergistic, and/or additive effects with direct and indirect impacts on a specific resource resulting from a proposed action and its alternatives.

**Past actions** – Past actions include activities that may have been initiated in the past, but could also involve present operations such as infrastructure development and non-mining–related actions. They may have lingering effects in degrading the environment, or may influence trends in the physical, biological, or social environment.

**Present actions** – Present actions include mining projects and related activities that may have just come online, or are currently under way and are causing impacts. They may also include other non-mining–related projects, such as transportation, oil and gas development, or community development that are currently in progress.

**Reasonably foreseeable future actions** – For this analysis, RFFAs are existing plans, permit applications, and fiscal appropriations that are external to the proposed action, and likely (or reasonably certain) to occur.

### ***Past and Present Actions in the EIS Analysis Area***

Past and present actions that have an interactive, synergistic, and/or additive effect (per 40 CFR Part 1508.7) with a specific resource (such as lingering effects or influencing trends) in the project are relatively limited, and are described below:

- **Commercial and Subsistence Harvest of Fish and Wildlife** – Past and present harvest of fish and wildlife for commercial and subsistence purposes put some degree of pressure on those resources. Although commercial fishing in the Bristol Watershed and Cook Inlet started in the 1880s, the period from the turn of that century through the adoption of Alaska Limited Entry Act by the State of Alaska in 1972 saw incremental changes in both fishing technology and the understanding of the salmon fishery resource. It was likely that there were historic instances of overharvest, with implications for the overall salmon resource. As shown in Section 3.6, Recreational and Commercial Fisheries, the commercial harvest of

salmon in Bristol Bay fisheries districts over the last 20 years has fluctuated significantly; in 2018, Bristol Bay saw record returns, even though Cook Inlet and others areas of the state saw declining returns. Factors influencing returns are complex, and there are no clear long-term trends with commercial harvests. However, Fall et al. 2009 noted that subsistence harvest of salmon in the Kvichak and Nushagak rivers declined from long-term averages, even though the number of Bristol Bay subsistence salmon permits has been stable. Similarly, local and non-local residents have historically harvested fish and wildlife in pursuit of traditional subsistence activities, and may affect such resources. For example, the subsistence harvest of Cook Inlet beluga whale is thought to have depleted its population, and contributed to its listing as an endangered species. There have been natural variability and changes in the historic distribution of some species harvested for subsistence and recreational purposes, such as returning salmon and caribou, although there is no clear agreement as to why. Regardless, fish and wildlife resources are managed by the Alaska Department of Fish and Game (ADF&G) and federal agencies to maintain sustainable populations, and to optimize public uses and economic benefits (ADF&G 2018p). Managers use management tools such as harvest limits and areas open and closed to sport and commercial harvest of fish and wildlife to maintain sustainable resources and allocate harvest. Section 4.23, Wildlife Values (non-TEs), and Section 4.24, Fish Values, discuss historic trends for area wildlife and fish populations where appropriate.

- **Commercial Recreation and Tourism** – Southwest Alaska, including the Bristol Bay region and the area around the project, is renowned for sport fishing, hunting, boating, and wildlife viewing opportunities; and there is a long history of these activities in area. Similar to commercial fishing, the sport harvest of fish and game is managed by ADF&G and federal land managers to maintain sustainable populations. These activities take place primarily from late spring to early fall, and there may be small plane, helicopter, and boat traffic associated with access that contribute to the disturbance of wildlife, as well as recreational and subsistence activity experience.
- **Community Development and Infrastructure** – The transition from seasonal communities to fixed locations with housing, public facilities, and transportation infrastructure has resulted in wetlands fill and loss of habitat. These communities also generate sewage and solid waste, and use fossil fuels for energy and heat generation. The limited number of communities, their relatively small footprint and population size, and the distance between communities have resulted in little past and present cumulative effects on a regional basis. Some transportation infrastructure such as airports, boat docks and connecting roads have increased accessibility to the region; reducing costs for communities, but facilitating visitation to the region, including airport facilities in King Salmon and Iliamna.
- **Mining Exploration Activities** – There are a number of mineral claims and resources in the Bristol Bay watershed that have been subject to mineral exploration activities. Exploration activities have been intermittent, depending on the specific claim or resources, and there has been small plane, helicopter, and boat traffic associated with exploration that contribute to the disturbance of wildlife, as well as recreational and subsistence activity experience. There have also been areas of ground disturbance associated with exploration drilling and support facilities, including at the site of the Pebble Project. In the immediate area of the project, there has been no past or present mineral production activity. It is fairly common in Alaska, where infrastructure is limited and there are long distances to market, for deposits to

undergo exploratory activity, but not progress to a stage where the nature of the mineral reserves, costs of development, and market price for minerals makes development feasible.

- **Williamsport-Pile Bay Road** – The Williamsport-Pile Bay Road, constructed in the 1930s, provides access between Cook Inlet and the Bristol Bay via a 15.5-mile road to Iliamna Lake and down the Kvichak River. The road allows transportation of fishing vessels bound for Bristol Bay commercial fisheries, as well as some goods and supplies for lake and river communities, contributing to road and lake traffic during the summer season. This results in noise disturbance and dust during the summer months along the road; and noise from waterborne activities at Williamsport, Pile Bay, and along Iliamna Lake. The road is owned and maintained by the State of Alaska.

### ***Reasonably Foreseeable Future Actions in the EIS Analysis Area***

For this analysis, RFFAs are existing plans, permit applications, and fiscal appropriations that are external to the proposed action, and likely (or reasonably certain) to occur. Actions are considered reasonably foreseeable if they would occur or have potential impacts in the area analyzed for direct and indirect effects on a specific resource. In addition, the likelihood that a specific RFFA would occur must also be assessed. This is not based on speculation, but must be anticipated to enter the permitting process based on project documentation; identified in public or private planning documents as scheduled for development; have identified indicated resources/reserves sufficient to develop a project; or have advanced exploration activities under way within the timeframe being used for assessment.

The following categories of RFFAs were considered for the cumulative effects analysis:

- Mineral Exploration and Mining
- Oil and Gas Exploration and Development
- Transportation and Infrastructure
- Energy and Utilities
- Commercial Fishing
- Subsistence
- Tourism, Recreation, and Hunting and Fishing
- Scientific Research and Surveys
- Contaminated Sites and Industrial Pollutants
- Residential/Community Development

With regard to mineral and oil and gas resources, a distinction was made between exploration and development activities. Many of the mineral projects assessed are on lands open to mineral entry and have been the subject of exploration activities for over 30 years, but have not been developed. Detailed knowledge of amount and grade of mineral reserves, along with ore price and the cost to develop, mine, and transport the ore to market is generally needed to make a development decision. For example, the Red Dog Project was originally developed in 1989, and the State of Alaska constructed the DeLong Mountain Transportation System to provide a public road and port system to serve the mine, and potentially other mineral deposits in the region. Since that time, the mine has expanded to develop an adjacent deposit under the same ownership, but none of the nearby deposits (notably Lik) have been developed in nearly 30 years, despite the availability of the transportation system.

There are similar patterns of mine expansion in Alaska, developing adjacent, commonly owned, and measured/indicated reserves, including Greens Creek, Usibelli, and Fort Knox. In none of these cases has the presence of existing mine/transportation infrastructure resulted in the development of a new mine. Similarly, oil and gas lease sales have been regularly held in waters of Cook Inlet for over 50 years, but although exploration continues to occur, not all exploration activities have led to oil and gas development. Mineral and oil and gas exploration and development activities can have a variety of impacts on the physical, biological, and social environments.

Table 4.1-1 presents the potential projects considered for analysis of cumulative effects, and the conclusions with regard to whether they are reasonably foreseeable. Figure 4.1-1 illustrates the location of RFFAs. Development of any of these projects would require some level of federal, state, and local permits and approvals; and in many cases, would be subject to a separate environmental assessment or EIS as part of the review and approval process. As discussed under past and present actions, activities associated with commercial, recreational, and subsistence harvest, and scientific study of fish and wildlife will continue to occur and have the potential to impact fish and wildlife populations. Although taken into consideration by federal and state management programs, these activities can contribute to cumulative effects of developing the project. Effects can include mortality and injury on an individual and population level, and disturbance and changes in distribution and migration, which can affect availability to various users. Climate change and other changes in the natural environment can contribute to cumulative effects through past, present, and RFFAs. Climate trends can affect water balance and stream flow, fish and wildlife habitat and distribution, and affect access for pursuit of subsistence activities and community travel. Climate change analysis framework for this EIS is included Section 3.1, Introduction to Affected Environment.

The following parameters were used to evaluate the categories of RFFAs listed above and identify specific RFFAs for the cumulative effects analysis in the EIS:

- **Timeframe** – Typically, only projects with dedicated funding, currently in or scheduled to undergo federal, state, or local permitting, and with a medium to high probability of occurring, are included. However, the US Army Corps of Engineers (USACE) has determined that expansion of the Pebble Project, as originally discussed in the Wardrop 2011 Preliminary Assessment Technical Report, (commissioned by Northern Dynasty Minerals to independently review and analyze project economics, current mineral resources, and valuation estimates in compliance with National Instrument 43-101, Standards of Disclosure for Mineral Projects in Canada) and refined in the response to RFI 062 (PLP 2018-RFI 062), will be analyzed under the cumulative effects analysis (see details in Table 4.1-1, and a list of assumptions in Table 4.1-2). As presented in the response to RFI 062 (PLP 2018-RFI 062), Pebble Project expansion would begin in year 20 of the proposed Pebble Project operations. Other reasonably foreseeable future activities that may occur during construction and operation of the proposed project will also be considered. However, to be considered reasonably foreseeable, potential RFFAs need to meet additional criteria.
- **Land status subject to mining** – Mineral projects must be on State lands designated as open to mineral entry or development, or on Alaska Native Claims Settlement Act lands where previous mining exploration or development activity have been allowed. When lands are classified as open to mineral development, it facilitates obtaining permits and other approvals for exploration and development activities.



- **Development projects with dedicated funding, currently in a federal, state, and/or local permitting process, undergoing a state or federal environmental assessment, or listed in a government planning document with a specific time-frame for development** – Projects may also be considered reasonably foreseeable for development if they have dedicated funding and a schedule for development; have federal, state, or local permit applications under review or approved; are currently being evaluated through a federal NEPA compliance effort or State Best Interest Finding document (a state decision-making document that determines if granting a permit is in the best interest of the state); or are identified in a published federal, state, or local planning document (such as scheduled lease sales and community capital projects) with a specific project description and timeframe for development.
- **Information to support the viability of development has been documented in a published or online report** – Projects that have conducted extensive exploratory drilling and analysis to compile information on mineral reserves in terms of measured, indicated, and inferred resources, along with characterization of the grades of ore in the deposit are included. The potential feasibility for development is evaluated based on the published information on results of drilling and delineation of measured, indicated, inferred, and grade of reserves. To the extent they are available, estimated costs associated with development are also assessed.
- **Proximity to the project infrastructure and factors affecting co-use by other parties** – The question of whether development of the proposed project would facilitate development of other nearby mineral deposits depends in part on proximity of a potential RFFA to the proposed project and ability to use project infrastructure. Construction of access to project transportation infrastructure is expensive, and also depends on land ownership access and sensitivity of environmental resources along the access route. Project infrastructure would be privately funded, and co-use of mining and port facilities dependent on permission from Pebble Limited Partnership (PLP). Although the access road would be privately funded on State land, the State of Alaska would likely require allowing access to other mineral deposit owners if an agreement could be reached with PLP regarding operation and maintenance costs, based on the precedent set in state permit conditions for granting Pogo Mine access (S. Buckley, personal communication 2018).
- **Geographic nexus with the direct and indirect effects of project development on specific resources evaluated in the EIS** – Along with the factors previously described, there would need to be interactive and synergistic effects of an RFFA (per 40 CFR Part 1508.7) on resources directly and indirectly affected by development of the project in a specific geographic range that varies by resource.

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
<b>Potential Mineral Deposits in Southwest and Southcentral Alaska</b>				
<p>Pebble Project Expansion – develop 55% of delineated resources</p>	<p>Expansion of the Pebble Project to develop 55% of its reserves over an additional 58 years of mining, and 20 to 40 years of post-mining processing low-grade ore and pyritic material, as outlined in response to RFI 062 (Pebble Limited Partnership [PLP] 2018-RFI 062) and summarized in Table 4.1-2. It would use the same transportation facilities, power plant, and natural gas pipeline facilities. It would need additional tailing storage, additional water storage, new waste rock storage facilities, additional processing facilities, a concentrate pipeline and a deepwater loading facility. It is not part of the proposed action, and would require additional permits and separate NEPA compliance. Table 4.1-2 presents assumptions for Pebble Project expansion development.</p>	<p>Potential project expansion. Expansion identified as an option in the Wardrop 2011 report, and refined in the response to RFI 062 (PLP 2018-RFI 062). A similar expansion concept was analyzed as Pebble 6.5 in the US Environmental Protection Agency (EPA) Watershed Assessment (EPA 2014) on the basis of lands being classified as open for mineral exploration and development, and assuming access to Pebble Project infrastructure.</p>	<p>Wardrop 2011, EPA 2014, response to RFI 062 (PLP 2018-RFI 062)</p>	<p>Yes – for continued exploration and development.</p> <p>Project expansion would begin within the timeframe of the proposed Pebble Project, in year 20 of the proposed project operations.</p> <p>The state lands on which expansion would occur are subject to PLP mining claims and open to mineral development.</p> <p>PLP has existing permits for resource exploration, but has not submitted permit applications for expanded development; expansion is not part of a current NEPA compliance or Best Interest Finding effort, and is not described as reasonably foreseeable in a government planning document.</p> <p>PLP has conducted extensive exploratory drilling and analysis to compile a 43-101 feasibility assessment level of information on mineral reserves in terms of measured, indicated, and inferred resources, along with characterization of the grades of component ore in the deposit and estimated costs of development of mine expansion (Wardrop 2011).</p> <p>If the Pebble Project was permitted, Pebble expansion could use and expand on the project mine site and</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
				transportation infrastructure that would be in place, similar to what has happened with other Alaskan mines where adjacent reserves are commonly owned.
Pebble South	A 54-square mile (mi <sup>2</sup> ) porphyry copper deposit/claim ~9 miles southwest of Pebble deposit. Prospect is part of the PLP/Northern Dynasty Minerals (NDM) Limited (Ltd.) claim block.	Subject to further exploration. Analyzed for cumulative effects in the EPA Watershed Assessment based on land classification of the deposit and assuming access to Pebble Project infrastructure.	EPA 2014	<p>Yes – for further exploration.                      No – for development.</p> <p>There is no indication that development of Pebble South would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The state lands on which expansion would occur are subject to PLP mining claims and open to mineral development. Resource delineation has not progressed sufficiently to forecast development with regard to identifying measured or indicated resources; and a project is not subject to development permitting or in a planning document.</p> <p>Because the Pebble South claims are currently owned by NDM Ltd., if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system. However, additional access would need to be constructed to connect to the project transportation infrastructure.</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
Big Chunk South	A 73-square-mile (mi <sup>2</sup> ) porphyry copper deposit/claim ~12 miles north of the Pebble project area. The claim block is entirely in the Chulitna River drainage, which flows into Lake Clark National Park and Preserve.	Undergone some airborne surveys and limited drilling to delineate the resource. Mineral Claims transferred by Liberty Star to NDM Ltd. in 2014, Liberty Star to NDM Ltd. in 2014, which is when the last state exploration permit expired. Analyzed for cumulative effects in the EPA Watershed Assessment (EPA 2014) based on land classification of the deposit and assuming access to Pebble Project infrastructure.	EPA 2014	<p>Yes – for further exploration. No – for development.</p> <p>There is no indication that development of Big Chunk North would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The state lands on which expansion would occur are subject to NDM mining claims and open to mineral development.</p> <p>Resource delineation has not progressed sufficiently to forecast development with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning.</p> <p>Because Big Chunk South claims are currently owned by NDM Ltd., if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system. However, additional access would need to be constructed to connect to the project transportation infrastructure.</p>
Big Chunk North	Porphyry copper deposit ~21 miles northwest of the Pebble project area. The claim block straddles the drainage divide between the Nushagak and	Mineral claims transferred by Liberty Star to NDM Ltd. in 2014, Liberty Star to NDM Ltd. in 2014, which is when the last state exploration	EPA 2014	<p>Yes – for further exploration. No – for development.</p> <p>There is no indication that development of Big Chunk North</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
	Kvichak River watersheds.	permit expired. Analyzed for cumulative effects of development in the EPA Watershed Assessment based on land classification of the deposit and assuming access to Pebble Project infrastructure.		<p>would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The state lands on which expansion would occur are subject to NDM mining claims and open to mineral development.</p> <p>Resource delineation has not progressed sufficiently to forecast development with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>Because claims are currently owned by NDM Ltd., if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system. However, additional access would need to be constructed to connect to the Project transportation infrastructure.</p>
Fog Lake	Gold, copper in volcanic rocks located ~46 miles southeast of the Pebble Project and south of Iliamna Lake, and roughly 10 miles north of the transportation corridor to Amakdedori port.	As of 2008, exploration was occurring, but drilling had not been initiated; the exploration permit expired at the end of 2008. Analyzed for cumulative effects of development in the EPA Watershed Assessment (EPA 2014) based on land classification of the deposit and assuming access to	EPA 2014	<p>Yes – for further exploration. No – for development.</p> <p>There is no indication that development of Fog Lake would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The lands on which the deposit is located have had mining claims, and are open to mineral</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
		Pebble Project infrastructure.		<p>development.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>Given the proximity to the proposed Pebble Project transportation corridor, if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system if an arrangement could be reached with PLP. However, additional access would need to be constructed to connect to the project transportation infrastructure.</p>
Groundhog	196 mi <sup>2</sup> porphyry copper claim ~3 miles east from the Pebble project area.	Exploration drilling under way. Hard rock exploration permit issued by Alaska Department of Natural Resources (ADNR) in 2017. Analyzed for cumulative effects of development in the EPA Watershed Assessment (EPA 2014) based on land classification of the deposit and assuming access to Pebble Project infrastructure.	EPA 2014	<p>Yes – for further exploration. No – for development.</p> <p>There is no indication that development of Groundhog would occur within the operations timeframe of the proposed Pebble Project.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>Resource delineation has not</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
				<p>progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>Given the proximity to the proposed Pebble Project transportation corridor, if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system if an arrangement could be reached with PLP. However, additional access would need to be constructed to connect to the Project transportation infrastructure.</p>
Humble	Also known as Kemuk, a 173-mi <sup>2</sup> gold and porphyry copper deposit/claim considered geologically similar to Pebble deposit. Deposit is ~83 miles southwest of the Pebble Project area.	This project has been removed from the Millrock Resources website and no longer appears to be active; the exploration permit expired in 2017. Analyzed for cumulative effects of development in the EPA Watershed Assessment (EPA 2014) based on land classification of the deposit, and assuming access to Pebble Project infrastructure.	EPA 2014, Millrock Resources, Inc. 2018	<p>No – for further exploration. No – for development.</p> <p>There is no indication that development of Humble would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The state lands on which the deposit is located have had mining claims and are open to mineral development.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
				<p>planning document.</p> <p>The project is closer to tidewater at Dillingham than the Pebble Project, and would not likely use the project transportation system.</p>
AUDN/Iliamna	113-mi <sup>2</sup> porphyry copper claim block ~55 miles southwest of the Pebble project area in the Kvichak River watershed.	Millrock Resources began exploration in 2012, but the project has been removed from the Millrock Resources and TNR Gold Corp websites and no longer appears to be active. Analyzed for cumulative effects of development in the EPA Watershed Assessment (EPA 2014) based on land classification of the deposit.	EPA 2014; Bristol Exploration Co., Inc. 2011	<p>No – for further exploration.</p> <p>No – for development.</p> <p>There is no indication that development of Humble would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The state lands on which the deposit is located have had mining claims and are open to mineral development.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>The project is closer to tidewater at Naknek than the Pebble Project, and would not likely use the project transportation system.</p>
Kamishak	Porphyry copper in a breccia pipe roughly 49 miles southeast of the Pebble Project area, and roughly 10 miles south of the transportation corridor to Amakdedori port.	There were 18 holes drilled between 1990 and 1991, and an additional 5 holes were drilled in 2006. As of 2008, reserves had not been identified, and the exploration permit expired.	AERI 2008	<p>No – for further exploration.</p> <p>No – for development.</p> <p>There is no indication that development of Kamishak would occur within the operations timeframe of the proposed Pebble Project.</p>



**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
				<p>The lands on which the deposit is located have had mining claims, and are open to mineral development.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>Given the proximity to the proposed Pebble Project transportation corridor, if future drilling and resource delineation indicate that it is feasible to develop the project, it is possible that construction and operations could access and use the Pebble Project transportation system if an arrangement could be reached with PLP. However, additional access would need to be constructed to connect to the project transportation infrastructure.</p>
Shotgun	<p>Quartz-feldspar porphyry deposit with gold as the primary interest, located roughly 99 miles northwest of the Pebble Project, 90% owned by TNR Gold Corporation. If developed, Shotgun could access tide water via barge transport from Dillingham (93 miles away) up the Nushagak River to Koliganek, New Stuyahok, or Ekwok (49, 68, and 74 miles away, respectively).</p>	<p>There have been extensive drilling programs since the late 1980s through 2012; and as of 2013, inferred mineral resources were estimated at 20.7 million tons, with a grade of 1.06 gram of gold per ton, with a cut-off grade of 0.50 gram per ton of gold. 34 exploration holes have been drilled onsite.</p>	<p>TNR Gold Corp. 2011, 2012, 2018; ADNR 2012</p>	<p>Yes – for further exploration.                      No – for development.</p> <p>There is no indication that development of Shotgun would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The lands on which the deposit is located have had mining claims and open to mineral development.                      Mineral exploration has</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
				<p>delineated inferred mineral resources, but to date have not been identified as measured or indicated.</p> <p>The project is not currently subject to development permitting or in a planning document.</p> <p>The project is closer to tidewater at Dillingham than the Pebble Project, and would not likely use the project transportation system.</p>
Johnson Tract	<p>Gold-rich poly-metallic deposit located roughly 80 miles east of the Pebble Project, owned by Cook Inlet Region, Incorporation (CIRI) and subject to an exploration agreement with Constantine Metals Resources Ltd. CIRI has access rights through Lake Clark National Park and Preserve to a port site at Tuxedni Bay on Cook Inlet.</p>	<p>Discovered by Anaconda in 1982, 90 holes have been drilled but no exploration has occurred in more than 20 years. In 2018, Constantine Metals agreed to resume exploration and take the project to the point of evaluating feasibility of developing the mine.</p>		<p>Yes – for further exploration. No – for development.</p> <p>There is no indication that development of Johnson Tract would occur within the operations timeframe of the proposed Pebble Project.</p> <p>The private lands on which the deposit is located have had mining claims, and are open to mineral development.</p> <p>Resource delineation has not progressed sufficiently with regard to identifying measured or indicated resources, and a project is not subject to development permitting or in a planning document.</p> <p>The project is closer to tidewater at Cook Inlet than the Pebble Project, and would not likely use the project transportation system.</p>

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
<b>Proposed Mining and Mineral Projects in Southwestern and Southcentral Alaska</b>				
Donlin Gold	Open-pit hard rock mine in the Kuskokwim River watershed, 277 miles west of Anchorage. The proposed mine would have a total footprint of approximately 16,300 acres. Includes a 315-mile-long pipeline to carry natural gas from Cook Inlet to the mine site.	Final EIS (FEIS) issued in April 2018. USACE and Bureau of Land Management (BLM) have issued a Joint Record of Decision (JROD) granting major federal permits.	USACE 2018	Yes – for further exploration. Yes – for development. FEIS on the project has been completed, and the JROD was signed in August 2018. The project is considered reasonably foreseeable in the 78-year timeframe.
Diamond Point Rock Quarry	Granite quarry project near the convergence of Cottonwood and Iliamna bays on the western side of Cook Inlet. Project involves modification of shoreline to construct an access road, breakwater, barge landing, and solid fill dock. Dredging would be required in Iliamna Bay.	The project has been developed as the first phase of a larger facility. Coastal infrastructure includes discharging fill material into 11.42 acres below the high tide line fill for staging equipment, stockpiling aggregate, and barge-loading facilities.	USACE 2010	Yes – for development expansion. Reserves of quarry rock have been estimated and a permit was issued. Construction has begun.
<b>Potential Oil and Gas Exploration and Development</b>				
Alaska Stand Alone Pipeline Project	Proposed 737-mile natural gas pipeline from Prudhoe Bay to Point McKenzie, Alaska. The project involves the construction of a liquefied natural gas (LNG) extraction plant on the western side of Cook Inlet at Point McKenzie.	A FEIS was completed in 2018. A ROD is expected soon. If developed, the project would generate additional construction and potentially LNG shipment vessel traffic in Cook Inlet.	Alaska Stand Alone Pipeline (ASAP) 2018	Yes – Because the project has a permit application and is near completion of an EIS, it is considered foreseeable for development. However, it would not be built if the Alaska LNG project is funded for development.
Alaska Liquefied Natural Gas Project (Alaska LNG)	Proposed 800-mile natural gas line from Prudhoe Bay to Nikiski, where the gas will be liquefied and shipped to foreign markets. Involves a natural gas pipeline crossing Cook Inlet and will result in increased marine traffic in Cook Inlet.	Federal Regulatory Energy Commission application filed. A Draft EIS (DEIS) will be released in 2019; a FEIS would be released in 2020. Construction would begin after 2020. The project does not have funding to proceed.	Alaska LNG 2018	Yes – Because the project has a permit application and is near completion of an EIS, it is considered foreseeable for development.

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
Drift River Decommissioning/Oil Pipeline Transportation Project	Proposes to repurpose an existing natural gas pipeline crossing Cook Inlet to an oil pipeline. Involves the installation of 9 miles of new cross-inlet pipeline between Beluga and Nikiski.	Decommissioning of the Drift River Terminal was initiated in 2017, and construction has begun. The project would result in gas pipeline construction in middle Cook Inlet, and generate additional vessel traffic in Cook Inlet to remove decommissioned materials.	Regulatory Commission of Alaska 2018; KDLL, Public Radio for Central Kenai 2018	Yes – for development. The project is in the permitting phase and scheduled for execution. It is considered reasonably foreseeable in the 78-year timeframe.
Cook Inlet Oil and Gas Lease Sales	<p>State: ADNR is responsible for leasing oil and gas in state waters.</p> <p>Federal: The Bureau of Ocean and Energy Management is responsible for leasing oil and gas in federal waters.</p> <p>Recent assessments by the US Geological Survey (USGS) estimate that the Cook Inlet region (excluding the Outer Continental Shelf) contains mean values of 637 billion cubic feet of natural gas, 600 million barrels of oil, and 46 million barrels of natural gas liquids (from BOEM 2016).</p> <p>There are 17 offshore production platforms located in Cook Inlet state waters (ADNR 2018e; BOEM 2016).</p> <p>Exploration activities continue with future development anticipated.</p>	<p>State: ADNR released a preliminary best interest finding on the Cook Inlet Area-wide Oil and Gas Lease Sale in June 2018.</p> <p>Federal: In 2017, Federal Lease 244 resulted in bids for 14 tracts in Cook Inlet. Federal Lease Sale 258 for Cook Inlet is scheduled for 2021.</p> <p>Oil and gas exploration and development activities in Cook Inlet are ongoing and likely to continue.</p>	ADNR 2018e BOEM 2016	<p>Yes – for exploration; oil and gas exploration has been subject to a 2016 EIS (federal waters) and a 2018 preliminary best interest finding (state waters).</p> <p>Yes – for development.</p> <p>Although no new offshore platforms are currently scheduled, work on and drilling from existing offshore platforms is likely to continue.</p>
Hydrocarbon Exploration Licensing and Leasing Program	ADNR, Lake and Peninsula Borough (LPB), Bristol Bay Borough, and Aleutians East Borough have signed a	Exploration has historically occurred, but not resulted in development.	Bristol Bay Area Plan for State Lands 2015	Yes – for exploration. The State of Alaska has held lease sales, and additional exploration is considered reasonably

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

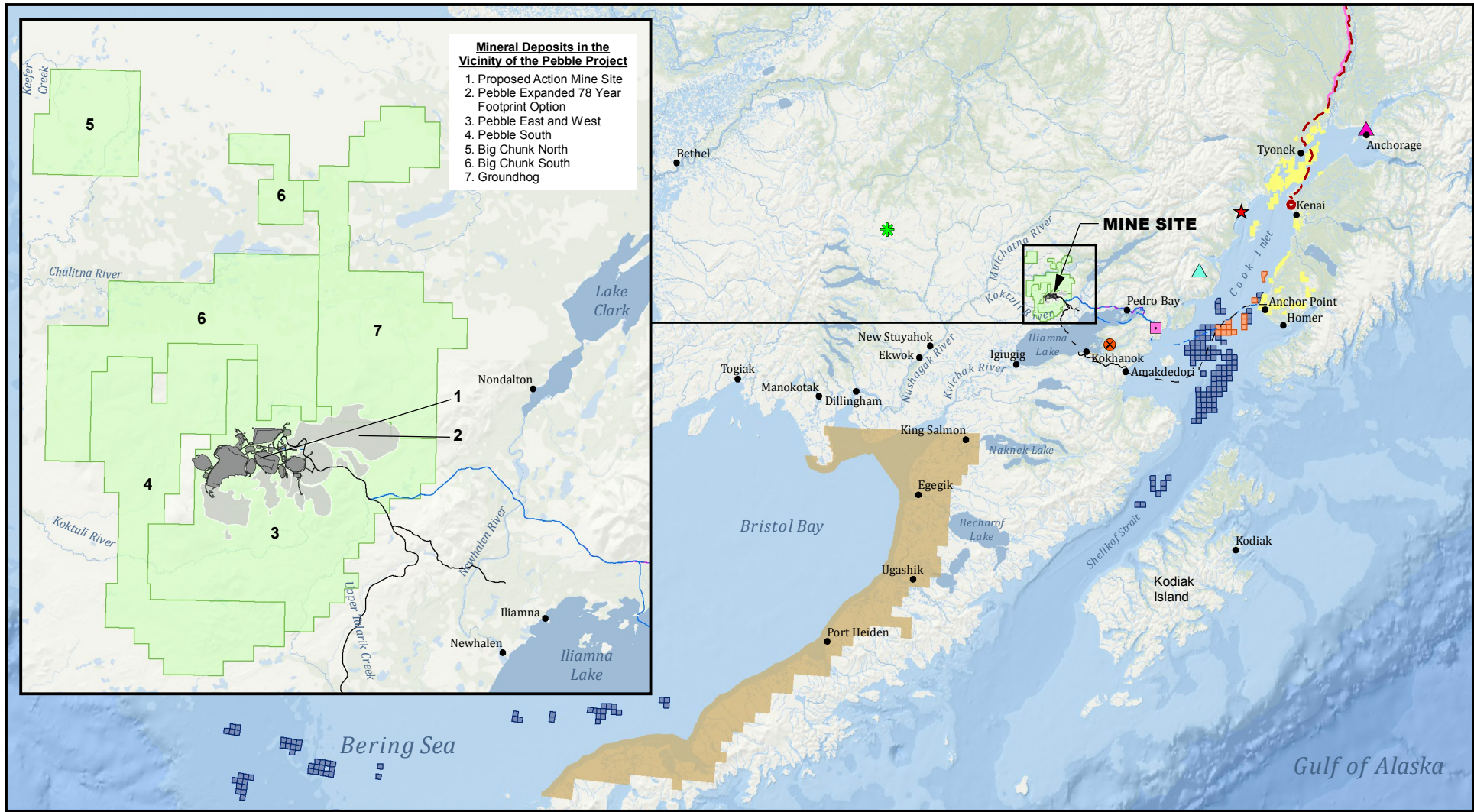
Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
	Memorandum of Understanding (MOU) in support of oil and gas lease sales and licensing on State land in the analysis area. Similar MOUs exist between ADNR and the Aleut Regional Native Corporation and Bristol Bay Native Corporation.			foreseeable. No – for development. Given the lack of previous oil and development in the region, development and production are not reasonably foreseeable.
<b>Transportation and Infrastructure</b>				
LPB Transportation Projects	Several road improvement and new transportation corridors currently being studied. Studies include the Williamsport-Pile Bay Road upgrade, Nondalton–Iliamna River Road Corridor and Bridge, and Kaskanak Road /Cook Inlet to Bristol Bay (Igiugig).	Ongoing.	LPB Comprehensive Plan 2017	Yes – for development. These projects are in a published Borough planning document.
LPB Community Development and Capital Improvement Projects	Village infrastructure development projects, including power plant upgrades, sewer and water improvement projects, transmission upgrades, and energy efficiency initiatives.	Ongoing. List of projects from LPB 2017 capital improvement projects.	LPB Comprehensive Plan 2017	Yes – for development. These projects are in a published Borough planning document.
Rural Alaska Village Grant Program	US Department of Agriculture Rural Development program to improve rural sanitization. Grant money used to improve water and sanitation services.	Ongoing	USDA Rural Development 2018	Yes – for development. These projects are considered small-scale community improvements, and could be approved for communities in the area of analysis.
<b>Energy and Utilities</b>				
Lake and Peninsula Borough (LPB) and other regional Renewable Energy Initiatives	LPB and other communities and electrical generation cooperatives are studying renewable energy projects to	Studies ongoing. Igiugig has been installing its pontoon-mounted power generator annually in the Kvichak River.	LPB Comprehensive Plan 2017	Yes – for development. These projects are in a published LPB planning document.

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
	help combat high fuel costs. Studies include wind, hydroelectric, river, and tidal energy alternatives. Igiugig has a permit for a removable in-river power generation facility in the Kvichak River.	The Tazimina Run of River Hydro Project upgrade has been completed, 12 miles northeast of the village of Iliamna.  The village of Kokhanok has received funding to refurbish its existing wind diesel power plant.		
Nushagak Electric Cooperative Village Intertie Project	The Nuyakuk Run of River Hydro Project would connect the communities of Dillingham, Levelok, New Stuyahok, Koliganek, Aleknagik, and Ekwok with power and fiber optics with operation projected for 2024.	Nushagak Cooperative has submitted a preliminary permit application to Federal Energy Regulatory Commission (FERC) for their hydro project on the Nuyakuk River in Wood Tikchik State Park.	US Department of Energy FERC 2018 (83 FR 15826)	Yes - for development. These projects have submitted, or are in the process of submitting, permits for development.
<b>Commercial Fishing</b>				
Bristol Bay – Nushagak and Naknek/Kvichak State Management Districts – Salmon  Lower Cook Inlet Management Area – Salmon and Herring	Continued stock assessment and allocation decisions under existing management plans.	Ongoing. Anticipate a continuation of commercial fishing in the EIS analysis area.	ADF&G Commercial Fishing Management Reports 2018	These actions will occur in response to annual stock assessments and direction from management plans.
<b>Subsistence Activities</b>				
Villages of Iliamna, Newhalen, Pedro Bay, Port Alsworth, Nondalton, Igiugig, Kokhanok, Koliganek, Levelock, New Stuyahok, King Salmon, Naknek, Aleknagik, Clarks Point, Manokotak, Dillingham, Ninilchik, and Seldovia	Past, present, and foreseeable subsistence activities are described in Section 3.9, Subsistence.	Ongoing. Anticipate a continuation of subsistence practices in the EIS analysis area.	See Section 3.9, Subsistence.	Subsistence harvest of fish, wildlife, and plants will continue for the foreseeable future.

**Table 4.1-1: Potential Reasonably Foreseeable Future Actions Evaluated for Cumulative Effects**

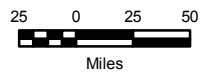
Prospect, Project, or Activity	Description	Status	References	Reasonably Foreseeable?
<b>Tourism, Recreation, Hunting, and Fishing</b>				
National Parks and Preserves Wildlife Refuges State of Alaska Special Management Areas Alaska Native Corporation Lands	Hiking, camping, wildlife viewing, and photography. Sport fishing is the primary recreational activity that occurs in the EIS analysis area. Hunting, primarily for moose, caribou, and bear, is a major recreational activity in the region.	Activities are expected to continue in the EIS analysis area.	See Section 3.5, Recreation.	Tourism, recreation, hunting, and fishing will continue for the foreseeable future.
<b>Industrial Pollutants and Contaminated Sites</b>				
Communities in project area	Identified sites with low levels of contamination have been identified in many Alaskan communities. Communities with site entries in the immediate vicinity of the project include Nondalton, Iliamna, Pedro Bay, Newhalen, and New Stuyahok. Many of the sites are associated with fuel storage tanks/power generation.	Many of the sites in the ADEC database have been cleaned up. The primary potential nexus with activities proposed by the project would be in communities where PLP proposes construction and operations support activities.	ADEC 2018	Yes – these projects would result in additional activities associated with clean-up of contaminated sites in communities in the EIS analysis area.
<b>Scientific Surveys and Research</b>				
Federal, state, institutional, and private surveys and research	Scientific surveys and research conducted by government, institutional, and private parties have the potential to disturb wildlife, as well as interfere with subsistence and recreational activities and experience. Activities conducted by aircraft typically have created the most potential for conflict.	Although some agencies and organizations conduct annual surveys, others are difficult to forecast.	See Section 3.23, Wildlife Values and Section 3.24, Fish Values.	There is a potential for airplane and helicopter traffic to disturb wildlife, and for interaction with subsistence and recreational activities and experience.



**Mineral Deposits in the Vicinity of the Pebble Project**

1. Proposed Action Mine Site
2. Pebble Expanded 78 Year Footprint Option
3. Pebble East and West
4. Pebble South
5. Big Chunk North
6. Big Chunk South
7. Groundhog

Sources: ADNRC 2010, 2018; BOEM 2018



- Fog Lake Mineral Deposit
- Shotgun Mineral Deposit
- Johnson Tract Mineral Deposit
- Diamond Point Granite Quarry
- Drift River Oil Terminal Removal Pipeline Project
- Nikiski (Proposed Alaska Liquefied Natural Gas Project Terminal)
- Alaska Liquefied Natural Gas Project
- Point McKenzie (Alaska Stand Alone Pipeline Construction Port)
- Alaska Stand Alone Pipeline
- Pebble Expanded 78 Year Footprint Option
- Mineral Deposits in Vicinity of Pebble Project (See Inset Map)
- Alaska Peninsula Onshore Oil and Gas Exploration
- State Cook Inlet Oil & Gas Exploration & Lease Sales
- Federal Oil & Gas Active Leases
- Federal Historical Oil & Gas Leases
- Mine Site
- Transportation Corridor
- Natural Gas Pipeline
- Kokhanok East Ferry Terminal Variant
- Alternative 2 Transportation Corridor
- Alternative 2 Ferry Route
- Alternative 2/3 Natural Gas Pipeline
- Alternative 3 Transportation Corridor

**LOCATION OF REASONABLY FORESEEABLE FUTURE ACTIONS**

PEBBLE PROJECT EIS

FIGURE 4.1-1



**Table 4.1-2: Assumptions for Pebble Project Expansion**

Component	Assumptions
<b>Assumptions/Facilities Common to All Alternatives</b>	
General Project	<ul style="list-style-type: none"> <li>• The current proposed project proceeds as outlined by EIS alternative for the first 20 years.</li> <li>• After 20 years, mining continues for 58 years and mill throughput is expanded to 250,000 tons per day.</li> <li>• After mining stops (year 78), milling continues for an additional 20 to 40 years to process low-grade ore and potentially acid-generating (PAG) waste that is not backhauled to the pit. Bulk and pyritic tailing would be deposited directly into the pit.</li> <li>• Concurrent reclamation would occur during mining, with the northern bulk TSF closed and reclaimed as soon as it is full, along with non-trafficked areas of waste rock facilities.</li> <li>• Concurrent reclamation would occur during milling of low-grade ore/PAG material, with a dry closure of the southern bulk tails TSF, and final closure of non-acid-generating (NAG) waste rock facilities (WRF).</li> <li>• After milling stops (year 98-118), removal of all facilities and infrastructure not required post-closure.</li> <li>• Post-closure monitoring and water treatment would occur as proposed, but involving an expanded mine site.</li> </ul>
Mine Site (See response to RFI 062 [PLP 2018-RFI 062] for mine layout)	<ul style="list-style-type: none"> <li>• The mine pit would be expanded starting in year 20.</li> <li>• Reclamation of the pyritic TSF and placement of pyritic tailings and PAG rock from the first 20 years of mining would be postponed until year 78.</li> <li>• Additional bulk tails would be stored separately in a new southern bulk tail TSF with a flow-through embankment; additional pyritic tails would be stored in a new lined southern PAG TSF.</li> <li>• With mine expansion, waste rock would increase and be stored in new northern and southern NAG WRFs. Low-grade ore and PAG waste rock would be stored on the western side of the northern WRF, which drains towards the pit. All runoff and seepage from the waste rock storage facilities would be captured and used in the process, or treated for release.</li> <li>• An additional train would be added to the mill, and the power plant would be expanded to 375 megawatts, requiring 70 million standard cubic feet per day (commonly abbreviated as mmscfd) of natural gas. Water treatment plants would have throughput increased, or additional treatment plants would be brought on line.</li> <li>• The natural gas pipeline would remain the same size and route for each alternative (see additional compression at port sites under individual alternatives below).</li> </ul>
Additional Concentrate Export Port Site	<ul style="list-style-type: none"> <li>• A deepwater port facility would be constructed in Iniskin Bay for transport of copper concentrate via the concentrate pipeline.</li> <li>• The concentrate handling, dewatering, and treatment facilities would be similar to those discussed at the Diamond Point port under the Alternative 3 Concentrate Pipeline Variant.</li> </ul>

**Table 4.1-2: Assumptions for Pebble Project Expansion**

Component	Assumptions
Additional Pipelines	<ul style="list-style-type: none"> <li>• A concentrate pipeline would be constructed from the mine site to the deepwater loading facility in Iniskin Bay, and would be buried in the same trench as the natural gas pipeline from the mine site to the vicinity of Williamsport, at which point it would head east to Iniskin Bay.</li> <li>• A small service road would be built along the pipeline extension from Williamsport to Iniskin Bay.</li> <li>• A diesel pipeline would be constructed between the deepwater port in Iniskin Bay and the mine site, capable of carrying 100 million gallons annually, and parallel the concentrate pipeline.</li> </ul>
<b>Assumptions Differing by Alternative</b>	
Alternative 1 – Applicant’s Proposed Alternative	<ul style="list-style-type: none"> <li>• The Amakdedori port and transportation system would continue to operate as proposed for the first 20 years.</li> <li>• After 20 years, an additional natural gas compressor station would be constructed at Amakdedori; the port and transportation system, including the ferry, would continue to be used for transport of supplies and consumables, and bags of molybdenum concentrate.</li> <li>• There would be less truck traffic with copper concentrate and diesel being transported via pipeline to/from Iniskin Bay.</li> <li>• A road would be constructed along the concentrate pipeline to provide access for servicing the pipeline, but would not be used for regular traffic.</li> </ul>
Alternative 2 – North Road and Ferry with Downstream Dams	<ul style="list-style-type: none"> <li>• The Diamond Point access road and north road would continue to operate as proposed for the first 20 years.</li> <li>• After 20 years, an additional natural gas compressor station would be constructed at Diamond Point. A road would be constructed to connect the two ferry terminals, and the ferry would be discontinued.</li> <li>• Diamond Point would continue to be used for transport of supplies and consumables, and bags of molybdenum concentrate.</li> <li>• There would be less truck traffic with copper concentrate and diesel being transported via pipeline to/from Iniskin Bay.</li> </ul>
Alternative 3 – North Road Only, Concentrate Pipeline Variant	<ul style="list-style-type: none"> <li>• The Diamond Point access road and north road would continue to operate as proposed for the first 20 years.</li> <li>• After 20 years, an additional compressor station would be constructed at Diamond Point.</li> <li>• Diamond Point would continue to be used for transport of supplies and consumables, and bags of molybdenum concentrate.</li> <li>• There would be less truck traffic with copper concentrate and diesel being transported via pipeline to/from Iniskin Bay.</li> </ul>

### 4.1.2 Issues Selected for Analysis

The USACE and cooperating agencies identified topics for further analysis, and eliminated others from evaluation, based on independent evaluation of topics and through scoping comments. Issues raised during scoping are documented as Statements of Concern in the Scoping Report (Appendix A). Issues selected for analysis include:

#### Social science topics:

- Socioeconomics
- Subsistence
- Traditional way of life
- Archaeological and cultural resources
- Land ownership, management, and use
- Transportation and navigation
- Recreation
- Environmental justice
- Public health and safety
- Visual resources
- Wilderness characteristics
- Food and fiber production

#### Physical science topics:

- Air quality
- Geology and seismic activity
- Surface and groundwater hydrology impacts
- Noise impacts
- Water quality and quantity

#### Biological science topics:

- Vegetation and ecosystems
- Fish and aquatic resources
- Wetlands and special aquatic sites
- Wildlife, birds, and mammals
- Endangered Species Act listed threatened and endangered species
- Invasive species

#### Other topics:

- Hazardous materials stored and transported to and from the mine site
- Tailings dams
- Climate change
- Fuel spill risks and releases
- Natural gas supply
- Pipeline safety

### 4.1.3 Other Resources

The NEPA provides the lead agency with discretion to determine, based upon the scoping process, which categories of resources merit detailed analysis, and which categories do not. This determination and impacts to resources that did not warrant detailed analysis are briefly addressed in this section. This is particularly the case where the resource has relevance to USACE public interest review under Section 404 of the CWA (see Table 3.1-1 in Section 3.1, Introduction to Affected Environment, for a detailed list of resource categories, and in which section of the EIS they are discussed). Note that affected environment for resources not specifically discussed in Section 3.2 to Section 3.26 is discussed in this section, along with environmental consequences.

