FINAL REPORT

Pebble Project
Compensatory Mitigation Plan

November 2020

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Executive Summary

Pebble Limited Partnership (PLP) submitted a Department of the Army (DA) application, pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, to the U.S. Army Corps of Engineers (USACE). The DA application proposes the development of a copper-gold-molybdenum porphyry deposit as a surface mine in Southwest Alaska. Project construction requires discharge of fill into 2,179.5 acres of jurisdictional wetlands and other waters and 105.4 miles of streams. Project operations will indirectly affect an additional 1,470.3 acres of jurisdictional wetlands and other waters and 79.6 stream miles. PLP is submitting this Compensatory Mitigation Plan (CMP) to the USACE in fulfillment of the requirements established by the Compensatory Mitigation for Losses of Aquatic Resources Final Rule issued by the USACE and the U.S. Environmental Protection Agency (EPA) on April 10, 2008 (33 Code of Federal Regulations [CFR] 332). The Project is comprised of four primary elements: the mine site at the Pebble deposit location, a port site in Iliamna Bay in Cook Inlet, a road corridor connecting the mine site and the port, and a natural gas pipeline and fiber optic cable connecting to existing infrastructure on the Kenai Peninsula.

To appropriately compensate for these permanent and unavoidable impacts to aquatic resources associated with the mine site and the transportation corridor, PLP is proposing preservation of a 112,445-acre Koktuli Conservation Area in the Koktuli River watershed. The preservation of the Koktuli Conservation Area will allow the long-term protection of a large and contiguous ecosystem that contains highly valuable aquatic and upland habitats. The Koktuli Conservation Area will preserve 31,026 acres of aquatic resources within the aquatic resource of national importance-designated Koktuli River watershed. The protected resources provide the physical, chemical, and biological functions highlighted by the EPA and U.S. Fish and Wildlife Service. Preservation of the Koktuli Conservation Area will remove the threat to, and prevent the decline of, aquatic resources in the Koktuli River watershed from potential future actions, therefore ensuring the sustainability of fish and wildlife species that depend on these aquatic resources, while protecting the subsistence lifestyle of the residents of Bristol Bay and renowned commercial and recreational sport fisheries.

Factors considered during the site selection process include consideration of watershed needs, on-site alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site, as outlined in 33 CFR 332.4(c)(4). While alternatives to the proposed preservation site have been explored prior to and during the DA permit evaluation and National Environmental Protection Act analysis period, the August 20, 2020, letter from USACE Alaska District to PLP stated that "…in-kind compensatory mitigation within the Koktuli River watershed will be required to compensate for all direct and indirect impacts caused by discharges into aquatic resources at the mine site" (USACE 2020b).

A Declaration of Covenants and Restrictions that establishes the conservation area will be recorded in the appropriate recording district prior to any Project construction. The included covenants and restrictions will run with the land and prevent incompatible uses. The Pebble Project Final Environmental Impact Statement (USACE 2020a) provides a detailed discussion regarding the ecological characteristics of the Project area. Section 5, Baseline Information, further describes the ecological characteristics of the Koktuli Conservation Area, providing an overview of the hydrology, wetlands and waterbodies, fish resources, Mulchatna caribou herd, and land management plans.

Mitigation credits are determined as a ratio of acres of wetlands and other waters impacted to acres of wetlands and other waters preserved in the Koktuli Conservation Area. The permanent placement of fill into wetlands and waters for Project infrastructure will directly impact 2,179.4 acres of wetlands and other waterbodies and indirectly impact 1,470.3 acres of wetlands and other waterbodies. The Project will also directly impact 105.4 miles of streams and indirectly impact 79.6 miles of streams. PLP proposes to mitigate for these impacts through preservation of 27,886 acres of wetlands, 1,174 acres of other waters, and 814 miles (1,967 acres) of streams in the Koktuli Conservation Area.

The Koktuli Conservation Area will be protected in its existing pristine condition. The mitigation work plan involves implementation of the Site Protection Instrument, monitoring, and long-term management. Performance standards consist of monitoring, enforcing, and documenting compliance of the requirements of the Site Protection Instrument. The Koktuli Conservation Area will be monitored by PLP for 5 years following establishment of the Site Protection Instrument and for the duration of the Long-term Management Plan. Monitoring will evaluate compliance with the Site Protection Instrument through documentation of the new surface disturbances prohibited by the Site Protection Instrument. Through the implementation of this Compensatory Mitigation Plan, PLP will fulfill its obligations of the permit application and mitigate for the impacts associated with the proposed Project.

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ACRONYMS AND ABBREVIATIONS

ADNR	Alaska Department of Natural Resources
ADF&G	Alaska Department of Fish and Game
AS	Alaska Statute
AWC	Anadromous Waters Catalog
CFR	Code of Federal Regulations
CMP	Compensatory Mitigation Plan
CWA	Clean Water Act
DA	Department of the Army
DMLW	Division of Mining, Land and Water
EIS	Environmental Impact Statement
ENWI	Enhanced National Wetlands Inventory
EPA	Environmental Protection Agency
HGM	Hydrogeomorphic
HUC	Hydrologic Unit Code
MCO	Mineral Closing Order
n.d.	no date
NEPA	National Environmental Policy Act
NHD	National Hydrology Dataset
NRWTUA	Nushagak River Watershed Traditional Use Area
PLP	Pebble Limited Partnership
RRMP	Rivers Recreation Management Plan
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WOUS	waters of the U.S., including wetlands

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1 Introduction

Pebble Limited Partnership (PLP) submitted a Department of the Army (DA) application, pursuant to Section 404 of the Clean Water Act (CWA) and Section 10 of the Rivers and Harbors Act of 1899, to the U.S. Army Corps of Engineers (USACE) on December 22, 2017, for the Pebble Project (Project) (POA-2017-271). A final DA application was submitted to the USACE on June 8, 2020. The Applicant proposes the development of a copper-gold-molybdenum porphyry deposit as a surface mine in Southwest Alaska. Project construction requires discharge of fill into 2,179.5 acres of jurisdictional wetlands and other waters (unvegetated lakes, ponds, estuarine, and marine waters) and 105.4 miles of streams. Project operations will indirectly affect an additional 1,470.3 acres of jurisdictional wetlands and other waters and 79.6 stream miles. Environmental effects of the Project were evaluated by the USACE under the National Environmental Policy Act (NEPA) through development of a Final Environmental Impact Statement (EIS) published July 24, 2020 (USACE 2020a).

PLP is submitting this Compensatory Mitigation Plan (CMP) to the USACE in fulfillment of the requirements established by the Compensatory Mitigation for Losses of Aquatic Resources Final Rule (2008 Rule) issued by the USACE and the U.S. Environmental Protection Agency (EPA) on April 10, 2008 (33 Code of Federal Regulations [CFR] 332). This CMP follows the 2008 Rule's requirements.

PLP has avoided and minimized, to the extent practicable, discharges of fill into waters of the U.S. (WOUS), including wetlands. Avoidance and minimization measures are discussed in Block 23 of the DA Application. To appropriately compensate for permanent, unavoidable impacts to aquatic resources, PLP proposes permittee-responsible mitigation in the form of preservation of an 112,445-acre area in the Koktuli River watershed, referred to from here forward as the Koktuli Conservation Area (Figure 1-1).

2 Objectives (33 CFR 332.4(c)(2))

The Project comprises four primary elements: the mine site at the Pebble deposit, a port site in Iliamna Bay in Cook Inlet, a road corridor connecting the mine site and the port, and a natural gas pipeline and fiber optic cable connecting to existing infrastructure on the Kenai Peninsula. For the purposes of this document, the port, road corridor, and the natural gas pipeline are collectively referred to as transportation infrastructure.

The Project will result in permanent direct and indirect impacts to wetlands and other waters (Table 2-1) (Figure 2-1). Permanent impacts include cut and fill activities at facility locations where the fill cannot be practicably removed from WOUS. Indirect impacts include activities associated with the discharge of dredge and fill material to an area of WOUS that will have more than *de minimis* (i.e., inconsequential) effect on the area, causing permanent identifiable individual or cumulative adverse effects on any aquatic function (33 CFR 323.2 (d)(6)). Indirect impacts include impacts related to fragmentation, fugitive dust, and dewatering (USACE 2020a).

Table 2-1. Summary of Direct and Indirect Impacts to Wetland/Other Waters (acres)

Facility	Direct (acres)		Indirect (acres)		Total* (acres)	
	Wetlands	Other Waters	Wetlands	Other Waters	Wetlands	Other Waters
Mine Site	2,051.5	61.4	773.8	70.8	2,825.3	132.2
Transportation	38.4	28.2	422.2	203.4	460.6	231.6
Grand Total[a]	**2,089.9**	**89.6**	**1,196.1**	**274.2**	**3,285.9**	**363.8**

[a] Values may not sum due to rounding.

The Project will also result in permanent direct and indirect impacts to streams (Table 2-2).

Table 2-2. Summary of Direct and Indirect Stream Impacts (miles)

Facility	Total* (miles)		
	Direct	Indirect	Total[a]
Mine Site	99.7	29.9	129.5
Transportation	5.7	49.8	55.5
Grand Total[a]	**105.4**	**79.6**	**185.0**

[a] Values may not sum due to rounding.

To appropriately compensate for these permanent and unavoidable impacts to aquatic resources associated with the mine site and transportation corridor, PLP is proposing preservation of an 112,445-acre Koktuli Conservation Area in the Koktuli River watershed. The Koktuli River watershed includes the Headwaters Koktuli River, the Outlet Koktuli River, and the Swan River Hydrologic Unit Code (HUC) 10 watersheds. The objective of the Koktuli Conservation Area is to maintain the long-term ecological sustainability of the Koktuli River watershed. The Koktuli Conservation Area will protect a substantial and contiguous portion of a riverine ecosystem to allow large-scale and self-sustaining riverine system functions to continue over the long term without threat of human-induced surface impacts. This riverine system, along with associated wetland and other aquatic areas, will continue to support a variety of functions and services, including support for fish and wildlife populations, critical to the sustainability of the Koktuli River watershed and the larger Bristol Bay region.

The Koktuli Conservation Area is comprised of wetlands, other waters, streams and rivers (including the portions of the North Fork Koktuli River, South Fork Koktuli River, and almost the entirety of the mainstem Koktuli River), and associated wetland and upland habitats (Table 2-3; Figure 2-2). A key feature of the Koktuli Conservation Area is preservation of the Koktuli riparian corridor, an approximately 19,000-acre floodplain across which the Koktuli River meanders over time. The Koktuli riparian corridor consists of a complex mosaic with forested, shrub, and herbaceous wetlands; uplands; and stream features including flood channels, gravel bars, and abandoned channels.

Table 2-3. Koktuli Conservation Area

Resource Type	Within Koktuli Riparian Corridor		Outside of Koktuli Riparian Corridor		Total[b]	
	acres	miles	acres	miles	acres	miles
Wetlands	4,130.6	–	23,754.9	–	27,885.5	–
Other Waters	59.4	–	1,114.2	–	1,173.6	–
Streams[a]	1,676.7	373.3	290.5	441.0	1,967.2	814.4
Uplands	13,295.1	–	68,123.5	–	81,418.6	–
Total Acres[b]	**19,161.8**	**373.3**	**93,283.0**	**441.0**	**112,444.9**	**814.4**

[a] Streams are reported as both acres and mileage for consistency with the Pebble Project Final EIS.

[b] Values may not sum due to rounding.

The Koktuli Conservation Area will preserve 39 percent of the total acreage of two Koktuli River HUC 10 watersheds: the Headwaters Koktuli River (1903030211), where Project impacts are proposed to occur, and the Outlet Koktuli River (1903030213) (Table 2-4; Figure 2-2). The Headwaters Koktuli River HUC 10 includes two major tributaries, the North Fork and South Fork Koktuli Rivers. The Outlet Koktuli River

HUC 10 has one additional tributary, the Swan River (HUC 1903030212). The Koktuli Conversation Area does not overlap the Swan River HUC 10 watershed. The Koktuli River is a tributary of the Mulchatna and Nushagak Rivers which are part of the larger Bristol Bay watershed.

Table 2-4. Koktuli Conservation Area by Watershed

Watershed			Koktuli Conservation Area	
HUC 10	**HUC 12**	**Area [a] (acres)**	**Area [a] (acres)**	**Percent of Watershed**
Outlet Koktuli River (1903030213)	Lower Koktuli River (190303021305)	34,589	33,716	97%
	Other HUC 12 Watersheds	85,620	–	0%
	Outlet Koktuli River Total	**120,210**	**33,716**	**28%**
Headwaters Koktuli River (1903030211)	Upper Koktuli River (190303021102)	34,475	23,148	67%
	Unnamed (190303021104)	34,899	26,674	76%
	Middle Koktuli River (190303021105)	29,533	28,906	98%
	Other HUC 12 Watersheds	71,725	–	–
	Total Headwaters River Koktuli	**170,632**	**78,729**	**46%**
Total Outlet Koktuli River and Headwaters Koktuli River		**290,842**	**112,445**	**39%**

Notes: HUC: Hydrologic Unit Code

[a] Values may not sum due to rounding

The Koktuli Conservation Area is on lands owned by the State of Alaska, part of which are in the Lake and Peninsula Borough. The proposed conservation area is in southwest Alaska, approximately 200 miles southwest of Anchorage and 60 miles west of Cook Inlet. The closest communities are the villages of Iliamna, Newhalen, and Nondalton, each approximately 20 miles from the Conservation Area (Figure 1-1).

Preservation of the Koktuli Conservation Area is appropriate under the criteria of 33 CFR 332.3 (h):

1. *The resources preserved provide important physical, chemical, and biological functions of the waters of the U.S., including wetlands (WOUS) (33 CFR 332.3 (h)(i))*

   The preservation of the Koktuli Conservation Area will allow the long-term protection of a large and contiguous ecosystem that contains highly valuable aquatic and upland habitats, including a riparian corridor along 70 miles of the Koktuli River (North Fork, South Fork, and mainstem). The proposed mitigation action is consistent with the watershed approach for permittee-responsible mitigation as defined in 33 CFR 332.3 (b)(4) and (c). The protected habitats support fish, including provision of high-value anadromous fish spawning and rearing habitat, and other wildlife, such as the Mulchatna caribou herd, important for subsistence, recreation, and other human uses. The EPA and the U.S. Fish and Wildlife Service (USFWS) determined that Project area watersheds, Bristol Bay and its tributaries, the Nushagak and Koktuli Rivers, are aquatic resources of national importance as they "provide extensive and heterogeneous habitats for fishery resources" (EPA 2019) and "brown bear, black bear, moose, caribou, wolves, waterfowl, and many other species of mammals and birds" (USFWS 2019). As summarized by the EPA, "the Bristol Bay watershed supports an abundance of genetically diverse wild Pacific salmon populations unrivaled in North America. These salmon populations have significant economic, nutritional, cultural, and recreational value, both within and beyond the Bristol Bay region" (EPA 2019).

   The Koktuli Conservation Area will preserve 31,026 acres of aquatic resources within the aquatic resources of national importance-designated Koktuli River watershed. The protected resources

provide the physical, chemical, and biological functions highlighted by the EPA and USFWS. A more detailed description of the aquatic resources within the Koktuli Conservation Area is provided in Section 5, Baseline Information (33 CFR 332.4(c)(5)).

2. *The resources to be preserved contribute significantly to the ecological sustainability of the watershed. (33 CFR 332.3 (h)(ii))*

   Preservation of the Koktuli Conservation Area will remove the threat to, and prevent the decline of, the 31,026 acres of aquatic resources in the Koktuli River watershed from potential future actions, thereby maintaining the aquatic resource functions necessary to sustain fish and wildlife species dependent upon these habitats. The action will also protect the subsistence lifestyle of the residents of Bristol Bay and renowned commercial and recreational sport fisheries.

   In addition to preservation of aquatic resources, the Koktuli Conservation Area will protect 81,419 acres of uplands, 13,295 of which are located within the Koktuli riparian corridor. Protection of these upland habitats is appropriate as outlined in 33 CFR 332.3(i) because they will help safeguard the long-term viability of the preserved aquatic resources by providing a protected habitat buffer for upland species and helping to sustain the adjoining aquatic resources by allowing the Koktuli watershed ecosystem to respond to natural variability in a resilient and adaptable manner. Upland buffers provide a means to minimize the risk of future degradation due to development activities, including those that do not require a Section 404 permit. Additional discussion regarding the contributions of the Koktuli Conservation Area to the ecological sustainability of the watershed are provided in Section 3, Site Selection (33 CFR 332.4(c)(3)).