### **4.1.3.1 Conservation**

Conservation is assessed in a regional context (USACE 2017). Beneficial or adverse impacts in terms of conservation for the proposed project are included in various sections of Chapter 4 in this context. Supporting discussions regarding impacts on the conservation of water supply, wetlands, wildlife, fish, aquatic resources, vegetation are provided in appropriate sections of this EIS (see Section 3.1, Introduction to Affected Environment, for details on where each resource is discussed in this document).

### **4.1.3.2 General Environmental Concerns**

General environmental concerns are assessed in a local, regional, state, national, and global context (USACE 2017). Beneficial or adverse impacts in terms of conservation for the proposed project are included in various sections of Chapter 4 in this context. Concerns with a large mineral resource extraction project are varied, interrelated, and complex. During the scoping period, concerns that did not fall into a specific social, physical, or biological science topic included hazardous materials storage and transportation, climate change, tailings dams concerns, fuel spill risks and releases, natural gas supply, and pipeline safety.

Climate change trends are discussed Chapter 3 sections, and climate change impacts are discussed in Chapter 4 sections (effects of the project on climate change per GHG emissions; effects of climate change on the project infrastructure). See the “Climate Change” subsection below. The framework for discussing climate change in this document is found in Section 3.1, Introduction to Affected Environment.

The probabilities and potential impacts of spills (unintended releases) from the project are analyzed for diesel fuel, natural gas, copper-gold ore concentrate, chemical reagents, bulk and pyritic tailings, and untreated contact water in Section 4.27, Spill Risk. Pipeline safety is also discussed in Section 4.27, Spill Risk.

Natural gas supply is addressed below under “Energy Needs.”

### **4.1.3.3 Energy Needs**

Energy needs are assessed in terms of power supplies to the mine site and port facilities, from a local and regional context (USACE 2017). There would not be expected to be beneficial or adverse impacts in terms of energy needs for the proposed project in this context.

The project purpose is not to generate energy. The purpose of the natural gas pipeline from the Kenai Peninsula is to provide a long-term stable supply of natural gas to meet the energy needs of the project by connecting to the existing regional gas supply network. See Chapter 1, Purpose and Need, for an expanded discussion on project purpose and need.

Due to the remote location and lack of current infrastructure, the project would be required to provide basic infrastructure in addition to support facilities typically associated with mining operations. The project would generate its own electricity using natural gas from the region and diesel fuel in back-up generators. The electricity would be used for ore extraction and processing. The peak electrical load for the project would be approximately 270 megawatts (MW). Various mine load centers would be serviced by a 69 kilovolt distribution system using a gas-insulated switchgear system located at the power plant. Waste heat from the power plant would be used to heat buildings and supply process heating to the water treatment plant, resulting in conservation of energy and reducing the amount of natural gas required to power ancillary facilities. The port site would include two 2 MW natural gas power generators with an emergency diesel generator. Natural gas would be fed to the port site power station to be used for heating. Natural gas pipeline infrastructure would include a compressor station on the Kenai

Peninsula side, and a second compressor station located at a Cook Inlet port site. The ferry mooring system design would allow engines to be turned off while parked conserving diesel fuel.

While natural gas supply was raised as a concern during the scoping period, the source of and production methods of natural gas are beyond the scope of this EIS because they are not a component of any federal permit required for this project. Additionally, the project proposes to purchase natural gas on the open market by linking with the existing pipeline system near Anchor Point, Alaska. Gas for the project would not be from a specific source. Potential sources at this time include any natural gas producer in Cook Inlet, Alaska.

#### **4.1.3.4 Mineral Needs**

Mineral needs are assessed in terms of precious metals resource extraction in an international market and global context (USACE 2017). The proposed project would result in a 20 year beneficial effect on the public's mineral needs in this context.

The proposed project would ultimately result in production of 7.4 billion pounds of copper, 36 million ounces of gold, and 398 pounds of molybdenum to meet global demand (see further details in the project description, Appendix N).

Copper is used for the production of electrical equipment (such as wiring and motors), official coins, construction (such as roofing and plumbing parts), industrial machinery (such as heat exchangers), and other uses. From the broad, macroeconomic scale, the project need is reflected in the worldwide demand for copper. In 2018, the International Copper Study Group projected a small surplus of projected available copper; however, worldwide demand for copper is projected to exceed the available supply in 2019 (ICSG 2018).

Gold is used for the production of jewelry, electronics and electrical components, official coins, and other uses. In the first 9 months of 2017, domestic consumption of gold used in the production of coins and bars decreased by more than 50 percent; however, gold consumption for jewelry increased slightly, and demand for gold coins and bars increased by 13 percent in comparison to the first 9 months of 2016 (USGS 2018d).

Molybdenum is used for the production of ferromolybdenum, metal powder, and various chemical products. Metallurgical application accounted for 87 percent of the total molybdenum consumed. In 2017, US imports for consumption of molybdenum increased by 68 percent from 2016; US exports increased by 37 percent from 2016, mainly owing to an increase in export of molybdenum ores and concentrates and molybdates. Apparent consumption increased by 26 percent in comparison to 2016 (USGS 2018d).

Project purpose and need is discussed in Chapter 1, Project Purpose and Need.

#### **4.1.4 Traditional Ecological Knowledge**

Information about traditional ecological knowledge (TEK) and the approach taken by the USACE to collect TEK is outlined in Section 3.1, Introduction to Affected Environment. The information collected is included in Appendix K3.1, Traditional Ecological Knowledge. Section 3.9, Subsistence, includes a discussion of TEK.

#### **4.1.5 Climate Change**

Chapter 3, Affected Environment, discusses climate change trends. Discussions are as follows:

- Section 3.1, Introduction to Affected Environment, provides a framework for discussion of climate change in the EIS, and the location of discussion of climate change.
- Section 3.9, Subsistence, discusses climate change in the context of traditional use change.
- Section 3.16, Surface Water Hydrology, discusses groundwater modeling incorporating cyclical and predicted climate data to account for changes in climate.
- Section 3.17, Groundwater Hydrology, provides baseline details of water balance models to discuss trends and potential changes, including how climate variability is incorporated into recalibrated modeling.
- Section 3.18, Water and Sediment Quality, discusses climate trends, and oscillations for temperature specifically.
- Section 3.20, Air Quality, provides detailed information about air quality and climate change in the context of estimated predicted future temperature and precipitation values.
- Section 3.22, Wetlands, includes discussion of the potential impacts on wetlands and other waters in a changing climate. Section 3.26, Vegetation, provides similar discussion on trends, such as changes in phenology that may affect vegetation.
- Section 3.23, Wildlife, includes detailed analysis of potential impacts of climate change on terrestrial wildlife, birds, and marine mammals, including Threatened and Endangered Species. Section 3.25, Threatened and Endangered Species, also includes discussion of climate change trends for Steller's eider.
- Section 3.24, Fish Values, discusses climate change in the context of hydrological changes and potential large-scale shifts in populations.

Chapter 4, Environmental Consequences of Action, discusses impacts of climate change from the proposed project, or contributions of the project to greenhouse gas (GHG) emissions. These impacts are primarily discussed in the physical science sections. Discussions are as follows:

- Section 4.16, Surface Water Hydrology, provides analysis of water balance models specific to the project components and operations that incorporate climate variability.
- Section 4.17, Groundwater Hydrology, also discusses climate variability in the context of analyzing water flow and balance in project components such as the pit lake.
- Section 4.20, Air Quality, includes a detailed analysis of project-related GHG emissions.

#### **4.1.6 Unavoidable Adverse Effects**

The Council on Environmental Quality (CEQ) guidelines require agencies to evaluate “any adverse environmental effects which cannot be avoided should the proposal be implemented” (40 CFR 1502.16). Unavoidable adverse effects are those remaining after the project has complied with applicable stipulations and mitigation measures. A detailed discussion of beneficial and adverse effects is presented for each resource in Section 4.2 through Section 4.26. A summary impacts subsection is presented at the end of each section.

#### **4.1.7 Irreversible and Irretrievable Commitment of Resources**

CEQ guidelines require an evaluation of “any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented” (40 CFR Part

1502.16). An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be recovered or reversed.

An irreversible resource commitment of a resource represents a loss of future options. This term applies primarily to the use of non-renewable resources, such as minerals, fossil fuels, or cultural resources, and to factors that are renewable only over long periods of time, such as soil productivity.

An irretrievable commitment of a resource represents opportunities that are foregone for the period of the proposed activities. This term applies primarily to the use of renewable resources, such as timber or human effort, or other utilization opportunities that are foregone in favor of the proposed activities.

Resources that would be irreversibly and irretrievably committed to the alternatives analyzed in this EIS include:

- **Cultural Resources and Historic Properties** – Any inadvertent effects to cultural resources or historic property would result in an irreversible commitment of resources.
- **Vegetation and Wetlands** – Ground disturbance, particularly due to project construction and operations, would cause irreversible impacts, including land to be permanently altered, soils and bedrock to be permanently displaced, vegetation to be permanently removed, and wetlands and other waters to be permanently altered or filled.
- **Aquatic Resources** – Irreversible changes to streamflows from permanent watershed alterations would eliminate aquatic habitat.
- **Aesthetics** – Development of infrastructure would create a visual contrast resulting in an irreversible commitment of resources in permanent fill areas, and an irretrievable commitment in areas subject to reclamation.
- **Resource consumption** – Irreversible consumption of renewable and non-renewable resources would be required for infrastructure development, including metals, aggregate, cement, wood, and other materials.
- **Soils and Geology** – Irretrievable and irreversible commitment of the use of copper, gold, and molybdenum ore resources.
- **Resource committal** – Non-renewable resources (e.g., gasoline, diesel, natural gas, and electrical power generated from these fuels) would be irreversibly committed for project construction, operations, and closure. Fuels would be required to operate aircraft, motor vehicles, barges, vessels, machinery, and mining equipment.
- **Funds and labor** – Funds and labor would be irretrievably committed for project permitting and development.
- **Water** – Water would be irretrievably committed for milling and processing.

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## 4.2 LAND OWNERSHIP, MANAGEMENT, AND USE

The Environmental Impact Statement (EIS) analysis area for land ownership and management includes the project footprint (including material sites), and use of those and adjacent lands. Potential direct and indirect impacts include:

- Change in land ownership status if a lease was to be issued, an easement was to be altered or vacated, or if additional access were legally acquired.
- Change in/or conflict with land management as a result of the project.
- Change in land use from an existing or allowed land use.

Indirect effects to lands adjacent to the project are discussed under specific resources.

The magnitude of impact is determined by the number of acres impacted or the distance in miles from the project components. The duration is described in relation to the phase of the project (construction, operations, closure, or post-closure). For example long term is considered to be for the life of the project, on the scale of years to decades, and short term would be for the construction phase, or months to years. The likelihood that the project would have an impact, and the geographic extent of impacts, are discussed for land ownership, management, and use. Mitigation measures that would reduce project impacts are discussed in Chapter 5, Mitigation.

### 4.2.1 No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Therefore, no additional future direct or indirect effects on land ownership, management, or use would be expected. Though no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). Pebble Limited Partnership (PLP) would have the same options for exploration activities that currently exist. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration.

PLP would be required to reclaim any remaining sites at the conclusion of their exploration program. If reclamation approval is not granted immediately after the cessation of reclamation activities, the State may require continued authorization for ongoing monitoring and reclamation work as deemed necessary by the State of Alaska.

Land use activities at the mine site, such as exploration or cessation of field activities, would occur in accordance with the requirements of the State of Alaska as the landowner. Such activities may result in a reversion of use (i.e., cessation of activity) or continuation of the existing use (i.e., exploration). Land ownership and management of the mine site, ports, and transportation and natural gas pipeline corridors would remain the same. Because the project would not be implemented, the No Action Alternative would have no new impacts on existing land ownership, management, and use.

### 4.2.2 Alternative 1 – Applicant’s Proposed Alternative

Scoping comments showed concerns regarding limiting access to state-owned lands for recreation and waterfront usage, ensuring consistency with land use plans and goals of the landowners, and addressing long-term patterns that could allow for additional development. Comments also requested that impacts to Native Allotments and Native corporation lands be disclosed. The following sections address these and other issues.

### 4.2.2.1 Land Ownership

For a description of land ownership under Alternative 1, see Section 3.2, Land Ownership, Management, and Use. No land in the project footprint would be conveyed or sold, although an Uplands Mining Lease may be acquired, and associated authorizations would be required for mining activities and facilities on State lands. Temporary use permits (if issued), easements, and rights-of-way (ROWs) for the transportation corridors and natural gas pipeline would be required on State and Alaska Native Claims Settlement Act (ANCSA) Native corporation lands to construct and operate the project if approved (see Appendix E, laws, permits, approvals, and consultations required). This would result in a change in land status and an encumbrance on use at the mine site, and along the route of the mine and port access roads, ferry terminals, and pipeline on both sides of Cook Inlet and including the alternative variants. The duration of the effect would be long term and likelihood would be certain under Alternative 1.

A tidelands lease would also be required for in-water facilities at the Amakdedori port site; this would include wetlands and other waters. These changes in land status constitute a direct impact, neither beneficial nor adverse, as there are no competing uses of encumbered lands at this time. The impact would last through the duration of the project, and after closure as long as the project components were in use. There would be no aspects of the project developed on federal or municipal owned lands.

### 4.2.2.2 Land Management

#### State Management

**Mine Site** – The mine site would be located on state-owned lands within units R06-23 and 24. Lands encumbered by State of Alaska mining claims by PLP and are managed under the Alaska Lands Act, which would be guided by the Bristol Bay Area Plan and further managed by the Alaska Reclamation Act, the Mine Operation Act, and the Alaska Administrative Code on mining reclamation. The State of Alaska made much of their land selections in the Bristol Bay Area Plan planning area because of its mineral potential (ADNR 2013a). The Bristol Bay Area Plan specifies that these lands are to be retained in public ownership and managed for multiple use, which includes recreation; timber; minerals; fish and wildlife; and natural scenic, scientific, and historic values. This does not preclude construction of the mine or related facilities. The project would generally be consistent with the plan's goals for the use of subsurface resources, which call for making metallic and non-metallic minerals available to contribute to the mineral inventory and independence of the US generally and Alaska specifically while protecting the integrity of the environment and affected cultures.

However, the "Management Intent" for Unit R06-23 as defined in the Bristol Bay Area Plan is: "The habitat resources of the two stream corridors that traverse this unit [R06-24] are to be protected," which includes small portions of the upper North and South Fork Kaktuli river corridors. Mineral development within R06-24 should be performed in such a manner as to ensure that impacts to the anadromous and high value resident fish streams are avoided or reduced to levels deemed appropriate in the state and federal permitting processes related to mineral deposit development. Specifically, such development should ensure the protection of the streams affected by mineral closing order (MCO) 393 and their associated riverine habitats, which includes the area within 100 feet of ordinary high water mark. Mineral entry and location in the two streams is not allowed pursuant to MCO 393. In addition, the area is managed for moose wintering habitat. Mineral development within R06-24 would be required to be performed in such a manner as to ensure that impacts to the anadromous and high value resident fish streams are avoided or reduced to levels deemed appropriate in the state/federal permitting

processes related to the project. Modification of active management for fish and wildlife protection would be necessary as a result of the project through the life of the mine and into post-closure. The impact would be certain to occur. Potential conflicts between management plans and development of the proposed project would be addressed and mitigated during the State permitting process, and may require permit conditions to accommodate additional plan direction related to fish and wildlife management.

**Transportation Corridor and Pipeline** – Some of the transportation corridor and natural gas pipeline (and alternative variants) would be located on state-owned lands managed under the guidance of the Bristol Bay Area Plan (see Section 3.2, Land Ownership, Management, and Use). The plan specifies that these lands are to be retained in public ownership and managed for a multiple use designation that does not preclude construction of the mine and port access roads. Modification of active management for fish and wildlife protection would be necessary in the immediate transportation and pipeline corridors and nearby McNeil River State Game Sanctuary and Reserve. The impact would be certain and long term, lasting through the life of the mine and into post-closure.

Iliamna Lake is managed as a navigable waterbody under the Bristol Bay Area Plan. The lake is co-designated for public recreation, dispersed tourism, and habitat. The designations allow for development insofar as essential habitat and recreation values are maintained. These designations do not preclude construction and operations of the project's proposed north and south ferry terminals, nor the ferry route across the lake.

Amakdedori port and the pipeline compressor station on the Kenai Peninsula would fall under the management of the state's Kenai Area Plan. The plan has management guidelines for the development of transportation and utilities that include protection of hydrologic systems and roads near wetlands. The plan also provides guidelines for waterfront development with regard to soil erosion and fuel storage (ADNR 2001). These guidelines would not preclude the development of Amakdedori port or the pipeline facilities on the Kenai Peninsula.

Because the project would not be counter to the state's planned land management of the area, project construction, operations, maintenance, or closure on state lands would not result in adverse direct or indirect effects on management of state lands. However, as described above, modification of active management may be necessary in some areas for the duration of the project and into post-closure.

### **Borough Management**

The mine site, the majority of the transportation corridor (including variants), and a portion of the natural gas pipeline corridor would lie within the boundaries of the Lake and Peninsula Borough (LPB). PLP would be required to obtain development permits from the LPB; however, no direct or indirect effects on land management in the LPB would occur outside of permit reviews and authorizations. Any permits from a borough would only be issued with permit stipulations that would address potential land use conflicts.

Amakdedori port and a portion of the proposed transportation corridor and the natural gas pipeline corridor on the western side of Cook Inlet would be located in the Kenai Peninsula Borough (KPB). The KPB Comprehensive Plan does not contain goals, objectives, or implementation actions specific to development of the project on lands in the KPB. However, the KPB does regulate development on the floodplain, in the coastal zone, and near certain anadromous fish streams throughout the borough. No direct or indirect effects on land management in the KPB would occur, outside of permit reviews and authorizations.

### **Alaska Native Regional and Village Corporation Management**

Portions of the mine access road (including the Kokhanok spur road) would cross surface lands owned by Alaska Peninsula Corporation, and Iliamna Natives Limited. The natural gas pipeline corridor would cross subsurface lands owned by Cook Inlet Region, Inc. and Bristol Bay Native Corporation. Uses on these surface and subsurface lands privately owned by Alaska Native corporations are subject to the approval of the landowners. Any activity would be conducted in accordance with lease and surface use agreements that PLP would establish with the landowners. Project construction, operations and maintenance, or closure would not result in adverse direct or indirect effects on management of these lands.

### **Federal Management**

Under Alternative 1, no physical project-related infrastructure would be developed on any federal land or in other legislatively designated areas. Therefore, project construction, operations, or closure would not result in any direct effects on the management, ownership, or use of federal lands. However, project-related activities could indirectly and cumulatively affect the environment, resources, and visitor experience of four federal management units: Lake Clark National Park and Preserve, Katmai National Park and Preserve, Kachemak Bay National Estuarine Research Reserve, and the Alagnak Wild River. There is a small likelihood that adaptation in land management may be needed in response to potential adverse indirect impacts, such as noise and visual disturbance to recreationists and wildlife from proposed project components or alternative variants. The indirect impact of displacement of visitors or disruption of the visitor experience would be low in intensity. These impacts would be distant from the project location for recreation and wildlife, but would be long term, lasting through construction and operations. These indirect impacts are discussed in relevant resource sections of this EIS. See Section 4.5, Recreation; Section 4.11, Aesthetics; Section 4.19, Noise; and Section 4.23, Wildlife Values, for discussions of impacts on those resources.

The Bureau of Safety and Environmental Enforcement has jurisdiction over the submerged lands seaward of state jurisdiction (3 nautical miles from shore). Under Alternative 1, the pipeline would cross Cook Inlet over this federal jurisdiction. The project would require permitting and federal oversight, but would have no direct or indirect impact to federal management.

### **Local Management**

Under Action Alternative 1, no physical project-related infrastructure would be developed on lands that are in local jurisdiction under guidance of community plans. Therefore, project construction, operations, or closure would not result in any direct effects on the ownership, management, or use of local lands. However, project-related activities could indirectly affect the environment and resources of local communities. Those impacts are discussed in relevant resource sections of this EIS.

### **Legal Access**

There are no state-recognized Revised Statute (R.S.) 2477 ROWs in the footprint of Alternative 1.

The project area encompasses several section line easements. These easements would not prohibit development of a pipeline ROW or access roads across the affected section lines. Access to the easements would not be prohibited, although any future use may need to account for the presence of the mine access road and pipeline, if permitted and constructed.

The port access road would intersect one ANCSA Section 17(b) easement, on the south shore of Iliamna Lake (EIN 17b C5). The road would not prevent access to the easement, and crossing points would be sign-posted, with appropriate traffic controls established to ensure public safety, if needed (PLP 2018-RFI 027). This easement would not be impacted by the Kokhanok East Ferry Terminal Variant. There would be no impact on access to the easement.

One state public access easement exists along the proposed pipeline route in Iliamna Lake (see Section 3.2, Land Ownership, Management, and Use). It is an easement for communication networks (for example, there are fiber optic cables in Iliamna Lake) and other utilities. Development of the project would not prohibit access to the easement, although PLP would need to be in contact with the easement holders to ensure that construction would not affect existing infrastructure. There would be no impact on access to the easement.

#### 4.2.2.3 Land Use

As discussed in Section 3.2, Land Ownership, Management, and Use, the prevalent land uses around the EIS analysis area are undisturbed landscape and natural habitat, low-intensity recreational activities, and subsistence activity. Land development in the Bristol Bay area is generally limited to the areas in and around geographically isolated communities, fish processing facilities, and small fishing and hunting lodges.

Project construction, operations, and closure would not affect small-scale mining and exploration activities that may currently occur in the project vicinity. Residential and commercial uses in surrounding communities would not be directly affected by the project, but could expand based on employment and support service opportunities, an indirect effect. End land use and designation (post-closure) would be determined by the state.

**Mine Site** – The magnitude of impact to land use at the mine site would be in the change from minimal disturbance from exploration activities to intense industrial development. This would constitute an acute and obvious change that would last over the life of the project. The area affected would represent only a small portion of the total land area owned and managed by the State in the Bristol Bay watershed. Subsistence activity and recreation would be excluded from the vicinity of the mine site during construction and operations (see Sections 4.5 Recreation and 4.9 Subsistence). Land use would change again at closure of the mine, as the site would be restored per permit requirements and no longer used for mining.

**Transportation Corridor** – Construction of the mine and port access roads and spurs would introduce artificial features to a previously undeveloped location; therefore changing land use. The magnitude of impact would be in the undeveloped locations that would now experience heavy use of industrial trucks along the transportation corridor. The access roads and spurs would be restricted to mine-related traffic and some controlled use by local residents and businesses, and would not facilitate land use associated with non-resident recreation and tourism activities. These impacts would be certain.

The ferry operating daily on Iliamna Lake would represent an addition to the watercraft currently used in open water. However, the ferry would present a new use of the lake during the winter, with the potential of the ferry to interfere with other uses of the ice for local transportation and subsistence activities throughout the life of the project. The geographic extent would be the lake itself and the likelihood of the impact would be certain. The transportation corridor would remain in place upon project closure to support monitoring activities, although the ferry would cease operations and the intensity of use from the project would decrease. Depending on any agreements between the State and LPB with local input, some level of local use of the corridor may continue. These remaining features would constitute a permanent effect seen and the

magnitude would be moderate as a shift from an undisturbed landscape with low levels of intermittent use to transportation infrastructure supporting an industrial use.

**Natural Gas Pipeline Corridor** – The natural gas pipeline would be located in the transportation corridor from Amakdedori port to the mine site, and would not result in any additional land use changes. Any potential future use of the corridor would have to accommodate the presence of the pipeline. At the compressor station on the Kenai Peninsula, where the pipeline would connect to existing infrastructure, the land currently has some industrial development. The magnitude of impact would be in the additional development from construction of the compressor station with restricted access lasting throughout the life of the project, but overall land use in that area would not change.

Where the pipeline would cross Iliamna Lake and Cook Inlet, it would introduce a new use to the lake and this portion of the inlet that would last the lifetime of the project. During construction, there may be some short-term disruption to current uses of these waterbodies; there would be no disruption during operations.

**Amakdedori Port Site** – Construction at the port site would introduce an industrial port facility to a previously undeveloped location that is currently used for occasional subsistence and cultural education purposes. The magnitude of the impact would be the land use in the geographic area of the port that would change with the addition of industrial ship traffic, truck traffic, and storage activities. Because of security concerns, it is likely that any use of the physical footprint of the port site without coordination with PLP would be displaced (including cultural education at the site), and adjacent use activities could be affected. However, current access to the port site is limited and existing use activities are intermittent so overall impacts would be long term, lasting for the life of the project but small in magnitude. Amakdedori port would remain in place until project closure when the port would no longer be needed to support reclamation and monitoring activities. The likelihood of impacts to land use at the port site would be definite under Alternative 1.

#### **4.2.2.4 Alternative 1 – Kokhanok East Ferry Terminal Variant**

The impacts to land ownership, management, and use would be same as described previously under Alternative 1. This variant would be on lands owned by the State of Alaska and Alaska Peninsula Corporation, although acreage would be different than the proposed alternative.

#### **4.2.2.5 Alternative 1 – Summer-Only Ferry Operations Variant**

The impacts to land ownership and management would be same as previously described under Alternative 1, except that during the winter, there would be no new use of Iliamna Lake and there would be no impacts to other uses of the lake from the project. During the summer, the magnitude would be in the amount of truck traffic and ferry traffic, which would double on the access roads and lake, respectively. The duration of the impact would be every summer throughout the life of the project, and the likelihood would be certain under this variant. Land ownership under this variant would not be different.

#### **4.2.2.6 Alternative 1 – Pile-Supported Dock Variant**

The impacts to land ownership, management, and use would be same as previously described under Alternative 1.

## **4.2.3 Alternative 2 – North Road and Ferry with Downstream Dams**

### **4.2.3.1 Land Ownership**

For a description of land ownership under Alternative 2, see Section 3.2, Land Ownership, Management, and Use. The Diamond Point port would be located on lands owned on Native Allotments and ANCSA regional and village corporations. As with Alternative 1, no land in the project footprint would be conveyed or sold, although an Uplands Mining Lease may be acquired, and associated authorizations permits would be required for mining activities and facilities on State lands. Temporary use permits, easements, and ROWs for the transportation corridor and natural gas pipeline would be issued to construct and operate the project if approved. The magnitude the impact on land ownership would be in the change in land status and an encumbrance on use along the route of the mine and port access roads and pipeline. The types of impacts would be the same as described in Alternative 1, but affect different areas, ANCSA village corporation owners, and communities along the transportation corridor and port site. A new or amended tidelands lease may be required from the State of Alaska and would impact wetlands and other waters. The impacts would be long term in duration and would be certain under Alternative 2.

### **4.2.3.2 Land Management**

State management at the mine site, transportation corridor, and on the Kenai Peninsula would be the same as Alternative 1, but would affect different areas along the transportation corridor. There would be no port facilities on state-owned lands.

Land use of surface and subsurface lands privately owned by Alaska Native corporations are subject to the approval of the landowners. Any activity would be conducted in accordance with lease and surface use agreements that PLP would establish with the landowners. Project construction, operations and maintenance, or closure would not result in long-term, adverse, direct or indirect effects on management of these lands.

The Diamond Point port would be located on Native Allotments. The lands are held in trust by the federal government and generally require Bureau of Indian Affairs (BIA) oversight for sales, gift deeds, leases permits, partitions, ROWs, and sand and gravel leases. Impacts on land use from development of the Diamond Point port would be minimally adverse changes to land management at the port site. The changes would be certain to occur under Alternative 2 and would last through the life of the mine.

As with Alternative 1, the mine site, the majority of the transportation corridor, and a portion of the natural gas pipeline corridor would lie in the boundaries of the LPB. The Diamond Point port and a portion of the proposed transportation corridor and the natural gas pipeline on the western side of Cook Inlet would lie in the KPB. Impacts for borough management in these locations would be similar to borough management for Alternative 1.

Federal land management under Alternative 2 would be similar to Alternative 1; project construction, operations, or closure would not result in any direct effects on the management, ownership, or use of federal lands. The Alternative 2 transportation corridor would be approximately 4 miles closer to Lake Clark National Park and Preserve than Alternative 1, and project transportation activities may be more noticeable to park users, but farther from both the Katmai National Park and Preserve and the McNeil River State Game Refuge and Sanctuary. Effects of project-related activities on the environment, resources, and visitor experience of the federal management units listed for Alternative 1 would be long term and certain under Alternative 2.

Under Alternative 2, no physical project-related infrastructure would be developed on lands that are in local jurisdiction. Impacts would be the similar to those in Alternative 1.

### **Legal Access**

The project area encompasses several section line easements from the mine site to Cook Inlet, and impacts would be similar to Alternative 1.

There is one R.S. 2477 ROW that runs from the community of Pile Bay to the community of Iliamna (RST 396). Alternative 2 project components would bisect the ROW at several locations, mostly between Knutson Bay and Pile Bay (see Section 3.2, Land Ownership, Management, and Use). Where a R.S. 2477 ROW would be impacted from construction or operations of the project, alternate access or marked crossings would be provided as appropriate. The magnitude of land ownership changes, although certain and long term, would not be apparent due to very low existing levels of use of the easement. Most local residents travel on Iliamna Lake via boat or snowmachine and not on this ROW.

The natural gas pipeline would intersect one Section 17(b) easement, on the northern shore of Iliamna Lake (EIN 30a C5 D1); the transportation corridor and natural gas pipeline would intersect one Section 17(b) easement, also on the northern shore of Iliamna Lake (EIN 15f C5). The project would not prevent access to the easements, and crossing points would be sign-posted, with appropriate traffic controls established to ensure public safety (PLP 2018-RFI 027). There would be no effect on legal access.

Alternative 2 would intersect the same public access easements in Iliamna Lake as Alternative 1, although the number and locations of the crossings would be different. Impacts would be similar to Alternative 1. The natural gas pipeline under Alternative 2 would intersect two additional public access easements (one would also be intersected by the transportation corridor; see Section 3.2, Lands Ownership, Management and Use). The project would not prevent access to the easements, and crossing points would be sign-posted, with appropriate traffic controls established to ensure public safety (PLP 2018-RFI 027). Therefore, project effects on this and other easements would not occur.

### **4.2.3.3 Land Use**

Impact to land use at the mine site and the Kenai Peninsula pipeline compressor station would be the same as discussed under Alternative 1.

Impacts to land use from the transportation corridor would be similar to Alternative 1 for the mine access road from the Eagle Bay ferry terminal to the mine site, and for the ferry use across Iliamna Lake, although they occur at different locations. The transportation corridor under Alternative 2 includes construction of a port access road in the vicinity of and in places overlapping the current Williamsport-Pile Bay Road, which is used for the summer season portage of fishing boats and some cargo from Cook Inlet to the Bristol Bay fishery. Construction could cause some disruption to pre-existing traffic, and pre-existing traffic would use the improved Williamsport-Pile Bay Road, which would have increased heavy industrial use. The change would be high intensity, certain under Alternative 2 and would last through the life of the project. After closure, the road would revert to the current level of use, although it may increase slightly. As a beneficial impact, an improved route could entice additional boat owners to use it.

At the Diamond Point port site, the magnitude of effects on land use would be in the change from active construction of a quarry to an industrial port. Changes associated with an increase of project-related industrial ship traffic in Iliamna Bay would occur, and truck traffic would



increase along the road connecting Diamond Point to the Williamsport-Pile Bay Road. These adverse impacts would be noticeable and would last through the duration of the project.

The natural gas pipeline from Pile Bay to the mine access road from Eagle Bay ferry terminal would introduce a change in land use by converting a mostly undisturbed area to an area with a utility corridor. These impacts would be certain, low intensity, and last until the pipeline was decommissioned, which could extend beyond the life of the project.

#### **4.2.3.4 Alternative 2 – Summer-Only Ferry Operations Variant**

The impacts to land ownership and management would be same as described under Alternative 1, except at a different location. As with Alternative 1, during the winter, there would be no new project use of Iliamna Lake and there would be no impacts to other uses of the lake from the project. During the summer, the magnitude of truck traffic and ferry traffic would double. The geographic extent of the additional footprint for this variant would be entirely on lands owned by ANCSA village corporations and Native Allotments. The likelihood of impact would be certain under this variant, and the impact would be long term, lasting for the life of the project.

#### **4.2.3.5 Alternative 2 – Pile-Supported Dock Variant**

The impacts to land ownership, management, and use would be same as described under Alternative 1, except at a different location. The additional footprint for this variant would be entirely on lands owned by ANCSA regional and village corporations.

### **4.2.4 Alternative 3 – North Road Only**

#### **4.2.4.1 Land Ownership**

For a description of land ownership under Alternative 3, see Section 3.2, Land Ownership, Management, and Use. The Diamond Point port would be located on lands owned on Native Allotments and ANCSA regional and village corporations. As with Alternative 1, no land in the project footprint would be conveyed or sold, although an Uplands Mining Lease may be acquired, and associated authorizations permits would be required for mining activities and facilities on State lands. Temporary use permits, easements, and ROWs for the transportation corridor and natural gas pipeline (including alternative variants) would be issued to construct and operate the project, if approved. The magnitude of the effect on land ownership is in a change in land status and an encumbrance on use along the route of the mine and port access roads and pipeline. The types of impacts would be the same as described in Alternative 1, but affect the same areas, ANCSA corporations, landowners, and communities as Alternative 2. The extent of the access road easement would be in the same area as Alternative 2 and include the Alternative 2 natural gas pipeline route. Long-term impacts on land ownership would be certain under Alternative 3.

#### **4.2.4.2 Land Management**

Land management under Alternative 3 would be the similar to Alternative 2 for federal, state, borough, and local management. The transportation corridor would transect the same ANCSA native corporation lands as the transportation corridor and natural gas pipeline under Alternative 2, and the impacts to land management would be similar to those of the transportation corridor under Alternatives 1 and 2.

## **Legal Access**

The project area encompasses several section line easements from the mine site to Cook Inlet, and impacts would be similar to Alternative 1.

Alternative 3 transportation corridor and natural gas pipeline would bisect the same R.S. 2477 ROW (RST 396), and Section 17(b) easements (EIN 30a C5 D1 and EIN 15f C5) as in Alternative 2, and the impacts would be similar. There would be no crossings of public access easements in Iliamna Lake, but the listed easement also crosses Cook Inlet at Iliamna Bay and the impacts would be similar to Alternatives 1 and 2.

### **4.2.4.3 Land Use**

Impact to land use at the mine site and the Kenai Peninsula pipeline compressor station would be the same as discussed under Alternative 1.

The impact to the transportation corridor along the Williamsport-Pile Bay Road would be similar to Alternative 2, with the addition of road access along the natural gas pipeline route to Pile Bay. From Pile Bay to the mine site, impacts to the transportation corridor would be similar to Alternative 1 along the mine and port access roads. There would be no impacts to summer or winter transportation and subsistence use of Iliamna Lake, compared to Alternatives 1 and 2.

As with Alternative 2, the area at the Diamond Point port site would change from active resource extraction to an industrial port, and there would be reconstruction of the Williamsport-Pile Bay Road and increased traffic levels. There would also be changes associated with an increase of project-related industrial ship traffic in Iliamna Bay. These impacts would be evident, certain, and would last through the duration of the project.

### **4.2.4.4 Alternative 3 – Concentrate Pipeline Variant**

Because the concentrate pipeline would be constructed adjacent to the natural gas pipeline, the impacts to land ownership and management would be the same as described previously under Alternative 3. Under this variant, the magnitude of the increase in use of the Williamsport-Pile Bay Road would be lower because of less project-related truck traffic as concentrate would be shipped by pipeline.

### 4.2.5 Summary of Key Issues

See Table 4.2-1 for a summary of key issues.

**Table 4.2-1: Summary of Key Issues for Land Ownership, Management, and Use**

Impact Causing Project Component	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
<b>Mine Site</b>			
Land management and ownership	The mine site would be entirely on lands by the State of Alaska and managed for multiple use, including habitat protection and mineral development. MCO 393 would be addressed by the State of Alaska during permitting. Permits and authorizations may be required by the LPB.		
Land use	Land use at the mine site would change from minimal disturbance from exploration activities to intense industrial development.		
<b>Transportation Corridor</b>			
Land ownership	66% would be owned and managed by the State of Alaska 34% would be owned and managed by ANCSA village corporations	40% State of Alaska 1% ANCSA regional corporations 57% ANCSA village corporations 2% Native Allotments	32% State of Alaska. >1% ANCSA regional corporations 67% ANCSA village corporations 1% Native Allotments
	<i>Kokhanok East Ferry Terminal Variant:</i> 72% State of Alaska. 28% ANCSA village corporations <i>Summer-Only Ferry Operation Variant would be the same as proposed</i> <i>Pile-Supported Dock Variant would be the same as proposed.</i>	<i>Summer-Only Ferry Operations Variant:</i> 2% ANCSA regional corporations 89% ANCSA village corporations 9% Native Allotments <i>Pile-Supported Dock Variant would be the same.</i>	<i>Concentrate Pipeline Variant would be the same.</i>
Land management	The state manages lands for multiple use, which does not preclude a mine access road. Permits and authorizations may be required by the LPB. Uses on surface and subsurface lands privately owned by Alaska Native corporations are subject to the approval of the landowners. There would be no direct effects to federal lands, but indirect impacts from the project may result in modification of active management considerations.		
Legal access	R.S.2477 ROWs: 0 17(b) easements: 1 Public access easements: 1	R.S.2477 ROWs: 1 17(b) easements: 2 Public access easements: 3	R.S.2477 ROWs: 1 17(b) easements: 2 Public access easements: 3

**Table 4.2-1: Summary of Key Issues for Land Ownership, Management, and Use**

Impact Causing Project Component	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
Land use	<p>The mine access roads would introduce a transportation system with industrial traffic to a previously undeveloped location, and would change the land use associated with industrial truck traffic.</p> <p>The ferry would cause increased summer traffic and an additional use to the lake during winter, with the potential to interfere with other uses of the ice for local transportation and subsistence activities.</p>	<p>Similar to Alternative 1 except the Williamsport-Pile Bay Road, which would change from intermittent, seasonal use, to heavy year-round industrial use.</p>	<p>Similar to Alternative 1 for the mine access road from Pile Bay to the mine site, and similar to Alternative 2 from Diamond Point to Pile Bay.</p>
	<p><i>Kokhanok East Ferry Terminal Variant: Would be the same as proposed.</i></p> <p><i>Summer-Only Ferry Operations Variant would have no impacts to use in the winter but would have twice the amount of truck and ferry traffic in the summer.</i></p> <p><i>Pile-Supported Dock Variant would be the same as proposed.</i></p>	<p><i>Summer-Only Ferry Operations Variant would have no impacts to use in the winter but would have twice the amount of truck and ferry traffic in the summer.</i></p> <p><i>Pile-Supported Dock Variant would be the same.</i></p>	<p><i>Concentrate Pipeline Variant would be the same.</i></p>
<b>Port Site</b>			
Land ownership	<p>Amakdedori port would be located on lands owned by the State and managed with guidelines for waterfront development.</p> <p><i>Pile-Supported Dock Variant would be the same as proposed.</i></p>	<p>42% ANCSA regional corporations 9% ANCSA village corporations 49% Native Allotments</p> <p><i>Pile-Supported Dock Variant would be the same.</i></p>	<p><i>Concentrate Pipeline Variant:</i> 42% ANCSA regional corporations 1% ANCSA village corporations 49% Native Allotments</p>
Land management		<p>Uses on surface and subsurface lands privately owned by Alaska Native corporations are subject to the approval of the landowners.</p>	

**Table 4.2-1: Summary of Key Issues for Land Ownership, Management, and Use**

Impact Causing Project Component	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
Land use	Amakdedori port would introduce artificial features to a previously undeveloped location, changing the land use to industrial ship traffic and storage activities.	At the Diamond Point port site, the area would change from active resource extraction to an industrial port. There would also be changes associated with industrial ship traffic in Iliamna Bay, and in Iniskin Bay with the Concentrate Pipeline Variant.	
<b>Natural Gas Pipeline</b>			
Land ownership	60% State of Alaska. 40% ANCSA village corporations.	13% State of Alaska 7% ANCSA regional corporations 79% ANCSA village corporations	26% State of Alaska 74% ANCSA regional corporations
	<i>Kokhanok East Ferry Terminal Variant:</i> 42% State of Alaska. 58% ANCSA village corporations.		
Land management	The pipeline would cross subsurface lands owned by Cook Inlet Region, Inc. and various village corporations. Uses on surface and subsurface lands privately owned by Alaska Native corporations are subject to the approval of the landowners.		
Land use	Effects on land use would be similar to the transportation corridor. The pipeline compressor station on the Kenai Peninsula would add to the existing industrial development.	Same as Alternative 1 except the ROW from Pile Bay to the mine access road would introduce a land use change from a mostly undisturbed area to a utility corridor.	Impacts from the mine access roads and pipeline compressor station would be similar to Alternative 1. The impacts to the Williamsport-Pile Bay Road and Diamond Point port would be similar to Alternative 2.