3. *Preservation is determined by the district engineer to be appropriate and practicable (33 CFR 332.3 (h)(iii))*

   On August 20, 2020, USACE Alaska District stated that in-kind compensatory mitigation within the Koktuli River watershed will be required to compensate for all direct and indirect impacts caused by discharges into aquatic resources at the mine site (USACE 2020b). Given the largely undisturbed nature of the Koktuli River watershed, as well as adjacent watersheds, preservation of the Koktuli Conservation Area was identified as the only appropriate and practicable option for consistency with the watershed approach (see Section 3, Site Selection (33 CFR 332.4(c)(3))).

4. *The resources are under threat of destruction or adverse modifications (33 CFR 332.3 (h)(iv))*

   Aquatic resources in the Koktuli Conservation Area are under threat of development from mining and other miscellaneous developments. As described in further detail in Section 3.3.5, the Koktuli River watershed contains several mineral prospects, and the possible development of the Pebble deposit location has led to the widespread staking of claims throughout the areas open to mining.

5. *The preserved site will be permanently protected (33 CFR 332.3 (h)(v))*

   The Koktuli Conservation Area will be protected under the Site Protection Instrument described in Section 4, Site Protection Instrument (33 CFR 332.4(c)(4)).

3 Site Selection (33 CFR 332.4(c)(3))

The 2008 Rule directs compensatory mitigation project proponents' site selection process to incorporate the principles of landscape ecology through the 2008 Rule's emphasis on the use of a watershed approach. As stated, the intended effect of implementing a watershed approach is to *improve the success and effectiveness of aquatic resource restoration, establishment, enhancement, and/or* ***preservation****…and to maintain and improve aquatic resource functions and services within watersheds* (emphasis added) (73 *Federal Register* 19631).

Mitigation banks and in-lieu-fee providers do not have service areas that include the watersheds where Project impacts would occur, leaving permittee-responsible mitigation as the only available compensatory mitigation option for project impacts. PLP has evaluated the opportunity to restore, create, or enhance wetlands within the affected Project watersheds, but these opportunities are not available given the largely undisturbed nature of the area and the limited, isolated, and small scale of available opportunities, which are predominately out of kind. Preservation of 112,445-acres within the Koktuli River watershed, including the Koktuli River mainstem floodplain area, as described, meets the requirements for compensatory mitigation (33 CFR 332.3(c)(2)), the site selection considerations outlined in 33 CFR 332.3(d), and the required criteria defined in 33 CFR 332.3(h)(1).

Factors considered during the site selection process, as outlined in 33 CFR 332.4(c)(4), include consideration of watershed needs, on-site alternatives where applicable, and the practicability of accomplishing ecologically self-sustaining aquatic resource restoration, establishment, enhancement, and/or preservation at the compensatory mitigation project site. The physical expanse of the Koktuli Conservation Area supports the ability for the area to self-sustainably provide a greater suite of watershed-level functions due to its size than would a variety of other permittee-responsible mitigation projects across the Bristol Bay and Cook Inlet watersheds.

3.1 Consideration of Watershed Needs

The Nushagak River Watershed Traditional Use Area (NRWTUA) Conservation Plan, which satisfies the key components of a Watershed Plan as defined in 33 CFR 332.2, emphasizes the importance of salmon throughout the watershed as an indicator of watershed health. Noting the ability of salmon to adapt to habitat and environmental changes that have occurred with past climate periods of warmer waters, the NRWTUA Conservation Plan states that "maintaining habitat is the most important thing watershed residents can do to provide conditions that will favor (salmon) adaptability" (Nushagak-Mulchatna Watershed Council 2007). The current state of the Koktuli River watershed is almost entirely undisturbed, therefore demonstrating that preservation of the landforms, soils, fish habitat, and hydrology (both surface and groundwater flows) is needed for the watershed to continue to self-sustainably function over time. The watershed needs, including the physical and chemical characteristics and processes, and the aquatic and riparian habitat diversity and connectivity, are assumed to be best met in an unaltered state. Preservation of the Koktuli Conservation Area meets these needs through protection of the existing ecological processes that contribute to the overall value and functions of the watershed.

3.2 On-site Alternatives where Applicable

While alternatives to the proposed preservation site were explored prior to and during the DA permit evaluation and NEPA analysis period, the August 20, 2020, letter from USACE Alaska District to PLP stated that "…in-kind compensatory mitigation within the Koktuli River watershed will be required to compensate

for all direct and indirect impacts caused by discharges into aquatic resources at the mine site" (USACE 2020b). The specific direction from the USACE for a compensatory mitigation site to be selected within the Koktuli River watershed limits the search area for potential compensatory mitigation projects. Restoration, establishment, or enhancement projects within the identified watershed are not plentiful enough in size or scale to mitigate for the identified acreage of direct and indirect impacts to be mitigated; therefore, preservation is the only available compensatory mitigation option.

Evaluation of potential preservation areas within the Koktuli River watershed was based on a watershed approach to landscape ecology and watershed needs. The physiography of the Koktuli River defines its namesake watershed, and protection of the river's mainstem provides the basis for overall watershed protection. Any alternative to the Koktuli Conservation Area would not encompass the watershed-level dynamics of the existing riverine and riparian systems, resulting in a less-environmentally preferable compensatory mitigation plan.

3.3 Practicability of Accomplishing Ecologically Self-sustaining Aquatic Resource Preservation at the Selected Site

The Koktuli Conservation Area is currently an ecologically self-sustaining system, given its remote and almost entirely undisturbed area. Maintaining the quality of existing aquatic resources requires preservation of the associated upland buffer areas that contribute to the current site conditions. The following criteria support the selection of the Koktuli Conservation Area to meet the mitigation requirements outlined in 33 CFR 332.3(d). Specifically, the Koktuli Conservation Area is ecologically suitable as appropriate mitigation for proposed impacts based on the following site selection criteria:

3.3.1 Hydrological conditions, soil characteristics, and other physical and chemical characteristics (33 CFR 332.3(d)(i))

The riparian corridor of the mainstem Koktuli River has function and value as an intact and undeveloped landscape feature. The proposed Koktuli Conservation Area, centered on the mainstem Koktuli River, is a complex of uplands and various wetland types including forest, shrub lands, and aquatic beds in flood channels, bars, and abandoned channels. The mainstem Koktuli River riparian corridor functions as an intact wetland ecosystem supporting the biological and physical water functions of the greater watershed. The floodplains in the Koktuli Conservation Area provide a variety of hydrologic conditions, including flood storage and conveyance, groundwater system recharge, reduction of flood velocity, sediment transport, and moderation of water surface elevations through flood-peak discharge. The highly sinuous main channels of the North and South forks are prone to regular lateral migration within the floodplain and contain poorly drained terrain with wet meadows, shrub wetlands, and oxbow lakes. These physical characteristics reduce chemical leaching from area soils during flood events through absorption and dispersion, supporting a stable and self-sustaining dynamic ecosystem comprised of a mosaic of aquatic and riparian habitats. In addition, streams also facilitate enrichment of riparian and terrestrial ecosystems with marine-derived nitrogen and other nutrients through the return of spawning salmon.

3.3.2 Watershed-scale features, such as aquatic habitat diversity, habitat connectivity, and other landscape scale functions (33 CFR 332.3(d)(ii))

The Koktuli River is part of the Nushagak watershed, an EPA- and USFWS-designated aquatic resource of national importance. The Koktuli watershed includes a diverse assemblage of streams, wetlands, lakes, and ponds that are relatively unaltered by human disturbance and provide extensive and diverse habitats for

fishery resources, specifically five species of Pacific salmon. Streams in the Koktuli Conservation Area also support at least four species of non-anadromous salmonids, as well as numerous non-salmonid fishes, providing migration, spawning, rearing, and overwintering habitats for fish and invertebrate species (Figures 3-1 and 3-3). The Koktuli River's dynamic riverine movement, as evidenced by its many oxbow lakes, side channels, and braided reaches, creates a diversity of aquatic, riparian, and upland habitats to support small-scale variability essential for species diversity and success of numerous life history processes (e.g., feeding, reproduction, rearing). The physical size of the floodplain, including valley bottoms between 0.5 and 1.7 miles wide, provide an uninterrupted habitat for numerous bird and mammal species, including beaver, which create highly used off-channel habitats.

The Koktuli River, as part of the Nushagak River system, supports the third-largest Chinook salmon run in the world, with annual escapement goals of between 55,000 and 120,000 fish (ADF&G n.d.). These Pacific salmon runs support large populations of brown bears, eagles and osprey, rainbow trout, Dolly Varden, Arctic grayling, whitefish, and northern pike that are resident in the area's lakes and streams (ADF&G n.d.). The Alaska Department of Fish and Game (ADF&G) *Anadromous Waters Catalog* (AWC) has identified 106 anadromous stream miles and 77 anadromous lake acres in the Koktuli Conservation Area (Giefer and Blossom 2020), although these figures likely underestimate anadromous fish habitat, as not all the streams have been surveyed and the coarse resolution of the data undercounts the actual length of streams.

3.3.3 The size and location of the compensatory mitigation site relative to hydrologic sources and other ecological features (33 CFR 332.3(d)(iii))

The Koktuli Conservation Area includes 112,445 acres of streams, open water, wetlands, riparian habitat, and uplands (Figure 2-2). Preservation of this system will preserve 39 percent of the total acreage of the Headwaters Koktuli River (HUC 1903030211), where the majority of Project impacts are proposed to occur, and the Outlet Koktuli River watersheds (HUC 1903030213) (Table 2-4). The Koktuli Conservation Area is within the Nushagak-Mulchatna River watershed, which is defined by low-lying mountains drained by meandering rivers such as the Koktuli, creating wide-scale ecological landscape features, eventually draining into wet tundra and tidal marsh at the mouth of the Nushagak River. The recent glacial advance and retreat cycles, which ended about 12,000 years ago, created a landscape with a shallow water table and widespread glacial lakes.

Hydrologic sources of the Koktuli Conservation Area are undisturbed, comprising perennial streams and their associated drainage basins; as such, there is no need to develop active engineering devices to maintain hydrologic sources or restore hydraulic conditions. Glaciers are not present in the region and permafrost occurs only in small localized areas (USACE 2020a), and therefore are not considered hydrologic sources. The existing hydrology patterns will allow for self-sustaining fluvial geomorphologic processes within the proposed mitigation area.

3.3.4 Compatibility with adjacent land use uses and watershed management plans (33 CFR 332.3(d)(iv))

The Koktuli River watershed is included in the NRWTUA Conservation Plan as one of six target conservation areas, referred to as the Upland Tundra Complex (Nushagak-Mulchatna Watershed Council 2007), and the EPA determined that fisheries resources in the Project area watersheds are aquatic resources of national importance (EPA 2019). The Nushagak-Mulchatna Watershed Council (2007) included the "Upland Tundra Complex" and "Salmon" as target conservation areas:

- Upland Tundra Complex. This conservation target area includes alpine tundra, generally found in hilly and mountainous areas in the upper Nushagak-Mulchatna watershed, but can be found throughout the Nushagak drainage (Nushagak-Mulchatna Watershed Council 2007). "Alpine tundra provides the plants and lichen that feed bear and caribou. Important subsistence plant food sources like blueberries, salmonberries, cranberries and blackberries are found in areas of upland tundra" (Nushagak-Mulchatna Watershed Council 2007).
- Salmon. "All five species of Pacific Salmon are distributed throughout the Nushagak-Mulchatna watershed. Salmon nourish everything. Their health and abundance are the clearest indicator we have that the Nushagak Watershed remains a viable ecosystem" (Nushagak-Mulchatna Watershed Council 2007).

The entire Koktuli Conservation Area is located within the area defined by the Nushagak-Mulchatna Watershed Council (2007) as Upland Tundra Complex. It includes aquatic resources important for the rearing and spawning of sockeye, Chinook, chum, coho, and pink salmon.

Additionally, the State of Alaska issued Mineral Closing Order (MCO) 393 across the Nushagak-Mulchatna river drainage and a portion of the Alaska Peninsula, which closed the main channel and large tributaries of the Koktuli River area to mineral entry and development and designated them as habitat (Figure 3-2). MCO 393 affects the stream, stream bed, and 100 feet of the riparian area measured 100 feet from the Ordinary High Water mark on either side of a stream. This buffer does not accommodate the extent of the Koktuli River's lateral migration as observed through aerial photography analysis and fluvial geomorphological signatures such as oxbow lakes and relic channels. These features suggest that river migration occurs across the river valley, which ranges from 0.4 to 1.7 miles in width. Comparing the observed width of past mainstem channel migration to the width of the protection provided by MCO 393 demonstrates that the physically narrow protection of MCO 393 would not adequately protect the natural processes of the river, the floodplain, the riparian corridor, or the upland buffer that support the existing diversity of aquatic resources in the watershed. Surface development restricted only by the MCO 393 buffer could directly impair river migration, forcing modification of sediment transport mechanisms and overall hydrology dynamics. The creation of the Koktuli Conservation Area in the Koktuli River watershed will supplement MCO 393 by protecting the entire preservation area from other surface development.

3.3.5 Reasonably foreseeable effects the compensatory mitigation project will have on ecologically important aquatic or terrestrial resources, cultural sites, or habitat for federally- or state-listed threatened and endangered species (33 CFR 332.3(d)(v))

The Koktuli Conservation Area will preserve and maintain existing vegetation, aquatic habitat diversity and connectivity, and floodplain habitat; provide protection to habitat for ecologically important wildlife species (e.g., salmonids, moose, caribou, furbearers); maintain water quality; and support naturally dynamic river systems. In the case of caribou, the Koktuli Conservation Area will protect areas of summer and winter use by the Mulchatna caribou herd. The Final EIS states that there are cultural camps that are important to indigenous people located within the Koktuli River watershed (USACE 2020a). Additionally, it is likely that the Koktuli Conservation Area contains trails, subsistence use areas, place names, and other cultural resources features.

3.3.6 Other relevant factors including, but not limited to, development trends, anticipated land use changes, habitat status and trends, the relative locations of the impact and mitigation sites in the stream network, local or regional goals for the restoration or protection of particular habitat types or functions (e.g., re-establishment of habitat corridors or habitat for species of concern), water quality goals, floodplain management goals, and the relative potential for chemical contamination of the aquatic resources (33 CFR 332.3(d)(vi))

Development trends could result in a demonstrable threat of loss or substantial degradation due to human mineral extraction activities in both active and inactive claims that might not otherwise be expected to be restricted. Flour gold in the gravel bars has been documented in the lower Koktuli River at two inactive placer deposits (USGS 2020a). The upper reaches of the watershed include seven mineral prospects, including the Pebble deposit location, for copper, gold, molybdenum, silver, lead, and zinc (USGS 2020a). The U.S. Geological Survey (USGS) has identified the conservation area as having potential for the discovery of porphyry copper deposits, epithermal vein deposits, intermediate-level intrusion-related gold deposits, and a variety of other types of mineral deposits (Schmidt 2007) (Figure 3-4).

The Project would result in permanent loss of 2,108.7 acres of wetlands and other waters in the Koktuli Watershed, specifically in the Headwaters Koktuli River HUC 10. Furthermore, the possible development of the Pebble deposit location has led to the widespread staking of claims throughout the areas open to mining (Nushagak-Mulchatna Watershed Council 2007). Active State mining claims held by PLP currently occupy 38,520 acres (34 percent) of the conservation area, while lapsed claims held by other parties previously occupied an additional 25,709 acres (23 percent) (Figure 3-2). The Final EIS identified "other mineral exploration projects" as reasonably foreseeable future actions in the project area. Issuance of a permit for the construction of the Pebble Mine could therefore foreseeably result in the development of additional new mines within this watershed, which could result in further degradation of the wetlands in the watershed. Except for 17 privately owned Native allotments, all the lands in the watershed are owned by the State of Alaska, and are managed for multiple uses, including mining. The Koktuli Conservation Area will preserve 112,445 acres within the Koktuli River watershed and remove the threat of development from the protected areas.

The preservation of the Koktuli Conservation Area will allow for continued recreational and commercial fisheries use, water-related recreation, and preservation of the aesthetics of the area. Preserving this area will support the existing use of recreational and commercial fisheries using the area in a sustainable manner, continuing to protect the subsistence lifestyle of the residents of Bristol Bay. The fisheries in the watersheds have significant economic, cultural, and recreational value. The preserved reaches in the Koktuli Conservation Area are also the most-used reaches for float trips and hunting. By preserving this area, the aesthetics of the area will also be preserved, maximizing the protection of the viewshed from the mainstem, where most of the use occurs.

4 Site Protection Instrument (33 CFR 332.4(c)(4))

A deed restriction will be recorded in the appropriate recording district to limit uses in accordance with the CMP. The deed restriction will be effectuated through a Declaration of Conservation Covenant and Restriction (Declaration), which constitutes the relevant Site Protection Instrument. The Declaration will be finalized and recorded prior to Project construction and will remain in effect for at least 99 years.