See Section 3.2, Land Ownership, Management, and Use, for complete land ownership.

#### 4.2.6 Cumulative Effects

The cumulative effects analysis area for lands includes the EIS analysis area above. Potential cumulative impacts to lands include incremental change in land ownership, management, legal access, and land use. The reasonably foreseeable future actions (RFFAs) identified in Section 4.1, Introduction to Environmental Consequences, that could contribute cumulatively to land ownership, use, or management impacts and are carried forward in this analysis include exploration and expansion of mining claims; oil and gas development in Cook Inlet; road improvement projects; and continuance of recreation activities in the greater regional area, as summarized below:

- Pebble Project buildout- develop 55 percent of the resource over 78 year period
- Pebble South/PEB\*
- Big Chunk South\*
- Big Chunk North\*
- Fog Lake\*
- Groundhog\*
- Johnson Tract\*
- Diamond Point Rock Quarry

- Alaska Stand Alone Pipeline Project
- Alaska LNG
- Cook Inlet Oil and Gas Lease Sales
- Hydrocarbon Exploration Licensing and Leasing\*  
*\*Indicates exploration activities only.*
- Lake and Peninsula Transportation, Infrastructure and Energy Projects
- National Parks and Preserves, Wildlife Refuges, State of Alaska Special Management Areas, Alaska Native Corporation Lands

#### 4.2.6.1 Past and Present Actions

Past and present actions in the analysis area that have resulted in the land ownership pattern in the area include the Alaska Statehood Act, ANCSA, and the Alaska National Interest Lands Conservation Act. Land status changes over time as lands selected under the Statehood Act and ANCSA are conveyed, and as additional easements and ROWs are developed. Land uses in the analysis area are primarily fish and wildlife habitat, low-intensity recreational activities, and subsistence. Outside of community settlements, some industrial and commercial land uses do exist in the analysis area, including those associated with mineral exploration and activity near the mine site and other mineral deposits, the Diamond Point port site, which is used for resource extraction, seasonal use of the Williamsport-Pile Bay Road, and commercial fishing in Cook Inlet; however, with the exception of these commercial and industrial land uses, the majority of the analysis area is characterized by low intensity land uses such that the area is generally in a natural state.

#### 4.2.6.2 Reasonably Foreseeable Future Actions

##### **No Action Alternative**

The No Action Alternative would not contribute to cumulative effects on land ownership, management, legal access, or land use.

##### **Alternative 1 – Applicants Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario would continue the impacts of the project for an extended amount of time, over a larger geographic area, adding intensity to activities (more traffic) and potentially more infrastructure to the Iliamna Lake area, which impacts land use.

Expansion would affect land management and ownership in ways similar to the combined effects of Alternative 1 and 3 due to the development of the Iniskin Bay/Diamond Point and concentrate pipeline along north shore of Lake Iliamna to Iniskin Bay/Diamond Point, but over an operating life of 78 years followed by a period of closure. Effects of expansion would be similar to Alternative 3 with the Concentrate Pipeline Variant, minus the concentrate truck traffic, and additive to the effects of Alternative 1. State permits and leases with the mine site would need to be amended and additional ROWs granted from State and ANCSA corporations. Additional tidelands leases might also be required. The proximity of expanded facilities to federal lands management units would be similar to a combined Alternatives 1 and 3, because the Pebble mine expanded development scenario would need to develop the Alternative 3 corridor for the concentrate export pipeline and would need a port at Diamond Point and/or Iniskin Bay. The primary impacts would be the expanded industrial use at the mine site and the introduction of industrial activities in two undeveloped areas over two transportation corridors instead of one over an extended timeframe. The impacts would be partially offset with the

construction of the concentrate pipeline, in that concentrate truck traffic and ferry on Iliamna Lake would be eliminated. The contribution of the proposed alternative to cumulative impacts would be the extended duration of mining land uses over an area and acreage roughly double the size of the proposed alternative.

**Other Mineral Exploration Projects** – Because they are currently permitted claims, mineral exploration is likely to continue in the analysis area for the mining projects listed above. Exploration activities would continue to contribute to industrial uses in the analysis area. However; the magnitude of these activities would be generally sporadic, and summer-seasonal.

**Oil and Gas Exploration and Development** – Oil and gas development in Cook Inlet would contribute cumulatively to impacts in Cook Inlet, with the magnitude dependent on the level of on- and offshore oil and gas development. Port development and use at Amakdedori combined with on- and off-shore exploration activities in Cook Inlet would both contribute to more industrial use in the area. The transportation, barging, boating, commercial fishing recreational and subsistence fishing, sightseeing, and wildlife habitat uses would continue but could decrease over time as the industrial activity associated with the mine continues and if oil and gas exploration and development activity increases, slowly changing the land use patterns in the analysis area.

**Road Improvement and Community Development Projects** – Anticipated road improvement projects in the region include new transportation corridors currently being studied in the Lake and Peninsula Borough, such as the Williamsport-Pile Bay Road upgrade. Impacts would be similar to Alternative 3 since the road upgrade is in the same location as the north access route under Alternative 3. Other community development and infrastructure projects would contribute to a slow land use change in the region, from undeveloped, generally natural landscapes to more industrial use and resource extraction. Transportation, infrastructure, energy, and utility RFFAs would also contribute to the slow transition of land use toward a more developed land use scenario with more prevalent industrial, commercial, and transportation land uses.

Other RFFAs described in Section 4.1, Intro to Environmental Consequences, would impact land ownership and management in the ways described above. There would be potential for some land conveyance and other changes in land ownership, such as encumbrance for an easement or a ROW, which might consequently cause changes to management actions. RFFAs that include current land uses (e.g., commercial fishing, subsistence, tourism, recreation, hunting and fishing, and scientific surveys and research) would continue along baseline trends. Increases in industrial and commercial land use could adversely affect some of these land uses, depending on measured and perceived changes in setting that affect the quality of resources and user experience.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same as Alternative 1; however, cumulative impacts from Alternative 2 combined with the mine expanded development scenario to land ownership, management, legal access, and use would be of lesser magnitude and geographic extent than Alternative 1 since there would be no development at Amakdedori and the Alternative 1 transportation corridor would not be used. Alternative 2, in combination with the mine expanded development scenario, would contribute to the slow transition of land use toward a more developed land use scenario with more prevalent industrial, commercial, and transportation land uses. However; these changes to land use patterns would occur over a smaller geographic area and acreage than under Alternative 1.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

### **Alternative 3 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to Alternative 1. Under Alternative 3, project expansion would continue to use the existing Diamond Point port facility, would use the same natural gas pipeline, and would use the same north access road and Concentrate Pipeline Variant but extend the concentrate pipeline to Iniskin Bay. The port site and associated facilities would be constructed at Iniskin Bay as discussed under Alternative 1 above. A diesel pipeline from the mine site to Iniskin Bay would be constructed as discussed under cumulative effects for Alternative 1. Alternative 3, in combination with the mine expanded development scenario, would contribute to the slow transition of land use toward a more developed land use scenario with more prevalent industrial, commercial, and transportation land uses. Since the Pebble mine expanded development scenario would use the North Road system that would already be built under Alternative 3 and not include any ferry operation, cumulative impacts from Alternative 3 combined with the mine expanded development scenario to land ownership, management, legal access, and use would be of lesser magnitude and geographic extent than Alternative 1 or 2.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.



### 4.3 NEEDS AND WELFARE OF THE PEOPLE—SOCIOECONOMICS

This section addresses the direct, indirect, and cumulative effects of the No Action Alternative and action alternatives on the regional and state economy, education and infrastructure, cost of living, and population characteristics. Potential direct, indirect, and cumulative effects on commercial fishing and recreational tourism are discussed in Section 4.6, Commercial and Recreational Fisheries. While subsistence activities are an indispensable component of the socioeconomic system of rural Alaska communities, this section addresses the monetized economy. Subsistence activity and the importance of subsistence as it relates to income and its support in stabilizing communities during economic downtimes are discussed in Section 4.9, Subsistence. Potential impacts to the socioeconomic environment include changes to economy and income, regional education and infrastructure, cost of living, and population. In addition, cultural ties to the area can impact the socioeconomic welfare of a community. The sociocultural dimensions are discussed in Section 4.9, Subsistence and Section 4.7, Cultural Resources.

The Environmental Impact Statement (EIS) analysis area for this section includes the state of Alaska, regions, and communities where aspects of the monetized economy (including population, employment and income, government revenue, housing, and education) would be impacted by the construction, operations, and closure of all components of each alternative of the proposed project. Relevant effects on the state of Alaska are also discussed. The boroughs and communities included in the EIS analysis area for the socioeconomic analysis are:

- Lake and Peninsula Borough
  - Igiugig
  - Iliamna
  - Kokhanok
  - Levelock
  - Newhalen
  - Nondalton
  - Pedro Bay
  - Port Alsworth
- Dillingham Census Area
  - Dillingham
  - Ekwok
  - Koliganek
  - New Stuyahok
- Kenai Peninsula Borough
- Bristol Bay Borough
- Anchorage
- Alaska

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. The following sections assess potential impact to these and other issues.

The magnitude of impact is discussed in terms of communities impacted or monetary implications (e.g., employment/income, potential revenue generated/lost, cost of living); the duration and geographic extent of impacts depends on the location and season in which the disturbance occurs during construction, operations, or closure; and the potential of impacts is how likely the impact would be.

Mitigation measures and actions designated to reduce or eliminate project impacts on socioeconomics are provided in Chapter 5, Mitigation.

### **4.3.1 No Action Alternative**

Under the No Action Alternative, the project would not be undertaken. No construction, operations, or closure activities would occur. Although no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). The Pebble Limited Partnership (PLP) would retain the ability to apply for continued mineral exploration activities under the State's authorization process, as well as any activity that would not require federal authorization. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration by other entities. Therefore, while there may be some decrease in the current level of economic activity generated by exploration of the project, exploration could continue, no changes in additional future direct or indirect effects to existing socioeconomics would be expected, and existing trends would continue.

#### **4.3.1.1 Regional Setting**

##### **Regional Economy**

The PLP employed around 100 and 150 local community members annually at the site during the pre-development phase of the project, which ended in 2012 (Loeffler and Schmidt 2017). Since then, PLP has had a minimal number of workers at the site for exploration and maintenance activities. Under the No Action Alternative, it is anticipated that PLP would continue current activities in an effort to identify future opportunities. As a result, the current number of direct and indirect jobs would remain roughly the same and there would be no impact to the regional economy.

##### **Cost of Living**

The No Action Alternative is not anticipated to result in changes to the current activities or infrastructure associated with the Pebble deposit or regional infrastructure. As a result, the No Action Alternative would have no effect on the cost of living in the potentially affected communities.

##### **Regional Infrastructure**

No impacts to the regional infrastructure would be anticipated as a result of the No Action Alternative. Because of the remoteness and small workforce, pre-development work has had little impact on the regional public infrastructure. The No Action Alternative would not affect the current or projected infrastructure, including education, health services, water, transportation, sewer, and solid waste operations.

#### **4.3.1.2 Potentially Affected Communities**

Since it is anticipated that PLP would continue current activities in an effort to identify future opportunities under the No Action Alternative, the current number of direct and indirect jobs would not be expected to change. Under the No Action Alternative, population trends in communities would continue. Declining populations in some communities can lead to school closures and other loss of services.

## **4.3.2 Alternative 1 – Applicant’s Proposed Alternative**

### **4.3.2.1 Regional Setting**

#### **Regional Economy**

Loeffler and Schmidt (2017) found that during the pre-development phase of the project (2009 to 2012), community members from the region accounted for about 43 percent of the project’s seasonal workforce. Since then, PLP has had a minimal number of workers at the site for exploration and maintenance activities. Under Alternative 1, the magnitude of the project’s impact on local employment would be an increase of 2,000 direct hire project employees during the construction phase, and 850 during the operations phase. The duration of these impacts would be short-term for construction employees, and long-term for operations. PLP has stated that its objective is to maximize opportunities for local hire; first, directly to residents of the EIS analysis area, or those with close ties to the area; and then to Alaska residents in general. It is estimated that during operations, 250 employees would come from surrounding communities, and the remaining 600 would be flown to the project area from Anchorage or Kenai. However, it is likely that during the construction phase, non-Alaskan labor would be required to fill the anticipated 2,000 jobs, potentially as high as 50 percent of hires (PLP 2018-RFI 027). Therefore, the geographical extent could extend from local communities to the state of Alaska, and beyond. In addition, indirect employment would increase from the services that would be needed to support construction and operation activities (e.g., air services, goods, and supplies). These activities could potentially create a large number of direct and indirect jobs in the region, relative to the population providing a measureable beneficial impact over both the short-term construction phase and long-term life of the project. These impacts would be certain to occur if the project is permitted and built.

Alternative 1 would provide year-round operations employment, which would help reduce the impacts of the seasonal fluctuations in employment that are prevalent in the region. Depending on the construction schedule and nature of activities, some construction employment while beneficial to the local economy may be short-term and seasonal in nature and/or limited in duration.

Loeffler and Schmidt (2017) also found during the pre-development phase that communities near the mine site provided a much higher percentage of local labor than more distant communities, such as those in the Dillingham Census Area or other coastal communities. In addition, opportunities and incomes from other sources of employment (e.g., commercial fishing) were greater in distant communities. Therefore, the impact on employment and income during the exploratory phase had a much higher magnitude of impact on the communities closest to the mine site than on more distant communities. It can be anticipated that the same pattern would occur during the operations phase; communities near the mine site and ferry/port terminals would see a greater employment impact than communities farther away, such as communities in the lower Bristol Bay watershed. This beneficial impact would last though the life of the project.

As most of the state’s professional and business service firms, including PLP’s office, are based in Anchorage, the Anchorage region would be anticipated to see an increase in jobs. However, the increase would be minor in relation to the larger and more diverse economy of Anchorage (approximately 130,000 employed workers in 2016). The extent of impacts from additional employment opportunities due to construction of the natural gas pipeline could reach to the Kenai Peninsula, with its oil services support industry. Similarly, services, particularly transportation and lodging that are based in Iliamna, and to a lesser extent in Homer, would also

be anticipated to see an increase in jobs. These increases would be higher over the short-term construction phase, and would be expected to occur if the project is permitted and built.

### **Cost of Living**

As described in Section 4.12, Transportation and Navigation, Alternative 1 would result in the construction of mine and port access roads, spur roads, and ports. Although some components are described as private, PLP has stated that they would work with all local communities to identify the best solutions for use of the access roads and ferry for community transportation (PLP 2018-RFI 027). Because the higher cost of living in rural areas is primarily associated with the high transportation cost of food, fuel, and other supplies (ADOL 2008, 2017a), Alternative 1 has the potential to reduce transportation costs to the communities located near the transportation corridor should arrangements be made to allow some controlled public use of the mine and port access roads and spur roads. It should be noted that state and local authorizations may affect final road alignment and uses. Reduced transportation costs would lower the high cost of living for the communities near the transportation corridor, specifically Kokhanok, Iliamna, Newhalen, and potentially Nondalton. This would be a beneficial long-term impact lasting the life of the project. The beneficial impacts would be expected to occur if the project is permitted and the transportation system is built as described for Alternative 1.

Communities adjacent to the natural gas pipeline (Kokhanok, Newhalen, and Iliamna) would have the opportunity to connect to the pipeline, depending on arrangements made with PLP. Natural gas would likely be less expensive than diesel heating oil. This impact could lower cost of living once equipment (e.g., furnace, water heater) is converted to natural gas. However, communities would be responsible for funding the connections and conversions, lowering the potential of a long-term economic benefit. These beneficial impacts would be long term, lasting through the life of the project, and would be expected to occur if the project is permitted and the natural gas pipeline is built.

### **Regional Infrastructure**

The temporary and long-term camps housing workers would be self-contained, and operated and maintained by PLP throughout the project. The work camps would be in remote areas, and employees would not have access to services in local communities. Therefore, local community services would not be adversely impacted by additional workforce population needs. In addition to housing facilities, the camps would be equipped with appropriate emergency medical facilities, electrical power generation, fuel storage, and facilities for sewage treatment and solid waste disposal and management. Potable water for the camps would be trucked in or sourced from on-site wells.

The direct effects of all phases of the project on public utilities in communities in the EIS analysis area would not be apparent, except for communities situated along the corridor of the natural gas pipeline, which may develop infrastructure to take advantage of the supply of natural gas or experience reduced costs of goods and services through access to the project transportation system. However, local employment opportunities could offset current trends of outmigration in some communities, and provide service fee revenue to maintain or even improve community infrastructure. These direct beneficial impacts would last the life of the project and would extend to communities in the EIS analysis area.

The sections below address the direct and indirect impacts to the regional infrastructure from activities associated with Alternative 1. However, the sections do not address changes in the regional infrastructure associated with potential decisions made by Lake and Peninsula Borough (LPB) or the State of Alaska related to the use of increased tax revenues. An increase in tax

revenues may lead to an increase in spending on regional infrastructure, which would improve infrastructure for the population of the region.

### ***Education***

The PLP has supported training and education programs in Alaska, such as the Alaska Native Science and Engineering Program, Teacher Industry Externship Program, and Alaska Resource Education (PLP 2018e). These activities would be anticipated to increase with Alternative 1 as the needs of the workforce expand. Conversely, some cultural education opportunities would be displaced, such as the current cultural camps that are held at the site of the proposed Amakdedori port, at Groundhog Mountain, Frying Pan Lake, Upper Talarik Creek and Koktuli River watersheds, and a stand of cottonwoods (Alaska Heritage Resources Survey site ILI-00254). This would be an adverse impact lasting the duration of the project if suitable alternatives cannot be found. The extent of impacts would be to communities in the EIS analysis area.

While the project is not anticipated to result in an increased number of schools in the region, it may benefit the educational opportunities of some communities through an increased revenue stream to the LPB and access to PLP-supported education programs. Because of declining population (i.e., out-migration) in some communities, schools are at risk of closing (LPB 2012). The project could reduce or eliminate this decline, thus allowing the local schools to remain open and continue to serve the local communities. This is a beneficial long-term effect, which would last for the life of the project. Conversely, steady employment and income may provide some families the ability to move to other areas, which may decrease the population of some communities. These impacts would be expected to occur if the project is permitted and built as described for Alternative 1.

### ***Transportation***

Alternative 1 would expand the transportation infrastructure in the region once the transportation corridor and ferry/port facilities are complete. Although the mine and port access roads and port are described as private, PLP has stated that they would work with all local communities to identify the best solutions for controlled use of the access roads and ferry for community transportation needs, which would help reduce the local cost of living (PLP 2018-RFI 027). Access to the infrastructure would be limited to local residents and businesses; it would most likely consist of escorted, scheduled convoys for private vehicle transport, and require coordination with PLP on third-party commercial-haul traffic on the access roads. Road traffic would be coordinated with scheduled third-party transportation by the ferry. The duration of this beneficial impact would be measurable and long term, lasting for the life of the project. The impacts would be certain to occur if the project is permitted and the transportation corridor and port facilities are constructed.

Because many of the workers and supplies would be transported to the region by air, the Iliamna Airport and local airfields would see increased use. While no direct impacts are expected to airport infrastructure, the airport would likely see indirect impacts, such as an increase in fuel sales and maintenance activities related to increased air traffic. This in turn could create additional indirect employment and economic activity at Iliamna and other airport hubs. Section 4.12, Transportation and Navigation, describes the impacts to air, surface, and water transportation systems. The impacts would be long term lasting for the life of the project, but would be greater over the short-term construction phase. The impacts would be expected to occur if the project is permitted and built.

With port and ferry features removed at closure, only the access roads and shallow draft barge facilities would remain for use in transporting bulk supplies associated with the closure operations, unless an agreement was reached for a third party to take over ferry operations. Access to the remaining infrastructure would likely be similar to that described above.

### ***Health Services***

The mine site would have on-site medical facilities to support workers. Many of the workers would be trained in emergency response and first aid. Most immediate care operations would be handled internally. Patients may be transported to a local clinic or airlifted to larger regional hospitals if needed. Therefore, existing health services are not anticipated to be directly impacted by the project. However, depending on the level of development associated with support services, there may be indirect beneficial or adverse impacts on these facilities for the life of the project. The extent of any indirect impacts would be anticipated in the communities nearest the mine site (i.e., Iliamna and Newhalen), which may have the highest level of indirect development to support the mining operations. In addition, an increased revenue stream to the LPB and stabilization of population levels attributable to employment opportunities could result in improvements to community health care facilities throughout the borough. The duration of these impacts would be long term over the life of the project and would be expected to occur if the project is permitted and built.

### ***Water, Sewer, and Solid Waste***

The project would construct temporary water and wastewater facilities at various sites used for project construction camps, and at the mine site, ferry terminals, and at Amakdedori port during operations. In addition, project generated solid waste would be addressed on site or removed from the area. As a result, existing community water, sewer, and solid waste facilities would not be directly impacted by the project. However, depending on the level of indirect activity associated with support services, there may be indirect beneficial or adverse impacts on these facilities lasting for the life of the project. The extent of indirect impacts would be the communities nearest the mine site. Similarly, an increased revenue stream to the LPB and stabilization of population levels attributable to employment opportunities could result in improvements to community water, wastewater, and solid waste services and facilities throughout the borough. The duration of these impacts would be long term over the life of the project and would be expected to occur if the project is permitted and built.

#### **4.3.2.2 Potentially Affected Communities**

Construction and operations would have direct and indirect impacts to local and regional socioeconomic conditions.

### **Population**

As discussed in Section 3.3, Needs and Welfare of the People—Socioeconomics, the population of some of the potentially affected communities has been declining, particularly in the LPB. Much of this decline has been associated with the lack of employment opportunities in the communities.

Alternative 1 would result in an additional estimated 2,000 direct jobs created during the construction phase and 850 direct jobs created during the operations phase. It is estimated that during operations, 250 employees would come from surrounding communities, and a majority of the remaining 600 would be flown in from Anchorage or Kenai (PLP 2018-RFI 027). Workers would be transported from multiple locations, including from local communities, to the mine site

via aircraft or other approved transport such as local roads, and would stay in work camps during their shift. Therefore, workers could live throughout the state and in other states and still have the ability to work at the mine. As a result, the local communities would not be anticipated to see a large increase in population from the project, particularly from in-migration. The largest impacts could occur in Iliamna, Kokhanok, Newhalen, and potentially Nondalton, which may see an increase in population related to any businesses that are developed to support the project.

While a large in-migration of population is not anticipated, Alternative 1 may lead to changing population patterns in the region. The population in some potentially affected communities has been declining (out-migration). The magnitude of project impacts could reduce or eliminate the population decline because of the increase in employment opportunities and indirect effects on education and infrastructure; it could also result in some past residents returning to communities. Conversely, steady employment and income may provide some families the ability to move to other areas, which may decrease the population of some communities. Therefore, the impacts on population are difficult to anticipate.

### **Economy and Income**

Estimating how many local community members would obtain work through the project (or would be interested in obtaining work) is difficult, but any increase in the number of jobs would help the local communities. Loeffler and Schmidt (2017) found that during the pre-development phase of the Pebble Project (2009 to 2012), community members from the region accounted for about 43 percent of the project's seasonal workforce. Communities near the mine site were found to provide a much higher percentage of local labor than more distant communities, where opportunities and incomes from other sources of employment (e.g., commercial fishing) were greater. Therefore, the impact on employment and income during the exploratory phase had a much higher magnitude of impact on the communities closest to the mine site than more distant communities.

PLP has stated that its objective is to maximize opportunities for local hire; first, directly to residents of the EIS analysis area, or those with close ties to the area; and then to Alaska residents in general. However, it is likely that during the construction phase, substantial local resident and non-Alaskan labor would be required to fill the anticipated 2,000 jobs required, potentially as high as 50 percent of hires (PLP 2018-RFI 027).

A majority of jobs would be taken by Alaskans during operations. PLP has estimated that 250 employees would come from the surrounding communities, with 50 of these employees coming from communities connected to the project site by road (PLP 2018-RFI 027). The majority of the remaining 600 employees would likely be from the Anchorage and Kenai areas. Therefore, the extent of beneficial impacts would be larger than the EIS analysis area and communities in that area. Operations jobs would be long term lasting for the life of the project and would be certain to occur if the project is permitted and built.

The direct jobs created by the project would be attractive to many residents with the requisite skills. In general terms, developments like the project provide economic benefits to individuals, families, and communities in increased and steady income. Many of the communities in the region, especially those in the LPB, have a lower median household income and a higher unemployment rate than Anchorage or Alaska as a whole. Therefore, employment through the project would have an impact on the income levels in the local communities.

The exploratory phase of the project revealed that the income earned by residents employed by the project was an important part of the total income earned in local communities, especially those communities close to the mine site (Loeffler and Schmidt 2017). The income earned by residents close to the mine working for PLP was greater than the income earned for commercial

fishing, indicating that even the limited employment during the exploratory phase had large impacts on the communities. In communities that were located further from the mine site, commercial fishing was a larger part of total income. Indirect employment that is developed to support the construction and operations of the project would provide additional opportunities for community residents.

On average, mining jobs pay much higher than most industry categories. The average monthly wage in Alaska for the mining industrial classification in the third quarter of 2017 was \$9,047, and mining support activities was \$7,855, which was higher than the average for Alaska of \$4,414 (ADOL 2017b). It should be noted that this average wage is likely for mine operations; construction wages would likely be lower. Because these figures are an average of all people employed in that classification, the monthly wage includes executives, specialized experts, and low-skill positions. Not all local residents would make the average wage. However, the wages earned would likely be higher than the median household incomes of the potentially affected communities (see Section 3.3, Needs and Welfare of the People–Socioeconomics), which would be an improvement to the welfare of the community members. For example, income from mining could be double the median household income in the LPB of about \$45,000. In addition, construction and operations of the mine would likely create opportunities for support services, creating indirect employment and income. This would most likely occur in support and transportation hubs, such as Iliamna and Port Alsworth, and in larger communities such as Anchorage and the Kenai Peninsula Borough (KPB). McDowell (2018c) estimates that modeling an employment multiplier of approximately 2.0 accurately captures the magnitude of total direct and indirect employment of the mining industry in Alaska (McDowell 2018c). Overall, the project would provide long-term beneficial impacts on the economy from employment and income in the region and state. These benefits would be expected over the life of the project and would be certain to occur if the project is permitted and built.

### **Tax Revenue and Other Fiscal Effects**

The magnitude of impacts from construction and operations would generate revenues for local governments and the state of Alaska. The revenue sources would potentially include mining license taxes, corporate income taxes, property taxes, sales taxes borough severance taxes, and production royalty payments, depending on the nature of mining production, real property value, and taxation measures authorized by statute or ordinance. The duration of revenues to state and local governments would begin during the construction phase, and escalate during the operations phase when mining license taxes, production taxes, severance taxes, and corporate income taxes would become effective. At the time the mine ends operations, and buildings, foundations, pipelines, and other infrastructure facilities are removed or reclaimed, these revenues would end, unless reuse of some of these facilities was negotiated with another party. These tax revenues would be realized if the project is permitted and built.

### ***Mining License Tax and Corporate Income Tax***

Alaska levies a mining license tax and corporate income tax on net income received in connection with mining properties and activities in the state. The collection of mining license tax and corporate income tax on project net income would have a beneficial effect on state government revenues. The magnitude and extent of the benefit as estimated by IHS (2013) would be \$27 million annually in state taxes (2011) during the construction phase, and an estimated \$69 million annually in state corporate taxes during the operations phase. IHS estimates the operations phase would also generate \$44 million annually from state mining license taxes.



Corporate income tax may increase further through the indirect and induced impacts of the mine construction and operation.

### ***State Royalty Payments***

Alaska requires holders of state mining locations to pay a production royalty on all revenues received from minerals produced on state land, per the Production Royalty Law, which applies to all revenues received from minerals produced from a state mining lease (Section 38.05.212). The production royalty is 3 percent of net income generated (ADNR 2015).

The collection of state royalty payments on project net income would have a beneficial long-term (extending for up to decades over the life of the project) effect on state government revenues. IHS (2013) estimates that magnitude of the benefit would be \$21 million annually (2011) in state royalty payments during the operations phase. The duration of this benefit would be long term; it would be certain to occur if the project is permitted and built.

### ***Borough Severance Taxes***

Mining operations are subject to severance taxes on resource extractions in a taxing jurisdiction, which would be the LPB. IHS (2013) estimates that the magnitude and extent of project benefits would be \$29 million annually in severance taxes paid to LPB during the operations phase. The estimated severance tax would represent a significant increase in revenue for LPB when compared to the estimated total revenue from external sources of approximately \$5 million for fiscal year 2019 (LPB 2018d). Another potential source of revenue available to local governments is Payment in Lieu of Taxes (PILT), which is available to local governments as an alternative to property or severance taxes; the Northwest Arctic Borough currently receives PILT from the operation of the Red Dog mine. This beneficial effect would be expected to last over the life of the project and would be certain to occur if the project is permitted and built.

### ***Borough Property Taxes***

Real property can be subject to property taxes. The LPB does not have a property tax (LPB 2018d), but the KPB has a borough property tax of 4.7 mills<sup>1</sup>, plus any other taxes assigned per the Tax Authority Group (e.g., hospital, road maintenance). The mill rate for the KPB is 4.70, meaning that for every \$1,000 of assessed taxable property value, the KPB receives \$4.70 in revenue.

Real property, including the Amakdedori port facilities and any other infrastructure located in the Kenai Peninsula Borough, would be taxed at a rate of 4.7 percent of its assessed taxable value. This includes the assessed value of the infrastructure itself, as well as a portion of the assessed land value (subject to lease terms). Mill rates are set annually by the borough assembly, municipalities, and service area boards. Beneficial impacts of increased property taxes to all boroughs affected would be long term and would be expected to occur if the project is permitted and constructed.

### ***Right-of-Way Acquisition***

The right-of-way (ROW) for the transportation corridor connecting the Amakdedori port to the mine site could be another fiscal element of the project. The State of Alaska would own 66 percent of the corridor, Alaska Peninsula Corporation would own 31 percent, and Iliamna Natives Limited would own 4 percent. Based on costs for a similar mine ROW and the value of

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<sup>1</sup> A mill represents 0.1 percent of \$1, equal to \$1 of tax revenue for each \$1,000 of assessed taxable property value.

state lands (ADNR 2008), a preliminary estimate of the magnitude of ROW costs for the transportation corridor ranged between \$1 million and \$1.5 million, which would be paid to the state government and to the Native corporations, creating a long-term beneficial economic effect.

The pipeline corridor would cross state and federal waters, as well as state and Alaska Peninsula Corporation lands. Historically, ROW costs account for approximately 7 percent of the total construction cost of a pipeline (Rui et al. 2011). These benefits would be certain to occur if the project is permitted and the transportation corridor and pipeline are constructed.

### **Housing**

Staff working at the mine would be housed in on-site facilities (i.e., work camps), and would follow a fly-in/fly-out or local road commute work arrangement. Therefore, there would not be an increase in housing demand in communities related to an influx of the direct employment of workers. However, employment opportunities could slow or reverse the decline in some communities, or encourage former residents to move back. This would affect the demand for local housing.

Communities closest to the mine and ferry terminals (i.e., Iliamna, Newhalen, Kokhanok, and potentially Nondalton) may see changes to the population as a result of support activities, which may lead to an increase in demand for housing. As presented in Section 3.3, Needs and Welfare of the People—Socioeconomics, vacant housing units are available in these communities. Although the condition of the vacant units is not known, some of the units could accommodate at least a portion of any increase in population. Housing is also available in the larger communities in the region where workers may reside. Overall, adverse impacts to housing supply would not be expected.

### **Education**

While the project is not likely to result in substantive demographic increases that would support an increase in the number or capacity of schools in the potentially affected communities in the immediate vicinity of the project, an increase in tax revenue to the LPB and the education programs supported by PLP could benefit schools and the student population. In addition, the local employment opportunities associated with the project could reduce the population decline in some communities, which could allow schools at risk of closing to remain open; a long-term beneficial effect lasting for the life of the project.

As with other mining operations in Alaska, employment at the mine would require at least a high school education or general equivalency diploma. Therefore, students may see employment opportunities provided by the mine as an incentive to complete at least a basic level of education, which could increase the high school graduation rates in the potentially affected communities. Similar to the experience with other Alaska mining projects, it might also provide opportunities for participating in vocational training, particularly if PLP, the LPB, and Alaska Native organizations provide support.

#### **4.3.2.3 Alternative 1 – Kokhanok East Ferry Terminal Variant**

The Kokhanok East Ferry Terminal Variant would result in similar impacts to those described above for all project components. For this variant, the State would own 72 percent of the Kokhanok East Ferry Terminal Variant, and Alaska Peninsula Corporation would own 28 percent.

#### **4.3.2.4 Alternative 1 – Summer-Only Ferry Operations Variant**

**Regional Economy** – Alternative 1 includes a variant for summer-only ferry operations, in which the transportation corridor would only operate during the open water season (PLP 2018-RFI 065). As a result, more employees for truck drivers and ferry/terminal workers would be needed during summer operations, but fewer would be needed during winter operations, leading to less year-round employment opportunity and a larger number of seasonal employees. Therefore, this impact would be less beneficial than that described for Alternative 1 without the variant.

**Cost of Living** – Under the Summer-Only Ferry Operations Variant, communities that would rely on the project transportation system may opt to stockpile food, fuel, and other supplies or receive shipments via air when the ferry is not operating. Overall, the variant would likely lower the high cost of living for the communities near the transportation corridor, but not to the extent of the Alternative 1.

**Economy and Income** – Under the Summer-Only Ferry Operations Variant, the transportation corridor would only operate during the open water season. As a result, more employees (e.g., truck drivers, ferry/terminal workers) would be needed during summer operations, but fewer would be needed during winter operations (PLP 2018-RFI 065). This would lead to a smaller number of year-round employees and a large number of seasonal employees. Due to the small populations of the potentially affected communities, it is less likely that the communities would be able to meet all of the demand for the increased number of seasonal employees (in addition to the year-round employees), requiring more employees to come from outside the region for the seasonal work. In addition, other employment opportunities are available to local residents during the summer (e.g., construction and commercial fishing), whereas fewer opportunities exist during the winter months. Therefore, the variant would likely shift some of the positions held by community members from year-round to seasonal, which would also lower the overall income that is earned by community members and decrease the incentive to retain population in the region compared to year-round employment under year-round ferry operations.

#### **4.3.2.5 Alternative 1 – Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would result in similar impacts to those described above for all project components.

### **4.3.3 Alternative 2 – North Road and Ferry with Downstream Dams**

#### **4.3.3.1 Regional Setting**

##### **Regional Economy**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 2 would have the same overall impacts to the regional economy as Alternative 1, but would have a different level of effects on specific communities due to differences in transportation corridor routes. Impacts to specific communities are discussed below.

##### **Cost of Living**

For the region as a whole, the impacts on the cost of living of Alternative 2 would be largely the same as the impacts of Alternative 1, and would likely lower the high cost of living for the communities near the transportation corridor. However, because of the different alignments of the transportation corridor and natural gas pipeline, Pedro Bay would be beneficially impacted

over the life of the project, and Kokhanok would likely see fewer beneficial impacts. This would be expected to occur if Alternative 2 is selected and the project is permitted and built.

### **Regional Infrastructure**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 2 would have the same overall impacts to the region as Alternative 1. However, Pedro Bay would experience more direct impacts, and Kokhanok would be impacted to a lesser extent.

#### **4.3.3.2 Potentially Affected Communities**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 2 would have the same overall impacts to the socioeconomic indicators of the potentially affected communities as Alternative 1. However, Pedro Bay would experience greater impacts and Kokhanok would be less impacted.

Revenues from the ROW acquisition for the transportation corridor and the natural gas pipeline would be similar to Alternative 1 and would impact the State (which owns 40 percent of the corridor), Cook Inlet Region, Inc. (1 percent), Iliamna Natives Limited (27 percent), Pedro Bay Corporation (16 percent), Tyonek Corporation (1 percent), Seldovia Native Association, Inc. (3 percent), and Salamatof Native Association, Inc. (<1 percent).

#### **4.3.3.3 Alternative 2 – Summer-Only Ferry Operations Variant**

**Regional Economy** – Alternative 2 includes a variant for summer-only ferry operations. The impacts of the variant would be the same as described in the similar Alternative 1 variant.

**Cost of Living** – Alternative 2 includes a variant for summer-only ferry operations. The impacts of the variant would be the same as described in the similar variant for Alternative 1.

**Potentially Affected Communities** – Alternative 2 includes a variant for summer-only ferry operations. The variant would be the same as described for Alternative 2.

#### **4.3.3.4 Alternative 2 – Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would result in similar impacts to those described above for all project components.

### **4.3.4 Alternative 3 – North Road Only**

#### **4.3.4.1 Regional Setting**

##### **Regional Economy**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 3 would have the same overall impacts to the regional economy as Alternative 1. The distribution of effects between communities would be similar to Alternative 2.

##### **Cost of Living**

For the region as a whole, the impacts on the cost of living for Alternative 3 would be largely the same as the impacts of Alternative 1; the magnitude of the impact would be to lower the high cost of living for the communities near the transportation corridor, similar to Alternative 2. However, because of the different alignments of the transportation corridor and natural gas

pipeline, Kokhanok would likely experience less of a benefit, while Pedro Bay would likely experience more of a benefit over the long term. These impacts would be expected to occur under Alternative 3.

### **Regional Infrastructure**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 3 would have the same overall impacts to the region as Alternative 1, with the exception of the ferry terminals. However, Kokhanok would experience fewer impacts, while Pedro Bay would experience more. One potential benefit of the alternative is that it would be more likely that regional governments and/or the state would maintain the access roads for public use following closure of the mine.

#### **4.3.4.2 Potentially Affected Communities**

While the alignment of the transportation corridor and natural gas pipeline would change, Alternative 3 would have the same overall impacts to the socioeconomic indicators of the potentially affected communities as Alternative 1. However, Kokhanok may experience fewer impacts, while Pedro Bay would experience greater impacts.

Revenues from the ROW acquisition for the transportation corridor and the natural gas pipeline would be similar to Alternative 1 and would impact the State (which owns 32 percent of the corridor), Cook Inlet Region, Inc. (1 percent), Iliamna Natives Limited (19 percent), Pedro Bay Corporation (38 percent), Tyonek Corporation (6 percent), Seldovia Native Association, Inc. (>1 percent), and Salmatof Native Association, Inc. (>1 percent).

#### **4.3.4.3 Alternative 3 – Concentrate Pipeline Variant**

**Regional Economy** – The magnitude of impacts of this variant would be decreased employment of truck operators and increased employment at the dewatering facility. Overall, the total number of employees needed during operations would likely decrease, which would decrease overall income and employment in the region. It could potentially have greater impact on property taxes for KPB than Alternative 1, depending on final footprint and project specifics.

**Regional Infrastructure** – The magnitude of impact of this variant would be the construction of the pipeline(s) and a dewatering facility near the port, which would likely be of no value and/or benefit to the potentially affected communities or the region as a whole, other than potential property tax revenue.

**Potentially Affected Communities** – The magnitude of impacts of this variant would be decreased employment of truck operators and increased employment at the dewatering facility. Overall, the total number of employees needed during operations would likely decrease, which would decrease the overall income and employment in the potentially impacted communities. However, the Kenai Peninsula Borough would receive an increase in property taxes levied on the assessed value of the portion of the concentrate pipeline located in the borough. This impact would be long term and would be expected to occur under Alternative 3.

### **4.3.5 Summary of Key Issues**

See Table 4.3-1 for a summary of key issues.

**Table 4.3-1: Summary Impact Table for the Socioeconomic Environment**

Project Impact	Alternative 1 (and variants)	Alternative 2 (and variants)	Alternative 3 (and variant)
Population	<p>Communities nearest the project components (Newhalen, Iliamna, Nondalton, and Kokhanok) may see a slight population increase.</p> <p>There would be no difference in impacts from variants.</p>	<p>Same as Alternative 1 except that impacts would be less likely to occur to Kokhanok because it would not be located on the transportation corridor and would occur in Pedro Bay.</p> <p>There would be no difference in impacts from variants.</p>	<p>Same as Alternative 1, except that impacts would be less likely to occur to Kokhanok and more likely to occur in Pedro Bay.</p> <p>There would be no difference in impacts from the variant.</p>
Economy and Income	<p>Alternative 1 would provide year-round employment, a positive impact which would help reduce the impacts of the seasonal fluctuations in employment. During construction, there would be an estimated 2,000 direct jobs, and during operations there would be an increase of direct employment by 850 people, plus indirect employment related to support services. Communities nearest the project components (Newhalen, Iliamna, Nondalton, and Kokhanok) would likely see the greatest impacts in employment and income.</p> <p>The Summer-Only Ferry Operations Variant would result in less year-round employment and greater seasonal employment, with less income remaining in the potential affected communities.</p>	<p>Same as Alternative 1 except that impacts would be less likely to occur to Kokhanok and more likely to Pedro Bay.</p> <p>The impacts of the Summer-Only Ferry Operations Variant would be the same as described for the variant for Alternative 1.</p>	<p>Same as Alternative 1, except that impacts would be less likely to occur to Kokhanok and more likely to Pedro Bay.</p> <p>The Concentrate Pipeline Variant would have less employment opportunities, which would decrease overall income.</p>
Tax Revenue and Other Fiscal Effects	<p>Alternative 1 would generate:</p> <ul style="list-style-type: none"> <li>• \$27 million annually in state taxes (2011) during construction.</li> <li>• \$69 million annually from state corporate taxes during the operations phase.</li> <li>• \$21 million annually (2011) from state royalty payments during the operations phase.</li> <li>• \$29 million annually in severance taxes for LPB.</li> <li>• Annual property taxes to KPB based on the assessed value of project related real property.</li> </ul>	<p>Same as Alternative 1.</p>	<p>Same as Alternative 1.</p> <p>The Concentrate Pipeline Variant would have greater impact on property taxes for KPB than Alternative 1, and the total number of employees needed during operations would likely be less.</p>

**Table 4.3-1: Summary Impact Table for the Socioeconomic Environment**

Project Impact	Alternative 1 (and variants)	Alternative 2 (and variants)	Alternative 3 (and variant)
Cost of Living	Reduced transportation costs would likely lower the high cost of living for the communities near the transportation corridor (Newhalen, Iliamna, Nondalton, and Kokhanok), a positive impact. The natural gas pipeline would also provide opportunities for adjacent communities to lower their winter heating costs, a positive impact.  The Summer-Only Ferry Operations Variant would likely have less impact than Alternative 1, as transportation costs would only be reduced in the summer.	Same as Alternative 1 except that impacts would occur to Pedro Bay and not Kokhanok.  The Summer-Only Ferry Operations Variant would likely have less impact than Alternative 1, as transportation costs would only be reduced in the summer.	Same as Alternative 1, except that impacts would occur to Pedro Bay and not Kokhanok.  The Concentrate Pipeline Variant could potentially have greater impact than Alternative 1 because of greater potential for public use of the north access road.
Regional Infrastructure	Alternative 1 would increase the infrastructure in the region. The impact of the transportation corridor depends on the access afforded to communities. Communities located along the natural gas pipeline may also benefit from the infrastructure.	Same as Alternative 1 except that impacts would be less likely to occur to Kokhanok and more likely to occur to Pedro Bay.  There would be no difference in impacts from variants.	Same as Alternative 1 except that impacts would be less likely to occur to Kokhanok and more likely to occur to Pedro Bay.  There would be no difference in impacts from the variant.