The Declaration's purpose is to preserve and protect the Koktuli Conservation Area by placing certain restrictive covenants on the Koktuli Conservation Area in order for the land to remain substantially in its natural condition in accordance with the terms of the CMP. To accomplish this, the Declaration will

reference the CMP, provide notice that the covenants and restrictions run with the land, and declare the right of enforceability of its terms by the USACE. The Declaration will mirror the CMP's conditions and restriction but will run with the land.

4.1 Draft Site Protection Language

Description of Property

This Site Protection Instrument and the included restrictions apply to lands owned by the State of Alaska and managed by the ADNR. The lands are located in the Koktuli River watershed. The Site Protection Instrument and the included restrictions apply to 112,445 acres as shown on the attached Figure 2-2 (herein referred to as the Property).

Natural Conditions

The purpose of the Site Protection Instrument and the included restrictions are to ensure that the Property will be preserved in a "Natural Condition," as defined as it exists at the time this document is recorded.

Documentation of Current Conditions

The Current Conditions of the Property as of the date of this Deed are further documented in a "Baseline Documentation and Monitoring Report" dated _____ and prepared by [preparer's name], which report is acknowledged as accurate by Grantor and Grantee:

(a) current aerial photograph of the Property at an appropriate scale taken as close as possible to the date the recording is made;

(b) on-site photographs taken at appropriate locations on the Property, including of major natural features;

(c) wetlands mapping, conducted in 2020, documenting the WOUS in the Property Area using USACE-guidance in place at the time of the mapping; and

(d) graphical depiction of the boundaries of the area being preserved at a scale and with a datum identified that can be used to overlay the Property Area on future site maps of the area.

Prohibitions

(a) There shall be no filling, flooding, excavating, mining, or drilling; no removal of natural materials; no dumping of materials; and no alteration of the topography in any manner except as provided for under Reserved Rights below.

(b) There shall be no clearing, burning, cutting, or destroying of trees or vegetation, except as expressly authorized in the Reserved Rights; there shall be no planting or introduction of non-native or exotic species of trees or vegetation.

(c) There shall be no construction, erection, or placement of buildings, billboards, or any other structures or any additions to existing structures in WOUS, except structures or additions in areas not mapped as WOUS, which are compatible with the purpose of preserving the lands in a natural condition and as otherwise provided for under *Reserved Rights* below.

(d) There shall be no construction of new roads, trails, or walkways except as provided under *Reserved Rights* below. The manner in which new roads, trails, and walkways are constructed must be consistent with the restrictions imposed by the Site Protection Instrument.

(e) There shall be no construction or placement of utilities or related facilities in WOUS.

Reserved Rights

Actions required to prevent or repair severe erosion or damage to the Property or portions thereof, or significant detriment to existing or permitted uses, is allowed, provided that such actions are generally consistent with preserving the natural condition of the Property.

Harvesting and management of timber by Grantor is limited to the extent necessary to protect the natural environment in areas where the forest is damaged by natural forces such as fire, flood, storm, insects, or infectious organisms.

Grantor reserves the right to allow public and subsistence uses on the Property, including but not limited to hunting, fishing, trapping, egg gathering, and vegetation collection.

Grantor specifically reserves a qualified mineral interest (as defined in § 170(h)(6) of the Internal Revenue Code) in subsurface oil, gas, or other minerals and the right to access such minerals. However, there shall be no extraction or removal of, or exploration for, minerals by any surface mining method, nor by any method that results in subsidence or that otherwise interferes with the continuing natural condition of the Property.

Grantor reserves the right to construct habitat improvements within the Property, including activities such as adding moose browse, replacing blocked culverts to improve fish passage, and constructing new fish habitat in the area. Grantor will be required to obtain the necessary permits for these activities, including from the ADF&G and the USACE, as required.

Grantor reserves the right to maintain roads, trails, or walkways. Maintenance shall be limited to removal or pruning of dead or hazardous vegetation; application of permeable materials (e.g., sand, gravel, crushed) necessary to correct or impede erosion; grading; replacement of culverts, water control structures, or bridges; and maintenance of roadside ditches.

Grantor reserves the right to engage in removal or trimming of vegetation downed or damaged due to natural disaster, removal of man-made debris, removal of parasitic vegetation (as it relates to the health of the host plant), and removal of non-native or exotic plant or animal species.

Grantor reserves the right to engage in all acts or uses not prohibited by the Restrictions, and that are not inconsistent with the conservation purposes of this grant, the preservation of the Property in its natural condition, or the protection of its environmental systems.

Amendment

After recording, this Declaration of Conservation Covenant and Restriction may be amended only by a recorded document signed by the USACE and PLP. Amendment shall be allowed at the discretion of the USACE, in consultation with resource agencies as appropriate. Compensatory mitigation for any adverse impacts associated with an amendment will be required pursuant to USACE mitigation policy at the time of amendment. There shall be no obligation to allow an amendment.

Notice of Actions to Void or Modify Declaration of Conservation Covenant and Restriction

Before any action is taken to void or modify the Site Protection Instrument at least sixty (60) days' written advance notice of such action must be provided to the Alaska District Engineer at the following address: Alaska District, U.S. Army Corps of Engineers, Regulatory Division, P.O. Box 6898, JBER, Alaska 99506-0898.

5 Baseline Information (33 CFR 332.4(c)(5))

The Pebble Project Final EIS (USACE 2020a) provides a detailed discussion regarding the ecological characteristics of the Project area. The following sections describe the ecological characteristics of the Koktuli Conservation Area, providing an overview of the hydrology, wetlands and waterbodies, fish resources, Mulchatna caribou herd, and land management plans.

5.1 Hydrology

Section 3.16, Surface Water Hydrology and 3.17, Ground Water Hydrology, of the Final EIS (USACE 2020a) describe existing hydrological characteristics of the proposed Project sites.

The proposed 112,445-acre Koktuli Conservation Area encompasses 39 percent of the 290,811-acre Headwaters Koktuli River and Outlet Koktuli River portions of the Koktuli River watershed, which is a subunit of the Nushagak River watershed. The Koktuli River is divided into three HUC 10 watersheds: Headwater Koktuli River, Outlet Koktuli River, and Swan River (Table 2-4). From its origin in tundra covered foothills, to cottonwood and spruce forested lowlands where it flows into the Mulchatna River, the Koktuli River winds for approximately 70 miles as it transforms from a narrow, shallow stream to a wide, deep river. The Koktuli River basin contains the mainstem of the Koktuli River itself and three major tributaries: the North Fork Koktuli River, South Fork Koktuli River, and the Swan River. The Koktuli Conservation Area will protect approximately 39 miles of the mainstem of the Koktuli River and 18 and 13 miles of the North Fork and South Fork Koktuli rivers, respectively (Figure 2-2). In addition to the Koktuli River, the Koktuli Conservation Area also includes an additional 744 miles of perennial and intermittent tributary streams in the Koktuli River watershed.

The USGS National Hydrology Dataset (NHD) has mapped a total stream network of approximately 830 miles in the Headwater Koktuli River and Outlet Koktuli River HUCs of the Koktuli River watershed (USGS 2020b). Based on wetland and waterbody mapping conducted for the mitigation project, the Koktuli Conservation Area contains a total of 814 miles (1,967 acres) of streams.[1] Thus, the Koktuli Conservation Area would protect a substantial portion of streams in the Koktuli River watershed.

5.2 Wetlands and Waterbodies

Section 3.22, Wetlands and Other Waters/Special Aquatic Sites, of the Final EIS (USACE 2020a) describes existing characteristics of wetland and other waters at the proposed Project sites.

[1] The USGS NHD is mapped at a 1:63,360 scale resolution. This data is coarser than wetland and waterbody mapping conducted specifically for the Koktuli Conservation Area (see Section 5.2). Thus, the estimated 830 miles of streams likely undercounts the actual length of streams in the Headwaters Koktuli River and Outlet Koktuli River HUCs. For reference, the NHD data set estimated a total of 355 miles of streams in the Koktuli Conservation areas as compared to the 814 miles mapped during wetland and waterbody mapping.

Wetlands and waterbodies in the Koktuli Conservation Area were mapped following the same methodology used to survey and map wetlands and waterbodies and prepare the Pebble Project Preliminary Jurisdictional Determination Report Revision 3 (HDR 2019) used for NEPA and Section 404 permit analyses. Field data collection occurred in 2007, 2008, 2012, and 2020.

During 2007, 2008, and 2012, wetland scientists collected data within the Koktuli Conservation Area at 865 wetland determination plots using data forms based on the 1987 Corps of Engineers Wetland Delineation Manual (USACE 1987) that were expanded to record more data to support the delineation, 2007 Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region (2007 Alaska Regional Supplement; USACE 2007) requirements, and future reclamation plan needs as refined over the course of the study. An additional 1,254 representative photo points and 455 waterbodies and stream-crossing photo points were also collected. The most recent field data collection within the Koktuli Conservation Area occurred between August 2 and September 2, 2020. During the 2020 field event, wetland scientists collected data at 1,058 wetland determination plots using data forms based on the standard forms in the 2007 Alaska Regional Supplement (USACE 2007). An additional 1,246 representative photo points and 234 waterbodies and stream-crossing photo points were also collected. In total, wetland scientists collected data at 1,923 wetland determination plots, 2,500 representative photo points, and 689 waterbodies and stream-crossing photo points within the Koktuli Conservation Area.

Following the field survey, wetlands and waterbodies mapping involved an evaluation of existing data, field work, digital mapping (line work and coding), characterization of wetlands in the study area, and quality control review. The identification and aerial photography-based delineation of wetlands required interpretation of the three parameters used for wetland determinations: vegetation type, soil type, and hydrologic characteristics. Wetland and waterbody boundaries were digitized on aerial photography at a scale ranging between 1:1,200 and 1:1,500; open water was digitized at a scale of 1:400 with a minimum polygon size of approximately 0.05 acre. Wetlands and waterbody categories were classified by an appropriate Enhanced National Wetlands Inventory (ENWI) classification code based on the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) and National Wetlands Inventory Mapping Conventions (USFWS 1995), HGM class (Brinson 1993), and Project Vegetation Type (3PP 2008). Additional detail regarding field data and mapping is provided in the Wetland and Waterbody Delineation Report in Attachment A.

The Koktuli Conservation Area encompasses 112,445 acres and includes 27,886 acres of wetlands, 1,174 acres of other waters (lakes and ponds), 814 miles (1,967 acres) of streams and rivers, and 81,419 acres of uplands, 13,295 of which comprise riparian buffers within the Koktuli River riparian corridor (Table 5-1; Figure 2-2).

Table 5-1. Wetlands and Other Waters in the Koktuli Conservation Area

HGM Class	Acres	Miles
Wetland and Other Waters		
Depressional	577.8	–
Flat	23.3	–
Lacustrine	200.8	–
Lacustrine Fringe	8.1	–
Riverine	3,528.6	–
Slope	24,720.7	–
Total Wetlands and Other Waters [a]	**29,059.1**	
Streams and Rivers		
Riverine Channel	1,967.2	814.4
Total Streams and Rivers	**1,967.2**	**814.4**
Uplands		
Riparian Corridor Uplands	13,295.1	–
Other Uplands	68,123.5	–
Total Uplands	**81,418.6**	**–**
Koktuli Conservation Area Total [a]	**112,444.9**	**814.4**

Notes: HGM: Hydrogeomorphic

[a] Values may not sum due to rounding

Consistent with Project impacts, the most common wetlands in the Koktuli Conservation Area by HGM class are slope wetlands. However, riverine wetlands make up a substantially larger percentage of wetlands within the Koktuli Conservation Area than will be impacted by the Project. This reflects both the efforts to avoid and minimize impacts to riverine wetlands during Project design due to their association with active floodplains, riparian corridors, and stream channels as well as the high-value habitats selected for preservation within the Koktuli Conservation Area. Specifically, riverine wetlands provide dynamic floodwater storage, high levels of sediment cycling, and opportunities for off-channel feeding, rearing, and refugia provided by access to the floodplain during high flow. This diversity of habitat, driven by area hydrology, demonstrates the ecological sustainability of the Koktuli River and floodplain system, as these habitats change often, depending upon their subject hydrologic regime. Rivers and riverine wetlands are often the focal points of communities with high recreational, economic, subsistence, and heritage value (USACE 2020a).

Wetland vegetation types found in the Koktuli Conservation Area are similar to those found in the Project area where low ericaceous and dwarf birch (*Betula nana*) shrub and tussock-forming sedges or grasses are common. The most common vegetation classes include evergreen and deciduous shrubs (both broad-leaved and needle-leaved) and herbaceous wetlands and, to a lesser extent, deciduous forest, evergreen forest, and aquatic bed wetlands. No invasive species were documented during field surveys. The Wetland and Waterbody Delineation Report summarizing existing wetland plant communities within the Koktuli Conservation Area is provided in Attachment A.

The Pebble Project Final EIS identifies regionally important wetlands within the Project vicinity (USACE 2020a; see Table 5-2). Regionally important wetlands in the Koktuli Conservation Area include riparian wetlands, forested wetlands, and fens. Regionally important wetland plants also occur. Special aquatic sites are defined in 40 CFR 230.3; special aquatic sites in the Project vicinity include wetlands, mudflats, vegetated

shallows, and riffle and pool complexes (USACE 2020a). Definition and identification of these features within the Koktuli Conservation Area sites followed the methodology provided in USACE (2020). Note that the acreages of regionally important wetlands and special aquatic sites are not totaled, in order to avoid double counting, as the same areas may qualify in multiple categories.

Table 5-2. Regionally Important Wetlands and Special Aquatic Sites

Type	Acres	Miles
Regionally Important Wetlands		
Riparian wetlands [a]	3,480.2	–
Forested wetlands [b]	80.0	–
Fens [c]	263.1	–
Total Regionally Important Wetlands	**3,823.3**	–
Special Aquatic Sites		
Wetlands [d]	27,885.5	–
Mudflats [e]	391.1	–
Vegetated shallows [f]	9.1	–
Riffle and pool complexes [g]	1,761.8	717.1
Total Special Aquatic Sites	**30,047.5**	**717.1**

Notes: Selection of regionally important wetlands and special aquatic sites followed the methodology provided in USACE 2020a. Specific details by type are provided below. Note that estuarine wetlands, or sanctuaries or refuges do not occur in the Koktuli Conservation Area.

[a] All wetlands where HGM is Riverine

[b] All wetlands where ENWI begins with PFO (Deciduous or Evergreen Forest)

[c] All wetlands where VEG is OWLSF (open willow low shrub fen)

[d] All wetlands

[e] Areas where ENWI class includes US (unconsolidated shore, assumes mud substrate)

[f] Areas where ENWI class includes AB (aquatic bed)

[g] Area and length of upper perennial stream habitats (ENWI class begins with R3) are used as a proxy for riffle and pool presence

Regionally important wetlands and special aquatic sites preserved within the Koktuli Conservation Area are similar to those impacted by the Project. However, the Koktuli riparian corridor contains a substantial acreage of riparian wetlands that support the biological and physical water functions of the greater watershed. Of the wetlands mapped in the Koktuli Conservation Area, 13.7 percent are classified as regionally important wetlands, compared to 12.6 percent of wetlands mapped in Project impact areas, and 16.8 percent of all wetlands mapped in the Headwaters Koktuli River watershed based on data used in the Final EIS (USACE 2020a). Specifically, riparian wetlands are found in higher frequency (12.5 percent) in the Koktuli Conservation Area than in areas impacted by the Project (7.8 percent) and within the portions of the Headwaters Koktuli River watershed that were mapped for analysis in the Final EIS (11.5 percent). Similarly, special aquatic sites also occur in higher frequency (26.7 percent) in the Koktuli Conservation Area than in the Project impact areas (16.4 percent) and the Final EIS analysis area in the Headwaters Koktuli River watershed (15.0 percent).

Furthermore, the Koktuli Conservation Area contains a substantial acreage of aquatic resources that the 2008 Rule identifies as higher quality and/or difficult to replace, such as forested wetlands, fens, and streams (Table 5-2). The 2008 Rule acknowledges that preservation is particularly valuable for protecting these types

of aquatic resources and that it may be the most appropriate form of compensatory mitigation, as it will provide the greatest certainty that the mitigation will successfully offset permitted impacts (33 CFR 332.3(e)(3), 73 *Federal Register* 19635). The Koktuli Conservation Area will effectively preserve these resources, supporting the ecological sustainability of the larger watershed.

5.3 Fish Resources

Section 3.24, Fish Values, of the Final EIS (USACE 2020a) describes existing characteristics of fish resources at the proposed Project sites.