### 4.3.6 Cumulative Effects

The cumulative effects analysis area includes the region around the potentially affected communities, and to a lesser extent, the state of Alaska. Similar to the proposed project, opportunities would also exist for employment for people living across a broad area of Alaska. Potential cumulative effects could occur on the regional and state economy, infrastructure, cost of living, government revenue, and population characteristics.

The reasonably foreseeable future actions (RFFAs) identified in Section 4.1, Introduction to Environmental Consequences, that could contribute to the regional and state socioeconomic cumulative impacts and are carried forward in this analysis include expansion of the Pebble Project, continuing exploration of mineral deposits; oil and gas development in Cook Inlet; road improvement projects; and continuance of commercial recreation activities in the greater regional area, as summarized below:

- Pebble Project Expansion
- Pebble South/PEB\*
- Big Chunk South\*
- Big Chunk North\*
- Fog Lake\*
- Groundhog\*
- Shotgun\*
- Johnson Tract\*
- Donlin Gold
- Alaska Stand Alone Pipeline
- Drift River Oil Pipeline
- Cook Inlet Lease Sales\*
- Alaska LNG
- Onshore Hydrocarbon Exploration\*
- LPB Transportation Projects

- LPB Community Development and Capital Improvement Projects
- LPB Renewable Energy Initiatives
- Bristol Bay - Nushagak and Naknek/Kvichak State Management Districts - Salmon
- Lower Cook Inlet Management Area- Salmon and Herring
- Federal, state institutional, and private surveys and research\*

*\*Indicates exploration and research activities only.*

#### **4.3.6.1 Past and Present Actions**

Past and present actions that have contributed to the existing socioeconomic conditions of potentially affected communities include natural resource extraction, commercial and subsistence fishing activities, commercial recreation and tourism, community development and infrastructure, mining exploration activities, and the construction and operation of the Williamsport-Pile Bay Road. Changes in fishing technology and the variability of fish returns have impacted the regional economy from year-to-year. The trend of declining local ownership of fishing permits has decreased the amount of local employment and income in some parts of the region, notably the area around Iliamna Lake. Fluctuations in oil prices have affected the availability of state and local revenue, affecting capital improvement projects and services in the region. When major projects are developed, there is often high employment associated with construction cycles, which then drops during operation cycles. Additionally, seasonal employment fluctuation exists at the regional level, largely due to seasonality of commercial fishing, construction, and tourism industries. Limited transportation infrastructure keeps cost of living high, which is offset somewhat by subsistence hunting and fishing. Declining population in some communities of the LPB have resulted in school closures when the number of students drops below the state minimum of 10 students to keep schools open.

#### **4.3.6.2 Reasonably Foreseeable Future Actions**

##### **No Action Alternative**

The No Action Alternative would not contribute to cumulative effects on the regional and state economy, infrastructure, cost of living, and population characteristics. While there may be some decrease in the current level of economic activity generated by exploration of the Pebble project, exploration activities could continue.

##### **Alternative 1 – Applicant’s Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario would extend the life of the project to recover more of the estimated reserves. The Pebble mine expanded development scenario would continue, and likely increase, the beneficial and adverse impacts that would be realized from the project. Employment and income impacts, as well as tax revenue and cost of living reductions, realized from the expansion would continue through the 78-year expansion period. If a severance tax on production was imposed by the LPB, increased production would generate additional local tax revenue. Similarly, if a new deepwater port was constructed in Iniskin Bay, it would generate additional tax revenue for the KPB. Any impacts to population, housing, and education would be anticipated to remain the same as experienced during the operation of the project, but extend for the longer period of



expansion. However, Pedro Bay would experience greater impacts under the Pebble mine expanded development scenario than if just the proposed project were implemented alone.

**Donlin Gold** – While the proposed Donlin Gold Project could potentially create state-wide competition for skilled workers, it would be located in a different region and would have little contribution to the regional socioeconomic effects. From a state-wide perspective, both the Donlin Gold Project and the Pebble Mine Project could create a competing need for support services and secondary/indirect jobs associated with such services.

**Other Mineral Exploration Projects** – The RFFAs related to continuing mining exploration activities would likely induce some measurable cumulative effects to the socioeconomic characteristics of the potentially affected communities during the exploratory phases, primarily through limited employment and support service activities. The cumulative impacts from mineral exploration and the project would be greatest during summer months since most mineral exploration activities would be limited to summer. Therefore, the contribution to cumulative effects would be greater with the Summer-Only Ferry Operations Variant, along with other mineral exploration projects during summer months, contributing to the seasonal work imbalance and further increasing the demand for summer employees and likely requiring more employees from outside the region for seasonal work.

**Oil and Gas Exploration and Development** – The RFFAs related to oil and gas exploration and development would likely induce some measurable cumulative effects to the socioeconomic characteristics of the potentially affected communities during the exploratory phases. If these projects are developed, they could create a competing need for direct employees, support services, and secondary/indirect jobs associated with such services, but offshore exploration activities would be supported out of the KPB, where there is a mature oil support service industry. Any continuing onshore oil and gas exploration on the Alaska Peninsula would be small in scale, and supported out of King Salmon rather than Iliamna Lake communities.

**Road Improvement and Community Development Projects** – The RFFAs related to transportation and infrastructure improvements, as well as renewable resources, could have an impact on the potentially affected communities. The projects could create small scale construction and operations employment opportunities, improve services, and potentially lower the cost of living. It is possible that such projects would support additional business development, taking advantage of the infrastructure and energy improvements. Community construction projects are a particularly important source of seasonal employment and income for small communities. These impacts would be anticipated to be greater if the project is implemented, which could increase development as support-related businesses take advantage of the additional opportunities provided by the mine.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts to the region would be the same as Alternative 1. Under Alternative 2, project expansion would continue to use the existing Diamond Point port facility, would use the same natural gas pipeline, and would use the constructed portion of the north access road. After 20 years, the ferry would be discontinued, road connections between ferry terminals would be constructed similar to what is described in Alternative 3, and the port site and associated facilities would be constructed at Iniskin Bay as discussed under Alternative 1 above. The concentrate pipeline from the mine site to Iniskin Bay would be constructed similar to Alternative 3, and a diesel pipeline from the mine site to Iniskin Bay would be constructed as discussed under cumulative effects for Alternative 1. Beneficial cumulative impacts from Alternative 2 combined with the Pebble mine expanded development scenario to income and

infrastructure would be less than Alternative 1 because the north ferry operation would be discontinued, and the south transportation system/ferry would not be in place. Therefore, employment opportunities would be lower since employees would not be required at those locations and the facilities would not generate taxable income.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

### **Alternative 3 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same as Alternative 1. Under Alternative 3, project expansion would continue to use the existing Diamond Point port facility, would use the same natural gas pipeline, and would use the same north access road and Concentrate Pipeline Variant, but extend the concentrate pipeline to Iniskin Bay. The port site and associated facilities would be constructed at Iniskin Bay as discussed under Alternative 1 above. A diesel pipeline from the mine site to Iniskin Bay would be constructed as discussed under cumulative effects for Alternative 1. Cumulative tax generation and cost of living benefits would be similar to Alternative 2. Beneficial cumulative impacts from Alternative 3 combined with the Pebble mine expanded development scenario to income and infrastructure would be less than Alternative 1 and 2 because no ferry operation would be in place and the north access road system used for the Pebble mine expanded development scenario would already be built under Alternative 3. Therefore, employment opportunities associated with truck traffic would be lower since employees would not be required at those locations and the facilities would not generate additional taxable income.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

## 4.4 ENVIRONMENTAL JUSTICE

As described in Section 3.4, Environmental Justice (EJ), Executive Order 12898 requires federal agencies to identify and address “disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations,” including Alaska Native communities. Furthermore, Executive Order 12898 also requires the protection of populations with differential patterns of consumption of fish and wildlife. The Council on Environmental Quality (CEQ) defines this as differences in rates or patterns of subsistence consumption by minority, low-income, and Indian tribes, as compared with rates and patterns of consumption by the general population (CEQ 1997).

The CEQ’s “Environmental Justice: Guidance Under the National Environmental Policy Act” (1997) and the Environmental Protection Agency’s (EPA’s) *Promising Practices for EJ Methodologies in NEPA Reviews* (2016a) were developed to provide agencies with a process for identifying environmental justice communities and addressing potential impacts on those communities. According to these guidance documents, the basic components of an environmental justice assessment should include:

- A demographic assessment of the affected communities to identify minority and low-income populations that may be present.
- An integrated assessment to determine whether any adverse impacts would disproportionately affect minority or low-income populations, including Alaska Native communities.
- An opportunity for the public to participate in the process, including community, minority, low income, and tribal participation.

CEQ guidance indicates that when determining whether natural and physical effects on the environment are “high and adverse,” agencies are to consider if environmental effects are significant (as that term is defined by the National Environmental Policy Act [NEPA] lead agency), and if those significant effects are or may have an adverse impact on minority populations, low-income populations, or Indian tribes that appreciably exceeds or is likely to appreciably exceed those on the general population or other appropriate comparison group (CEQ 1997).

CEQ guidance also indicates that when determining whether human health effects, which may be measured in risks and rates, are high and adverse, agencies are to consider if those risks and rates are significant or above generally accepted norms (CEQ 1997).

In addition, the EPA recommends considering the following factors in the determination of disproportionately high and adverse human health effects (EPA 2007, 2016a):

- Proximity and exposure to chemical and other adverse stressors, including impacts commonly experienced by “fence-line” communities.
- Unique exposure pathways, including subsistence fishing, hunting, or gathering in minority and low-income populations.
- Multiple or cumulative impacts, including exposure to several sources of pollutions or pollutants from single or multiple sources.
- Physical infrastructure, including inadequate housing, roads, or water supplies in communities.
- Non-chemical stressors, including chronic stress related to environmental or socioeconomic impacts.

The project's potentially affected population includes those who live, work, subsist, visit, or recreate in the Environmental Impact Statement (EIS) analysis area. The EIS analysis area for this section includes the EIS analysis areas described in Section 4.3, Needs and Welfare of the People—Socioeconomics; Section 4.9, Subsistence; and Section 4.10, Health and Safety. This includes the six Iliamna Lake communities that would be most impacted by the project economically and through subsistence resources, and regional communities in the Bristol Bay who may experience some small economic impacts from the project. Section 3.4, Environmental Justice, presents racial and ethnic characteristics and poverty status for the population in the EIS analysis area that would be affected during construction and operations of the project. In the EIS analysis area, Igiugig, Iliamna, Kokhanok, Newhalen, Nondalton, and Pedro Bay, all of which are communities in the Lake and Peninsula Borough (LPB), meet the CEQ definition of minority and/or low-income communities (see Section 3.4, Environmental Justice). Many of the potential physical, environmental, and social effects would be experienced more frequently and intensely by residents of those communities, given their proximity to multiple project components and their use of the area and nearby areas for subsistence harvests.

Section 4.3, Needs and Welfare of the People—Socioeconomics; Section 4.9, Subsistence; and Section 4.10, Health and Safety, describe impacts to affected communities and the population in the EIS analysis areas for these resources. This environmental justice analysis considers information presented in those sections, considers the distribution of adverse and beneficial impacts throughout the EIS analysis area, and concludes whether there may be disproportionately high and adverse effects to minority or low-income communities. Potential impacts include:

- Changes in job opportunities, employment, recreational opportunities, income, and the cost of living;
- Changes in access to and competition for subsistence resources and resource availability;
- Changes in sociocultural conditions; and
- Changes in health and well-being, including the risk of exposure to hazardous chemicals and bioaccumulative compounds, and non-chemical stressors.

Impacts are discussed in terms of magnitude, extent, duration, and potential or likelihood. The magnitude of impact is discussed in terms of the communities impacted; the duration of impacts would be short term lasting only through the construction phase or months to years, or long term lasting throughout the life of the project (decades). The geographic extent of impacts depends on the location and proximity to the affected community; and the potential of impacts is how likely the impact would be. For this analysis, impacts would be expected to occur as described if the project or alternatives are permitted and constructed.

Scoping comments were received related to disproportionate, adverse impacts to low income and minority communities as result of the proposed project. Commenters requested that the EIS identify low income, minority, and Alaska Native communities that may be impacted by the project. Concerns regarding food security and subsistence resources, health impacts from pollution and exposure to increased industrial activities and noises, increased risk of injury and exposure to hazardous materials, increased exposure to outsiders and the cascading social and psychological effects should be addressed.

#### **4.4.1 No Action Alternative**

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Though no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated

with the project may continue (ADNR 2018-RFI 073). Pebble Limited Partnership (PLP) would have the same options for exploration activities that currently exist. PLP has employed local community members at the site during the exploratory phase of the project. In particular, the communities closest to the exploration area in the LPB, likely including Nondalton, Iliamna, and Newhalen, provide the greatest proportion of the local workforce. These communities are identified as minority and/or low-income communities. Similarly, these communities and others harvest caribou, large land mammals and other subsistence resources in the vicinity of project components. Scoping comments suggested that exploration activities have affected wildlife populations (caribou) used for subsistence. While there may be some decrease in the current level of economic activity generated by exploration of the project, exploration could continue. No changes in additional future direct or indirect effects to existing socioeconomics, subsistence resources, or access to subsistence resources would be expected. Therefore, existing socioeconomic and habitat and resource trends would continue.

#### **4.4.1.1 Needs and Welfare of the People – Socioeconomics**

Under the No Action Alternative, although no resource development would occur, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). The PLP would retain the ability to apply for continued mineral exploration activities under the State's authorization process, as well as any activity that would not require federal authorization. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration by other entities. Therefore, while there may be some decrease in the current level of economic activity generated by exploration of the project, exploration could continue and no changes in additional future direct or indirect effects to the regional economy, cost of living, or current or projected infrastructure would be expected; existing trends would continue. As a result, the current number of direct and indirect jobs would remain the same and there would be no impact on income, economic stability, or social integrity in minority and low-income communities.

#### **4.4.1.2 Subsistence**

The extent of effects on subsistence would be limited to the exploration area. No construction, operations, or closure activities would occur; however, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073).

Resource availability would not change from the conditions present during exploration activity and environmental studies at the mine site; therefore, no additional future direct or indirect effects to subsistence resources or access to subsistence resources would be expected, and existing habitat and resource trends discussed in Section 3.9, Subsistence, would continue. Existing exploration activities associated with the project provide some local employment and income, which could contribute to pursuit of subsistence activities. There is no guarantee that such employment would continue to be available, which could affect minority and low-income communities in the vicinity of the exploration area disproportionately as these communities may more heavily rely on subsistence activities. Existing trends in subsistence resources and uses would be expected to continue, and these communities would continue to harvest subsistence resources; the effects of the No Action Alternative would not be high or adverse.

#### **4.4.1.3 Health and Safety**

Although the current number of direct and indirect jobs would remain roughly the same (see Section 4.3, Needs and Welfare of the People – Socioeconomics), human health impacts associated with any potential loss of employment opportunities (and subsequent decrease in household income) primarily concern increases or decreases in social determinants of health

(SDH), such as income, psychosocial stress, substance abuse, and family stability. Any potential SDH impacts would be relatively small in magnitude, relative to baseline conditions, and would largely be confined to communities closest to the mine site (Nondalton, Iliamna, and Newhalen). There would be no impact to more distant communities in the lower Bristol Bay watershed, such as Dillingham, other than removing uncertainty about the fate of this project. Other health factors would likely be similar to current conditions (i.e., baseline), such as potential rates of accidents and injuries, communicable and non-communicable diseases, exposure to hazardous constituents, and access to healthcare services (see Section 4.10, Health and Safety).

Human health impacts from the No Action Alternative would not be perceptible, or those impacted would be able to adapt with ease and not require medical intervention. Direct effects would be largely similar to baseline levels of health. Current health conditions and trends, as described in Section 3.10, Health & Safety, would continue in the EIS analysis area (see Section 4.10, Health and Safety). In addition, a decision not to permit the project may relieve some stress in affected communities associated with concerns regarding project development and perceived impacts on salmon.

#### **4.4.2 Alternative 1 – Applicant’s Proposed Alternative**

This section presents the potential for Alternative 1 to result in high and adverse effects on minority and low-income populations. Both adverse and beneficial effects are summarized below.

##### **4.4.2.1 Needs and Welfare of the People – Socioeconomics**

As discussed in Section 4.3, Needs and Welfare of the People—Socioeconomics, Alternative 1 would provide economic benefits to individuals, families, and communities in the form of increased incomes, year-round employment, and steady income, and would reduce the impacts of the seasonal fluctuations in employment. Under Alternative 1, in terms of magnitude of impacts, the number of employees would increase to about 2,000 during the 4-year construction phase, and 850 during the 20-year operation of the mine. For the operations phase, PLP has estimated that 250 employees would come from the surrounding communities, with 50 of these employees coming from communities connected to the project site by road (PLP 2018-RFI 027).

The communities closest to the mine site include Nondalton, Iliamna, and Newhalen, and Kokhanok on the southern shore of Iliamna Lake; these communities are also proximal to the proposed transportation corridor. These communities meet the definition of minority and low-income communities. Although PLP has generated exploration-related employment for residents of villages throughout the LPB and broader Bristol Bay region over the past decade, the communities surrounding Iliamna Lake and connected by road, have provided the greatest proportion of the local workforce. It would be anticipated that residents of the communities surrounding Iliamna Lake would continue to provide the majority of the local workforce for construction and operations of the project. An increased revenue stream and stabilization of population levels attributable to employment opportunities could result in improvements to community health care facilities throughout the borough, including minority and low-income communities. Therefore, employment through the project would have beneficial economic effects on minority and low-income communities. These effects would be long term, lasting through the life of the project.

The LPB would not be connected by road to the rest of the state and has few roads, contributing to an extremely high cost of living. As described in Section 4.12, Transportation and Navigation, Alternative 1 would result in the construction of roads and ports. Although the road and port

would have limited access, PLP has stated that they would work with all local communities to identify the best solutions for controlled-access use of the road and ferry for community transportation (PLP 2018-RFI 027). Additional access would be coordinated between the State of Alaska, the LPB, PLP, and landowners. In terms of magnitude and extent, Alternative 1 has the potential to reduce transportation costs of materials and goods to the transportation corridor area's potentially affected communities (Kokhanok, Iliamna, Newhalen, and potentially Nondalton). Reduced transportation costs would lower the cost of living for these communities for the life of the project, many of which are minority and low income.

Communities adjacent to the natural gas pipeline (Kokhanok, Newhalen, and Iliamna) would have the opportunity to connect to the pipeline. Natural gas would likely be less expensive than diesel heating oil, which could lower the cost of living once equipment (e.g., furnace, water heater) is converted to natural gas; however, communities would be responsible for funding the connections and conversions, lowering the potential of a long-term economic benefit. No other impacts to public utilities would be apparent.

The increase in job opportunities, year-round or seasonal employment, steady income, and lower cost of living described above would have beneficial impacts on the EIS analysis area, especially for communities in the LPB, during construction and operations of the project. Therefore, the effects of Alternative 1 on the needs and welfare of the people would not be "high or adverse."

#### **4.4.2.2 Subsistence**

As discussed in Section 4.9, Subsistence, communities closest to project infrastructure would be the most affected by changes in resource availability. These include the minority and/or low-income communities of Iliamna, Newhalen, Pedro Bay, Igiugig, Nondalton, and Kokhanok. Communities in the Nushagak River drainage and the Kvichak River drainage below Iliamna Lake would experience little to no impact on resource availability or access to resources during routine operations because they use areas that are distant from the project area.

Project construction—and to a lesser extent, operations—would impact the availability and abundance of traditional and subsistence resources through habitat loss; behavioral disturbance to resources from increased noise and human activity; fugitive dust deposits on vegetation; concerns about contamination of resources; avoidance of traditional use areas; and increased costs and times for traveling to more distant areas. In terms of magnitude and extent of impacts, there would be a potential for a small population increase in communities closest to the mine site, which could introduce a small amount of resource competition to the area. Adaptive strategies for the harvest of resources would likely maintain harvest levels for affected communities, but potentially at the cost of additional time and money. In general, the impacts of subsistence resource availability on minority and low-income communities would potentially be adverse and long term, lasting for the life of the project.

Construction and operations of the project would result in changes in access to subsistence resources. During the construction period, access to resources in the immediate vicinity of project components would be inhibited or restricted. In terms of extent, this would impact a number of communities located near project infrastructure that use this land for subsistence fishing, hunting, gathering, education of youth on subsistence traditions, and other cultural and customary practices. Construction of linear features, such as the roads, pipeline, and ice-breaking ferry corridor, could interrupt travel to resources or communities on the other side of the linear features. Additionally, safety considerations and presence of project equipment and personnel may restrict hunting activities in proximity to construction activities and facilities, resulting in adverse effects on those minority and low-income communities.

Once constructed, in terms of magnitude, the natural gas pipeline corridor right-of-way and the transportation corridor roads would likely have a positive impact on minority and low-income communities by providing access to subsistence resources, because these cleared routes would facilitate overland all-terrain vehicle and snowmachine travel under approved conditions. During operations, PLP would work with local communities to identify safe, practicable ways for residents to use the access roads, such as scheduled, escorted convoys for private vehicle transport. However, the Iliamna Lake ice-breaking ferry could disrupt winter travel over the frozen lake by potentially adding to travel time and increasing fuel expenditures. This could potentially result in adverse effects on minority and low-income communities that rely on winter travel over the lake. In addition, the open water in the ferry's wake would present a safety hazard for subsistence users. PLP would work with communities (and supply funding) to provide for the marking and maintenance of snowmachine trails between communities across Iliamna Lake when lake ice would be thick enough to support such traffic (see Chapter 5, Mitigation).

In terms of extent, impacts on access to subsistence resource harvest areas would occur for the minority and/or low-income communities located closest to the project components: Nondalton, Iliamna, Newhalen, Pedro Bay, Igiugig, and Kokhanok. In terms of magnitude, impacts associated with access around the mine site for subsistence use and harvest would be most concentrated near the mine site area and would diminish with distance. The magnitude, extent and duration of impacts of the transportation corridor and associated uses to use areas would vary depending on the activity of the user and the location of the use area in relation to the transportation corridor. The effects would be limited in geographic extent and subsistence users would be able to access other areas for harvest of resources. The duration of impacts from the transportation corridor and associated uses would be intermittent to long term over the 24-year period of project construction and operations, and extend beyond the life of the mine. Although impacts would be long term, there would be other easily accessible areas for subsistence hunters. Therefore, the impacts of access to subsistence resource harvest areas for minority and low-income communities would not be "high and adverse" (see Section 4.9, Subsistence, for a detailed discussion of impacts related to changes in access of subsistence resource harvest areas for the communities of Nondalton, Iliamna, Newhalen, Pedro Bay, Igiugig, and Kokhanok).

In terms of magnitude and extent, project construction and operations would be expected to increase employment opportunities for local residents, particularly for those living in communities surrounding Iliamna Lake. Many subsistence activities depend on cash income to pay for the tools, ammunition, equipment, maintenance, and fuel used to harvest, process, and store subsistence resources. When cash incomes increase, subsistence production often increases as a result. Therefore, new employment opportunities that would last throughout the life of the mine would benefit minority and low-income communities.

Changes in harvest participation are a leading indicator of cultural changes. The level of participation may be affected by changes in resource abundance and quality, season and bag limits, changes in physical access, real or perceived changes in cultural perceptions of resources (e.g., fish and animals are seen as tainted/contaminated, or water would be seen as polluted) and the times and funds available for subsistence activity change. Year-round and rotational employment could reduce the opportunity for subsistence users to harvest and process resources, as well as reduce their ability to pass on skills and knowledge to the next generation. Households and communities would need to adjust to new roles of subsistence labor, changes in sharing networks, and to possible changes in harvest levels. Project employment or related regional out-migration could cause the reduction or loss of subsistence production from high-harvesting households. In typical communities, 30 percent of households harvest 70 percent of the resources and there is a high level of sharing that occurs among



households (Wolfe et al. 2010). If high-harvesting households leave the community or reduce their production, it could have an impact on the rest of the community and nearby communities from sharing. The loss of high-harvesting households and a reduction in sharing could result in adverse impacts on minority and low-income communities; the impacts would be long term, lasting through mine closure. However, the effects could be reduced with planned periods of leave options during subsistence harvest periods.

#### **4.4.2.3 Health and Safety**

Section 4.10, Health and Safety, and Appendix K4.10 describe impact ratings for the health effects category under Alternative 1. These effects determinations take into account impact-reducing design features proposed for the project. Although eight health effect categories (HEC) were considered, the primary focus of the health assessment were HECs 1 through 4, including SDH, accidents and injuries, exposure to hazardous materials, and food, nutrition, and subsistence activity. The relevance to the project of the remaining HECs (5 through 8) is expected to be low and they are not summarized below, but are presented in Section 4.10, Health and Safety, and Appendix K4.10 for completeness.

The project would increase household incomes, employment rates, and education attainment during construction and operations phases, and those economic benefits would likely result in an improvement to the overall health and well-being of residents living in the communities from which the workforce for the project would be employed. Many of the communities that would experience these beneficial effects are minority and low-income communities. Economic benefits to these communities would also likely result in increased dietary options, lower regional food costs, and increased income for purchasing subsistence-related equipment. The benefits would be more apparent in the small, rural LPB communities where even minor changes in their economies could have a measureable impact on their overall health and well-being.

Impacts on psychosocial health, family stress, other unintentional injuries (e.g., falls, poisoning), and food security (relative to impacts to cost of living/food and subsistence resources) would be both beneficial and adverse. In terms of magnitude and extent, beneficial effects could include increased funding for the borough to maintain or improve community health services, and increased financial security for community members employed by the project. Adverse health consequences may be related to fear of changes in lifestyle and cultural practices, depression and increased substance abuse, land encroachment, impact to the environment, and real or perceived impacts on food security and quality associated with both commercial and recreational fishing, and with subsistence activities. The project could result in an increase of transportation/navigation accidents and injuries for mine workers and the public at surface access road crossings (at a minimum), if alternate safe routes or mitigation measures were not taken. In addition, the project could potentially result in increased intentional injury (suicide) due to increases in psychosocial stress and any decreases in family stability. However, it is difficult to predict changes in the direction and magnitude of impacts to suicide rates because it is influenced by complex, multi-dimensional contributing factors.

Impacts on access to and quantity of subsistence resources could be both adverse and positive to health, and in terms of magnitude and extent, many of these effects would be most noticeable to communities in close proximity to the mine site, including material sites, and transportation corridor. Potential negative impacts could be from actual or perceived decreases in access to, availability, and/or quality of subsistence resources, which could also adversely impact food security, community health/well-being, and cultural identity. Subsistence users would likely adjust the seasonal round, resource use areas, and species composition of harvest resources to target resources that would be less affected by project activities. Although these adaptive

approaches would likely sustain harvest levels for affected communities, they may increase expenses and time needed to harvest subsistence resources, and add to psychosocial stress and anxiety. However, benefits may also occur since increased incomes and employment can positively affect subsistence harvest levels and participation including making procurement of hunting and fishing equipment more affordable, which in turn could positively affect food security.

The magnitude of health impacts related to unanticipated project spills may include psychosocial stress and anxiety regarding the possible or actual occurrence of spills, potential temporary releases of hazardous chemicals to air, water, and soil, and possible exposures to chemicals by subsistence resources that are ultimately consumed by humans. Planned measures to address these potential impacts include prompt measures for spill containment, rapid community outreach and notifications, as well as testing and monitoring of environmental media such as air, water, and subsistence food resources (see Section 4.27, Spill Risk).

Other adverse key health outcomes considered are the potential for increased risk of exposure to hazardous chemicals in air, soil, groundwater, surface water, and sediment from the project construction, operations, and closure activities. Exposure to hazardous chemicals could occur through inhalation, physical (i.e., dermal) contact, and direct or indirect ingestion (e.g., direct exposure through incidental soil ingestion or indirect exposure through ingestion of subsistence foods that have the potential to bioaccumulate chemicals of potential concern [COPCs]). Recreational and subsistence activity users are expected to be the most frequent visitors to the areas affected by project-related chemicals; in terms of impact extent, these users may be drawn from the potentially affected communities identified in the EIS analysis area, particularly those in closest proximity: Nondalton, Iliamna, and Newhalen, each located approximately 17 miles from the mine site, and Kokhanok, which would be located approximately 2 miles from the main road and pipeline route and would have a spur road to the community. Specific project sources of hazardous materials, the media in which they might occur, and the magnitude, and extent of impacts on potentially affected communities are summarized below. The duration of potential impacts from exposure would be long term. See Section 4.10, Health and Safety, and Appendix K4.10 for a discussion of modeling criteria used to determine health risks associated with exposure to of metals, COPCs, and hazardous air pollutants (HAPs).

- **Air Exposure Pathways:** Project air emissions resulting from stationary sources (e.g., turbines, generators, boilers), mobile sources (e.g., vehicle and mobile equipment exhaust), and fugitive sources (e.g., air particulates from blasting, drilling, vehicle road dust, and wind erosion) could potentially be inhaled by residents in the affected communities, subsistence receptors, and recreational users. Quantitative and qualitative air emission evaluations conducted for this EIS determined that the air inhalation exposure pathway from all project components would not be expected to impact the health of the affected communities, including residents, subsistence receptors, and recreational users. In addition, with implementation of dust mitigation measures, the potential localized and near-field air quality fugitive dust impacts from the project would be further reduced.
- **Soil Exposure Pathways:** Mine site fugitive dust emissions from material and handling activities (mined ore, quarry rock, overburden, and waste rock) could result in wet and dry dust deposition of metals onto soils, waterbodies, and vegetation (e.g., berries) due to the concentration of heavy metals found in orebody materials. Mine Site fugitive dust deposition modeling indicates that this could result in negligible increased concentrations of HAP metals and non-HAP metals above baseline outside of the mine site. Since it is expected that concentrations of HAP and non-HAP metals in soils would be almost indistinguishable from current baseline

concentrations, they would not result in any new exceedances of health-based criteria (beyond those that already exceed baseline concentrations). The transportation corridor, Amakdedori port, and natural gas pipeline fugitive emissions also have the potential to result in dust deposition. However, since only existing soils with baseline levels of naturally occurring metal concentrations would be disturbed during construction and local non-potentially acid generating rock sources would be used for construction of the roadway, dust deposition would not be expected to increase metal concentrations above baseline conditions. Overall, dust deposition impacts to soil would not be expected to impact the health of the affected communities, including subsistence receptors and recreational users, through direct exposure relative to baseline conditions.

- **Water Exposure Pathways:** Affected communities could be exposed to mine site surplus water, inadvertent release of vehicle- or ferry-related materials (e.g., fuel, oil, and lubricants) during transportation corridor operations, and mine site fugitive emissions that could result in dust deposition of metals to surface water bodies or to soil and subsequent leaching to groundwater. Mine site surplus water (e.g., non-contact stormwater runoff and contact water) would be collected separately on site and discharged to downstream drainages during operations and closure after treatment under permits. Since mine site effluent would be treated to meet permitting requirements (if permits are issued) prior to discharge, the mine site effluent would not be expected to result in impacts to surface water quality and would be presumed to be protective of human health even for the most intensive uses, such as potable use and household water supply.

Mine site material and handling activities would result in fugitive emissions that could result in wet and dry dust deposition of metals to surface water bodies. Expected concentration increases in surface water and sediment at the end of the mine site operations are negligible relative to baseline and future risk/hazards for metal concentrations would be indistinguishable from baseline risk/hazards. Therefore, the surface water and sediment exposure pathways from dust deposition would not be expected to impact the health of the affected communities above baseline conditions, including subsistence receptors and recreational users.

Iliamna, Newhalen, and Nondalton have community drinking water wells north of the mine site. Mine Site groundwater would be expected to be captured by the seepage collection systems or contained in the open pit cone of depression, remaining within the mine site boundaries, and would not be expected to impact the mine drinking water wells on these communities. Metals deposited on soil from mine site fugitive emissions may subsequently leach to groundwater, representing a potential source of increased metals to groundwater. Any dust deposition impacts to soil and subsequently groundwater would be greater for those communities located in close proximity to the mine site boundary, and would be less for other potentially affected communities located farther away. Since dust deposition impacts to soil would be expected to result in negligible increases from baseline soil, they would not result in any new migration to groundwater exceedances of health-based criteria (beyond those that already exceed at baseline concentrations). Therefore, dust deposition impacts to soil and subsequent potential migration to groundwater would not be expected to impact the health of the affected communities relative to baseline groundwater conditions.

- **Subsistence Food Exposure Pathways:** Exposure to project-related chemicals through food may occur through consumption of food resources that dust containing chemicals have deposited directly on (e.g., berries and other plant produce) or

consumption of food that has taken up project-related chemicals from the surrounding environmental media by bioaccumulation (e.g., uptake of metals by edible fish from sediments, water or invertebrate prey items, or by plants from soils). Affected communities consuming a subsistence diet may be exposed to higher levels of bioaccumulative compounds because subsistence foods may comprise a very large portion of daily dietary intake.

Consumption of terrestrial plant foods impacted by mine site dust deposition may be seasonal, as dust would be washed off of the vegetation/berries surrounding the project during winter months, or can occur throughout the duration of project activities. The geographic extent of effects to vegetation from fugitive dust would be areas adjacent to the construction activities, active mine site, and roads with vehicle traffic or in unpaved surface areas, with the highest concentrations of dust closest to the source. Fugitive dust impacts would be expected to discourage subsistence users from harvesting resources near the areas affected by the mine site and the transportation corridor. Therefore, potential dietary exposure to plant foods impacted by dust deposition would be anticipated to be low for subsistence users.

Vegetation has the potential to be ingested by wildlife, which may subsequently be harvested and consumed by subsistence users. Caribou and moose would be expected to avoid areas impacted by dust deposition and subsistence users may avoid harvesting resources near the mine site and transportation corridor due to air/dust deposition concerns. In addition, increases on or in terrestrial wildlife (upland game) at the end of the project operations phase would be expected to be negligible to slight given the predicted negligible increases of HAP and non-HAP metals in abiotic media at the end of project operations. Therefore, potential dietary exposure to terrestrial wildlife impacted by dust deposition would be anticipated to be low for subsistence users.

Mine site fugitive emissions would result in direct dust deposition to surface water bodies. In addition, mine site activities would create new areas of standing water in the mine site that may attract waterbirds, including various freshwater storage impoundments, the tailings pond, and the pit lake. Edible fish have the potential to uptake bioaccumulative metals from water, sediments, or invertebrate prey items; and waterbirds have the potential to uptake bioaccumulative metals in water and aquatic prey items. The edible fish and waterbirds may then be harvested and consumed by subsistence users. However, surface water concentrations outside the mine site are expected to be below water quality criteria protective of the environment and human health. Increases of all bioaccumulative metals in fish in surface water bodies outside the mine site at the end of operations would be expected to be negligible to slight. Bioaccumulation potential would be expected to be low for migratory waterfowl because they would not be expected to have sufficient exposure to the mine site water storage features, including the pit lake. Impacts to wildlife from all aspects of the project, including around the pit lake, would be minimized or mitigated through PLP's development and implementation of a Wildlife Management Plan. Therefore, potential dietary exposure to bioaccumulative chemicals from fish and waterbirds would be anticipated to be low for subsistence users.

#### **4.4.2.4 Alternative 1 – Kokhanok East Ferry Terminal Variant**

The Kokhanok East Ferry Terminal Variant would have the same magnitude, extent, duration and likelihood of impacts to socioeconomics, subsistence, and health and safety in the context of environmental justice as discussed above.

#### **4.4.2.5 Alternative 1 – Summer-Only Ferry Operations Variant**

The Summer-Only Ferry Operations Variant would have the same magnitude, extent, duration and likelihood of impacts to health and safety in the context of environmental justice as discussed above. Impacts from socioeconomics and subsistence would be the same except that for socioeconomics, it would likely shift some of the positions held by community members from year-round to seasonal, which would also lower the overall income earned by community members that stays in the region compared to year-round ferry operations and would have fewer beneficial impacts than Alternative 1 without the variant. For subsistence, this variant would not have impacts to lake travel and associated harvest activities in the winter. Overall there would be tradeoffs, but environmental justice determinations would be the same.

#### **4.4.2.6 Alternative 1 – Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would have the same magnitude, extent, duration and likelihood of impacts to socioeconomics, subsistence, and health and safety in the context of environmental justice as discussed above.

### **4.4.3 Alternative 2 – North Road and Ferry with Downstream Dams**

#### **4.4.3.1 Needs and Welfare of the People**

The magnitude, extent, duration and likelihood of impacts of Alternative 2 on employment and income would be expected to be the same as the impacts of Alternative 1. It would be anticipated that residents of the communities surrounding Iliamna Lake would continue to provide the majority of the local workforce for construction and operations of the project under Alternative 2. The increase in job opportunities, year-round employment, and steady income under Alternative 2 would have the same beneficial impacts on minority and low-income communities as Alternative 1. However, Pedro Bay would primarily experience more of these impacts instead of Kokhanok.

The impacts on the cost of living of Alternative 2 would likely be the same as the impacts of Alternative 1 for the communities of Nondalton, Iliamna, and Newhalen. However, because the mine and port access roads and ferry route would be located at the north end of the lake around Pedro Bay as opposed to the mid-lake region, the cost of living benefits provided to Kokhanok under Alternative 1 would not be provided under Alternative 2; however, Pedro Bay, which is considered a minority community, would benefit from reduced transportation costs that would lower the high cost of living.

#### **4.4.3.2 Subsistence**

The magnitude, extent, duration and likelihood of impacts from the changes in resource availability, access to subsistence resources, and the sociocultural dimension of subsistence under Alternative 2 would be the same as Alternative 1, except for the differences described below. As described for Alternative 1, impacts could result in both beneficial and adverse effects on minority and low-income communities.

Changes in resource availability along the transportation corridor and the natural gas pipeline for Alternative 2 would be similar to Alternative 1. Disturbance to and displacement of subsistence resources would occur at approximately the same levels. The primary difference is that there are fewer communities using the area between Pile Bay and Williamsport for subsistence, and so the magnitude of the impact would be less than Alternative 1.

Under Alternative 2, there would be an overland pipeline right-of-way from Pile Bay to the mine site. This could introduce some competition to subsistence users from recreational sport hunting and fishing, although because of the relatively low recreational use of the area, the magnitude of the effects on minority and low-income communities from competition for subsistence resources would be expected to be small.

In terms of extent of impacts under Alternative 2, the mine and port access roads and ferry terminals would be located at the northern and eastern end of the lake as opposed to the mid-lake region. In terms of magnitude, the transportation corridor and ferry would cause more disruption of access to subsistence resource areas for residents of Nondalton, Iliamna, Newhalen, and Pedro Bay and less disruption of access for residents in Kokhanok, and no impacts to residents of Igiugig. In addition, there would be a higher number of overlapping use areas along the road corridor of Alternative 2 from Pedro Bay to the mine site, and the magnitude of the impact would be slightly greater than Alternative 1. Ferry operations would also result in a higher magnitude impact to resource availability for seals compared to Alternative 1, due to impacts from ferry operations. However, similar to Alternative 1, there would be availability of alternate areas within traditional subsistence areas for activities for these communities. Magnitude of impacts would vary from year-to-year, depending on location of subsistence resources during any given year.

Therefore, the impacts of access to subsistence resource harvest areas for minority and low-income communities would not be “high and adverse”, and offset to some degree by the availability of alternate resources.

#### **4.4.3.3 Health and Safety**

Alternative 2 would have the same magnitude, extent, duration and likelihood of health and safety impacts on minority and low-income communities as Alternative 1. Alternative 2 would provide the same economic benefits and improvements to the overall health and well-being of residents, would have the same beneficial and adverse impacts on psychosocial health, family stress, and unintentional and intentional injuries, and would have the same beneficial and adverse impacts on access to and quantity of subsistence resources as described above for Alternative 1.

Alternative 2 would have the same magnitude and duration potential for increased risk of exposure to hazardous chemicals in air, soil, groundwater, surface water, sediment, and bioaccumulative compounds as Alternative 1. However, this alternative includes a natural gas pipeline variant along the north road, which eliminates any potential transportation/navigation hazards and impacts at the Iliamna Lake segment during the construction phase under Alternative 1. In terms of extent, under Alternative 2, the communities closest to the transportation corridor are Iliamna, Newhalen, Nondalton, and Pedro Bay.

See Section 4.10, Health and Safety, for information on risk of exposure.

#### **4.4.3.4 Alternative 2 – Summer-Only Ferry Operations Variant**

The Summer-Only Ferry Operations Variant would have the same magnitude, extent, duration, and likelihood impacts to socioeconomics, subsistence, and health and safety in the context of environmental justice as discussed above and as Alternative 1.

#### **4.4.3.5 Alternative 2 –Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would have the same magnitude, extent, duration, and likelihood of impacts to socioeconomics, subsistence, and health and safety in the context of environmental justice as discussed above.

#### **4.4.4 Alternative 3 – North Road Only**

##### **4.4.4.1 Needs and Welfare of the People**

The magnitude, extent, duration, and likelihood of impacts of Alternative 3 on employment and income would likely be the same as the impacts of Alternative 1. It would be anticipated that residents of the communities surrounding Iliamna Lake would continue to provide the majority of the local workforce for construction and operations of the project under Alternative 3. The increase in job opportunities, year-round employment, and steady income under Alternative 3 would have the same beneficial impacts on minority and low-income communities as Alternative 1. There would be no interference with winter access across Iliamna Lake as there would be no ferry operations under Alternative 3.

The impacts on the cost of living of Alternative 3 would likely be the same as the impacts of Alternative 1 for the communities of Nondalton, Iliamna, and Newhalen. However, because the north access road would be located at the north end of the lake around Pedro Bay as opposed to the mid-lake region, the cost of living benefits provided to Kokhanok under Alternative 1 would not be provided under Alternative 3; however, Pedro Bay, which is considered a minority community, would benefit from reduced transportation costs that would lower the high cost of living.

##### **4.4.4.2 Subsistence**

The magnitude, extent, duration, and likelihood of impacts from the changes in resource availability, access to subsistence resources, and the sociocultural dimension of subsistence under Alternative 3 would be the same as Alternative 1, except for differences described below. As described above for Alternative 1, these impacts could result in both beneficial and adverse effects on minority and low-income communities.

In terms of magnitude and extent, changes in resource availability along the transportation corridor and the natural gas pipeline corridor for Alternative 3 would be similar to Alternative 1, but would occur over a different geographic area. Disturbance to and displacement of subsistence resources would occur at approximately the same levels. The primary difference is that there are fewer communities using the area between Pile Bay and Williamsport for subsistence (Iliamna, Newhalen, Nondalton, and Pedro Bay). However, there are a high number of overlapping use areas along the road corridor of Alternative 3 from Pedro Bay to the mine site for Iliamna and Pedro Bay, and so the magnitude of the impact to those communities would be slightly higher than Alternative 1.

Under Alternative 3, the north access road would connect Pile Bay to the mine site. In terms of magnitude and extent of impacts, this road could introduce some competition to subsistence uses of resources from recreational sport hunting and fishing. The port access road beyond Pile Bay would have similar controlled access as described under Alternative 1, therefore the magnitude of effects would be similar.

Access to subsistence resource use areas would be similar to Alternative 2 for residents of Nondalton, Iliamna, Newhalen, Pedro Bay, Igiugig, and Kokhanok. Similar to Alternative 1, there would be availability of alternate areas in traditional subsistence areas for activities for these

communities. However; magnitude of impacts would vary from year-to-year depending on location of subsistence resources during any given year. There would be no ferry operations, and therefore no impacts to winter seal hunting or access on Iliamna Lake. Therefore, the impacts of access to subsistence resource harvest areas for minority and low-income communities would not be “high and adverse”.

#### 4.4.4.3 Health and Safety

Alternative 3 would have the same or similar magnitude, extent, duration and likelihood of health and safety impacts on communities as Alternative 1. Alternative 3 would provide the same economic benefits and improvements to the overall health and well-being of residents, would have the same beneficial and adverse impacts on psychosocial health, family stress, and unintentional and intentional injuries, and would have the same positive and adverse impacts on access to and quantity of subsistence resources as described above for Alternative 1.

In terms of likelihood of impacts, Alternative 3 would have the same potential for increased risk of exposure to hazardous chemicals in air, soil, groundwater, surface water, sediment, and bioaccumulative compounds as Alternative 1. In terms of magnitude, this alternative includes a natural gas pipeline variant along the north road, which eliminates any potential transportation/navigation hazards and impacts at the Iliamna Lake segment during the construction phase under Alternative 1. Communities closest to the transportation corridor are the same as Alternative 2. See Section 4.10, Health and Safety, for information on risk of exposure.

Because Alternative 3 does not involve operation of a ferry across Iliamna Lake, there would be no potential safety hazards to winter transportation by local residents across Iliamna Lake compared to Alternatives 1 and 2.

#### 4.4.4.4 Alternative 3 – Concentrate Pipeline Variant

The Concentrate Pipeline Variant would have the same extent, duration, and likelihood of impacts to subsistence in the context of environmental justice as discussed above. In terms of magnitude, for socioeconomic and health and safety, the impacts of the variant would likely be a decrease in employment of truck operators and increased employment at the dewatering facility. Overall, the total number of employees needed during operations would likely decrease, which would decrease the overall income and employment in the potentially affected communities. However, the variant would still provide some economic benefits to minority and low-income communities by providing job opportunities, year-round employment, and steady income to a lesser extent than Alternative 1. Overall environmental justice determinations would be the same.

#### 4.4.5 Summary of Key Issues

See Table 4.4-1 for a summary of key issues.

**Table 4.4-1: Summary of Key Issues for Environmental Justice**

Impact	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
Socioeconomics	Economic benefits to minority and low-income communities. Alternative 1 would increase job opportunities, create year-round employment, and provide steady income.	Same as Alternative 1 except that the cost of living benefits would not be provided to Kokhanok, but would be provided to Pedro Bay instead.	Same as Alternative 2 except that the impacts of the Concentrate Pipeline Variant would likely be less to employment and income. There would still



**Table 4.4-1: Summary of Key Issues for Environmental Justice**

Impact	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	<p>Minority and low-income communities nearest the project components (i.e., Newhalen, Iliamna, Nondalton, and Kokhanok) would likely see the greatest impacts in employment and income.</p> <p>Reduced transportation costs would likely lower the high cost of living for the communities near the transportation corridor (i.e., Newhalen, Iliamna, Nondalton, and Kokhanok). The natural gas pipeline could also provide opportunities for adjacent communities to lower their cost of living.</p>		<p>be economic benefits to minority and low-income communities from job opportunities, year-round employment, and steady income, but to a lesser extent.</p>
Subsistence	<p>Changes in resource availability would be adverse for minority and low-income communities.</p> <p>Impacts to access of subsistence resource harvest areas for minority and low-income communities would not be high or adverse because of access to alternate subsistence resource harvest areas. Employment opportunities could provide additional revenue to support subsistence activities.</p>	<p>Same as Alternative 1, except that the transportation corridor and ferry would cause more disruption of access to subsistence resource areas for residents of Iliamna, Newhalen, and Pedro Bay, and less disruption of access for residents in Igiugig and Kokhanok.</p>	<p>Same as Alternative 1 for resource availability, access to subsistence resources.</p> <p>Access to subsistence resource use areas would be the similar to Alternative 2 for residents of Iliamna, Newhalen, Pedro Bay and, Nondalton.</p>
Health and Safety	<p>Alternative 1 would provide economic benefits and improvements to the overall health and well-being of residents, especially those in the LPB.</p> <p>Beneficial and adverse impacts on minority and low-income communities from psychosocial and family stress, unintentional injuries (e.g., falls, poisoning).</p> <p>Beneficial and adverse impacts on minority and low-income communities related to access to and quantity of subsistence resources and food security.</p> <p>Adverse impacts from potential increased transportation/navigation accidents and potential increase in suicide rates.</p>	<p>Same as Alternative 1.</p>	<p>Same as Alternative 1, except that the impacts of the Concentrate Pipeline Variant. This variant would provide the same economic benefits and improvements to the overall health and well-being of residents as described for Alternative 1, but to a lesser extent.</p>

**Table 4.4-1: Summary of Key Issues for Environmental Justice**

Impact	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	Potential for increased risk of exposure to hazardous chemicals in air, soil, groundwater, surface water, sediment, and bioaccumulative compounds would be low and imperceptible from baseline. Real or perceived impacts could cause additional stress for local residents harvesting salmon for subsistence, commercial fishing, and recreational fishing purposes.		

**4.4.6 Cumulative Effects**

The cumulative effects analysis area consists of the geographic area of those who live, work, subsist, or recreate in the EIS analysis area and the broader region that would be affected by the RFFAs. These areas include the communities in the LPB and Dillingham Census Area, which are considered minority and low-income communities (see Section 3.4, Environmental Justice). There could be some cumulative effects on minority and low income residents in the Kenai Peninsula Borough (KPB), Bristol Bay Borough, and Municipality of Anchorage, which are not considered minority or low-income communities as a whole. Past, present, and reasonably foreseeable future actions (RFFAs) in the cumulative impact analysis area have the potential to cumulatively contribute to disproportionately high and adverse effects on minority and low-income communities.

This cumulative analysis considers information presented in Section 4.3, Needs and Welfare of the People—Socioeconomics, Section 4.9, Subsistence, and Section 4.10, Health and Safety. These sections took into consideration RFFAs as identified Section 4.1, Introduction to Environmental Consequences. The specific RFFAs with the greatest potential to cumulatively impact socioeconomic, subsistence, and health and safety conditions are identified in those respective sections.

**4.4.6.1 Needs and Welfare of the People**

**Past and Present Actions**

Past and present actions that have contributed to the existing socioeconomic conditions of potentially affected communities include natural resource extraction, commercial and subsistence fishing activities, commercial recreational and tourism, community development and infrastructure, mining exploration activities, and the construction and operation of the Williamsport-Pile Bay Road. Local employment and income associated with fishing has been decreasing around Iliamna Lake, but remains the economic mainstay of portions of the Bristol Bay Borough and Dillingham census area. Commercial recreation and mineral exploration have created employment opportunities for local residents. Fluctuations in oil prices have affected the availability of state and local revenue, affecting capital improvement projects and services in the region. Employment fluctuates due to construction cycles of major projects and seasonal employment associated with commercial fishing, construction, and tourism industries. Limited transportation infrastructure keeps the cost of living high, which has contributed to the

population outmigration in some Lake and Peninsula Borough communities. Subsistence has remained a cultural and economic foundation of communities in the project area.

## **Reasonably Foreseeable Future Actions**

### ***No Action Alternative***

The No Action Alternative would not contribute to cumulative effects on the regional and state economy, infrastructure, cost of living, and population characteristics. While there may be some decrease in the current level of economic activity generated by exploration of the project, exploration activities could continue.

### ***Alternative 1 – Applicant’s Proposed Alternative***

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario would continue, and likely increase, the beneficial and adverse impacts to socioeconomic conditions for minority and low-income communities that would be realized from the project. Employment and income impacts and cost of living reductions realized from the expansion would continue through the 78-year expansion period. Pedro Bay would experience greater impacts under the Pebble mine expanded development scenario than if just the proposed project were implemented alone.

**Donlin Gold** – The proposed Donlin Gold Project would contribute to regional economic benefits similar to those of the Pebble Project. Employees would likely come from the city of Bethel as well as other parts of the Bethel Census Area, the Kusilvak Census Area, and the Yukon-Koyukuk Census Area. Therefore, these benefits would not directly contribute to economic benefits for minority and low-income communities in the cumulative effects analysis area. From a statewide perspective, both the Donlin Gold Project and the Pebble Mine Project could create a need for support services and secondary/indirect jobs associated with such services in the region.

**Other Mineral Exploration Projects** – The RFFAs related to continuing mining exploration activities would likely induce some measurable cumulative effects to the socioeconomic characteristics of minority and low-income communities during the exploratory phases, primarily through limited employment and support service activities. Since most mineral exploration activities would be limited to summer, the contribution to cumulative effects would be greater with the Summer-Only Ferry Operations Variant, along with other mineral exploration projects during summer months, contributing to the seasonal work imbalance and further increasing the demand for summer employees and likely requiring more employees from outside the region for seasonal work. The proposed Diamond Point rock quarry would be located near the convergence of Cottonwood and Iliamna bays. This project could increase job opportunities and provide steady income to minority and low-income communities in the LPB and the KPB.

**Oil and Gas Exploration and Development** – If the RFFAs related to oil and gas exploration and development are developed, they could create a competing need for direct employees, support services, and secondary/indirect jobs associated with such services, but offshore exploration activities would be supported out of the KPB, where there is a mature oil support service industry. Any continuing onshore oil and gas exploration on the Alaska Peninsula would be small in scale, and supported out of King Salmon rather than minority or low-income Iliamna Lake communities.

**Road Improvement and Community Development Projects** – The RFFAs related to transportation and infrastructure improvements could have a cumulative impact on potentially affected communities in the cumulative effects analysis area. For example, the LPB

transportation projects, such as the Williamsport-Pile Bay Road upgrade and the Nondalton-Lliamna River Road corridor and bridge, would reduce high transportation costs and lower the cost of living for minority and low-income communities in the LPB. These benefits would be anticipated to be greater if the project is implemented.

### ***Alternative 2 – North Road and Ferry with Downstream Dams***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts to the region would be the same as Alternative 1. Beneficial cumulative impacts from Alternative 2 combined with the Pebble mine expanded development scenario to income and infrastructure for minority and low-income communities would be less than Alternative 1 because the north ferry operation would be discontinued, and the south transportation system/ferry would not be in place. Therefore, employment opportunities would be lower since employees would not be required at those locations.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

### ***Alternative 3 – North Road Only, Concentrate Pipeline Variant***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same as Alternative 1. Cumulative cost of living benefits would be similar to Alternative 2. Beneficial cumulative impacts from Alternative 3 combined with the Pebble mine expanded development scenario to income and infrastructure would be less than Alternative 1 and 2 because no ferry operation would be in place and the north access road system used for the Pebble mine expanded development scenario would already be built under Alternative 3. Therefore, employment opportunities for minority and low-income communities associated with truck traffic would be lower since employees would not be required at those locations and the facilities would not generate additional taxable income.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

## **4.4.6.2 Subsistence**

### **Past and Present Actions**

Past and present actions have caused noticeable effects to subsistence resources. Such activities include subsistence activities, sport fishing and hunting, mining exploration, and non-mining related projects, such as transportation, oil and gas development, or community development actions. Subsistence harvests of sockeye salmon, caribou, and Cook Inlet Beluga Whales have occurred. There have been some impacts related to aircraft disturbance and localized restriction of access to subsistence activities associated with mineral exploration activities, including the Pebble project.

### **Reasonably Foreseeable Future Actions**

#### ***No Action Alternative***

The No Action Alternative would not contribute to cumulative effects associated with changes to resource availability, access to resources, or competition for resources. If there are fewer local

employment opportunities associated with future exploration of the Pebble deposit, there could be less income that could contribute to support subsistence activities. However, that could be offset by exploration of other nearby mineral deposits.

### ***Alternative 1 – Applicant’s Proposed Alternative***

**Pebble Mine Expanded Development Scenario** – The expanded development scenario at the mine site would affect more fish habitat in the upper reaches of the North Fork and South Fork of the Kuktuli River, as well as Upper Talarik Creek (UTC), and would contribute to the cumulative effects with additional infrastructure, habitat loss, and disturbance over a long period of time, up to an additional 78 years depending on the period of post-mining milling and closure activities. This additional habitat loss associated with the mine site would not be expected to have population levels effects on fish and wildlife; however, the quality and cultural experience of subsistence activities could be affected. Effects such as habitat fragmentation, noise, and potential for increased access for recreational hunting and fishing disrupt subsistence cycles may result in direct impacts on resource gathering areas and harvest quantities. Local residents have observed that there has already been a loss to subsistence opportunities and the way of life due to planning and exploration activities that are associated with the Pebble Project from helicopter traffic and that there have been disruptions to local wildlife. The cumulative impacts would be long-term over extended operations, and decrease in magnitude as closure is implemented.

**Other Mineral Exploration Projects** – Actions that expand mineral exploration near the Pebble deposit and around Iliamna Lake contribute to landscape-level effects, where there is continuous introduction of additional impediments to the movement of people and animals; increased seasonal noise, vibration, and atmospheric pollution; and increased numbers of people to the area. This would lead to similar effects to resource availability, access to resources, competition for resources, and sociocultural conditions described above for the Pebble mine expanded development scenario, but on a smaller scale. These potential effects would be seasonal in nature, as mineral exploration activities have historically been conducted during summer months. Since the other mineral exploration RFFAs are generally close to the Pebble Project, subsistence use areas would experience continued and increasing pressure from development, which would continue to affect subsistence uses. Specifically, subsistence users in Nondalton, a minority and low-income community, noted that their community uses traditional trapping and hunting areas near Groundhog Mountain. Impacts to Nondalton, Iliamna, and Newhalen from the Groundhog project would be additive to impacts from the proposed Pebble Project and the Pebble expansion RFFA, potentially causing them to travel farther and expend more time to trap and hunt. Similar additive impacts would result from other mineral exploration RFFAs.

**Oil and Gas Exploration and Development** – An increase in resource development actions along the coast of Cook Inlet could impact those minority and/or low-income communities that use the Amakdedori area, and potentially the east side of Cook Inlet, for subsistence resources and access to sites that are important for harvest and cultural practices central to the healthy relationship of people with the land they inhabit. The cumulative impacts from exploration would be temporary and seasonal in nature. Any long term development that may result would be long-term and geographically broad in scope (i.e., regional level).

**Road Improvement and Community Development Projects** – Anticipated road improvement projects in the region include new transportation corridors, which are currently being studied in the LPB, such as the Williamsport-Pile Bay Road upgrade and the Nondalton – Iliamna River Road Corridor and Bridge and Kaskanak Road /Cook Inlet to Bristol Bay road projects. These transportation projects would increase access to the area, which could improve access to

subsistence resources but also introduce additional disturbance to and competition for resources, affecting all minority and low-income communities in the cumulative effects analysis area.

Additional RFFAs that have the potential to affect subsistence in the cumulative effects area include energy and utility projects, the Diamond Point rock quarry, and various village infrastructure development projects. These projects would have similar effects to the Pebble Project, but would be of lesser magnitude and geographic extent; however, when considered in combination with the Pebble Project, impacts to resource availability, access to resources, and competition for resources would increase for minority and low-income communities in the cumulative effects analysis area.

### ***Alternative 2 – North Road and Ferry with Downstream Dams***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to but of lesser magnitude than Alternative 1, as the Amakdedori port and connecting transportation infrastructure would not be built. As a result, potential cumulative impacts to Kokhanok would also be less under this alternative.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

### ***Alternative 3 – North Road Only***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to Alternatives 1 and 2. Since the Pebble mine expanded development scenario would use the north access road system that would already be built under Alternative 3 and not include any ferry operations, cumulative impacts from Alternative 3 combined with the Pebble mine expanded development scenario to resource availability and access to resources would be less than Alternatives 1 or 2. Potentially affected minority and low-income communities would be similar to Alternative 2.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

## **4.4.6.3 Health and Safety**

### **Past and Present Actions**

Past and present actions such as sport fishing and hunting, mining exploration, and non-mining related projects, such as transportation, oil and gas development, or community development actions, have all influenced health and safety conditions for minority and low-income communities in the cumulative effects analysis area. Community development and transportation infrastructure projects have generally improved human health and safety on project area communities. A certain amount of psychosocial stress would be created by the variability in salmon runs and fish prices, affecting participants in commercial fishing. Past and present mineral exploration has also created stress with regard to concerns about potential mining development in the Bristol Bay watershed.

## **Reasonably Foreseeable Future Actions**

### ***No Action Alternative***

The No Action Alternative would not contribute to cumulative effects to health and safety.

### ***Alternative 1 – Applicant’s Proposed Alternative***

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario has the potential to result in increased health impacts, especially from increased impact durations, possible increased releases into the environment, and affected community exposure to potentially hazardous materials over an additional 78 years. The geographic exposure would combine the footprints of Alternatives 1 and 3, with two operating ports and transportation corridors. However, the Pebble mine expanded development scenario would require additional permits and separate NEPA compliance. Minority and low-income communities in the cumulative effects analysis area with pre-existing industrial pollutants and contaminated sites have the potential to add to the cumulative health impacts from exposure to potentially hazardous materials in communities where PLP proposes construction and operations activities. It would be expected that mitigation measures would be used to minimize or mitigate exposure (e.g., avoidance of Alaska Department of Environmental Conservation [ADEC] contaminated sites, protective clothing and equipment, dust suppression).

**Other Mineral Exploration Projects** – Actions that expand mineral exploration near the Pebble deposit and around Iliamna Lake contribute to landscape-level effects where there is continuous introduction of additional impediments to the movement of people and animals; increased noise, vibration, and atmospheric pollution; and increased numbers of people to the area. This, in combination with the Pebble Project, could result in increased stress associated with fear of changes in lifestyle and cultural practices, land encroachment, impact to the environment, and real or perceived impacts on food security and quality.

**Oil and Gas Exploration and Development** – Oil and gas exploration and development have the potential to increase household incomes, employment rates, and education attainment; those economic benefits would likely result in an improvement to the overall health and well-being of residents living in the communities from which the workforce would be employed. Many of the communities in the region that would experience these beneficial effects are minority and low-income communities. The benefits would be more apparent in the small, rural communities, where even small economic changes could have a measureable impact on their overall health and well-being.

**Road Improvement and Community Development Projects** – The capital improvement-related RFFAs and rural development projects have the potential to add to positive impacts to many affected minority and low-income communities (e.g., road improvement and increased safety) in the EIS analysis area, and improve safety and access to healthcare.

### ***Alternative 2 – North Road and Ferry with Downstream Dams***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to but of lesser magnitude than Alternative 1, as the Amakdedori port and connecting transportation infrastructure would not be built. As a result, potential cumulative impacts to Kokhanok would also be less under this alternative.

**Other Mineral Exploration Projects, Road Improvement, and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

***Alternative 3 – North Road Only***

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to Alternatives 1 and 2. Since the Pebble mine expanded development scenario would use the north access road system that would already be built under Alternative 3 and not include any ferry operations, cumulative impacts from Alternative 3 combined with the Pebble mine expanded development scenario would be less than Alternatives 1 or 2. Potentially affected minority and low-income communities would be similar to Alternative 2.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.



## 4.5 RECREATION

For the purposes of this section, the Environmental Impact Statement (EIS) analysis area is defined as the area from Lake Clark National Park and Preserve south to Katmai National Park and Preserve, and from the Nushagak River east to the western Kenai Peninsula. Figure 3.5-1 shows these designations and other regional recreation areas. Potential impacts include:

- Adverse effects to recreation opportunities and experiences for recreationists participating in hunting, fishing, wildlife viewing, boating, camping, backpacking, beach combing, clamming, and picnicking activities.
- Displacement of recreationists participating in hunting, fishing, wildlife viewing, boating, camping, backpacking, beach combing, picnicking activities, and snowmachine use.
- Adverse effects to recreation experiences for visitors flying over the EIS analysis area.
- Increased access to recreational areas.
- Changes to recreational settings.

The magnitude of impact from the project depends on the level of current recreation use that would be impacted, the extent to which the recreation setting, opportunities, and experiences are altered, as well as the ability of recreationists to relocate to another area with similar recreation opportunities, settings, and experiences. The duration and geographic extent of impacts depends on the location and season in which the disturbance occurs during construction, operations, or closure, as well as the audibility and visibility of any changes to the recreation setting. Duration would be considered long term if the effect lasted throughout the life of the project, or years to decades. A short-term effect for example, would be expected last only though the construction phase, on the order of months to years. The potential for impacts is related to how likely the project would be to alter the recreation setting, opportunities, experiences, and use level.

### 4.5.1 No Action Alternative

Under the No Action Alternative, the Pebble Project would not be undertaken. There would be no mine site, transportation corridor, port development, or natural gas pipeline corridor. No construction, operations, or closure activities would occur. Therefore, no additional future direct or indirect effects on recreation would be expected. Though no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). Pebble Limited Partnership (PLP) would have the same options for exploration activities that currently exist. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration. Noise and disturbance from activities such as drilling and aircraft overflights could occur. The magnitude of helicopter traffic related to exploration activities would remain at the same level it has the past 10 years, and a slight decrease from current activity. The mine site itself is generally not used for recreation, but helicopter traffic would be noticeable to recreation users of the Newhalen River and the northern shoreline of Iliamna Lake near Iliamna. Decreases in noise and disturbance would benefit the recreation setting and enhance recreation experiences in these areas by decreasing human-made noise and increasing naturalness.

PLP would be required to reclaim any remaining sites at the conclusion of their exploration program. If reclamation approval is not granted immediately after the cessation of reclamation

activities, the state may require continued authorization for ongoing monitoring and reclamation work as deemed necessary by the State of Alaska. While these activities would also cause noise and disturbance, reclamation would benefit the recreational setting.

#### **4.5.2 Alternative 1 – Applicant’s Proposed Alternative**

The following sections describe anticipated project impacts on recreation. Scoping comments related to recreation focused on potential disruption to recreational hunting and fishing use near the mine, along river systems, and in the transportation/pipeline corridor during construction and operation. Impacts to lodges in the Iliamna and Lake Clark areas were specifically noted. The following sections consider the potential project impacts on guided hunting and fishing activities, increased access for additional recreationists, and displacement of wildlife, specifically within the McNeil State Game Refuge. For a discussion on economic impacts related to commercial and recreational fishing, see Section 4.6, Commercial and Recreational Fisheries.

##### **4.5.2.1 Mine Site**

Recreational use at the mine site is estimated to be low; use consists of some sport hunting, sport fishing, and occasional snowmachining. Flights taking recreationists to various destinations in the region may pass over the mine site. For a discussion of potential impacts to subsistence hunting use, see Section 4.9, Subsistence.

The magnitude and extent of impacts on recreation at the mine site would be the alteration and physical removal of 8,086 acres of land (i.e., size of the mine site footprint including material sites) currently available for recreation. This would include the loss of 3,458 acres of wetlands and other waters, which support the fish and wildlife that attract anglers and sport hunters. The impacts would be permanent, and certain if the mine is permitted and built. The acres directly impacted do not see much recreational use and any users would be displaced to other nearby state or federal lands where similar recreation opportunities and settings exist.

Construction, operations, and closure at the mine site would affect sport hunting, fishing, and other recreation activities on lands surrounding the EIS analysis area. Project-related activities that generate noise, such as blasting and operation of heavy equipment and helicopters, would adversely affect the recreational experience for hunters, anglers, and other recreationists. The magnitude of the effects would be to change the setting from the current low level of summer exploration activities to a developed year-round industrial area in visual and auditory distance of the mine site. The effects would be certain if the mine is permitted and built and would be long term, lasting throughout the life of the project.

As discussed in Section 4.19 Noise, the magnitude and geographic extent of increase in noise from construction and operations at the mine site would be 10 decibels (dBA) higher than the ambient noise level up to 2.3 to 2.4 miles away from the mine site. An increase of 10 dBA would sound, based on human perception, “twice as loud” as the current ambient noise level. Project construction and operation noise would exceed a 30 dBA equivalent noise level up to 3.3 and 3.5 miles from the mine site, respectively. Above this 30 dBA noise level, the project would risk causing sleep disturbance to recreationists sleeping outdoors on lands considered “wilderness ambient.” These adverse effects to recreation experiences generally within 3.5 miles of the mine site would be certain if the project is permitted and built, and, may result in minimal displacement of visitors to other areas for the duration of the project. For further analysis, see Section 4.19, Noise.

The noise generated by project construction, operations, and closure activities would also displace wildlife and fish from the immediate mine site area, and likely from lands immediately surrounding the EIS analysis area. The magnitude of this effect is that hunting and fishing

success close to project components would be reduced. Therefore, hunters, anglers, or guides who currently use the immediate vicinity would be displaced to other areas during construction, operations, and closure activities. This effect would be certain if the mine is permitted and built. For further analysis, see Section 4.23, Wildlife Values. However, the mine site and immediate surrounding area is not popular for sport hunting, fishing, and other recreation uses and potential users would be displaced to other state lands in the area with similar habitat.

As discussed in Section 4.11, Aesthetics, visibility of the mine site would generally be limited to high-elevation areas on Sharp Mountain and Groundhog Mountain, and the upper Stuyahok River Valley. The extensive development at the mine site and contrast of the mine site with the surrounding area would alter the recreation setting. Visual contrast is expected to attenuate to a weak level at a distance of about 20 miles of the mine. There is a lack of existing night lighting in the analysis area, and mine facility lighting would result in strong contrast from high elevation locations. The quality of the night sky would also be impacted in areas where there are no direct views of the mine site by brightening the night sky, reducing visibility of stars and other astronomical observations. Impacts would be of high magnitude within 8 miles of the mine site and decrease with distance; low magnitude impacts could occur at distances of up to 70 miles from the mine site. These impacts would occur if the mine is permitted and built. Changes to the recreation setting due to visibility of the mine would alter recreation experiences for visitors within view of the mine for daytime impacts, and further for impacts to night sky. The impacts would last for the duration of the project and after project closure, and may result in displacement of recreation visitors to areas where the mine site is not visible. For further analysis, see Section 4.11, Aesthetics.

The mine site would be approximately 15 miles from the border of Lake Clark National Park and Preserve, the nearest regional recreation destination and well-known recreational use area to the mine site. Project-related noise and activities would not result in meaningful, direct effects on recreational settings or activities in the preserve. As stated in Section 4.11, Aesthetics, and shown in the viewshed figures in Appendix K4.11, the geographic extent of the impact of the coarse ore stockpile at the mine site would be limited because it would only be visible from high elevations in the southwestern corner of the park near Roadhouse Mountain which is a small portion of the total park unit. Visibility from this distance would be low and therefore magnitude of impacts to recreation settings and experiences from increased development in a primitive setting would be low. This impact would be long term to permanent and would occur if the mine is permitted and built.

As described in Section 4.19, Noise, mine site construction and operations noise would not affect sensitive receptors in the park unit. Recreational berry-picking, fishing, and drinking water collection by recreationists in Lake Clark National Park and Preserve would not be affected due to the distance between the mine site and the park unit. The geographic extent of long-term fugitive dust impacts on vegetation, water quality, aquatic ecosystems, and berry-picking would be limited to the area around the mine site and within 35 feet of the mine access road. Therefore, magnitude of impacts from fugitive dust to recreational activities would be low since recreational activities are limited that close to the mine site. These effects would be certain if the mine is permitted and built, but implementation of dust suppression, on-site water treatment processes, and enforcement of slow speed limits at all stream crossings would minimize dust-related impacts to vegetation, water quality, and aquatic ecosystems (see Chapter 5, Mitigation, for additional mitigation for fugitive dust). Impacts to fish are described in Section 4.24, Fish Values.

Activities at the mine site would be visible and potentially audible to visitors flying over the area. The presence of the mine, a large industrial facility in an otherwise generally primitive area, would adversely affect the recreational experience for visitors flying over the mine site by

causing a change in the recreational setting. Given the mine site's location relative to nearby lodges and airstrips/airports, some unscheduled recreational flight paths would cross the mine site itself. Although the number of visitors flying into the area is relatively low, their experience would be affected by the presence of the project, and the magnitude of impact would be high. The mine site may be visible to recreationists taking flightseeing tours in Lake Clark National Park and Preserve, but these tours are not likely to fly over the mine site itself. Therefore, project construction, operations, and closure are likely to have a noticeable adverse effect on the recreational experience for flightseeing visitors.

Any recreation by construction and operations staff would be expected to occur outside of the mine site, because site rules would prohibit hunting, fishing, or gathering on site to minimize impacts on local subsistence resources. Since the mine would operate on a fly-in, fly-out basis, non-resident staff members would not likely contribute to an increase in recreational use. They may, however, occasionally stay in the area or participate in recreational trips to nearby destinations. As described in Section 4.3, Needs and Welfare of the People—Socioeconomics, operation of the mine is not expected to generate a large increase in the number of full-time residents. Therefore, a small increase in recreational use would likely occur during project construction, operations, and closure due to a small increase in the full-time residential population and local residents may notice slightly more people participating in recreation activities locally. However, it is not anticipated that the small increase in the number of full time residents or employees who may use recreational resources would eliminate any existing recreation opportunities or experiences, but may decrease opportunities for solitude. These impacts would be of low to medium magnitude and could occur anywhere within the EIS analysis area, and potentially beyond.

#### **4.5.2.2 Transportation Corridor**

The proposed transportation facilities would directly impact 1,160 acres of land, including 86 acres of wetlands and other waters, and would remove it from use for recreation opportunities. These impacts would occur for the duration of the project through closure and would be certain if the project is permitted and built. The direct loss of these acres would negatively impact recreational opportunities and experiences as discussed below.

Near the transportation corridor there is recreational use of Roadhouse Mountain to the northeast of Iliamna, as well as use of some all-terrain vehicle (ATV) trails around the Iliamna area for transportation, subsistence, and recreation. There are also recreational use opportunities in the general transportation corridor area, particularly along the Newhalen River and Upper Talarik Creek (UTC) by the mine access road. Recreation opportunities also exist in the Gibraltar River and Gibraltar Lake portions of the port access road corridor, where some local lodges advertise guided fishing, hunting, and sightseeing trip options (Haugen, Bush, and Rice 2003). Recreational sport hunting and snowmachine use may occur occasionally in this road corridor. At Iliamna Lake, some boating takes place (motorized and non-motorized), both as an activity in itself and as a means of accessing other recreation opportunities, primarily fishing, which is the main recreation activity at Iliamna Lake along with boating (ADNR 2013a). Due to its current inaccessibility and location of nearby recreation opportunities, recreational use of the port access and mine access road corridors, the Kokhanok spur road, and the Iliamna spur road is likely low and would have low magnitude impacts.

Noise and activities along the transportation corridor during project construction, operations, and closure would affect the recreation setting and experiences for sport hunting, fishing, and other recreational activities in and surrounding the EIS analysis area by generating potential noise and visual impacts. Those lodges, guides, and clients that use the immediate area in the vicinity of the transportation corridor would experience an adverse effect on the quality of recreation

experience. This effect would be long-term and certain if the transportation system is permitted and built. Roadway truck traffic of up to 39 round trips per day would result in noise-related impacts to the recreation setting about 1 to 2 miles from the roadway (see Section 4.19, Noise, for more information). Magnitude of impacts would be medium due to the limited amount of truck traffic and number of recreationists impacted. The geographic extent of those impacts would be limited. Impacts on recreation opportunities and experiences in this area would be similar to those described above for the mine site but would last beyond the life of the project until the roads are decommissioned and reclaimed.

In addition to roadway traffic, operations would increase aviation traffic at both the Iliamna and Kokhanok airports as discussed in Section 4.12, Transportation and Navigation. Unless the size and/or power of project-related aircraft were substantially different than that of existing aviation traffic, the per-event sound levels associated with aircraft takeoff, landing, and taxiing would not change, and therefore would not be expected to cause an adverse noise effect beyond about 11 additional flights per week. Given the current level of aviation traffic at the Kokhanok airport, the increase in noise at the airport would primarily be due to the increase in aviation traffic from the project. Using a sleep disturbance criterion of 45 dBA  $L_{max}$ , the perpendicular distances within which a sleeping recreationist (not within a building) might be awakened is 6.5 miles and 4.5 miles for takeoff and approach, respectively. However, most flights would occur in the daytime. Based on the information above, the geographic extent of aircraft noise adversely affecting the recreation setting and experiences in the Kokhanok airport area by decreasing naturalness and may lead to displacement of recreation from a limited area of around 4.5 to 6.5 miles from the airport for the duration of the project. Based on the slight increase in aviation traffic at the Iliamna airport, noise-related impacts to the recreation setting and experiences surrounding the airport would generally be of low magnitude expected for the duration of the project.

The ferry terminals would result in long term, direct loss of recreational area during project construction, operations, and closure. This impact would be certain to occur if the ferry terminals were permitted and built and limited to the immediate areas around the ferry terminals. However, given the low use of these portions of the corridor for recreation and the availability of comparable areas for recreation, the loss of acreage for recreation would likely result in minimal displacement of recreational use to other lands in the general area with similar habitat and magnitude of impacts would be low.

Project-related construction, operations, and closure activities would result in noise impacts, geographically limited to 0.4 miles from ferry terminals for operations and up to 2 miles for closure activities, which would affect both on and off-water recreation uses surrounding the terminals for the life of the project.

Construction of the pipeline and ferry terminals and operation of the ferry would likely displace boaters from the area immediately surrounding the equipment, ferries, and facilities. Boaters would likely be displaced to other areas of the lake during project construction, operations, and closure to avoid the noise and hazards presented by the equipment and activities. Project-related noise and equipment would particularly affect non-motorized boating, which is generally a quieter activity that requires more time and effort to circumnavigate in-water obstructions. Magnitude of impacts would be medium to high for recreation at Iliamna Lake during construction but would be low during project operations since there would be just one ferry trip per day, which would not be expected to contribute considerably to boat traffic on the lake. The likelihood of the impact would be high if the ferry terminal is permitted and built. Although recreational lake boat traffic may slow down and avoid the ferry, alternative open water would be available for boating use during ferry operations. The ferry terminals would be visible from portions of the lake (within about 3 to 5 miles of the terminal) and would change the recreation setting within these limited areas of the lake to a more developed setting for the duration of the

project. However, recreationists could relocate to nearby lake areas and shorelines for a less developed setting. Impacts to night sky from ferry terminal lighting would have a larger geographic extent, affecting visibility of stars for up to 12 miles from the ferry terminals. Impacts to land-based recreation opportunities, experiences, and settings would be similar to those described above for recreation near the mine site.

During the winter after adequate ice has formed, there is heavy snowmachine use of the lake. Although most of this use is considered transportation use, there is some recreational snowmachine use of the lake. The operational winter ice-breaking ferry traffic may displace snowmachine use in and adjacent to the ferry route across the lake; however, the remainder of the lake would be available for snowmachine use. Therefore, magnitude of impacts would be high where ice-breaking would occur since it would eliminate the use of recreational snowmachine use but those impacts would occur over a limited geographic extent. Impacts would be long term, occurring every winter during the life of the project and would be certain to occur if the project is permitted and built. Recreationists may need to take longer routes to avoid open water from the ice-breaking ferry. For more information on snowmachine traffic impacts, see Section 4.12, Transportation and Navigation.

Iliamna Lake provides opportunities for wildlife viewing, although there are no known opportunities specific to the proposed ferry terminal locations, ferry route, or pipeline route. Fishing is the primary recreational use of the lake, and extensive opportunities for fishing are available given the lake's size. The project would likely displace wildlife and fish from the locations of the ferry terminals and ferry route during all phases, thus reducing the likelihood of viewing any wildlife or catching fish in and immediately adjacent to the EIS analysis area. Impacts would be of medium to high magnitude since the recreational experience could be reduced. These effects would be certain if the project is permitted and built and would be long term. Project noise would also alter the recreation setting of the terminal sites from quiet and remote to developed and active. Therefore, while all project phases would adversely affect wildlife viewing and fishing experiences and opportunities around the Iliamna Lake portions of the transportation corridor, other locations around the lake would be available for displaced wildlife viewing and fishing use.

As stated in Section 4.11, Aesthetics, the magnitude of the effect of mine traffic would be highest when viewed from higher elevations or superior viewer positions, where visual contrast is strongest. Therefore, the presence of the mine and port access roads, mine traffic, and night lighting may adversely affect the recreation setting within visible distances of the transportation corridor by decreasing the naturalness of the area and increasing visible human development of the area. This may adversely affect recreation experiences for people participating in wilderness or wilderness-type recreation opportunities. These impacts would be certain to occur if the mine is permitted and built and would begin during construction and would be long term, lasting through mine closure.

Project-related noise and activities would not affect recreational settings or activities in Lake Clark National Park and Preserve, which is located over 8 miles at the closest point from the transportation corridor (along the Iliamna spur road). As stated in Section 4.11, Aesthetics, the geographic extent of impacts from the transportation corridor would be limited since it would only be visible from high elevations in the southwestern corner of the park near Roadhouse Mountain. Due to the distance of the park unit from the transportation corridor, roadway, ferry, and aviation noise during all project phases it would not be expected to affect recreation settings or experiences for park users.

The road and vehicles associated with the transportation corridor may be intermittently visible from the far northern edges of the preserve at high elevations; however, visibility from this

distance would be limited. Similarly, transportation corridor on the McNeil River State Game Refuge would be visible in some portions of the refuge, at higher elevations. See Appendix K4.11 for complete viewshed figures and Section 4.11, Aesthetics, for more information on viewsheds and aesthetic impacts. These northern borders of the refuges are generally inaccessible; however, the construction, operations, and closure of the corridor could adversely affect the recreation experience for the few visitors using the northern border of both recreation areas from the change in recreation setting to a more developed and less remote and primitive area. Given the distance of the transportation corridor from these areas, intermittent visibility, and the low level of recreational use of the northern borders of both refuges, the magnitude of impacts to recreation experiences would be low and geographic extent of those impacts would be limited although they would be certain to occur and would last through mine operations and closure.

Activities in the transportation corridor would be visible and potentially audible to visitors flying over the corridor. The presence of roads, ferry terminals, and ferries in an otherwise generally primitive area would adversely affect the recreation experience post-closure of the mine for visitors flying over the corridor because the recreational setting would change from remote and primitive to more developed and seemingly accessible. However; because of the narrow road corridor and the small size of land displaced by the ferry terminals (27 acres), the geographic extent of impacts would be limited. The magnitude of impacts would be of medium magnitude, taking into account changes to recreation setting, number of recreators affected, and the limited extent those impacts would be realized. The impact would be permanent (lasting post closure) and would be certain if the transportation corridor is built.

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.

As stated in Section 4.3, Needs and Welfare of the People—Socioeconomics, limited access to the roadways and ferry terminal would be available to local residents and businesses only. Therefore, the transportation corridor facilities would induce a small amount of recreation and expose some previously inaccessible areas to public access and use from a few residents near the mine and port access roads (PLP 2018-RFI 027).

Alternative 1 would result in increased air transportation associated with project construction and operation. There would be 20 to 40 flights per month (average of 5 to 10 flights per week) to Amakdedori port before the Kokhanok airstrip could be accessed by road. Once the Kokhanok spur road is established, there would be up to 10 flights per month by Twin Otters to Kokhanok. Temporary impacts to recreational activities due to elevated noise would be of high magnitude and intermittent and could affect recreation opportunities at Lake Clark or Katmai National Park and Preserve, McNeil River State Game Refuge, Alaska Maritime National Wildlife Refuge, or commercial lodges. During operations, project flights would include those transporting employees on 2-week rotations as well as cargo flights. These operational increases in air traffic have the potential to be observed by visitors to Lake Clark National Park and Preserve, where small aircraft are the primary transportation for park visitors. The potential would be reduced, however, because flights from Anchorage to Bristol Bay generally fly over Iliamna Lake or the project area (FAA 2018) (see Section 3.12, Transportation and Navigation), rather than the

preserve. Additionally, the Pebble-related air traffic would not conflict with small planes which fly at lower altitudes and use narrow passes such as Lake Clark Pass. Helicopter traffic would remain throughout operations to perform ongoing environmental monitoring (variable of frequency and season) and aerial inspections of the transportation corridor (weekly or monthly) (PLP 2018-RFI 027b). These effects would be long term, occurring throughout the life of the project, and would be definite, if the project is permitted and constructed. Operational impacts would be of high magnitude and intermittent, and could affect recreational opportunities at Lake Clark or Katmai National Park and Preserve, McNeil River State Game Refuge, Alaska Maritime National Wildlife Refuge, or commercial lodges.

#### **4.5.2.3 Amakdedori Port**

The construction and operation of Amakdedori port would directly impact an area 30 acres in size, including 11 acres of wetlands and other waters. These acres would be permanently removed from use for recreation opportunities. The impact would be certain to occur if the project and port are permitted and built.