Based on the data in the AWC, the Koktuli Conservation Area will preserve a total of 106 miles of anadromous streams and 77 acres of anadromous lakes in the Koktuli River watershed, including the mainstem of the Koktuli River to its confluence with the Mulchatna River, portions of the North Fork and South Fork Koktuli rivers, and additional anadromous streams in nine tributary watersheds (Giefer and Blossom 2020) (Figure 3-1). These rivers and streams support all five Pacific salmon species as well as 81 miles of Chinook salmon spawning habitat, 71 miles of sockeye spawning habitat, and 68 miles of coho salmon habitat (Giefer and Blossom 2020) (Figure 3-3). In addition, the Koktuli Conservation Area will protect 29,059 acres of wetlands and other waters within the Koktuli River watershed, including 3,529 acres of Riverine HGM class wetlands that provide more direct hydrologic support to streams and rivers in the watershed.

The Koktuli River is part of the Nushagak River drainage, home to the largest runs of coho, Chinook, and chum salmon in Bristol Bay, as well as significant runs of sockeye and pink salmon. All five Pacific salmon species, as well as Dolly Varden, rainbow trout, Arctic grayling, and various whitefish species, are present in the Koktuli River drainage (Table 5-3). Anadromous habitat in the Koktuli Conservation Area comprises mainstem rivers (Koktuli River, North and South forks) as well as first-, second-, and third-order tributary systems.

Mainstem habitat in the North and South forks within the Koktuli Conservation Area is generally characterized by single-thread, gravel-bedded channels that meander in lower-gradient segments. Groundwater upwellings present in the lower reaches of both forks contribute to spawning and rearing habitat for Chinook, coho, and sockeye salmon. Habitat studies indicated that both forks contain mostly riffle habitat, followed by varying degrees of run/glide habitat. Beaver ponds account for a significant portion of off-channel habitat for adult Pacific salmon spawning and juvenile overwintering.

The mainstem Koktuli River (below the confluence of the North and South forks) has a lower gradient than upstream reaches, with a wider overall floodplain and greater propensity to meander. This dynamic system of extensively braided channels and off-channel habitats is found in many reaches of the Koktuli River. Float surveys have documented these reaches as highly productive spawning and rearing habitat for Chinook, coho, chum, and sockeye salmon (Russell 1985). The more complex floodplain systems, with sloughs and backwaters, provide high-quality rearing habitat for a variety of resident fish species as well. From the Swan River to the confluence with the Mulchatna River, the mainstem Koktuli channel widens up to 200 feet with much slower water velocity and deep pools of 10 feet or more. Chinook salmon adults are found in high numbers in this area, supporting significant sport fishing (Russell 1985).

The Koktuli Conservation Area also encompasses nine complete tributary systems with documented anadromous spawning or rearing. These tributaries generally have low to moderate gradients with mixed pool and riffle stream habitats. Gravel/cobble substrates, which are more conducive to salmon spawning than

sand/silt substrates in the mine impact area, are found throughout these tributaries. Likewise, riparian vegetation is typically herbaceous with a mix of tall alders and willow shrubs, providing more large woody debris and nutrients to support spawning and rearing activity. These nine systems support spawning for all five Pacific salmon species and rearing for Chinook and coho salmon (Giefer and Blossom 2020). Three unsurveyed tributary systems in the conservation area have characteristics (gradient, drainage area) that indicate high potential for anadromous fish presence (Figure 3-1).

Generally, spawning densities of Pacific salmon in both the North Fork and South Fork Koktuli rivers increase with distance downstream from the headwater tributaries located near the proposed Project mine site. Coho salmon spawning is more widespread than other Pacific salmon species in the North and South forks, but the most productive spawning areas are within the Koktuli Conservation Area (Owl Ridge 2020). The highest densities of all adult Pacific salmon are within reaches of the North Fork and South Fork Koktuli rivers that will be preserved within the proposed Koktuli Conservation Area; 90 percent or more of the most densely used spawning areas in these drainages will be preserved.

The Koktuli Conservation Area will protect the most productive Pacific salmon reaches of the Koktuli River, supporting long-term ecological sustainability of the salmon life cycle. More than 46 percent of all documented stream rearing habitat miles in the Koktuli River will be preserved for the five Pacific salmon present. More than 57.5 percent of all documented spawning habitat miles (by species) will be preserved, as well as some modest preservation of lacustrine coho and sockeye salmon rearing habitat. The areas targeted for preservation within the drainages are documented to be the most heavily used by spawning Pacific salmon as well as for recreational fishing.

Table 5-3. Anadromous Waters in the Koktuli River Watershed and Anadromous Waters Preserved by the Koktuli Conservation Area

Fish Species	Koktuli River	Koktuli Conservation Area	Percent in Koktuli Conservation Area	Koktuli River	Koktuli Conservation Area	Percent in Koktuli Conservation Area	Koktuli River	Koktuli Conservation Area	Percent in Koktuli Conservation Area
	Present			Rearing			Spawning		
Dolly Varden									
Stream (miles)	77.7	51.5	**66.3%**	--	--	--	--	--	--
Chinook salmon									
Stream (miles)	10.6	2.1	**19.7%**	114.3	68.3	**59.7%**	115.5	80.7	**69.9%**
Lakes (acres)	164.3	--	**--**	--	--		--	--	
Chum salmon									
Stream (miles)	3.5	--	**--**	6.7	3.1	**46.6%**	90.8	72.4	**79.7%**
Coho salmon									
Stream (miles)	20.6	10.8	**52.5%**	182.7	88.7	**48.5%**	118.3	68.0	**57.5%**
Lakes (acres)	219.1	52.0	**23.7%**	187.1	22.6	**12.1%**	--	--	
Pink salmon									
Stream (miles)	29.3	21.2	**72.4%**	--	--		4.4	4.4	**100.0%**
Sockeye salmon									
Stream (miles)	15.7	5.1	**32.5%**	82.8	68.1	**82.3%**	101.2	72.3	**71.4%**
Lakes (acres)	**52.0**	**51.2**	**98.5%**	--	--		164.3	--	
Whitefish, undifferentiated									
Stream (miles)	10.1	10.1	**100.0%**	--	--		--	--	

5.4 Mulchatna Caribou Herd

Section 3.23, Wildlife Values, of the Final EIS (USACE 2020a) describes existing characteristics of caribou and other wildlife at the proposed Project sites.

Although the Mulchatna caribou herd population has been in decline since the 1990s, the herd has continued to use tundra habitats in the Koktuli River watershed. Based on a radio-collared subset of the Mulchatna herd, the area west and northwest of the mine site facilities, including in the vicinity of the Koktuli Conservation Area (as compared to south or east), shows higher use than the mine site footprint itself (USACE 2020a). The Koktuli Conservation Area appears to have higher seasonal range use for all seasons than Project impact sites, including the mine site (USACE 2020a, Figure 3.23-5). Analysis of the radio-collar data indicate that across 29 years of data, collared individuals in the Mulchatna herd occurred in moderate to high densities in the Koktuli River watershed in spring, low density during calving, high density during summer and winter, and moderate density during autumn. Harvests of large land mammals, including caribou, by communities in the region are smaller than harvests of salmon, but play an important role in subsistence food diversity (USACE 2020a).

The NRWTUA Conservation Plan includes the "Upland Tundra Complex" as a target conservation area as "alpine tundra provides the plants and lichen that feed bear and caribou." The NRWTUA Conservation Plan identifies the area that will be preserved as the Koktuli Conservation Area as within the area defined as Upland Tundra Complex. Upland habitats that support caribou will be protected as part of the overall Koktuli Conservation Area. Conserving an area as large as that included in the Koktuli Conservation Area also supports the ecological sustainability of the herd by providing a diversity of protected and dynamic habitat for caribou in all life stages.

5.5 Land Management Plans

The Koktuli Conservation Area includes public lands owned by the State of Alaska and private Native allotments. The Alaska ADNR manages the public lands in the Koktuli Conservation Area in accordance with the Bristol Bay Area Plan (ADNR 2013) and the Nushagak and Mulchatna Rivers Recreation Management Plan (RRMP) (ADNR 2005).