Boat traffic to and from the port would be up to 27 concentrate vessels and 33 supply barges per year during operations. Concentrate vessels would be moored for four to five days at the lightering locations. There would be a larger number of boats used during construction with fewer used during operations. These impacts would be long term and certain to occur if the port is built. However, Cook Inlet is large with expansive shorelines and waters available nearby for any boaters displaced from construction or operation of the port or lightering sites. Therefore, construction, operations, and closure activities at Amakdedori port (including lightering) would result in low magnitude adverse impacts on recreational boat traffic, and thus on boating experiences and opportunities around the port site, lightering locations, and in Cook Inlet. The visual presence of the port would affect the recreational setting for boaters within visual distance of the port for the duration of the project and may adversely affect the recreational experience for boaters preferring a more natural/less developed setting. The geographic extent of these impacts would be limited to a small portion of Cook Inlet.

Construction, operations, and closure of the project may affect wildlife viewing, hunting, and fishing opportunities at the port site, to the extent that they occur. Noise and activities would displace wildlife and fish from the immediate area, thus adversely affecting wildlife viewing, hunting, and fishing opportunities and experiences. Recreationists would be less likely to see wildlife or catch fish for the duration of the project. 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 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.

#### **4.5.2.4 Natural Gas Pipeline Corridor**

Potential impacts on recreation have been described above for the transportation corridor where it shares a footprint with the natural gas pipeline. Existing recreational use along the pipeline alignment in Cook Inlet and on the Kenai Peninsula consists of boating in the inlet; beach combing, clamming, fishing, and hunting in and around the area where the compressor station is located; and recreational use at the state park sites on the Kenai Peninsula. Boating in Cook Inlet is both an activity in itself and a means of accessing other recreation opportunities such as fishing, wildlife viewing, birdwatching, and beach combing.

Visible and audible effects from equipment present in Cook Inlet during project construction and closure would occur over a limited geographic extent to recreational boaters (motorized and non-motorized) within about 2 to 3 miles of the activities and would be short term, lasting only during construction and closure activities. These impacts would temporarily displace any boating and fishing use from the area immediately surrounding the equipment and construction activity; however, alternate open water would be available for use by displaced boaters or anglers. This temporary displacement would cease upon completion of construction and closure

activities, and the types of vessels and construction activities used for the project would be typical of the types of activities already occurring in the Cook Inlet. Impacts would be medium magnitude, since it would completely displace some recreational activities, but the activities could occur in other locations nearby. The impacts would be certain to occur if the pipeline is permitted for construction.

Noise and activities during project construction and closure may temporarily adversely affect recreation experiences for visitors to the Stariski State Recreation Site, which is located approximately 1.5 miles north of the proposed compressor station. Visitors participating in camping and picnicking may be temporarily adversely affected by the change in the recreation setting caused by the noise and project activities, thus adversely affecting their recreation experiences. Some visitors may be temporarily displaced from the site to other state parks or locally managed recreation sites along the Kenai. The campground at the state recreation site would be located at a distance such that temporary noise-related impacts to sleeping at the campground would not be expected. The compressor station would not be seen from Anchor Point State Recreation Area or Stariski Campground. Overall, the magnitude of impacts would be low and limited in their geographic extent. These temporary effects would be certain to occur during construction and closure if the pipeline and compressor station is permitted and built.

The recreation facilities including the boat launch and boat use at the Anchor River State Recreation Area are over 5 miles from the compressor station and pipeline; no visual impacts or noise impacts to Anchor River State Recreation area are expected.

Recreation activities also occur in the general area surrounding the gas pipeline and compressor station outside of the two state park units, including beach combing, clamming, fishing, and hunting. Project construction and closure noise and activities would temporarily displace wildlife, clams, and fish from the area. In addition, recreationists would be discouraged from hunting and fishing where disturbance and noise from construction is occurring. Project construction may temporarily close a portion of the beach for recreation activities; but this impact would be short term, occurring only during the construction phase. Noise and activities from general project construction and closure would also temporarily adversely affect the recreation setting for beach recreation within the visual and auditory distance of the construction activities and thus may temporarily adversely affect recreational experiences for people in the area surrounding the compressor station and gas pipeline. Long-term impacts from the visual presence of the compressor station on the recreational setting and experiences would be low magnitude because it would introduce weak visual contrast against the existing landscape. The likelihood of these impacts would be certain if the pipeline and compressor station are permitted and built.

The pipeline would be located south of Augustine Island in Cook Inlet. Although no recreation occurs on the island itself, some sightseeing of the island's volcano and wildlife occurs from the water. Therefore, equipment and noise associated with construction and closure would temporarily adversely affect sightseeing opportunities and experiences along the south side of the island. These impacts would be low magnitude because of low number of recreationists affected and because displaced boats would be able to view the island from other locations around the island that would not be affected by project equipment and noise. Noise impacts would be limited to approximately 2 to 3 miles from construction activity, with the exception of helicopter support which would have further reaching effects.

The pipeline would not be visible above ground and would not remove any acreage from use for recreation opportunities. Recreation experiences for on-water or state park unit visitors during pipeline operations because of the presence of boat traffic during pipeline maintenance. These impacts would extend along the pipeline right-of-way (ROW). Their likelihood to affect recreation

activities would depend on timing of the maintenance activity. Though there would be anchoring restrictions along the pipeline, recreation use could continue and the area around the pipeline in the Cook Inlet, except for the width of the pipeline itself, would be available for anchoring.

#### **4.5.2.5 Alternative 1 – Kokhanok East Ferry Terminal Variant**

The magnitude of impacts from the Kokhanok East Ferry Terminal Variant would be similar to those described above for Alternative 1. The geographic extent of impacts would be a direct loss of area available for recreation activities of 9,395 acres including 3,504 acres of wetlands and other waters. This includes all project components. The loss would be long term, and would be certain to occur if this Alternative 1 ferry terminal variant is chosen, permitted and built.

#### **4.5.2.6 Alternative 1 – Summer-Only Ferry Operations Variant**

The Summer-Only Ferry Operations Variant would avoid impacts to snowmachine use of the lake. See Section 4.12, Transportation and Navigation, for impacts to non-recreational lake traffic. The magnitude of impacts during summer months would be higher than Alternative 1 due to daily truck traffic between the mine site and the port that would double to 78 round-trips per day on either side of the ferry route, or approximately 5.5 trucks per hour crossing in each direction (PLP2018-RFI 065). In addition, a summer-only ferry operation would require two daily ferry trips. The geographic extent of impacts would be the direct loss of area available for recreation activities would be 9,343 acres including 3,458 acres of wetlands and other waters. This includes all project components. These impacts would be long term, lasting for the life of the project and would be realized if the Summer-Only Ferry Operations Variant is chosen and implemented.

#### **4.5.2.7 Alternative 1 – Pile-Supported Dock Variant**

The magnitude of impacts from the Pile-Supported Dock Variant would be similar impacts to those described above.

### **4.5.3 Alternative 2 – North Road and Ferry with Downstream Dams**

#### **4.5.3.1 Mine Site**

The project construction, operations, and closure at the mine site would be the physical removal of 8,241 acres of land currently available for recreation. This would include the loss of 3,518 acres of wetlands and other waters. Magnitude of impacts on recreation from the mine site would be the same as discussed under Alternative 1 and geographic extent would be slightly larger. These impacts would be long term and would be certain to occur if the Alternative 2 is chosen as the preferred alternative and is permitted and built.

#### **4.5.3.2 Transportation Corridor**

This alternative would result in the direct loss of 1,162 acres of area available for recreation activities, including 101 acres of wetlands and other waters. Visitors would likely be displaced to other lands in the general area with similar habitat. These impacts would be long term and would occur if Alternative 2 is chosen as the preferred alternative and the transportation system associated with this alternative is permitted and built.

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.

The north access road would be visible from Roadhouse Mountain, where there is some known recreational use. Therefore, the project would alter the setting for recreationists on Roadhouse Mountain by decreasing the naturalness of the area and increasing visible human development of the area. This may adversely affect recreation experiences for people participating in wilderness or wilderness-type recreation opportunities at Roadhouse Mountain. These impacts though low magnitude, would occur through all phases of the project and would last beyond project closure. Impacts would be certain to occur if Alternative 2 is chosen as the preferred alternative and is permitted and implemented.

Impacts to visitors flying over the corridor would be the same as those described under the transportation corridor for Alternative 1, with fly-in visitors to the lodges in the Pedro Bay area in particular being affected by the change in recreation setting with the additional road, ferry terminal, and gas pipeline development.

Northern Iliamna Lake and the surrounding area provide opportunities for wildlife viewing. There are no known opportunities specific to the proposed ferry terminal locations, ferry route, or road corridor. 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.

Impacts to fishing under Alternative 2 would be the same as those described under Alternative 1; however, there are more guided fishing operations that could be impacted by Alternative 2.

Impacts to boating and snowmachine use on Iliamna Lake would be the same as those discussed under Alternative 1. See Section 4.12, Transportation and Navigation, for impacts to non-recreational lake traffic.

Similar to the mine site, project-related noise and activities along the Alternative 2 transportation corridor would not have substantial direct effects on recreational settings or activities in Lake Clark National Park and Preserve, which is 3 miles or further from the corridor. Project-related construction, operations, and closure activities under Alternative 2 would result in similar noise impacts to those described for the Alternative 1 transportation corridor. Roadway traffic would generally result in noise-related impacts to the recreation setting geographically limited to about 1 to 2 miles from the roadway and project-related activities would generally result in noise impacts limited to 0.4 and 2 miles of the ferry terminals, for operations and closure activities, respectively. Given the distance of the Lake Clark park unit, noise impacts to recreation settings or activities would not be expected within the park unit.

As noted in Section 4.11, Aesthetics, the magnitude of effect of the transportation corridor, including the roads and the ferry terminals, would be highest from higher elevation or superior viewer positions located in the west end of the Lake Clark park unit. Visitors to these few locations of the park would be able to see the transportation corridor, which would adversely affect recreation experiences, particularly wilderness experiences, due to the increased sight of human-made development. Refer to Appendix K4.11 for project viewshed models. These impacts would occur through all phases of the project and would last beyond project closure. They would be certain to occur if Alternative 2 is permitted and built.

The transportation corridor facilities would not expose previously inaccessible areas to public access and use for some area residents as roads would either be for private use only, used by some residents in coordination with PLP, or would be located near an existing roadway. The improved Pile Bay to Williamsport road would be located in the vicinity of the current

Williamsport-Pile Bay Road and thus would not create access to a previously inaccessible area. The mine access road and the new portions of the port access road would have controlled access with scheduled public or shipping use. This would enhance the economic and logistic appeal of shipping supplies to villages so that recreational equipment (such as an ATV or a kayak) may be more readily available and/or less expensive to obtain. Thus, the road may increase recreation use on or around Iliamna Lake. Use of the transportation corridor and Pile Bay ferry terminal site may impact the annual transport of boats from Homer to Bristol Bay, which is further described in Section 4.12, Transportation and Navigation.

Construction of the natural gas pipeline along the port access and mine access roads would result in similar impacts to those described below for Alternative 3 transportation corridor.

Frequency and impacts of flights to and from Iliamna would be the same as Alternative 1. Construction cargo and passenger flight frequencies to the airstrip in Pile Bay would be similar to flight frequencies to Kokhanok in Alternative 1. Impacts to Pedro Bay and Pile Bay would be similar to those discussed for Kokhanok in Alternative 1, including the use of the airport at Pedro Bay during construction. PLP would not construct a new airstrip at Diamond Point, but would improve the existing airstrip near Pile Bay for limited use during construction.

#### **4.5.3.3 Diamond Point Port**

The construction of the Diamond Point port would be the direct loss of 112 acres of area that is currently available for recreation, including 14 acres of wetlands and other waters. However, there are already some industrial activities occurring in the area; some authorized fill has already been placed for the Diamond Point Quarry project. Therefore, the magnitude and extent of recreational impacts in Cook Inlet would be less under Alternative 2 than Alternative 1. The loss of recreational area would be permanent and would be certain to occur if the Diamond Point port is permitted and built.

Construction, operations, and closure noise and activities would displace wildlife and fish from the Diamond Point port area, thus adversely affecting wildlife viewing, hunting, and fishing opportunities and experiences by reducing the likelihood of seeing wildlife or catching fish. Project-related noise and activities during construction, operations, and closure at Diamond Point port would add to current adverse effects to recreational experiences of visitors in the port area due to existing activity at the quarry site and may lead to additional displacement of visitors from increased noise and visual disturbance in the area and reduced opportunities for wildlife viewing, hunting, and fishing. Geographic extent of effects would be limited to a relatively small portion of Cook Inlet. There are nearby alternate locations where such recreational activities could occur, so impacts would be low magnitude but would be long term, lasting for the life of the project and would occur if the Diamond Point port is permitted and built.

Impacts to boating from the Diamond Point port would be similar to those described under Alternative 1 for the Amakdedori port, except during the period of time when commercial fishing boats are transported from Williamsport to Pile Bay. During this transport, boats can get backed up in Iliamna Bay and project-related boat traffic, particularly during construction when more boats may be accessing the port site or during lightering activities, would have a more noticeable effect on boat traffic during this time. However, Iliamna Bay is large and would provide enough space for all boat traffic.

The Alaska Maritime National Wildlife Refuge is the only designated recreation area where the port site, including construction, operations, and closure activities, would be visible. The recreational setting in affected areas of the refuge would change from a natural, undeveloped setting with mostly fishing boat traffic, to a setting with visible developed facilities and larger vessel traffic. Therefore, project construction, operations, and closure may adversely affect

recreation experiences for refuge visitors who desire a more natural (less human-made development) view for recreation activities such as wildlife viewing and nature photography. However; since the Alaska Maritime National Wildlife Refuge would be approximately 13 miles from the port, magnitude of impacts would be low and geographic extent limited to portions of the refuge with views toward the port. These effects would be long term and would be realized if the Diamond Point port is permitted and built.

#### **4.5.3.4 Natural Gas Pipeline**

Impacts on recreation from construction of the natural gas pipeline through Cook Inlet (except near Ursus Cove) would be the same as discussed under Alternative 1, except that the pipeline would pass north of Augustine Island.

Under Alternative 2, the natural gas pipeline would come into Ursus Cove and then cross land north to reach Cottonwood Bay and the Diamond Point port site. Ursus Cove is a known bear hunting location (H&H Alaskan Outfitters 2018) and both Ursus Cove and Cottonwood Bay are known commercial fishing locations (ADNR 2001) and are used for recreational fishing as well. Both Ursus Cove and Cottonwood Bay may also be used for other hunting activities and wildlife viewing.

Project-related noise from construction of the natural gas pipeline would occur during construction of the transportation corridor and may result in temporary impacts to recreation settings and experiences. These impacts would be short term, lasting only through construction of the transportation corridor. The loudest anticipated noise would be general activities and utility equipment with helicopter support. The noise level from this activity would exceed 30 dBA, which could cause sleep disturbance for recreationists up to 3.7 miles from the roadway. Therefore, recreation users within this area, including Lake Clark park unit users within the Roadhouse Mountain and Tazimina River areas, could be temporarily affected by noise from construction of the pipeline and roads. Temporary impacts to recreation from the increased noise level would include low magnitude adverse effects on the recreation setting and recreation experiences, particularly wilderness experiences due to increased human-made sounds. These impacts would be certain to occur if Alternative 2 is chosen as the preferred alternative and the gas pipeline is permitted and built.

The magnitude and extent of noise and activities related to construction of the natural gas pipeline and roads would be sufficient to temporarily displace wildlife and fish from the area surrounding the construction area, thus reducing the likelihood of viewing or hunting any wildlife or catching fish in and immediately adjacent to the EIS analysis area. These temporary construction impacts would occur along the rivers and areas in the northern Iliamna Lake area crossed by the pipeline, as well as the Diamond Point port site, Cottonwood Bay, and Ursus Cove. The impacts would occur if Alternative 2 is chosen as the preferred alternative and the pipeline is built and permitted. Hunters, anglers, or guides who currently use these areas would likely stop using these areas and would be displaced to other areas during construction activities.

As discussed in Section 4.12, Transportation and Navigation, during operations, the pipeline ROW between the two ferry terminals may create a route for ATV or snowmachine traffic. The most likely users of this new route along the ROW would be the residents in the communities of Pedro Bay, Nondalton, Iliamna, and Newhalen. Therefore, low magnitude impacts would result from an increase in recreation use along the ROW, in particular to gain access to hunting and fishing areas along the ROW, which previously would have been more difficult to access. If recreation use were to increase along the ROW via motorized vehicles, this may adversely affect recreation experiences for current visitors to the pipeline ROW area desiring solitude and

other wilderness-type experiences. These impacts to recreation use and recreation experiences would be long term and continue beyond project closure. They would occur if Alternative 2 is implemented and the gas pipeline is permitted and built. Impacts to visitors flying over the pipeline would be the same as those described under the transportation corridor for this alternative.

The magnitude of impacts would be highest from the cleared pipeline ROW between the junction with the Eagle Bay ferry terminal access road and the east ferry terminal access road, which would contrast with the existing natural landscape as described in Section 4.11, Aesthetics. This would adversely affect recreation experiences for visitors that could see this contrast due to a decrease in naturalness, particularly from nearby higher elevations were a larger portion of the entire cleared ROW would be visible. These impacts to the recreation setting and recreation experiences would be long term, extending beyond project closure. They would be realized if Alternative 2 is chosen as the preferred alternative, and the project is permitted and built.

Similar to the pipeline under Alternative 1, the pipeline in Alternative 2 would not remove any acreage from use for recreational opportunities. Impacts to boaters would be similar to those described for Alternative 1.

#### **4.5.3.5 Alternative 2 – Summer-Only Ferry Operations Variant**

The Summer-Only Ferry Operations Variant would avoid the winter impacts to snowmachine use of the lake. See Section 4.12, Transportation and Navigation, for impacts to non-recreational lake traffic. The magnitude of impacts of this variant would be higher in summer due to doubling the daily truck traffic between the mine site and the port to 78 round-trips per day on either side of the ferry route, or approximately 5.5 trucks per hour crossing in each direction (PLP 2018-RFI 065). In addition, a summer-only ferry operation would require two daily ferry trips. The extent of impacts to recreation would be the direct loss of 10,408 acres and 3,525 acres of wetlands and other waters that would otherwise be available to recreationists. This includes all project components. These impacts would be long term, lasting through the life of the project and would be realized if Alternative 2, Summer-Only Ferry Operations Variant was chosen, permitted and built.

#### **4.5.3.6 Alternative 2 – Pile-Supported Dock Variant**

The magnitude of impacts from the Pile-Supported Dock Variant would be similar to those described above.

#### **4.5.4 Alternative 3 – North Road Only**

This alternative would result in the direct loss of 10,047 acres of area available for recreation activities, including 3,588 acres of wetlands and other waters. This includes the mine site, transportation corridor, port, and natural gas pipeline components. The impact would be long term, lasting through the life of the project and would be certain to occur if Alternative 3 was chosen as the preferred alternative and the project was permitted and built.

Under Alternative 3, the magnitude, extent, and duration of impacts on recreation would be the same as discussed under Alternative 2 for the mine site, Diamond Point port, and portions of the north access road that overlap with the transportation corridor of Alternative 2. Impacts from construction of the natural gas pipeline would be the same as Alternative 2; however, operational impacts from potential ATV or snowmachine use of the ROW would not occur as the pipeline would be in the ROW of the north access road, which would be a private use road. Therefore, public use of the road would be limited as would the magnitude of impacts. Impacts

to the recreation setting and recreation experiences from the road would be similar to those described in Alternative 2 for the natural gas pipeline.

Impacts from the north access road on recreation settings, opportunities, and experiences from project-related noise and activities would be similar to those described above for the mine site under Alternative 1 and under Alternative 2 for the natural gas pipeline. Impacted visitors would likely be displaced to other lands in the general area with similar habitat. Impacts to visitors flying over the corridor would be the same as those described under the transportation corridor for Alternative 2. Impacts to recreational settings, experiences, and activities in Lake Clark National Park and Preserve would be the same as those described for Alternative 2.

The project may also affect incidental wildlife viewing along the transportation corridor; although most recreational use in the corridor is from other activities, such as fishing. 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.

There are fishing opportunities on the rivers and streams that cross the Alternative 3 transportation corridor, particularly along the Newhalen and Iliamna rivers due to the quality of the fishing on these rivers and the presence of lodges in the Pedro Bay area. Construction noise and activities would displace fish at river/stream crossings, which would particularly affect fishing at the road crossings on the Newhalen and Iliamna rivers. Project noise would also change the recreation setting of the north access road corridor from quiet and remote to developed and active. Therefore, all project phases would adversely affect fishing experiences and opportunities along the transportation corridor. These impacts would be long term and would occur if Alternative 3 is permitted and built. Impacts would be medium magnitude since other portions of the streams crossed by the transportation corridor would be available for anglers that prefer a remote experience away from the roadway. See Section 4.6, Commercial and Recreational Fishing, for more information on impacts to fishing, and Section 4.12, Transportation and Navigation, for information on how structures would impact boat traffic.

The transportation corridor facilities would not expose previously inaccessible areas to public access and use as roads would either be for private use only, used by some area residents in coordination with PLP, or would be located near an existing roadway. Impacts to recreation from the Williamsport-Pile Bay Road would be the same as described under Alternative 2.

Impacts to boat portaging on the Williamsport-Pile Bay Road would be similar to those described for Alternative 2, and are further described in Section 4.12, Transportation and Navigation.

Frequency of flights, and associated magnitude of effects, to and from Iliamna would be the same as Alternative 1. Flight frequencies to Pedro Bay and associated magnitude of effects, would be similar to Alternative 2, but the connecting of Pedro Bay by road to the Cook Inlet would affect frequency of flights after construction, if the road leads to more traffic through Pedro Bay. Potential effects on Kokhanok would be limited to resident crew change flights.

#### **4.5.4.1 Alternative 3 – Concentrate Pipeline Variant**

The Concentrate Pipeline Variant would result in impacts of similar magnitude to those described above for Alternative 3.



### 4.5.5 Summary of Key Issues

See Table 4.5-1 for a summary of key issues.

**Table 4.5-1: Summary of Key Issues for Recreation**

Category	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
Permanent loss of area available for recreation (all components)	Loss of 9,317 acres Kokhanok East Ferry Variant: 9,395 acres Summer-Only Ferry Operations Variant: 9,343 acres Pile-Supported Dock Variant: 9,265 acres	Loss of 10,341 acres Summer-Only Ferry Operations Variant: 10,408 acres Pile-Supported Dock Variant: 10,330 acres	Loss of 10,047 acres Concentrate Pipeline Variant: 10,048 acres
Recreation experience	Project-related noise and activities, lasting from construction through operations and closure may adversely affect recreation experiences for recreationists by changing the recreation setting and displacing wildlife and fish throughout the EIS analysis area. Adverse effects on recreational experiences for visitors within visual and auditory distance may displace visitors that prefer a quiet, undisturbed recreation setting. These impacts would last throughout the life of the project.	Same as Alternative 1, but would particularly affect visitors to lodges in the Pedro Bay area. Recreation experiences for visitors to Lake Clark park unit impacted due to the increased sight of manmade development from roadway and at ferry terminals and construction noise of pipeline.	Same as Alternative 2
Recreation setting	Recreationists flying over project components would be adversely impacted, as the project would be visible from planes. The recreational setting from Iliamna Lake would be impacted by ferry terminals. Vessel traffic may intermittently affect the recreation setting of McNeil River Camp. The port may be visible from small portions of northern borders of Katmai National Park and McNeil River Game Refuge and from National Wildlife Refuge islands.	Impacts would be similar to Alternative 1, except it would not affect the McNeil River State Game Refuge or Katmai National Park, but may affect views from portions of the Alaska Maritime National Wildlife Refuge and change the recreational setting for visitors to Roadhouse Mountain.	Same as Alternative 2 except there would be no ferry terminals.

**Table 4.5-1: Summary of Key Issues for Recreation**

Category	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	These impacts would last throughout the life of the project.		
Recreation activities	There would be adverse effects on wildlife viewing, hunting, and fishing opportunities and experiences by displacing wildlife and fish. Boating and snowmachine use on Iliamna Lake could be displaced or altered. These impacts would last throughout the life of the project.	Same as Alternative 1 except that more guided fishing opportunities would be impacted. There would also be adverse effects to activities in Ursus Cove and Cottonwood Bay during construction.	Same as Alternative 2 except with additional adverse effects on fishing opportunities and experiences at road river/stream crossings, particularly at Newhalen and Iliamna rivers. There would be no adverse effect to recreation on Iliamna Lake.
Recreation Use	Potential for slight increase in recreation use due to increase in full-time resident population. These impacts would last throughout the life of the project.	Same as Alternative 1 and potential for additional recreation use due to recreation equipment more readily available and/or less expensive. Also potential for increased recreation use along pipeline ROW, though motorized use here may affect recreation experiences for wilderness-type recreation activities.	Same as Alternative 1. No additional use or opportunities associated with pipeline ROW due to presence of private road.

#### 4.5.6 Cumulative Effects

The cumulative effects analysis area for recreation is the same as the EIS analysis area: from Lake Clark National Park and Preserve south to Katmai National Park and Preserve, and from the Nushagak River east to the western Kenai Peninsula. Potential cumulative impacts to recreation include reduction of recreational opportunities and changes in recreational setting and recreation experiences.

Past, present, and reasonably foreseeable future actions (RFFAs) in the cumulative impact analysis area have the potential to contribute cumulatively to impacts on recreation. Section 4.1, Introduction to Environmental Consequences, details the past, present, and RFFAs considered for evaluation. Of the RFFAs detailed in Section 4.1, Introduction to Environmental Consequences, all types are considered to have the potential for cumulatively impacting recreation in the analysis area because they would all introduce people and/or structures into the environment that could impact the recreation setting. Some listed RFFAs that were removed from further consideration include those outside the analysis area (e.g., Donlin Gold) or those with temporary impacts, such as during construction or with only one field season (e.g., Drift River).

The RFFAs identified in Section 4.1, Introduction to Environmental Consequences, that could contribute cumulatively to recreation impacts and are carried forward in this analysis include

mining claims; oil and gas development within Cook Inlet; road improvement projects; and continuance of recreation activities in the greater regional area, as summarized below:

- Pebble Project buildout- develop 55 percent of the resource over 78 year period
- Pebble South/PEB
- Big Chunk South\*
- Big Chunk North\*
- Fog Lake\*
- Groundhog\*
- Johnson Tract\*
- Diamond Point Rock Quarry
- Alaska Stand Alone Pipeline Project
- Alaska LNG
- Cook Inlet Oil and Gas Lease Sales
- Hydrocarbon Exploration Licensing and Leasing\*
- Lake and Peninsula Transportation, Infrastructure and Energy Projects
- National Parks and Preserves, Wildlife Refuges, State of Alaska Special Management Areas, Alaska Native Corporation Lands

*\*Indicates exploration activities only.*

#### **4.5.6.1 Past and Present Actions**

Past and present actions that have, or are currently, affecting recreation in the analysis area are minimal. Current development consists of a small number of towns, villages, and roads. Present activities include mining exploration and non-mining related projects, such as transportation, oil and gas development, or community development actions. These actions have resulted in displacement of recreation activities and adversely affected the recreation setting. While these actions have affected localized areas, they are also additive to other actions, increasing the total areas affected and compounding impacts to the recreation setting, opportunities, and experiences. Around the mine site, past and current exploration drilling at the Pebble deposit has disturbed some wildlife that attracts hunters and anglers, and has displaced some recreationists.

Recreation and subsistence activities are currently the most prevalent uses of the land in the region, including several lodges and opportunities for guided recreation activities. Participation in recreation and subsistence activities may be increasing slightly, which increases the number of people in the area and can detract from the recreation experiences of people looking for opportunities for solitude and wilderness-type experiences.

#### **4.5.6.2 Reasonably Foreseeable Future Actions**

##### **No Action Alternative**

The No Action Alternative would not contribute to cumulative effects on recreation.

##### **Alternative 1 – Applicant’s Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – An expanded development scenario for this project would include additional years of mining and processing and involve a larger mine site and transportation system footprint. The Pebble mine expanded development scenario project footprint would result in approximately 34,790 acres that would be unavailable for recreation. In addition to removing the footprint acreage from potential recreation use, the expanded mine would also displace wildlife over a larger area than Alternative 1 and thus opportunities for hunting, fishing, and wildlife viewing would be reduced. Recreation opportunities in the footprint

and wildlife-related recreation opportunities surrounding the mine site area would be displaced to other lands in the region. Therefore, the expanded mine scenario would contribute to cumulative impacts on recreation opportunities. Potential cumulative effects on recreation associated with the expanded Pebble project would be longer in duration (78 total years of mining with another 20 to 40 years of processing) than Alternative 1.

Mineral exploration activities associated with other deposits and expansion of the Pebble mine would increase the developed/modified area of the region, which would affect the recreation setting and thus recreation experiences for visitors within viewing distance of the mine site by reducing the naturalness of the area. There would also be additive effects to recreation experiences for visitors flying over the region, as the landscape as a whole is more visible from a higher elevation, and the mine site would be more noticeable as it expanded. Due to the substantial increase in development at the mine site, there would also be decreased opportunities for solitude in the area and increased recreation experience degradation for visitors participating in wilderness or wilderness-type activities or visitors seeking wilderness experiences.

Mine expansion would place waste rock storage and water management into the headwaters of the UTC watershed, and the expansion of the open pit and bulk tailings facility would increase the amount of disturbance in the North Fork Kaktuli (NFK) and South Fork Kaktuli (SFK) rivers. The potential effects of mine site expansion would affect fish habitat, distribution, and population levels. However, even under routine operations, there could be project generated noise and perceived impacts on the quality of the sport fishing experience in the upper portions of those drainages.

Since the Amakdedori port facility and applicant's proposed transportation corridor (including ferry) would continue to be used through the life of mine expansion, impacts to recreation in those areas would continue, although with reduced levels of truck traffic after 20 years. The construction and operation of additional facilities in Iniskin Bay, along with concentrate and diesel pipelines and an access road to Diamond Point, would further reduce recreational opportunities, displace recreation opportunities to other areas and waters, and reduce the naturalness of the area thus impacting the recreation setting and recreation experiences for those visitors desiring or requiring a natural setting. A new road from Pile Bay to the mine site would result in impacts similar to those described for Alternatives 2 and 3, and would cumulatively affect recreation opportunities and experiences in the region, as well as adversely affect the overall recreation setting of the area by increasing development.

**Other Mineral Exploration Projects** – Mineral exploration is likely to continue in the analysis area for the mining projects listed above, and involve summer drilling and helicopter and camp support. Mineral exploration activities could contribute cumulatively to degradation of recreation experiences, particularly wilderness experiences, through noise in the immediate vicinity of drilling and the presence of aircraft, and increase in landscape disturbance. Exploration activities would also reduce acreage available for recreation and displace wildlife, thereby reducing opportunities for hunting, fishing, and wildlife viewing in remote areas during the summer season. There would be additive effects to recreation experiences for visitors flying over the region as there would be even more development noticeable in this remote area.

The Diamond Point Rock Quarry could adversely contribute to cumulative impacts to recreational opportunities and experiences, boat traffic, and changes to the recreation setting in Iliamna Bay.

**Oil and Gas Exploration and Development** – Oil and gas projects in Cook Inlet could contribute cumulatively to temporary adverse impacts to boating, fishing, and boat traffic in the inlet if construction periods overlapped. Note that there would not be development of both the

Alaska Liquefied Natural Gas (LNG) project and the Alaska Stand Alone Pipeline Project; only one of these two projects would be carried forward.

**Road Improvement and Community Development Projects** – Anticipated road improvement projects in the region, such as the Williamsport-Pile Bay Road upgrade, could create new access to recreation areas and/or improve current access, thereby increasing opportunities for recreation and reducing opportunities for solitude and adversely affecting wilderness experiences. The most likely road improvements are within the development footprint of existing communities and would not affect recreation. Development in the vicinity of Stariski Creek could reduce the effect of the natural gas compressor station on the recreation setting by increasing development and thus decreasing the noticeability of the station. However, this development would also reduce the naturalness of the area, thus cumulatively affecting the recreation setting.

Additional RFFAs that have the potential to affect recreation in the region include commercial fishing, subsistence activities, and tourism and recreation activities. Depending on final design and permitting, these projects could impact the recreational setting and increase the number of people in certain areas, thus decreasing opportunities for solitude and adversely affecting wilderness experiences.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same as Alternative 1 although there would not be concurrent operations activities and traffic associated with Amakdedori port and the southern transportation corridor. Under Alternative 2, there would be a road constructed between the ferry terminals, resulting in impacts to recreation opportunities, experiences, and the recreation setting described above. Impacts from the Diamond Point port would also continue, and development in Iniskin Bay would result in impacts to recreation described in this section under Alternative 1, but would cumulatively contribute to impacts to recreation as described under Alternative 2 and there would be existing impacts at the port site and in Iniskin Bay. The addition of a service road to both Iniskin Bay and between the ferry terminals would increase adverse impacts to recreation opportunities, experiences, and the recreational setting, although it is likely that the north ferry would cease operations once the access road was constructed. The use of the concentrate pipeline would reduce truck traffic associated with transporting copper/gold concentrate to Diamond Point.

**Other Mineral Exploration Projects, Oil and Gas Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

### **Alternative 3 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same as described under Alternative 1. Under Alternative 3, additional project facilities would have the same impacts to recreation as discussed under Alternative 2 above, with the exception that there would be no ferry operations associated with Alternative 3.

**Other Mineral Exploration Projects, Oil and Gas Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

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## 4.6 COMMERCIAL AND RECREATIONAL FISHERIES

This section addresses the direct and indirect effects of the No Action Alternative and action alternatives on commercial and recreational fishing. As noted in Section 3.6, Commercial and Recreational Fisheries, the Alaska Department of Fish and Game (ADF&G) Commercial Salmon Fishery Area T and Area H, ADF&G Commercial Shellfish Area H, the Cook Inlet Management Area (groundfish), and ADF&G Statewide Harvest Survey (SWHS) areas S, T, N, and P comprise the Environmental Impact Statement (EIS) analysis area for this resource.

Potential impacts include:

- Short- or long-term direct and indirect changes in salmon populations, or harvestability of returning salmon, which reduce the number of returning adult spawners available for harvest by commercial permit holders and thus reducing:
  - wholesale fisheries value, payments to permit holders and crew, and expenditures into local economies;
  - delivery of fish to processors, revenue generated by processed fish, and employment of and payments to processing labor;
  - generation of tax revenue to state and local governments through sales tax, real property tax, and raw fish tax; and
  - directed recreational fishing effort.
- Short- or long-term direct and indirect changes in groundfish or shellfish populations in Cook Inlet thus reducing:
  - wholesale fisheries value, payments to permit holders and crew, and expenditures into local economies;
  - delivery of fish to processors, revenue generated by processed fish, and employment of and payments to processing labor;
  - generation of tax revenue to state and local governments through sales tax, real property tax, and raw fish tax; and
  - directed recreational fishing effort.
- Reduction in consumer willingness to buy Bristol Bay salmon due to a perceived loss of quality, resulting in a lower price paid to commercial harvesters.
- A reduction or displacement of recreational fishing effort associated with affected waterbodies, along with an associated reduction in guide/lodge company revenues and government revenue generated by the professional guide tax if the proposed project reduces fish populations or the quality of fishing opportunities.
- An increase in recreational fishing effort associated with long-term project driven population changes and/or changes in the regional transportation network.

The magnitude of impact from the project is determined by the number of fish that would be impacted; the duration and geographic extent of impacts depends on the location and season in which the disturbance occurs during construction, operations, or closure; and the potential of impacts is how likely it would be that the project would impact fisheries. Duration would be considered long term if the effect lasted throughout the life of the project, or years to decades.

Scoping comments specifically addressed concerns that Bristol Bay commercial and recreational fisheries would be impacted, and that the Bristol Bay wild salmon brand would be damaged by the presence of the project because the watershed would no longer be pristine. Other comments expressed concern that all commercial fishing jobs would be lost, that

construction and operation of the Amakdedori port would conflict with commercial salmon fishing, and that increased marine traffic would impede other fishing operations.

**Commercial Fisheries.** The project has the potential to affect the Bristol Bay commercial fisheries sector and related fiscal contributions through two primary mechanisms. One potential mechanism of effect would be a decline in the productivity of Bristol Bay river systems from placement of fill in waters functioning as fish habitat and changes in habitat quality, such as increased sedimentation or altered stream flows, which would be reflected through a decline in total fishery harvest. The other mechanism, though not expected to occur, would be a change in market reception of Bristol Bay fish. The total value of the fishery in economic terms starts with volume (i.e., productivity) and price (i.e., what the market will pay for the fish). While the permit holders and processors are the two most frequently discussed groups associated with the fishery, the economic connections of the fishery extend to crew members, shipping companies, local businesses, utilities, and governments. In Cook Inlet, impacts on fisheries would be in the form of potential disruption of traditional fishing practices and locations (e.g., groundfish fisheries, salmon fisheries in the Chenik sub-district) or by affecting productivity (e.g., the Kamishak Bay scallop beds or the recovery of Pacific herring populations). Mitigation measures to reduce impacts to fish populations and thus reduce impacts on the economic value of the fish are discussed in Chapter 5, Mitigation.

In terms of magnitude, the loss of any harvestable fish from a project-induced decline in productivity would result in a lower total fishery value. Every harvested salmon has a quantifiable value to permit holders, processors, and state and local governments. This value varies from year-to-year with average ex-vessel price and average wholesale value, but it is demonstrable that every salmon lost to harvest has an economic value. This section uses estimates of lost productivity as noted in Section 4.24, Fish Values, to estimate lost ex-vessel payments, lost wholesale value, and lost fishery-related government revenues.

It is easier to connect lost productivity in the fishery to lost ex-vessel and first wholesale values than it is to connect the effect of a change in consumer willingness to pay to these same measures. As noted in Section 3.6, Commercial and Recreational Fisheries, Bristol Bay salmon is a “price-taker;” it does not have cohesive brand identification as the Copper River fishery does to help drive prices higher. Therefore, Bristol Bay prices reflect both the market for wild Alaska salmon products and the broader market for all salmon products. In addition, prices paid in Bristol Bay are nearly always lower than those paid in other Alaska salmon fisheries producing similar products, which reflects the higher transportation expense associated with Bristol Bay’s geographic location.

In Cook Inlet, the project could affect commercial groundfish, shellfish, and salmon harvests. Because the fishery is smaller, the magnitude of these disruptions would be smaller than potential Bristol Bay effects, but broader in extent. Commercial groundfish harvesters may have to change where they place fixed gear such as pots and longline gear because of the proposed natural gas pipeline. They could experience changes in harvest rates or increased operational costs. Processors would only experience effects if the project changed the timing and distribution of harvests, which it is not expected to do for these fisheries. Commercial salmon harvesters could experience changes in fishing patterns in the Amakdedori sub-district of the Lower Cook Inlet salmon fishery. In addition, the harvest and long-term productivity of the Kamishak Bay scallop fishery could be affected by the route of the proposed natural gas pipeline. These effects would be long term and would be expected to occur at some degree.

**Recreational Fisheries.** Specific potential effects of the project on recreational fisheries could be:



- Direct loss of angling days on portions of the North and South Fork of the Koktuli River, which are located in the project area.
- Changes in angler behavior and charter business behavior in Cook Inlet to avoid the route of the proposed natural gas pipeline or to adapt to change in the geographic distribution of the Pacific halibut resource caused by the pipeline or port operations.
- A reduction in angling days downstream of the project area if the project reduces fish populations of target species such as rainbow trout, Dolly Varden, and adult salmon in downstream waters.
- Reduction in angling days caused by a change in the quality of the fishing experience (i.e., changes in catch rates and/or the aesthetic quality of the experience) on waterbodies affected by the selected transportation routes.
- Reduction in and/or redistribution of income to commercial guides, lodges, and air transporters based on reduction in angler days or redistribution of angler response to changes in the quality of the fishing experience.
- An increase in angling days caused by an increase in the number of opportunities through expansion of the local road network or an increase in regional population.

The Bristol Bay watershed is renowned for the diversity of its recreational angling opportunities. Therefore, fishing effort (angling days) and the ability of anglers and guides to redirect operations to substitute sites are key in determining the magnitude and duration of recreational fishing impacts.

#### **4.6.1 No Action Alternative**

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur at the mine site, port site, transportation corridor, or the natural gas pipeline corridor. Therefore, no future direct or indirect effects on commercial or recreational fisheries would be expected. Although no resource development would occur, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). PLP would have the same options for exploration activities that currently exist. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration. Current trends in commercial and recreational fisheries would continue.

##### **4.6.1.1 Commercial Fishing**

The total value of the Bristol Bay salmon fishery depends on two primary factors: the volume of salmon harvested, and the value per pound of that salmon. Direct and indirect effects to commercial fishing from the proposed project require a connection between any alternative and either or both of those factors.

#### **Permit Holders and Crew Members**

Under the No Action Alternative, there would be no project-associated change in the number of returning fish available for harvest, the long-term productivity from the Nushagak and Kvichak river systems, and no change in the reputational value, which could affect price. The ex-vessel value of the fishery earned by permit holders and wages paid to crew members would continue to be affected by the broader drivers of the value of the Bristol Bay salmon fishery including world protein markets, world salmon markets, the overall productivity of the fisheries, and the decisions of processors about what products to produce.

## **The Processing Sector**

Without an effect on the value or volume of salmon produced by the ecosystem, the No Action Alternative would not have any effect on the processing sector.

## **Fiscal Contributions**

The No Action Alternative would not negatively affect fiscal contributions to state and local governments. It is possible that the future attractiveness of the fishery could increase if permit holders and processors had been withholding investment in recent years with the expectation that the proposed project would be built and would materially affect the fishery. However, there is no evidence that permit holders or processors have been withholding investment in the fishery. In 2014, Silver Bay Seafoods opened the fishery's first new major plant in several years. The company expanded the plant in 2015 and has the capability to expand more if the flexibility is needed (SBS 2018). Over the last decade, permit holders have installed refrigerated seawater systems to properly chill their salmon immediately after harvest and obtain the chilling bonuses offered by processors. The amount of slush ice in Bristol Bay, usually provided by processors, has not increased in recent years. Without growth in slush ice availability, new chilling capacity is coming from refrigerated seawater installations (NEI 2018).

### **4.6.1.2 Recreational and Tourism-Based Fishing**

Recreational fishing is driven by two populations: resident anglers and non-watershed resident anglers, including other Alaskans. The Bristol Bay region is renowned for its productive rainbow trout, king salmon, and sockeye salmon fisheries, as well as its ability to provide an uncrowded fishing experience in a remote and "pristine" environment. Fishery effort varies with fishing conditions, the availability of tour providers/guides, and the state and world economy. Recreational fishing in areas N, S, and T declined from 2000 to 2002 and from 2007 to 2009 as the US economy experienced economic recessions (see Section 3.6, Recreational Fisheries). Recreational fishing in Area T also declined from 2014 to 2016. Effort in individual fisheries varies with the quality of the runs, and weak Chinook returns can affect participation in Chinook fisheries. For example, weak runs over the last decade have reduced the number of guided angler days on the Kenai River between Cook Inlet and the Soldotna Bridge from 34,000 angler days in 2008, to just under 22,000 days in 2016. In 2010, the Nushagak River closed to the retention of Chinook salmon. Angler days between the ADF&G sonar site and the mouth of the Mulchatna River declined from 8,100 days in 2009 to 3,600 days in 2010. Thus, the data imply that retention closures reduced angling days by more than 4,000 or 50 percent of prior year effort (ADF&G 2018d). In Cook Inlet, total saltwater effort currently stands at approximately 185,000 days per year. Effort in Cook Inlet is slowly growing but is economically sensitive; total effort dropped from 175,000 days in 2008 to 166,000 days in 2009. Effort recovered to 196,000 days in 2014 as the local and national economies recovered, but then dropped to 181,000 in 2016 as Alaska entered the largest recession since the 1980s. Under the No Action Alternative, recreational fishing would continue under current conditions and trends affected by temporally limited events such as recessions and temporary restrictions on fishing effort or harvest.

## **Commercial Fishing Guides, Lodges, and Air Transporters**

The high value fishing experience that can be found in the Bristol Bay Region and portions of Cook Inlet supports a number of commercial fishing guides and charter operations, commercial fishing lodges, and air transporters. Under the No Action Alternative, the availability of sport fish that support these operations and the quality of the fishing experience would remain the same in the EIS analysis area.

## **Fiscal Contributions**

Under the No Action Alternative, recreational fishing fiscal contributions including guide and air taxi revenues, government sales, and use tax revenues would continue under current conditions and trends.

### **4.6.2 Alternative 1 – Applicant’s Proposed Alternative**

Project construction and operations could have an impact on both the commercial fishing community from crew members to the processing sector, on the recreational sector via recreational fishing, and on revenue generated to state and local government. Potential impacts are influenced by project-related effects on fish population, habitat, and runs (see Section 4.24, Fish Values), as well as on real and perceived effects on the quality of the fish, environment, and fishing experience. The duration of effects on commercial fishing would be long-term lasting throughout the life of the project, and possible to the extent that the project is permitted and constructed.

#### **4.6.2.1 Commercial Fishing**

As noted in Section 3.6, Commercial and Recreational Fisheries, the ADF&G manages for the long-term health of the fishery by ensuring that a minimum, but preferably optimal, number of spawners reach their home rivers. ADF&G has no control over external factors such as ocean conditions, so it largely manages the number of returning spawners by adjusting commercial and recreational fishing harvest via effort. The ADF&G restricts effort when the strength of the returning run requires less harvest to meet the escapement goals, and liberalizes harvest opportunity when run strength threatens to exceed optimal escapement maximums goals. Beyond the scheduling of fishing openings and closures, the ADF&G also has the ability to define the geographic extent of fishery openings. For example, the points at which the Naknek and Kvichak rivers empty into Bristol Bay are just miles apart. In years when the Kvichak sockeye run has been weak, the ADF&G has restricted the fishing fleet to the mouth of the Naknek River to limit the harvest of Kvichak-bound fish. Under more normal conditions, this district is managed with less specificity. During project construction and operations, should the projected and actual returns indicate a measurable loss of returning fish, and if the ADF&G does not adjust the escapement goals to account for any lost carrying capacity associated with the project, then, in terms of the magnitude of impact, the reduction in returning spawners would directly translate into lost harvest opportunities for permit holders. If the ADF&G adjusts the escapement goals for lost carrying capacity, then a portion of lost harvest opportunities would be captured with the adjusted escapement goals, and the remaining portion would transmit to commercial permit holders as lost harvest opportunities.

Crew members, permit holders, processors, and local municipalities are all dependent on the total value of the Bristol Bay fishery, which is a function of market price and harvested volume. When permit holders harvest fewer fish, the net result is that permit holders receive less net income, crew members are paid less, processors have less product to sell, and municipalities have less economic activity to tax.

This section relies on Section 4.24, Fish Values, which estimates that Alternative 1 would not have measurable effects on the number of adult salmon returning to the Kvichak and Nushagak river systems as a result of project operations, due the limited lineal footage of upper Koptuli river fish habitat affected by placement. Section 4.27, Spill Risk, discusses the potential for salmon loss resulting from spills.

As noted above, the commercial fishing sector is concerned that the existence of the project could lower the perceived quality of Bristol Bay salmon and thus lower price. Prices paid in

Bristol Bay are nearly always lower than those paid in other Alaska salmon fisheries producing similar products, which reflects the higher transportation expense associated with Bristol Bay's geographic location. Other salmon fisheries in Alaska exist in conjunction with non-renewable resources. For example, the Cook Inlet salmon fisheries exist in an active oil and gas basin and headwaters are located near developed areas of Anchorage and the Matanuska-Susitna Borough. The Copper River salmon fishery exists in the remains of the historic Kennecott Copper Mine and the Trans-Alaska Pipeline System crosses the headwaters of portions of the fishery. Both of these fisheries have average higher prices per pound than the Bristol Bay Salmon Fishery (see Section 3.6, Commercial and Recreational Fisheries). This information noted, no other wild salmon fishery in the world exists in conjunction with an active mine of this size and thus existing examples are limited in their usefulness as working comparisons. Section 4.27, Spill Risk, discusses the impacts of the *Exxon Valdez* oil spill and the Fukushima nuclear accident on fish prices.

The Amakdedori port would be located in the Chenik sub-district of the Kamishak Bay District of the Lower Cook Inlet Management Area. As noted in Section 3.6, Commercial and Recreational Fisheries, commercial salmon harvest in this area averages approximately 240,000 sockeye salmon annually, but harvests vary significantly from year to year. In terms of the magnitude of impacts, construction and operation of the project would not be expected to have measureable effects on the number of adult salmon returning to the area. In terms of the extent of impacts, commercial harvesters may have to change fishing patterns based on the proximity of fishing to port operations, or could experience losses if port operations affected salmon returns. This area also historically hosted a commercial Pacific herring sac roe fishery, which has been closed since 2000 because of low abundance. The ADF&G has noted that during the life of the project, it is likely that the Pacific herring biomass would recover enough to support a reopening of the fishery. In terms of effect magnitude, extent, and duration, project activities at the port site could delay the recovery of the biomass and, if the fishery were reopened, that "purse seine gear interacts with the bottom in waters shallower than approximately 95 feet and may create a conflict with the natural gas pipeline and port activities" (ADF&G 2018p).

Alternative 1 would route the applicant's proposed natural gas pipeline through the Kamishak Bay scallop beds identified in Section 3.6, Commercial Fisheries. If the Kamishak Bay scallop fishery reopens, then it would be expected that fishing gear and the pipeline would interact. The magnitude and extent of impacts would be lower harvest per unit of effort and potentially lost gear. Both reduced harvest efficiency and damaged gear increase permit holder operating costs and lower profits. In terms of duration of impact, this routing could adversely affect long-term bed productivity (over the life of the project). The fishery is currently closed because of low biomass but could reopen before the mine closes. Thus, the proposed pipeline in this alternative could affect the timing of the reopening of the fishery or affect biomass enough to result in the closure of a re-opened fishery. Impacts on the scallop bed would be expected to occur under Alternative 1.

The natural gas pipeline would follow the transportation corridor and would not directly interact with the Bristol Bay salmon fishery. Although the pipeline would cross waters fished by the Cook Inlet salmon fishery, it would not directly interact with the salmon fishery, outside the Chenik sub-district noted above, given that the salmon fishery occurs in the top 30 feet of the water column. After construction, groundfish commercial harvesters (in the halibut and Pacific cod fisheries) may need to adjust the placement of their bottom gear, such as pots or longlines, to avoid the natural gas pipeline. This could result in decreased harvest efficiency and increased costs and risks, but they would have flexibility to do so. The magnitude of effects of required changes in fishing behavior could make harvesters less efficient and increase costs and risks. Generally, the duration of impacts on commercial fisheries from the gas pipeline would be long

term, occurring throughout the life of the project, but the extent would be only along the pipeline corridor. This activity could displace some commercial fishing over the short term during the construction phase.

### **Permit Holders and Crew Members**

Based on estimations of the effect to fish populations discussed in Section 4.24, Fish Values, this alternative would not result in changes in permit holder revenues, crew member payments, or permits based on a change in the return of adult spawners.

### **The Processing Sector**

Any reduction in harvest by permit holders is immediately transmitted to the processing sector as fewer fish to be processed and sold into the world sockeye market. The lost harvest results in lower total wholesale value for processors. The magnitude of the financial loss depends on the size of the harvest reduction and individual choices by processor around how to adjust their product mix. Processors make these decisions based on run size, their individual capabilities, and the needs of the world market, which means that any long-term loss in harvest would express itself differently each year based on the aforementioned factors. Based on estimates from Section 4.24, Fish Values, previous discussion that there would be no measurable effects on the number of returning salmon, and the historical relationship between ex-vessel values and wholesale values, there would be no changes to wholesale values or processor operations expected for this alternative.

### **Fishery Fiscal Contributions**

As noted above, the fiscal contributions of the Bristol Bay salmon fishery to state and local government depend on the long-term health of the fishery. In terms of magnitude of impacts, lost harvest value would be directly expressed through reduced Fisheries Business Tax and Raw Fish Landings Taxes. Significant reductions in long-term value of the fishery would affect property taxes, sales taxes, and use taxes. Potential effects of reductions in state and local revenue are discussed in Section 4.3, Needs and Welfare of the People—Socioeconomics. However, based on the results of Section 4.24, Fish Values, no long-term measurable changes in the fishery would be expected; therefore, there would be no long-term changes expected in fishery fiscal contribution attributable to this alternative.

#### **4.6.2.2 Recreational and Tourism-Based Fishing**

Recreational fishing effort in areas S, T, N, and P is based on several different types of fisheries with different goals, attributes, and experiences. For example, a Chinook salmon angler on the Nushagak River is likely to be fishing from a boat and focused on the harvest of Chinook salmon for consumption. An angler fishing the Gibraltar River is fishing a much smaller waterbody with more shore fishing and is more likely to be targeting rainbow trout for a non-consumptive purpose. The effects of Alternative 1 on the overall recreation fishery would depend on the factors noted above and the availability of alternative opportunities. There are few worldwide alternatives to the Nushagak River, as its Chinook fishery is one of the largest recreational Chinook fisheries in Alaska. In 2016, anglers harvested more than 7,500 Chinook from the Nushagak, nearly as many as the 8,500 Chinook harvested from the Kenai River, and more than the 4,700 harvested in the entire Susitna River drainage (ADF&G 2018d). The Gibraltar River offers a remote fishing experience for rainbow trout but is one of several streams offering this type of experience in the Bristol Bay region. Rainbow trout are common and angling opportunities in remote conditions are widespread throughout the region. The loss of fishing opportunities in these areas would be more likely to be experienced by select guide and lodge

operators than by a substantial portion of all anglers in the Bristol Bay region. For example, on average between 2011 and 2014, ADF&G Freshwater Guide Logbook data recorded nine businesses providing 289 fishing days a year on the Gibraltar River system. Across all of Area S, the Kvichak drainage, guided anglers generated an average of 10,400 fishing days per year. Thus, the Gibraltar River system represents less than 3 percent of all angling effort in Area S. Affected operators could substitute fishing on different streams, albeit at potentially higher costs to themselves and their consumers, or anglers could redirect their fishing to other sites in the Bristol Bay region or in Alaska. Anglers themselves would likely be able to find similar opportunities on other streams in the region if the extent of effects of Alternative 1 are limited to a subset of regional fishing opportunities. Impacts would be long term, extending through construction and operations, but opportunities would be available at other locations.

Mine facilities under Alternative 1 would directly impact portions of the tributaries of the North and South Fork Kuktuli River watersheds, while support and transportation infrastructure would affect the Upper Talarik Creek Watershed, the Gibraltar River, and Iliamna Lake. As noted in Section 3.6, Commercial and Recreational Fisheries, in terms of potential magnitude of effects, these watersheds account for a small portion of overall recreational fishing effort in SWHS areas S, T, and N. The ADF&G SWHS estimates and Guide Logbook Program data indicate that total fishing effort on the Kuktuli River and Upper Talarik Creek is less than 100 angling days per year each, while total effort in SWHS areas S and T is estimated at over 40,000 days per year. In terms of extent of impacts, the two most important fisheries that would interact with Alternative 1 are Iliamna Lake and the Gibraltar River. Iliamna Lake and unnamed tributaries host roughly 1,900 to 2,200 angling days per year. This effort is dispersed across the lake and numerous unidentified tributaries without enough SWHS survey responses to allow for individual effort estimates. Under normal operations, the ferry across the lake would not be expected to limit or affect the quality of these fishing days. The Gibraltar River (approximately 650 angling days per year) primarily hosts fly-in wade and float anglers. The river is currently roadless and the transportation corridor would create a new road and crossing along the river. While Section 4.24, Fish Values, does not anticipate that there would be measurable changes in the number of fish along the river, the presence of the road and bridge crossing would change the fishing experience on the river, particularly for float anglers who would have to pass the bridge to float the length of the river. Construction activities would be disruptive, and the road and bridge would be in place through project operations and post-closure until they are no longer needed. Therefore, potential adverse impacts to the recreational fishing experience would be long term.

The waterbodies affected by Alternative 1 have fewer total recreational angling days than the waterbodies affected by Alternatives 2 or 3. However, the main angling waterbodies affected by Alternatives 2 and 3 (the Newhalen, Pile, and Iliamna rivers), already have some road access from local communities. Alternative 1 differs from Alternatives 2 and 3 in its establishment of a new road affecting a waterbody without current road access and more than 500 recreational fishing days per year; Alternatives 2 and 3 would not affect a river with these qualities. Impacts would be expected to occur under Alternative 1 and would be long term, lasting through closure until the road is no longer used.

The Amakdedori port site is located closer to the Kamishak River, which hosts several hundred guided angling days per year, than the port site in Alternatives 2 and 3. This resource is approximately 20 air miles south of the port site; the magnitude, extent and duration of the effects of project operations on recreational fishing at that location is unclear.

In terms of magnitude and extent of impacts, Cook Inlet saltwater recreational fishing could be affected by the natural gas pipeline, which could disrupt traditional groundfish fishing locations. The pipeline is not expected to have measureable effects on the numbers of groundfish, salmon, or rockfish, but could result in changes in the localized distribution of groundfish

resources which could then affect angler success rates or costs. These impacts would be long term and would be expected to occur.

Shore-based anglers and boat anglers in Kachemak Bay would not be expected to notice or need to change their behavior because of the project. In terms of extent of impacts, some anglers fishing from just north of Anchor Point to the boundary between Cook Inlet and the Northern Gulf of Alaska could interact with the natural gas pipeline if they were targeting groundfish such as Pacific halibut and Pacific cod. Pacific halibut are the primary target of recreational anglers in Cook Inlet with the species accounting for approximately 60 percent of the recreational harvest, based on SHWS data. The next most commonly harvested species are rockfish species (approximately 12 percent of harvest), Chinook salmon (approximately 6-7 percent of harvest), and silver salmon (approximately 6-7 percent of harvest). These four species account for more than 80 percent of area's recreational harvest. The salmon species are primarily caught through trolling or by shore anglers at the Homer Spit. In terms of duration of effects, these angling days would not be expected to interact with the project's pipeline. Anglers fishing for Pacific halibut can catch the species while trolling, but the dominant method is to place weighted and baited hooks on the seabed where halibut live. In terms of magnitude and extent of impacts, these anglers would risk losing gear if fishing over the proposed pipeline, and the pipeline itself could disturb traditional halibut concentrations referred to as "holes." The impacts would be long term and would be expected to occur under Alternative 1.

### **Commercial Fishing Guides, Lodges, and Air Transportation**

As detailed in Section 4.24, Fish Values, there would be no measureable impacts on sport fish that could affect commercial fishing guides, lodges, or air transporters. The extent of the effect of construction and operations of the project would be to affect the quality of fishing experience in the immediate vicinity of the project where project facilities are visible or project activities are audible, as described above. In terms of magnitude there could be associated reductions in and/or redistribution of income to commercial guides, lodges, and air transporters based on reductions in angler days. Redistribution of angler response to changes in the quality of the fishing experience would depend on the availability and appeal of substitute fishing destinations. Fishing packages in Bristol Bay cost between \$600 and \$1,000 per night. Client concerns about the quality of the experience could result in cancellations and associated economic impacts to the guide companies, lodges, air transporters, and the communities that support them. In terms of duration, such effects would be more pronounced during construction, but would continue during operations, be long-term in duration, and would be expected to occur.

### **Fiscal Contributions**

Under Alternative 1, the magnitude of impacts on fiscal contributions from recreational fishing would be a potential reduction in guide and air taxi revenues, as well as government sales and use tax revenues if anglers reduced fishing effort in the region. In terms of the extent of impacts, if anglers shift effort within the region, but do not change overall effort, then revenues would shift between municipalities and companies, but not necessarily change in total. The result is that the project would not be expected to affect overall fiscal contributions from recreational fishing.

#### **4.6.2.3 Alternative 1 – Kokhanok East Ferry Terminal Variant**

Under this variant, the impacts to recreational fishing on the Gibraltar River from the transportation corridor would not occur as this variant would not cross that river.

#### **4.6.2.4 Alternative 1 – Summer-Only Ferry Operations Variant**

In terms of magnitude and extent, during the summer, truck traffic under this variant would double, which would increase the impacts to the setting of recreational fishing where the transportation corridor crosses the Gibraltar River. This impact would be long term lasting through operation of the mine, and would be certain to occur under this variant.

#### **4.6.2.5 Alternative 1 – Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would result in similar magnitude, extent, duration, and likelihood of impacts as those described above for commercial and recreational fisheries.

### **4.6.3 Alternative 2 – North Road and Ferry with Downstream Dams**

Under Alternative 2, the magnitude, extent, duration, and likelihood of project effects on commercial fishing would be expected to be the same as Alternative 1; mine operations would be the same and the different transportation corridors would not be expected to affect fish populations over the long term. The magnitude, extent, duration, and likelihood of impacts to the commercial and recreational fisheries in Cook Inlet from the pipeline would also be similar to Alternative 1. However, in terms of extent, the Alternative 2 transportation corridor would affect different recreational fishery resources. This alternative would avoid the currently roadless Gibraltar River area, the Amakdedori area, and would be much farther away from the Kamishak River. However, the mine access road and/or the pipeline right-of-way (ROW) would cross a number of waterbodies with fishing pressure, including the Newhalen River and the Iliamna River.

#### **4.6.3.1 Commercial Fishing**

As with Alternative 1, in terms of magnitude and extent, Alternative 2 would not be expected to affect the health or value of the Bristol Bay salmon fishery including permit holder earnings, permit holder value, crew earnings, fishery first wholesale values, processor earnings, or local fiscal contributions. With respect to the magnitude and extent of impacts in Cook Inlet, Alternative 2 would avoid the potential effects on the Chenik sub-district salmon fishery, the Kamishak Bay Pacific herring fishery, and the Kamishak Bay Weathervane scallop fishery. However, the presence of the Diamond Point port location has the potential to interfere with an intermittent Chum salmon fishery located around Cottonwood Creek. The ADF&G provided harvest numbers for Iliamna and Iniskin bays: the average harvest in years when harvest was recorded was just over 27,000 chum salmon and approximately 3,600 pink salmon (ADF&G 2018q). In stakeholder meetings, commercial permit holders expressed concern that port operations at this site would interfere with tidally dependent seine opportunities (ADF&G 2018q). The magnitude and duration of disruption to these fisheries would be due to additional boat traffic. More boat traffic would be expected during construction than during operations.

#### **4.6.3.2 Recreational and Tourism-Based Fishing**

The Newhalen River drainage (approximately 1,900 angler days per year) and the Iliamna River (approximately 1,000 angler days per year) are the most frequently fished waterbodies along the Alternative 2 transportation corridor route. Most of this effort is by unguided anglers. ADF&G Freshwater Guide Logbook data indicate an average of fewer than 200 guided days per year on Newhalen River and just over 400 on the Iliamna River, determined by an average of nine and seven businesses, respectively. In terms of magnitude and extent of impacts, truck transport activity may dislocate fishing effort where the road corridor transects these waterbodies but would not be expected to run along them for significant lengths. Fishing effort should not be



adversely affected as long as fish populations are unaffected, but may redistribute along the waterbodies. Iliamna Lake and unnamed tributaries host 1,900 to 2,200 angler days per year of recreational fishing effort, which is distributed across the entirety of the lake and where tributaries flow into it. Although detailed data about the geographic distribution of this effort are not available, a single ferry transport route across the lake should not affect the number of fishing days under normal operations.

In terms of magnitude and extent, Alternative 2 would affect waterbodies with higher fishing effort than Alternative 1, but it would not establish new roads near waterbodies such as the Gibraltar River, which are known for the remote characteristics and have measurable fishing effort. Alternative 2 crosses fewer waterbodies along the Iliamna Lake's northern boundary than Alternative 3 by virtue of the ferry from Eagle Bay to Pile Bay and then the road corridor to Diamond Point port. However, the pipeline ROW would cross the same streams as discussed below for Alternative 3. In terms of the magnitude and extent of effects, access along the ROW could increase slightly for recreational fishing. To the extent that fishing efforts are redistributed, there could be adverse economic impacts to fishing guides and lodges. The impacts would be long term, lasting through the duration of operations.

### **Commercial Fishing Guides, Lodges, and Air Transporters**

The magnitude, duration, and likelihood of potential economic impacts to commercial fishing guides, lodges, and air transporters would be similar to those discussed under Alternative 1. The extent would differ because different recreational fishing areas would be affected as described above, consequently affecting different service providers.

### **Fiscal Contributions**

Under Alternative 2, recreational fishing fiscal contributions, including guide and air taxi revenues as well as government sales and use tax revenues, could be affected if anglers reduced fishing effort in the region. In terms of magnitude and extent, if anglers shift effort within the region, but do not change overall effort, then revenues would shift between municipalities and companies, but not necessarily change in total. The duration of these impacts would be long term, lasting throughout the life of the project.

#### **4.6.3.3 Alternative 2 – Summer-Only Ferry Operations Variant**

In terms of magnitude and extent, during the summer the truck traffic under this variant would double, which would increase the impacts to the setting of recreational fishing where the transportation corridor crosses the Newhalen and Iliamna rivers. These impacts would be long term and would be expected to occur under this variant.

#### **4.6.3.4 Alternative 2 – Pile-Supported Dock Variant**

The Pile-Supported Dock Variant would result in similar magnitude, extent, duration, and likelihood of impacts as described above for commercial and recreational fisheries.

#### **4.6.4 Alternative 3 – North Road Only**

Under Alternative 3, magnitude, duration, and likelihood of effects of the project on commercial and recreational fishing would not be expected to be different than under Alternative 1, as mine operations would be the same, and the transportation corridor would not be expected to affect fish populations over the long term. However, though overall effects would remain the same, the extent of impacts due to Alternative 3 would differ because different recreational fishery resources and lesser used recreational fishery resources would be affected compared to

Alternative 1. Alternative 3 would avoid the currently roadless Gibraltar River, but would cross a number of waterbodies with measurable recreational fishing pressure including the Newhalen River, the Pile River, and the Iliamna River.

#### **4.6.4.1 Commercial Fishing**

As with Alternatives 1 and 2, Alternative 3 would not be expected to measurably affect the health or value of Bristol Bay salmon fishery including permit holder earnings, permit holder value, crew earnings, fishery first wholesale values, processor earnings, or local fiscal contributions. The extent, duration, and likelihood of effects on Cook Inlet fisheries are identical to Alternative 2 with fewer expected effects than Alternative 1 as discussed above.

#### **4.6.4.2 Recreational and Tourism-Based Fishing**

The Alternative 3 transportation corridor would extend from Diamond Point on land across Chekok, Canyon, and Knutson creeks, on to Pile Bay, across the Pile River, and then cross the Iliamna River, leading to the mine site.

As noted for Alternative 2, the Newhalen River drainage (approximately 1,900 angler days per year) and the Iliamna River (approximately 1,000 angler days per year) are the most frequently fished waterbodies along this route. The magnitude and extent of impacts from Alternative 3 would be that transport activity may displace fishing effort where the corridor intersects with these waterbodies, but the corridor overlap would be short in length. Truck traffic would adversely affect the recreation experience that occurs in the vicinity of the road. Fishing effort should not be adversely affected, but in terms of extent, may be redistributed along the waterbodies as long as fish populations are unaffected by changes in distribution of fishing effort. ADF&G data indicate that Chekok Creek receives some fishing pressure (less than 50 days per year), while the other waterbodies along the Alternative 3 transportation corridor do not appear in published ADF&G data.

The magnitude and extent of impacts from Alternative 3 would be to increase fishing pressure on freshwater waterbodies compared to Alternative 1 and Alternative 2. This is primarily due to the presence of a continuous road providing access to these waterbodies along the north side of Iliamna Lake between the mine site and Pile Bay. These impacts would be long term and would be certain occur under Alternative 3.

### **Commercial Fishing Guides, Lodges, and Air Transporters**

The magnitude, duration, and likelihood of potential economic impacts to on commercial fishing guides, lodges, and air transporters would be similar to those discussed under Alternatives 1 and 2, but would affect those service providers that use the recreational fishing areas described above.

### **Fiscal Contributions**

In terms of the magnitude and extent of effects under Alternative 3, recreational fishing fiscal contributions, including guide and air taxi revenues as well as government sales and use tax revenues, could be affected if anglers reduced fishing effort in the region. If anglers shift effort within the region, but do not change overall effort, then revenues would shift between municipalities and companies, but not necessarily change in total. Alternatives 2 and 3 affect more waterbodies than Alternative 1, but would not establish new roads near currently roadless waterbodies with existing fishing effort.

#### 4.6.4.3 Alternative 3 – Variant: Concentrate Pipeline

The concentrate pipeline variant would add a pipeline in the road/natural gas pipeline corridor, increasing the width of visual disturbance that could affect the quality of the fishing recreational experience. It would result in similar impacts in magnitude, extent, duration, and likelihood as those described above for commercial and recreational fisheries.

#### 4.6.5 Summary of Key Issues

Under normal operations, the alternatives would not be expected to have a measurable effect on fish numbers and result in long-term changes to the health of the commercial fisheries in Bristol Bay (see Table 4.6-1). In terms of magnitude and extent, Alternative 1 would be expected to have minimal effects on commercial fisheries in Cook Inlet with the highest probability of impacts centered around the Amakdedori port site and the siting of the natural gas pipeline. The Chenik sub-district salmon harvests and the Kamishak Bay Weathervane scallop fishery are the fisheries most likely to experience direct effects from construction and operations activities. The Cook Inlet groundfish fishery could also experience direct effects because of pipeline construction and operations. The Pacific herring fishery in Kamishak Bay could experience direct or cumulative effects, but the magnitude of effects is unknown. In terms of geographic extent of impacts, Alternatives 2 and 3 avoid the noted Cook Inlet salmon, scallop, and herring interactions of Alternative 1.

The extent of impacts from the project would be that recreational fishing effort would be displaced by mining activities along a short length of the upper Kaktuli River and by road transportation activities along Lower Talarik Creek. In terms of magnitude of effects, ADF&G data indicate that effort along these rivers is low, around 110 angling days per year. Alternative 1 would result in a new road alongside, and across the Gibraltar River, which receives six times the annual recreational fishing effort of the Kaktuli River and Lower Talarik Creek combined. Alternatives 2 and 3 would intersect with the Newhalen and Iliamna rivers. These rivers are already connected by road to local communities and together host approximately 2,900 angling days per year (see Table 4.6-1). Alternative 3 would also intersect the Pile River, which has measurable effort. The road corridor intersections may result in the redistribution of some angling days along the river.

**Table 4.6-1: Summary of Key Issues for Commercial and Recreational Fisheries**

	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variants
<b>Mine Site</b>			
Effects to commercial fisheries	Impacts from the mine site would be the same across all alternatives. The mine site would result in loss of fish habitat in the North and South Fork Kaktuli rivers. As noted in Section 4.24, Fish Values, this disturbance would not be expected to have measurable effects on the number of adult salmon returning to the Nushagak and Kvichak district. The mine site area is not connected to the Togiak, Ugashik, Naknek, and Egegik watersheds and is not expected to affect fish populations or harvests from these watersheds.  The mine site is not expected to affect Cook Inlet commercial fisheries.		
Effects to recreational fisheries	All three alternatives would affect the North and South Fork Kaktuli rivers. The Kaktuli River does not appear in some ADF&G SWHS publications because not enough survey respondents report fishing on the river. The river also does not appear in ADF&G Guided Logbook data for 2011-2014. The unpublished ADF&G SWHS estimates for the Kaktuli River for 2007-2016 average 63 angler days per year. Some of these days would be displaced if they occurred in the project area.		

**Table 4.6-1: Summary of Key Issues for Commercial and Recreational Fisheries**

	<b>Alternative 1 and Variants</b>	<b>Alternative 2 and Variants</b>	<b>Alternative 3 and Variants</b>
	The mine site is not expected to affect Cook Inlet recreational fisheries.		
<b>Transportation Corridor</b>			
Effects to commercial fisheries	<p>This corridor would intersect with Upper Talarik Creek, Pete Anderson Creek, the Gibraltar River, Dunultak Creek, and Amakdedori Creek and cross Iliamna Lake. This alternative would not be expected to have measurable effects on the numbers of adult salmon, and therefore would have no impact to commercial fisheries.</p> <p>The east Kokhanok ferry terminal variant would avoid impacts to Gibraltar River.</p>	<p>This corridor would intersect with Upper Talarik Creek, the Newhalen River and the Iliamna River while crossing Iliamna Lake. This alternative would not be expected to have measurable effects on the number of adult salmon, and therefore would have no impact to commercial fisheries.</p>	<p>This corridor would intersect with Upper Talarik Creek, the Newhalen River, Chekok Creek, Canyon Creek, Knutson Creek, the Pile River, and the Iliamna River. This alternative would not be expected to have measurable effects on the number of adult salmon, and therefore would have no impact to commercial fisheries.</p>
Effects to recreational fisheries	<p>Only the Gibraltar River hosts a measurable amount of angling pressure (approximately 650 SWHS angling days per year). The Gibraltar River is currently roadless and the project would change the character of the river in the immediate vicinity of the intersection. Angling pressure on the river may redistribute to other locations along waterbody or to other waterbodies. This could impact the revenue of guides, lodges, and air transporters that support recreational fishing in this area, with related impacts to local and state revenue.</p> <p>The corridor would cross Iliamna Lake which (with its tributaries) host 1,900-2,200 angler days per year. Transport across the lake should not affect these fisheries.</p> <p>The east Kokhanok Ferry Terminal Variant would avoid impacts to Gibraltar River.</p>	<p>The Newhalen River drainage (approximately 1,900 angler days per year) and the Iliamna River (approximately 1,000 angler days per year) are the most frequently fished waterbodies along this route. Transport activity may dislocate fishing effort where the corridor intersects with these creeks, but this effort should redistribute along the waterbodies as long as fish populations are unaffected. The lake itself and unnamed tributaries, host 1,900-2,200 angler days per year of effort. Transport across the lake should not affect these days.</p> <p>Only the pipeline ROW would intersect with the smaller creeks noted in Alternative 3, impacting recreation experience primarily during construction.</p> <p>The Summer-Only Ferry Variant would have more impacts to recreational</p>	<p>The Newhalen River drainage (approximately 1,900 angler days per year) and the Iliamna River (approximately 1,000 angler days per year) are the most frequently fished waterbodies along this route. Transport activity may disrupt fishing effort where the corridor intersects with these creeks and other waterbodies, but this effort would redistribute along the waterbodies.</p>

**Table 4.6-1: Summary of Key Issues for Commercial and Recreational Fisheries**

	<b>Alternative 1 and Variants</b>	<b>Alternative 2 and Variants</b>	<b>Alternative 3 and Variants</b>
	The Summer-Only Ferry Operations Variant would have more impacts to recreational fishing at the Gibraltar River.	fishing at the Newhalen River based on increased truck traffic.	
<b>Port Site</b>			
Effects to commercial fisheries	The Amakdedori port site intersects with the Chenik sub-district of the Kamishak Bay District and is the location of an annual salmon fishery. In addition, the port site is located in an area which hosted a historical Pacific herring fishery. This fishery is now closed because of low biomass, but could reopen in the future.	The Diamond Point port site is located near chum salmon fishery, which does not experience harvest every year. Permit holders have expressed concern that the presence of the port would interfere with tidal seine operations during years when there is harvest.	
Effects to recreational fisheries	The Amakdedori port site is located near Amakdedori Creek, which does not appear in SWHS or Guide Logbook data. The closest waterbody with measurable fishing effort is the Kamishak River, which is approximately 20 air miles to the south.	There are no recreational fishing resources of note near the Diamond Point port site. The closest waterbody with measurable fishing effort is the Iliamna River.	
<b>Pipeline Route</b>			
Effects to commercial fisheries	The pipeline would follow the transportation corridor and would not directly interact with the Bristol Bay salmon fishery. The pipeline would cross waters fished by the Cook Inlet salmon fishery and Cook Inlet groundfish fisheries. The pipeline would not directly interact with the salmon fishery given that the salmon fishery occurs in the top 30 feet of the water column.  The Alternative 1 pipeline route could disturb the northern Kamishak Bay Weathervane scallop bed negatively affecting biomass and delaying or impeding the reopening of that fishery. Alternatives 2 and 3 avoid this potential effect.		
Effects to freshwater recreational fisheries	The pipeline would follow the transportation corridor and is not expected to affect recreational fishing resources beyond those aforementioned under the transportation corridor. Cook Inlet and Anchor River fishing opportunities should be unaffected.	The pipeline ROW would cross the same streams as the north access road in Alternative 3. Access along the ROW may increase for recreational fishing, but the increase would be low intensity. Cook Inlet and Anchor River fishing opportunities should be unaffected.	The pipeline would follow the transportation corridor and is not expected to affect recreational fishing resources beyond those aforementioned under the transportation corridor. Cook Inlet and Anchor River fishing opportunities should be unaffected.

**Table 4.6-1: Summary of Key Issues for Commercial and Recreational Fisheries**

	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variants
Effects to Cook Inlet saltwater recreational fisheries	The pipeline would cross waters used by Cook Inlet salmon and groundfish anglers. Salmon in saltwater are traditionally caught by trolling in the upper reaches of the water column. As the pipeline will lie on the seabed, salmon anglers are unlikely to be affected by it. Groundfish anglers traditionally target Pacific halibut by laying baited and weighted hooks on or just above the seabed. They may be affected by needing to avoid the pipeline route, the disruption of traditional halibut "holes," and the potential for changes in local halibut abundance.		

#### 4.6.6 Cumulative Effects on Commercial and Recreational Fisheries

The cumulative effects analysis area for commercial and recreational fisheries encompasses the EIS analysis area. Potential cumulative impacts to commercial fisheries come from productivity losses including incremental loss of spawning and rearing habitat, fragmentation of habitat, changes in wetland types, and loss or degradation of ecosystem functions. Potential cumulative impacts to recreational fisheries come from any reduced fish populations (both salmon and non-salmon) associated with productivity losses, as well as loss of scenic and recreational value of fishing sites.

Past, present, and reasonably foreseeable future actions (RFFAs) in the cumulative effects analysis area have the potential to contribute cumulatively to impacts on commercial and recreational fisheries. Section 4.1, Introduction to Environmental Impacts, details the past, present, and RFFAs considered for evaluation. Several of the RFFAs detailed are considered to have no potential for cumulatively impacting commercial and recreational fisheries in the analysis area. These would include non-industrialized point-source activities that are unlikely to result in any appreciable impact on wetlands beyond a temporary basis (such as tourism, recreation, fishing, and hunting). Other RFFAs removed from further consideration include those outside the analysis area (e.g., Donlin Gold).

The list of RFFAs includes a number of potential mineral projects that are likely to be subjected to continued exploration and study (e.g., Big Chunk South, Big Chunk North, Fog Lake, Groundhog, Shotgun, and the Johnson Tract), as well as expansion of the Pebble Project, which is reasonably foreseeable as a future development in the RFFA timeframe. In addition, the RFFAs include community, transportation, and utility improvements spurred by economic activity in the area. Each project has the potential to impact localized fish population numbers, contributing to the cumulative effects to commercial and recreational fisheries in the region.

Section 4.24, Fish Values, does not estimate fish population changes associated with cumulative effects of the RFFAs. It is clear that changes in the number of returning salmon spawners have a direct effect on the value of the Bristol Bay salmon fishery. The ADF&G is obligated to manage for the long-term health of the resource, which means that if escapement goals remain unchanged, reductions in returning spawners are directly transmitted as lost harvest opportunities for the commercial fleet.

Cumulative effects on recreational fisheries are harder to quantify than those on commercial fisheries. In addition to salmon, recreational anglers in the region primarily target rainbow trout and Dolly Varden, which depend on salmon eggs and salmon flesh for a good portion of their annual caloric intake. Mineral development could contribute cumulatively to the reduction of the undeveloped nature of the region, and thereby reduce opportunities available for recreation activities fishing in remote areas. However, recreational anglers are more mobile and have the option to select similar substitute experiences. The most likely effect is a redistribution of days to

different locations rather than a large reduction in total days. Lodges are not mobile, and providers who frequent rivers that may no longer provide the same experience they once did may choose to change the services that they offer, access different locations via air, and/or lose a portion of their clientele. Changes in angler demand for trips in the region would depend on the magnitude of changes in the angling experience, angler preferences, and the type of responses by trip providers.

#### **4.6.6.1 Past and Present Actions**

Past and present actions that have, or are currently, affecting commercial and recreational fisheries in the analysis area are minimal. Current development consists of six lake communities and roads. Present activities include mining exploration and non-mining related projects, such as transportation, oil and gas development, or community development actions. These actions have resulted in a loss of some fish habitat, and aircraft activity associated with mining exploration can degrade the quality of a remote recreational fishing experience. As noted in Section 4.22, Wetlands and Other Waters/Special Aquatic Sites, and Section 4.24, Fish Values, given the relatively small amount of past and present effects in individual watersheds, and the project area in general, and limited footprint of drilling, past/present cumulative impacts on fisheries are minimal in extent and magnitude for all alternatives.

#### **4.6.6.2 Reasonably Foreseeable Future Actions**

##### **No Action Alternative**

The No Action Alternative would not contribute to cumulative effects on commercial and recreational fishing.

##### **Alternative 1 – Applicant’s Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – The Pebble Mine Expanded Development Scenario would result in an additional 78 years of mining/milling and include a larger open pit mine with expanded and new storage facilities for tailings and waste rock. Expanded development and associated contributions to cumulative impacts would be the same for all alternatives at the mine site and the Iniskin Bay port; however, there would be differences among the alternatives in the transportation, pipelines, and natural gas compressor station footprints. Construction of the concentrate pipeline would reduce truck traffic along the transportation corridor.

The primary potential future impacts to fish from the Pebble mine expansion would be direct loss of habitat, fish displacement and injury, habitat degradation, and changes in the natural flow regime. These impacts would be similar to those described for the project in Section 4.24, Fish Values. With the mine expansion, the duration of these impacts would be extended by 78 years. The construction of the south waste rock facility collection pond would affect the South Fork Kuktuli and Upper Talarik Creek watersheds affecting sockeye, coho, chum, and possibly Chinook salmon. Expanded development would increase the magnitude and duration of disturbance impacts. Any impacts that result in a reduction in the number of returning adult spawners would affect commercial fisheries. Commercial fishing impacts related to expansion of the mine site are limited to the Bristol Bay commercial fishery. However, the construction and operation of a deep-water port in Iniskin Bay would affect the chum and pink salmon fishery in that area and could affect the recovery of the Pacific herring fishery. These effects would be similar to the potential direct effects described for Alternatives 2 and 3 earlier in this section.

Cumulative effects on recreational fishing would mirror those for commercial fishing as recreational target species include salmon or species that are dependent on salmon. The desirability and viability of South Fork Koktuli River (SFK) and Upper Talarik Creek (UTC) as recreational fishing locations would follow changes in salmon and salmonid populations. The construction of a deep-water port at Inskin Bay with associated pipelines (concentrate, diesel) and access roads would mean recreational fishery effects similar in magnitude to potential combined direct effects described for Alternatives 1 and 3 earlier in this section, over a 78 year period.

**Other Mineral Exploration Projects** – Mineral exploration is likely to continue in the analysis area for the mining projects listed previously in this section. Exploration activities, including additional borehole drilling and temporary camp facilities would not affect commercial fishing but might affect the quality of experience of recreational fishing, depending on location and the level of associated aircraft noise. Impacts to commercial and recreational fisheries are expected to be limited in extent and low in magnitude.

**Road Improvement and Community Development Projects** – Anticipated road improvement projects in the region include new transportation corridors currently being studied in the Lake and Peninsula Borough (LPB), such as the Williamsport-Pile Bay Road upgrade. The most likely road improvements are in the development footprint of existing communities. The construction of linear features and sedimentation could functional productivity and result in changes to salmon and non-salmon fish populations thus affecting the value of the commercial fishery and recreational fishing opportunities. Some of these improvements could result in additional access to recreational fisheries.

Additional RFFAs in the region including oil and gas exploration and development, energy and utility projects, the Diamond Point rock quarry, and various village infrastructure development projects would not affect commercial fishing, but could result in in temporarily or permanent displaced recreational fishing, depending on location. Ease of access to waterbodies could increase recreational fishing opportunities and effort.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same for all alternatives. Under Alternative 2, project expansion would continue to use the existing Diamond Point port facility, would use the same natural gas pipeline, and would use the constructed portion of the north access road. After 20 years, the concentrate and diesel pipelines would be constructed, the road extended along the pipelines to Pile Bay, and the ferry would be discontinued. Truck traffic along the transportation corridor would decrease, potentially decreasing the effects on quality of the recreational experience.

As noted in Section 4.24, Fish Values, the magnitude of cumulative fish effects, and thus commercial and recreational fishery effects, would be lower than Alternative 1 because it would not affect the Gibraltar River. However, the magnitude of effects would be higher than Alternative 3 because it would stagger road construction and ferry operations over a longer period of time.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.



### **Alternative 3 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be the same for all alternatives. Under Alternative 3, project expansion would continue to use the existing Diamond Point port facility, would use the same natural gas pipeline, and would use the same north access road and Concentrate Pipeline Variant, but would extend the concentrate pipeline to Iniskin Bay.

While Alternative 3 would have the same cumulative mine site effects as Alternatives 1 and 2, cumulative effects related to transportation and infrastructure would be less than Alternative 1 or 2, as it would avoid the Gibraltar River and the need for a ferry, and because the natural gas pipeline and most of the road would exist under Alternative 3.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

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## 4.7 CULTURAL RESOURCES

This section discusses the environmental consequences that construction, operation, and closure of the project would have on cultural resources. Section 4.8, Historic Properties, focuses specifically on the consideration of effects on Historic Properties, as defined by the National Historic Preservation Act (NHPA) and 36 Code of Federal Regulations (CFR) Part 800. For the purposes of this section, the broad definition of cultural resource types is maintained as described in the affected environment (Section 3.7, Cultural Resources). Cultural resource types may range from prehistoric archaeology sites, traditional cultural properties, place names, traditional resource collecting areas (see Section 3.9, Subsistence), sacred or religious sites, and historic-era sites such as cabins or shipwrecks. This section also includes Alaska Heritage Resource Survey (AHRs) locations, because most of these locations have not yet been evaluated for National Register of Historic Places (National Register) eligibility under Section 106, and are not yet defined as historic properties.

When cultural resources are identified in the Environmental Impact Statement (EIS) analysis area, impacts that may result are considered. The EIS analysis area for cultural resources is the project footprint for direct effects; and lands within 3 miles of the mine site (including material sites) and within 1 mile of the other project components (e.g., port sites, transportation corridors, and ferry terminals) for indirect impacts (e.g. dust, visual, auditory, and olfactory). The EIS analysis area guides the discussion of direct and indirect environmental consequences on cultural resources.

The magnitude of impact considers the types of impacts (direct or indirect), and quantifies, to the extent possible; the number and types of cultural resources in each alternative subject to these impacts. The duration of impact is determined by whether the resource would be permanently removed, mitigated, or have indirect impacts that would cease at the end of mining activity. For example, long-term impacts would last throughout the life of the project—on the order of years to decades. Short-term effects would be temporary, lasting only through the construction phase, or months to years. Potential is the likelihood as to whether the impacts would occur.

### 4.7.1 Analytical Limitations

Not all of the current locations of proposed project components, including Alternatives 1, 2, and 3, have been researched or inventoried for cultural resources during the previous baseline studies completed by the Pebble Limited Partnership (PLP) between 2004 and 2013, and summarized in the Environmental Baseline Reports (SRB&A 2011a, 2015a, 2015b). Only the current configuration of the mine site has been subjected to more systematic cultural resource research and field investigations. Identified cultural resources have not all been evaluated for eligibility to the National Register. The previous PLP investigations completed background literature and file reviews for a broader regional area, and conducted interviews to identify cultural resources, place names, and land use areas in and near the project as it was proposed at the time. These data are supplemented by other sources of available ethnographic, traditional knowledge, and subsistence investigations that cover all or portions of the study area (see Section 3.7, Cultural Resources, for a list of these additional sources). The information contained in them is integrated into this analysis to the extent feasible. Further investigation is occurring through the NHPA Section 106 process (see Section 3.8, Historic Properties), which may result in the identification and analysis of additional cultural resources.

Where site-specific surveys have not been completed or where there are research gaps, site-specific impacts are undeterminable at this time, as is the ability to quantify the number of

resources potentially affected by the proposed project and alternatives. Impacts are based on interview-identified cultural resource features and place names data; it is assumed that a wide range of cultural resources exist across the landscape, and are within the project footprint. Gaps in data and analysis are reviewed in Section 3.7, Cultural Resources and Section 3.8, Historic Properties. As is usual where systematic cultural resources field studies have not been completed at the time of submittal of permit applications, the qualitative and quantitative impacts discussion will be refined through consultation and additional studies. In addition, it is not atypical during the National Environmental Policy Act (NEPA) process that field surveys by the applicant focus solely on the proposed alternatives, and have not been conducted for alternatives. The procedures detailing further work beyond the issuance of the Final EIS (FEIS) (e.g., the process for additional identification research and surveys, evaluation, and mitigation measures) will be established through the development of a Programmatic Agreement (PA), and is discussed in Section 3.8, Historic Properties.

#### **4.7.2 Impacts to Cultural Resources**

Scoping comments generally expressed concerns regarding impacts to historical and prehistorical sites, and the confidentiality of information shared on culturally and religiously significant properties. Some places of cultural importance were provided, and incorporated into Section 3.7, Cultural Resources, and the below analysis.

All of the action alternatives have the potential for direct impacts to cultural resources from the construction, operation, reclamation, and closure of the project. Necessary ground-disturbing actions involved with constructing and operating the mine and its facilities (i.e., transportation corridor, natural gas pipeline, and port facilities) can destroy, remove, or otherwise damage cultural resources. Direct impacts can include the physical destruction of a cultural resource, removal of a cultural resource from its original location, or result from project activities that increase a site's susceptibility to erosion. These types of direct effects are irreversible and permanent. For example, an archaeological site or spiritual object cannot be reconstructed once gone, and the significance (both cultural and scientific) is lost.

Indirect impacts are those that occur later in time or that are further removed in distance from the initial and primary action. For example, the presence of new visual elements, noise, olfactory (odors), and air pollution can impact aspects of a cultural resource from which they derive their significance. These changes result in alterations to the character and setting of a cultural resource. There is potential for permanent visual effects that alter the viewshed to or from a cultural resource with the introduction of buildings and roads where none currently exist. These impacts are particularly acute where setting and feeling are important aspects of a cultural resource's importance. Access restrictions, noise, pollution, lack of privacy, visual and olfactory intrusions can all negatively impact cultural landscapes, traditional cultural properties, and sites of religious or ceremonial significance, including burial grounds. Access to these areas and cultural practices can be limited or eliminated. Conversely, increased access to the region resultant from constructing access roads could lead to inadvertent or purposeful negative effects on cultural resources, such as looting, vandalism, or trespass in culturally sensitive areas. Collectively, these indirect changes can result in a loss of cultural identity at a landscape level as lifeway patterns and practices are disrupted. Temporary disruptions can still result in permanent impacts on lifeway practices and values.

The construction and operation of the project and related infrastructure could impact the availability and access to subsistence and cultural resources, which would alter the manner in which people interact with their natural surroundings. The highest intensity of impacts would occur nearest to the project, and would diminish in intensity with distance. These impacts would last through the project operations, and would diminish if cultural resources are re-established

after closure. Although there is a time horizon for the mine, and subsequent closure and reclamation actions are planned that might restore the visual and natural conditions following operation, the damage to cultural resources may not always be restorable to pre-project conditions. For example, impacts on harvest areas and hunting grounds may be permanent if those resources do not return following the disturbances caused by the mine.

In general, NEPA involves strategies such as modifying the project to avoid or minimize impacts to cultural resources. It is expected that the NEPA public process will result in gathering information and perspectives on potential mitigation measures. These will be incorporated into the FEIS. Project-related mitigation measures are incorporated into this analysis, and are discussed in Chapter 5, Mitigation.

In an area where the manner of how people interact with the natural environment is at the core of cultural beliefs, impacts of the project would be heightened, typically adverse, and may be permanent. Impacts on lifeway patterns, cultural and spiritual interactions with the environment, physical or indirect changes to archaeological sites, and other cultural resource types represent disruptions to the relationship between the people, and natural and cultural resources, and could impact the current and continuing health and vitality of their cultures.

### **4.7.3 No Action Alternative**

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Although no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). PLP would have the same options for exploration activities that currently exist. In addition, there are many valid mining claims in the area, and these lands would remain open to mineral entry and exploration.

There would be no new impacts to known AHRS sites, and existing activities that impact place names or other types of cultural resources would continue at the current intensity.

### **4.7.4 Alternative 1 – Applicant’s Proposed Alternative**

#### **4.7.4.1 Mine Site**

As noted in Section 3.7, Cultural Resources, there are a number of cultural resources in or near the mine site area that include AHRS-listed resources, interview-identified cultural resources (routes/trails, resource gathering areas, battle sites, reindeer stations, and camps), and place names. A complete survey of the project component footprints, however, has not yet been completed by PLP. Consequently, additional resources may be identified through public input, further research, and field survey.

Cultural resources in or near the mine site may be directly or indirectly impacted by construction and operation activities. Construction and operation of the mine involves activities such as grading/excavation and blasting. Ground disturbance is necessary not only for the open pit operation, but also for activities such as construction of all the ancillary facilities, including camps, shops, power and crushing plants, waste rock and tailings storage areas, quarry development, and road construction and maintenance. Ground disturbance would occur for both permanent and temporary activities. Each of these actions can directly impact cultural resources. Indirect impacts include auditory impacts from construction and operations (running equipment, blasting), dust and air pollution, olfactory pollution, and introduction of new visual elements. The indirect effects can alter the character, setting, and experience of adjacent cultural resource and/or change the use pattern and access to these resources.

Two known AHRS locations are in the mine site footprint. ILI-00251 is a small lithic scatter composed of two flakes, and falls within the proposed seepage collection system. The magnitude and extent of adverse effects from construction of the seepage system would be the destruction of this site. In addition, ILI-00218, a single microblade core, is in the footprint of the mine access road along the eastern side of the water management pond. Construction of the mine access road and pond would also permanently destroy this site and cover it with water. These impacts are irreversible, and would not be diminished through reclamation activities. The impacts on these two sites are certain to occur.

There are 40 interview-identified sites present in the mine site EIS analysis area; 14 of these features are in the project footprint. These consist primarily of trails/routes and traplines that cross through the area, and traditional use areas (e.g., camps, harvest locations) for fishing, trapping, caribou and moose hunting near Sharp Mountain, the headwaters of the Koktuli River, Frying Pan Lake, and Groundhog Mountain. There are no place names in the project footprint, but five place names are in the analysis area, one of which is categorized as a spiritually important place in the interview-identified cultural resources information (Groundhog Mountain: *Qiyhi Qelahi, Qiyhi Dghil'u*).

The magnitude and extent of adverse impacts on the use of these trails/routes from construction and placement of mine facilities and the presence of obstacles would be an interruption to the continuity and use of these linear features. Resources accessed by these routes may also be displaced, which alters use patterns and changes the relationship of users to those resources. To the extent these areas are used for hunting and trapping, mine construction and operation would disrupt the subsistence use patterns of the area (see Section 4.9, Subsistence). Although physical disruption of cultural features on the ground (e.g., camps and harvest areas) is unlikely, because none are identified in the footprint, the potential for indirect effects remains. The impacts on traditional use areas would be long-term lasting for the duration of mine construction and operation, and are potentially permanent, because these patterns of resource access and use would be altered. There would also be permanent impacts remaining after closure such as the pit lake and new landform resulting from closure and burial of the bulk tailings storage facility. These impacts on trail and site use would be realized if the project is permitted and built.

Indirect impacts may include visual, atmospheric, olfactory, and audible intrusions as a result of construction and operation activities, or disruptions to the subsistence lifestyle and increased presence of people in culturally sensitive areas. Traditional use areas for fishing and hunting fall within the geographic extent of the mine site EIS analysis area, and there are camps, cabins, and trails/routes surrounding the mine site. Cultural resources sites identified in the EIS analysis area, but outside of the mine footprint, include hunting camps composed of modern and historic rock features (e.g., tent rings), refuse (e.g., shell casings, plastic, and food wrappers), and caribou antlers or bones, all demonstrating continued use for traditional subsistence and resource procurement activities. Other AHRS locations in the analysis area include isolated artifacts, lithic scatters, and cobble formations (e.g., rings and piles). Indirect effects related to visual, audible, or atmospheric changes (air pollution, olfactory) on archaeological sites are not expected because historical integrity would not be impacted. The magnitude of indirect effects on archaeological sites and other cultural resources from increased population and use of the area would be site looting or trampling of cultural features—both purposefully, or inadvertently. The magnitude and extent of impacts due to the introduction of noise new visual elements in the landscape, and dust from construction and operation of the mine would be in the potential reduction of the use of traditional harvest areas identified near the mine. This impact would decrease with distance from the mine site, but would be long term, lasting through the life of the mine and into closure. The impacts on use of traditional harvest areas would be certain to occur.

The camps, cabins, and sites themselves would not be subject to indirect impacts as much as the use of the area due to resource displacement.

#### 4.7.4.2 Transportation Corridor

The Alternative 1 transportation corridor, and particularly the port access road between Amakdedori and Kokhanok, is the component of the proposed project with the least amount of information from previous surveys. The transportation corridor (including the overland pipeline route and ferry terminals) would potentially subject cultural resources to the direct and indirect effects as characterized above in the mine site discussion. Direct impacts from road, pipeline, and ferry terminal construction are one aspect of the potential consequences for cultural resources. The magnitude and extent of adverse impacts from construction activity would be the destruction of any cultural resources in the port and access roads, spur roads, ferry terminal, and pipeline footprints. The impacts would be permanent, and would occur if the mine and transportation corridor are permitted and constructed.

There are nine known AHRS locations in the transportation corridor analysis area. None of these are in the project footprint, so none would be subject to direct impacts. These AHRS locations include lithic debitage, cobble features, one shipwreck, and two village remains (Gibraltar and Amakdedori). The shipwreck and Amakdedori Village are discussed below. The magnitude and extent of indirect impacts on the AHRS locations from increased access and potential visitation to these resources would be the potential destruction or looting of the site. These impacts would be permanent and possible if the transportation corridor is built. For these archaeological sites, indirect effects related to air, noise, or visual impacts are unlikely because historical integrity would not be impacted.

There are 190 interview-identified cultural features in the transportation corridor for Alternative 1 (with 69 occurring in the footprint), primarily those identified by informants in Kokhanok. These include a range of cultural resource types as discussed in Section 3.7, Cultural Resources. There is one spiritually important place identified (a fish camp and old church site near Kokhanok), and two interview-identified place names (Gibraltar Mountain and a cabin near the mouth of Talaquana Lake). The place name database does not cover the section from Kokhanok to Amakdedori, but five place names are identified north of Iliamna Lake, and two of those are intersected by the footprint (Mouth of Upper Talarik Creek: *Eseni Dghil'u Hdakaq'* and the Newhalen River: *Nughil Vetnu*).

The magnitude of adverse direct and indirect effects on these cultural resources from noise and visual intrusions may adversely qualities of these resources that contribute to their cultural significance and use. For example, burial sites and other spiritual sites may be impacted by traffic noise and visual intrusions of a new mine or port access road in the vicinity that result in disruptions to users visiting these sites. Routes and trails that intersect the mine and port access roads and spur roads would be impacted, and use patterns would be perceptibly altered as a result. The discussion of impacts from disruption of traditional use areas in the mine site applies here. For example, traditional hunting and resource-gathering grounds may be disrupted by traffic noise adjacent to the corridor, and access to these areas may be restricted or changed. These impacts would be most noticeable in the immediate vicinity of project component footprints, but would diminish with distance from the roads and spurs. The magnitude and extent of impacts to sites of spiritual significance would be an alteration of the viewshed. Noise and dust from construction and operations may also affect the setting and experience of these places. These impacts would be long term, and would last through construction and operation of the transportation corridor. However, the displacement of resources and alteration of land use patterns could permanently impact cultural resources in the

transportation corridor. Impacts to the spiritual significance and use of cultural resources would occur under Alternative 1.

#### **4.7.4.3 Amakdedori Port**

Construction and operation of the port facility area would also subject cultural resources to direct and indirect effects, as characterized above. In addition to the three known AHRS locations (one village, one lithic scatter, one historic shipwreck), interview-identified data and public input suggest more cultural resources exist in this area; including, but not limited to, burials, cabins, and trails/routes. Five interview-identified sites were recorded in the port footprint.

Two archaeological sites are subject to indirect impacts. Although not in the project footprint, the revised location of Amakdedori Village (ILI-00044) places it southwest of the main port facility. The lithic scatter (HDR-AMK-01) is along the port access road north of the main port facility. The magnitude and extent of indirect effects to these sites would be the potential for site destruction due to increased access to the area. This area is also used for culture camps and field trips, and the presence of a port facility would be an intrusion on that experience. Noise and dust would also have an adverse impact on the use of these sites. The setting and experience of contemporary site users would be adversely altered over the long term (i.e., years to decades) by construction and operation of the port. The indirect impacts to these two sites would be possible if the port is approved and built.

#### **4.7.4.4 Natural Gas Pipeline Corridor**

The discussion on the environmental consequences of other project components provided in the previous sections also applies to the natural gas pipeline; particularly the direct and indirect impacts associated with the transportation corridor. This is because the pipeline is co-located with the transportation corridor from Amakdedori port to the mine site. Regarding the Cook Inlet Crossing, limited underwater archaeology or historic maritime investigations have occurred for the subsea bed portion of the pipeline. Side-scan sonar data have been gathered, but have not yet been subject to archaeological analysis. One shipwreck (ILI-00291: AGRAM) has been identified, but is not in the footprint of the offshore components near Amakdedori port; therefore adverse effects to this shipwreck are not expected. Any archaeological sites or shipwrecks in the alignment could be directly affected by construction, but these cultural resources would likely be avoided, and therefore not impacted. The magnitude of indirect effects to cultural resources adjacent to the pipeline route in Cook Inlet would be in changes to the sites from subsurface wave action and sediment disturbance. These impacts would be short term, lasting only during the construction phase but would be expected to occur.

On the coast of the Kenai Peninsula, there are cultural resources in the analysis area near the compressor station. These include SEL-00164 (Clabo Midden Site), SEL-00369 (Whiskey Gulch Site 1), and SEL-00379 (Sterling Highway). Of these, the Sterling Highway is in the project footprint. Indirect effects on the other two sites are unlikely due to their distance from the potentially disturbed area.

#### **4.7.4.5 Alternative 1 – Kokhanok East Ferry Terminal Variant**

The area of the Alternative 1 Kokhanok East Ferry Terminal Variant includes known AHRS locations at Kokhanok, a contemporary village that contains historic-era buildings identified in the AHRS (e.g., ILI-00025 Saints Peter and Paul Chapel and ILI-00262 Kokhanok BIA School). Direct impacts to these buildings or Old Kokhanok (ILI-0008) are not likely to occur from the construction of the Kokhanok east spur road to the village. The magnitude and extent of indirect



impacts would be in a change in the setting from increases in project-generated noise and dust due to traffic. As described above, these impacts would be and long term and would be realized under this variant.

#### **4.7.4.6 Alternative 1 – Summer-Only Ferry Operations Variant**

This variant for Alternative 1 does not change the types of direct or indirect impacts anticipated, or the quantity of resource impacted.

#### **4.7.4.7 Alternative 1 – Pile-Supported Dock Variant**

This variant for Alternative 1 does not change the types of direct or indirect impacts anticipated, or the quantity of resource impacted.

### **4.7.5 Alternative 2 – North Road and Ferry**

Alternative 2 would have the same potential for direct and indirect impacts on cultural resources at the mine site as discussed above for Alternative 1. The transportation corridor, Diamond Point port, and the natural gas pipeline would have the same types of potential effects as Alternative 1, but in different locations. These include 21 known AHRS sites in the transportation corridor, of which two are in the footprint: the Williamsport-Pile Bay Road (ILI-00132) and the historic Knutson Bay houses (ILI-00032). The transportation corridor would overlap with the existing Williamsport-Pile Bay Road, which would have both direct and indirect impacts. There are no known AHRS sites at the Diamond Point port site, and one interview-identified feature recorded in the port footprint.

In terms of potential modification and setting, this alternative would cross through areas where there are 23 known locations with indigenous place names (12 of which are in the footprint), and 169 interview-identified cultural features are present across the landscape, with 84 of them in the project footprint. The magnitude, extent, and duration of direct and indirect impacts to these cultural features would be similar to those described above for sites potentially impacted by Alternative 1. Impacts to these features would occur under Alternative 2.

#### **4.7.5.1 Alternative 2 – Summer-Only Ferry Operations Variant**

This variant would not change the types of direct or indirect impacts anticipated or the quantity of resource impacted.

#### **4.7.5.2 Alternative 2 – Pile-Supported Dock Variant**

This variant would not change the types of direct or indirect impacts anticipated or the quantity of resource impacted. Alternative 3 – North Road and Ferry

Alternative 3 would have the same potential for direct and indirect impacts on cultural resources at the mine site as discussed above for Alternative 1. The transportation corridor, Diamond Point port, and the natural gas pipeline would have the same types of potential effects as Alternative 1, but in different locations. These include 19 known AHRS sites in the transportation corridor, of which two are in the footprint. Additionally, the transportation corridor would overlap with the existing Williamsport-Pile Bay Road, which would have both direct and indirect impacts. There are no known AHRS sites at the Diamond Point port site.

In terms of potential modification and setting, this alternative would cross through areas where there are 23 known locations with indigenous place names (12 of which are in the footprint), and 156 interview-identified cultural features are present across the landscape, including 78 that would be in the project footprint. The magnitude, extent, and duration of direct and indirect

impacts to these cultural features would be similar to those described above for sites potentially impacted by Alternative 1. Impacts to these features would occur if under Alternative 3.

#### 4.7.5.3 Alternative 3 – Concentrate Pipeline Variant

The variant proposed for Alternative 3 would be located in the immediate vicinity of the natural gas pipeline, and would not change the types of direct or indirect impacts anticipated or the quantity of resource impacted.

#### 4.7.6 Summary of Key Issues

Table 4.7-1 provides a summary of key issues.

**Table 4.7-1: Summary of Key Issues for Cultural Resources**

	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
<b>Mine Site</b>			
Known AHRS locations (identified to date)	2 known sites in the footprint would be destroyed as a result of facilities construction.		
Place names	No locations with place names are the footprint, but five known place names are in the analysis area. Each of these is subject to indirect effects as a result of constructing the mine. These include visual, auditory, olfactory, and atmospheric changes that may alter the character, setting, and use of these resources.		
Interview-identified cultural resources	40 interview-identified cultural resources are in the mine site analysis area. Direct impacts could occur due to disruption to resource gathering cycles, routes, and trails. 14 sites would be subject to indirect impacts. Indirect impacts could occur from new visual, auditory, olfactory, and atmospheric changes that may affect character, setting, and use of these cultural resources.		
<b>Transportation Corridor</b>			
Known AHRS locations (identified to date)	0 known sites would be subject to direct impacts. 9 known sites would be subject to indirect impacts. <i>Kokhanok east ferry terminal variant</i> : 3 known sites subject to indirect impacts.	2 known sites would be subject to direct impacts. 19 known sites would be subject to indirect impacts.	2 known sites would be subject to direct impacts. 17 known sites would be subject to indirect impacts.
Place names	2 place names in the footprint would be subject to direct impacts. 4 place names would be subject to indirect impacts.	23 place names would be subject to direct impacts. 12 place names would be subject to indirect impacts.	
Interview-identified cultural resources	190 features would be subject to direct and indirect impacts, including 69 features that would be subject to direct impacts.	169 features would be subject to direct and indirect impacts, including 84 features that would be subject to direct impacts.	153 features would be subject to direct and indirect impacts, including 78 features that would be subject to direct impacts.
<b>Amakdedori Port and Diamond Point Port</b>			
Known AHRS locations (identified to date)	0 known sites would be subject to direct impacts. 3 known sites would be	0 known sites would be subject to direct impacts. 0 known sites would be subject to indirect impacts.	

**Table 4.7-1: Summary of Key Issues for Cultural Resources**

	Alternative 1 and Variants	Alternative 2 and Variants	Alternative 3 and Variant
	subject to indirect impacts.		
Place names	None identified to date in the area separate from the transportation corridor.		
Interview-identified cultural resources	5 features in the project footprint.	1 features in the project footprint.	
<b>Natural Gas Pipeline</b>			
Known AHRS locations (identified to date)	Same as transportation corridor, except for the pipeline crossing Cook Inlet: 1 known site would be subject to direct impacts. 3 known sites would be subject to indirect impacts.		
Place names	Same as transportation corridor, except for the pipeline crossing Cook Inlet. No investigations have occurred for this portion of the pipeline. Any archaeological sites or shipwrecks in the alignment would be directly affected by construction.		
Interview-identified cultural resources			

### 4.7.7 Cumulative Effects

The cumulative effects analysis area for cultural resources encompasses the EIS analysis area described above. Past, present, and reasonably foreseeable future actions (RFFAs) have the potential to contribute cumulatively to effects on cultural resources, detailed in Section 4.1. These potential future actions are similar to the proposed alternatives in that each may result in direct and indirect effects on cultural resources, as discussed above. These actions could generate incremental changes to cultural resources, exposing additional sites, or causing disturbance to the sites or their setting. The following RFFAs identified in Section 4.1, Introduction to Environmental Consequences, apply to the consideration of cumulative effects on cultural resources.

- Pebble Project Expansion—develop 55 percent of delineated resources over a 78-year period
- Pebble South/PEB\*
- Big Chunk South\*
- Big Chunk North\*
- Fog Lake\*
- Groundhog\*
- Shotgun\*
- Johnson Tract\*
- Donlin Gold
- Diamond Point Rock Quarry
- Alaska Stand Alone Pipeline (ASAP)
- Alaska Liquefied Natural Gas (LNG)
- Drift River Oil Pipeline
- Cook Inlet Lease Sales
- Hydrocarbon Exploration
- Lake and Peninsula Borough (LPB) Transportation Projects
- LPB Capital Improvement Projects
- US Department of Agriculture (USDA) Rural Development Projects
- LPB Renewable Energy Projects
- Nushagak Intertie Project
- Subsistence Activity
- Tourism, Recreation, Hunting, and Fishing
- Scientific Surveys and Research

*\*Indicates exploration activities only.*

Each of the above RFFAs would contribute to the increased potential for impacts on a wide range of cultural resources, because each action involves some aspect of ground-disturbing activity that can lead to the irreversible destruction of cultural resources, or affect the character or setting of the cultural resources.

#### **4.7.7.1 Past and Present Actions**

Past and present actions that have, or are currently, affecting cultural resources in the EIS analysis area are minimal; there is no industry and limited infrastructure in the area. Such activities that have likely resulted in a loss of some cultural resources include development projects involving transportation infrastructure and community development actions, mining exploration and non-mining-related projects, commercial and subsistence fishing and hunting, and commercial recreation and tourism. Although past and present activities and development have removed or altered the character of some cultural resources in these areas, they are additive to other actions, increasing the total number of cultural resources affected.

Past exploration drilling at the Pebble deposit and other mineral deposits have occurred, including over 1,600 boreholes for the project. The direct cumulative impact of these past and present actions on cultural resources from mining exploration activities are minimal due to limited ground disturbance, although there may be indirect effects on use and cultural context.

Past development projects such as transportation infrastructure and housing development have also occurred. Construction of roads affects cultural resources through direct removal and destruction of an archaeological site. Indirect effects may be associated with the visual changes of introducing a new road, and the potential for increased access and traffic noise that would result from constructing a new road. However, these development projects have a relatively small construction footprint; and consequently, have likely resulted in limited past and present cumulative effects on a regional basis. Those past and present projects that are considered federal undertakings, consistent with 36 CFR 800.16, and since the passing of the NHPA in 1966, would have required the applicable federal agencies to avoid, minimize, or otherwise resolve adverse effects to properties eligible for, or listed in, the National Register.

#### **4.7.7.2 Reasonably Foreseeable Future Actions**

##### **No Action Alternative**

The No Action Alternative would not contribute to cumulative effects on cultural resources.

##### **Alternative 1 – Applicant’s Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario would increase the geographic area affected and duration of effects of the project by combining project elements of Alternatives 1 and 3. Once a cultural resource feature, archaeological site, or historic site is destroyed, its value is gone and cannot be restored. Actions that expand mineral development at the Pebble deposit and around Iliamna Lake contribute to landscape-level effects, where there is continuous introduction of intrusive visual elements, increased noise and atmospheric pollution, and an increased volume of people. Such effects would occur over an extended period of operations. These could lead to inadvertent and purposeful destruction of cultural resource features, invasion of privacy and solace at spiritual and ceremonial sites, adverse impacts on natural resources that are central to cultural belief systems, and subsequent degradation of these cultural belief systems that have far-reaching social and physical health impacts. Effects such as habitat fragmentation, noise, and increased

access for recreational hunting and fishing also disrupt subsistence activity, and may result in impacts to resource-gathering areas and other cultural features.

**Other Mineral Exploration Projects** – Mineral exploration is likely to continue in the analysis area for the mining projects listed above. Many of the mining exploration activities would have minimal ground disturbance, but would include helicopter overflights that can disturb cultural activities and the context of a cultural resource site. Exploration activities, including additional borehole drilling and construction of temporary camp facilities, may result in disturbance to cultural resources. Impacts to cultural resources are expected to be limited in extent and low in magnitude.

**Road Improvement and Community Development Projects** – Anticipated road improvement projects in the region include new transportation corridors, such as the historic Williamsport-Pile Bay Road upgrade. Road improvements are most likely in the development footprint of existing communities. Construction of roads affects cultural resources through direct removal and destruction of an archaeological site. Indirect effects may be associated with the visual changes of introducing a new road, and the potential for increased access and traffic noise that would result from constructing a new road. In particular, archaeological sites in the vicinity of the road could be subject to increased visitation and damage from use, vandalism, and trampling.

An increase in resource development and marine traffic along the Cook Inlet coastline could impact traditional uses and the associated cultural resources, such as ceremonial and harvest sites and religious and spiritual practices centered on the health and relationship of people to the land they inhabit.

Additional RFFAs that have the potential to affect cultural resources in the region include mineral and oil and gas exploration projects, energy and utility projects, the Diamond Point rock quarry, and various village infrastructure development projects. These projects would have effects similar to the Pebble Project, but would be of lesser magnitude and geographic extent. However, when considered in combination with the Pebble Project, impacts to cultural resources would increase.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to those discussed under Alternative 1, but without the Amakdedori port facilities and transportation corridor. Under Alternative 2, project expansion would continue to use the existing Diamond Point port facility; would use the same natural gas pipeline; and would use the constructed portion of the north access road. After 20 years, the ferry would be discontinued; road connections between ferry terminals would be constructed similar to what is described in Alternative 3; and the port site and associated facilities would be constructed at Iniskin Bay, as discussed under Alternative 1 above. The concentrate pipeline from the mine site to Iniskin Bay would be constructed similar to Alternative 3, and a diesel pipeline from the mine site to Iniskin Bay would be constructed as discussed under cumulative effects for Alternative 1. Cumulative impacts to cultural resources from Alternative 2, combined with the Pebble mine expanded development scenario, would be of lesser magnitude and geographic extent than Alternative 1 because there would be no development at Amakdedori, and the Alternative 1 transportation corridor would not be used. Alternative 2, in combination with the Pebble mine expanded development scenario, may result in impacts to cultural resources; however, these changes to cultural resources would occur over a smaller geographic area and acreage than under Alternative 1.

**Other Mineral Exploration Projects, Road Improvement, and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

**Alternative 3 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to Alternative 1. Under Alternative 3, project expansion would continue to use the existing Diamond Point port facility; would use the same natural gas pipeline; and would use the same north access road and Concentrate Pipeline Variant, but extend the concentrate pipeline to Iniskin Bay. The port site and associated facilities would be constructed at Iniskin Bay, as discussed under Alternative 1 above. A diesel pipeline from the mine site to Iniskin Bay would be constructed as discussed under cumulative effects for Alternative 1. Because the Pebble mine expanded development scenario would use the north access road that would already be built under Alternative 3, and not include any ferry operation, cumulative effects from Alternative 3, combined with the Pebble mine expanded development scenario to cultural resources, would be less than Alternatives 1 or 2.

**Other Mineral Exploration Projects, Road Improvement and Community Development Projects** – Cumulative effects of these activities would be similar to those discussed under Alternative 1.

## 4.8 HISTORIC PROPERTIES

Section 4.8 discusses the effects that construction, operations, and closure of the mine would have on historic properties (see Section 3.8, Historic Properties, for definitions and use of the term “historic property”). However, because historic properties are defined being as eligible for inclusion, but not necessarily listed, on the National Register of Historic Places (National Register) and eligibility determinations have not yet been made for the sites discussed in Section 4.7, Cultural Resources, at this time there is only one historic property identified in the Environmental Impact Statement (EIS) analysis area (see below). Therefore, Section 4.7, Cultural Resources, offers a discussion of the effects on cultural resources that includes known Alaska Heritage Resources Survey (AHRS) sites, archaeological sites, place names, and interview-identified cultural resources. There are four sites discussed in Section 4.7, Cultural Resources, for which eligibility is not determined. This section considers the process for assessing effects on historic properties as defined by US Code (USC) 306108 of the National Historic Preservation Act (NHPA) (54 USC 300101 et seq.) and its implementing regulations “Protection of Historic Properties” (36 Code of Federal Regulations [CFR] Part 800), in the statute 54 USC 300308, and in 33 CFR Part 325 Appendix C. Section 106 requires considering the project’s potential to cause effects on historic properties in the Area of Potential Effect (APE) for the undertaking as defined in association with the permit area. At this time, the APE is not defined, and the permit area is defined as the direct footprint of all areas where fill or excavation would occur, where facilities or structures would be installed, and the areas used for construction of the project. The EIS analysis area described in Section 3.7, Cultural Resources, provides the geographic extent for identifying historic properties and the direct and indirect effects that may result: the project footprint for direct impacts and within 3 miles of the mine site (including material sites) or 1 mile of other project components for indirect impacts. There were no specific scoping comments expressing concern for historical properties. Applicable comments were made only in the context of cultural resources (see Section 4.7, Cultural Resources).

The magnitude of impacts considers the types of impacts (direct or indirect) and quantifies, to the extent possible, the number and types of historical properties potentially subject to these impacts. The duration of impact is determined by whether the resource would be permanently removed, mitigated, or have indirect impacts that would cease at the end of mining activity. For example, long-term impacts would last throughout the life of the project, years to decades. Short-term impacts would be temporary, lasting only through the construction phase, or months to years. The likelihood of impacts would be the certainty that the impact would occur.

### 4.8.1 Analytical Limitations

Adjustments to the number of historic properties affected are anticipated, because additional properties will likely be identified during the course of additional research and studies conducted under consultation currently under way as part of the NHPA Section 106 compliance process and development of the Programmatic Agreement (PA). The APE is not yet established for NHPA compliance purposes, and the permit area (defined under 33 CFR Part 325 Appendix C), in which the US Army Corps of Engineers (USACE) will analyze direct and indirect effects, is defined as the project footprint. Because identified cultural resources features are considered as potential historic properties, the number of historic properties may increase and expand the content and scope of this analysis. The consultation process is ongoing between the USACE, the Alaska State Historic Preservation Office (SHPO), and other consulting parties regarding the definition and delineation of the APE for the project. Eligibility for inclusion in the National Register defines a historic property, and the process of evaluation can occur concurrent with the

National Environmental Policy Act (NEPA) process. Not all of the project components were inventoried for historic properties during the baseline studies completed by Pebble Limited Partnership (PLP) between 2004 and 2013 (SRB&A 2011a, 2011b, 2015a, 2015b), and none of the sites identified in those studies were evaluated for eligibility for inclusion in the National Register. The evaluation step has not yet been taken for any cultural resources identified in the project components, with the exception of the Williamsport-Pile Bay Road (discussed below). Only the mine site has been subjected to systematic cultural resource field investigations. However, previous PLP investigations did complete background literature and file reviews for a broader regional area, and conducted interviews to identify cultural resources, place names, and land use areas in and near the project footprint. These data are supplemented by other sources of available ethnographic, traditional knowledge, and subsistence investigations that cover portions of the study area (see Section 3.7, Cultural Resources, for a preliminary list of these additional sources). It is likely that many of the identified cultural resource features (approximately 1,600) may also be evaluated and determined as historic properties. Archaeological and historic districts, and specific types of significance ascribed to certain areas, such as traditional cultural landscapes or traditional cultural properties, have also not yet been considered for eligibility.

#### **4.8.2 Effects on Historic Properties**

Per Section 106 of the NHPA, an adverse effect is found when an undertaking may alter, directly or indirectly, any of the characteristics of a historic property that qualify the property for inclusion on the National Register in a manner that would diminish the integrity of the property's location, design, setting, materials, workmanship, feeling, or association (36 CFR Part 800.5[a][1]). All of the action alternatives have the potential to cause adverse effects resultant from the construction, operations, and closure of the mine. The discussion of types of effects and environmental consequences provided in Section 4.7, Cultural Resources, for direct and indirect impacts on cultural resources can apply to the consideration of adverse effects on historic properties.

Additional identification and evaluation of each project component would take place through the NHPA Section 106 process to quantify the number and types of historic properties present prior to assessing types of effects that may occur. This process can be concurrent with the NEPA process and is currently underway. The USACE will address effects on historic properties through development of a Section 106 PA pursuant to 36 CFR Part 800.6 and 36 CFR Part 800.14(b)(3), and tie the completion of this process to the action of issuing a final permit for mine operation.

The steps and processes that the USACE will employ to complete the identification, evaluation, and mitigation of effects on historic properties will be captured in the PA. Per 36 CFR 800.14(b), the agency official (USACE) may negotiate a PA to govern the implementation of a particular program or the resolution of adverse effects from certain complex undertakings. The following applicable criteria for the use of a PA are met by the PLP project (36 CFR Part 800 14 [b][1][i, ii, and v]):

- When effects on historic properties are similar and repetitive or are multi-state or regional in scope.
- When effects on historic properties cannot be fully determined prior to approval of the undertaking.
- When other circumstances warrant a departure from the normal Section 106 process.



The USACE intends to confer with consulting parties through the NHPA Section 106 process to develop the PA. The PA will record the terms and conditions agreed on to resolve the potential adverse effects, and to include consideration of mitigation measures and the ongoing strategies to identify and evaluate historic properties pre- and post-permitting. The PA will be part of the Record of Decision (ROD), and permits (if issued) will be conditioned with reference to completing the project in accordance with the PA. Compliance with the procedures established by the executed PA would satisfy the federal agency NHPA Section 106 responsibilities for the project.

### **4.8.3 Resolution of Adverse Effects**

Specific measures will be developed through the NHPA Section 106 and PA process to resolve (avoid, minimize, or mitigate) adverse effects on historic properties, to the extent practicable. The following are typical measures used to resolve adverse effects:

- Avoidance, which could be accomplished by shifting the footprint away from the resource, limiting activities in the vicinity of the resource, monitoring construction activities near the resource to inform whether additional actions are warranted, or through any combination of these techniques.
- Minimization, which would reduce the effects on the resource through avoidance measures as described above, but would not completely eliminate the effects.
- Mitigation, which may involve data recovery, protections of similar resources in nearby areas, contributions to local heritage programs in affected communities, interpretive exhibits, education curricula, or a host of other measures that would be decided on through consultation with the agencies and involved consulting parties.

### **4.8.4 No Action Alternative**

Under the No Action Alternative, the Pebble Project would not be undertaken. No construction, operations, or closure activities would occur. Although no resource development would occur under the No Action Alternative, permitted resource exploration activities currently associated with the project may continue (ADNR 2018-RFI 073). PLP would have the same options for exploration activities that currently exist. In addition, there are many valid mining claims in the area and these lands would remain open to mineral entry and exploration. There would be no new impacts to known historic properties in the region.

### **4.8.5 Alternative 1 – Applicant’s Proposed Alternative**

No historic properties have been identified in the EIS analysis area for the mine site, transportation corridor, Amakdedori port, or natural gas pipeline corridor. Therefore, there would be no direct or indirect impacts to identified historic properties under this alternative.

No historic properties have been identified in the EIS analysis area for the Summer-Only Ferry Operations Variant, the Kokhanok East Ferry Terminal Variant, or the Pile-Supported Dock Variant. Therefore, there would be no direct or indirect impacts to identified historic properties under these variants.

### **4.8.6 Alternatives 2 – North Road and Ferry with Downstream Dams and Alternative 3 – North Road Only**

The single historic property currently identified in the analysis area for all project components under Alternatives 2 and 3 is the Williamsport-Pile Bay Road (ILI-00132), described in Section 3.8, Historic Properties. Both alternatives share the construction of an access road from

Diamond Point to Pile Bay, and this road intersects and in some cases is collocated with the historic property. The magnitude and extent of the impact would be the partial destruction of the historic property and introduction of a new visual element in the current road corridor that affects the historic setting and feeling of the historic property; the indirect impacts (change in historic setting) would decrease in intensity with distance. The duration of the direct impact (i.e., partial destruction) would be permanent. The likelihood would be certain under these alternatives.

#### **4.8.7 Cumulative Effects**

The cumulative effects analysis area for identified historic resources encompasses the EIS analysis area described above. Past, present, and reasonably foreseeable future actions (RFFAs) detailed in Section 4.1, Introduction to Environmental Impacts, have the potential to contribute cumulatively to effects on historic properties listed in the National Register. These potential future actions are similar to the above alternatives in that each may result in direct and indirect effects on historic properties, as discussed above. These actions could generate incremental changes to historic properties, exposing additional sites, or causing disturbance to the sites or their setting. As there is only one identified historic property in the EIS analysis area, the following RFFAs identified apply to the consideration of cumulative effects:

- Pebble Project Expansion—develop 55 percent of delineated resources over a 78-year period.
- Potential improvements to the Williamsport-Pile Bay Road.

The above RFFAs would contribute to the increased potential for impacts on the identified historic resource, because each action involves some aspect of ground-disturbing activity that can affect the character or setting of the identified historic resource.

##### **4.8.7.1 Past and Present Actions**

Past and present actions that have, or are currently, affecting the identified historic property in the EIS analysis area are minimal. Some improvements, maintenance, and repair have likely been made for continued operation of the Williamsport-Pile Bay Road. It is also likely that the nature of traffic and use of the road has changed since original construction. However, it is unlikely that these improvements have affected the character or setting of the property.

##### **4.8.7.2 Reasonably Foreseeable Future Actions**

###### **No Action Alternative**

Under the No Action Alternative, future road improvements and maintenance activities have been identified for the Williamsport-Pile Bay Road. However, these activities would be typical of other Alaska roads that have been identified as eligible for the National Register, which are subject to road improvements.

###### **Alternative 1 – Applicant’s Proposed Alternative**

**Pebble Mine Expanded Development Scenario** – The Pebble mine expanded development scenario would result in both improvements to portions of the existing Williamsport-Pile Bay Road after 20 years of initial operation, and construction of an improved and parallel alignment along steeper portions of the road. As an indirect benefit, the condition of the road would be improved for current and future non-project users, although some access and traffic controls could be implemented to ensure the safety of mixed mine and non-mine traffic. The road would be maintained for year-round traffic, and the level of traffic would increase over current volumes.

This would have some effect on the character and setting of the Williamsport-Pile Bay Road, but would be typical of other Alaska roads that have been identified as eligible for the National Register, which are subject to road improvements.

**Other Road Improvement Projects** – The road improvement and maintenance activities that are currently for the Williamsport-Pile Bay Road would be similar to those indicated under the No Action Alternative. These activities would likely occur before year 20 expanded operations, and would have similar impacts as described under the No Action Alternative.

### **Alternative 2 – North Road and Ferry with Downstream Dams**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to those discussed under Alternative 1. However, project-related improvements to and realignment of the Williamsport-Pile Bay Road would be done during initial project construction. Project expansion traffic levels on the Williamsport-Pile Bay Road would be higher than Alternative 1, where project truck traffic would be split between ports at Amakdedori and Diamond Point in Iniskin Bay.

**Other Road Improvement Projects** – Road improvement and maintenance activities would have contributions to cumulative effect as described under Alternative 1.

### **Alternative 2 – North Road Only**

**Pebble Mine Expanded Development Scenario** – Expanded mine site development and associated contributions to cumulative impacts would be similar to those discussed under Alternative 2.

**Other Road Improvement Projects** – Road improvement and maintenance activities would have contributions to cumulative effect as described under Alternative 1.

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