The Koktuli Conservation Area is located within "Unit 17 Koktuli River Corridor" and "Unit 19 Lower Mulchatna Uplands" of the Nushagak and Mulchatna RRMP, which includes the following relevant information regarding resources and uses:

Unit 17 Koktuli River Corridor

- **Land status.** Most of the land in the unit is State-owned land. A number of Native allotments are located in the unit. The upper portion of the corridor is within the Lake and Peninsula Borough.
- **Access.** Downstream of the Swan River, the Koktuli River is easily accessible by motorboat; upper portions are increasingly difficult to access. Airplane accessibility is moderate in the upper portion; a few landing sites provide drop-offs for floating.
- **Existing Development.** Two cabins and one site used as a commercial sport fishing and outfitting camp for hunting are located in the unit.
- **Fisheries.** The rivers provide important spawning and rearing habitat for Chinook, sockeye, and chum salmon. Sport fishing for Arctic grayling, Dolly Varden, and rainbow trout in the lower portion of the unit is moderate but can be high quality. Subsistence fishing use is low. Commercial sport

fishing (guided outfits) concentrates mostly on the lower portion of the Koktuli River and is based out of nearby camps or fly-in day use. Both options have motorboats stored on-site. Fishing in the remaining portion of the Koktuli River is mostly associated with floating and day use by helicopter.

- **Wildlife**. Moose density is moderate, caribou density is high, and brown bear density is high near Jack Rabbit Hills. Upper portions of the unit provide essential caribou calving habitat. Subsistence hunting use is high. Subsistence hunters concentrate their efforts in the lower portion of the unit for moose and caribou in fall, and hunt throughout the unit for caribou in winter. Use by guided or outfitted sport hunters is moderate to high during fall and has been increasing in recent years.
- **Easements**. None.
- **Other Values**. Floating use is high and chiefly unguided. The corridor has high scenic value because of views of nearby uplands and high landscape diversity grading from upland tundra to bottomland forest. One cultural site is located in the unit.
- **Public Use Sites.**
    - Site 27 Campsite on the Koktuli River at the mouth of the Swan River. There is a pending Native allotment in this site.
    - Site 28 Wheeled plane landing area on the Koktuli River, 1 mile downstream from the confluence of the north and south forks. There is a pending Native allotment in this site.
    - Site 29 Campsite on the Koktuli River at the confluence of the north and south forks. There is a pending Native allotment in this site.
    - Site 30 Floatplane landing area on unnamed lake, 1 mile south of the upper Koktuli River and campsite on the Koktuli River, connected by a trail.
    - Site 31 Floatplane landing area on unnamed lake on the south side of the upper Koktuli River, 2.5 miles northwest of Sharp Mountain.

Unit 19 Lower Mulchatna Uplands

- **Land Status.** The unit is predominantly owned or selected by the State. Smaller amounts of land are owned or selected by Koliganek Natives, Ltd., and Stuyahok, Ltd. A number of Native allotments are located in the unit. The eastern portion of the unit is within the Lake and Peninsula Borough. Mining claims are located in the northern portion of the unit.
- **Access**. The unit is easily accessed by floatplane at many lakes and on the lower Swan River, except in the hilly northern portion of the unit where relatively few airplane landing sites exist. The southern portion of the unit is easily accessed by snowmobile from Nushagak River communities. Most of the unit is about a 1-hour flight from Iliamna.
- **Fisheries.** Fisheries values are generally low. Subsistence and sport fishing uses are low.
- **Wildlife.** Moose density is moderate, caribou density is high, and brown bear density is high in Jack Rabbit Hills and moderate elsewhere. Portions of the unit provide essential caribou calving habitat. Subsistence hunting for caribou is high in winter. Sport hunting use in fall is high for caribou and moderate to high for moose, primarily by nonresident and non-local Alaskans. Guided brown bear hunting use is moderate in the Jack Rabbit Hills vicinity.
- **Easements**. The following 17(b) easements are located in this unit: EIN 25 and 25a.

6 Determination of Credits (33 CFR 332.4(c)(6))

6.1 Project Impacts

Proposed impacts will result in a total of 2,179.4 acres of permanent direct impacts and 1,470.3 acres of indirect impacts on wetlands and other waters (Table 2-1). The vast majority of these impacts will occur to slope wetlands (Table 6-1).

Table 6-1. Project Impacts by Hydrogeomorphic Class

HGM Classification	Wetlands (acres)		Other Waters (acres)		Total (acres) [a]		Total acres (%)
	Direct	Indirect	Direct	Indirect	Direct	Indirect	
Coastal Fringe	0.1	2.4	24.3	112.7	24.4	115.1	139.5 (4%)
Depressional	11.9	25.8	39.6	81.7	51.5	107.4	159.0 (4%)
Flat	9.9	23.2	–	–	9.9	23.2	33.1 (1%)
Lacustrine	–	–	0.1	59.7	0.1	59.7	59.9 (2%)
Lacustrine Fringe	0.2	10.3	–	–	0.2	10.3	10.5 (<1%)
Marine	–	–	–	0.3	–	0.3	0.3 (<1%)
Riverine	123.0	117.6	9.8	10.2	132.9	127.9	260.7 (7%)
Slope	1,944.7	1,016.7	15.7	9.7	1960.4	1026.5	2,986.8 (82%)
Total[a]	**2,089.8**	**1,196.1**	**89.5**	**274.3**	**2,179.4**	**1,470.3**	**3,649.7 (100%)**

Notes: HGM: hydrogeomorphic

[a] Values may not sum due to rounding.

Regionally important wetlands and special aquatic sites are a subset of wetlands and other waters described in Table 6-1. The proposed Project will directly impact 209.3 acres of regionally important wetlands and 2,166.8 acres of special aquatic sites (Table 6-2). It will indirectly impact 204.6 acres of regionally important wetlands and 1,393.3 acres of special aquatic sites. The acreages of regionally important wetlands and special aquatic sites are not totaled to avoid double counting, as the same areas may qualify in multiple categories.

Table 6-2. Project Impacts to Regionally Important Wetlands and Special Aquatic Sites (acres)

Type	Direct	Indirect	Total
Regionally Important Wetlands			
Riparian wetlands[a]	132.5	123.3	255.8
Forested wetlands[b]	4.8	28.9	33.7
Estuarine wetlands[c]	0.1	2.4	2.6
Fens[d]	71.8	50.0	121.8
Total Regionally Important Wetlands [i]	**209.3**	**204.6**	**413.9**
Special Aquatic Sites[e]			
Wetlands[e]	2,089.8	1,196.1	3,285.9
Mudflats[f]	28.6	84.5	113.1
Vegetated shallows[g]	2.1	0.6	2.7
Riffle and pool complexes[h]	46.2	112.1	158.3
Total Special Aquatic Sites [i]	**2,166.8**	**1,393.3**	**3,560.1**

Notes: Selection of regionally important wetlands and special aquatic sites followed methodology provided in USACE 2020a. Specific details by type provided below. Note that sanctuaries or refuges will not be impacted by the Project.

[a] All wetlands where HGM is Riverine

[b] All wetlands where ENWI begins with PFO (Deciduous or Evergreen Forest)

[c] All wetlands where ENWI is in estuarine system (E)

[d] All wetlands where VEG is OWLSF (open willow low shrub fen)

[e] All wetlands; these areas represent the same wetland impacts quantified in Table 6-1, above.

[f] Areas where ENWI class includes US3 (unconsolidated shore with mud substrate)

[g] Areas where ENWI class includes AB (aquatic bed)

[h] Area and length of upper perennial stream habitats (ENWI class begins with R3) are used as a proxy for riffle and pool presence

[i] Values may not sum due to rounding.

As described in Table 2-2 in Section 2, Objectives (33 CFR 332.4(c)(2)), the Project will directly impact 105.4 miles of streams, 94 percent of which occur in the Headwaters Koktuli River HUC 10. The Project will indirectly affect an additional 79.6 miles of streams due to fragmentation, dust, and dewatering.

Of these stream miles, the Project will directly impact 8.2 miles of anadromous streams as the result of fill placement due to mine site construction. These impacts will not affect the North Fork and South Fork Koktuli rivers directly; rather, direct impacts will affect two anadromous tributaries that provide low-quality and low-use habitat rearing habitat for coho and Chinook salmon and low-use spawning habitat for coho salmon. The Project will also directly affect an additional 0.3 mile of anadromous streams at 31 anadromous steam crossings along the transportation corridor.

6.2 Mitigation Credits

Mitigation credits are determined as a ratio of acreage of wetland and other waters impacted to acres of wetlands and other waters preserved in the Koktuli Conservation Area. The permanent placement of fill into wetlands and waters for Project infrastructure will directly impact 2,179.4 acres of wetlands and other waterbodies and indirectly impact 1,470.3 acres of wetlands and other waterbodies (Table 6-1). PLP proposes to mitigate for these impacts through preservation of 27,886 acres of wetlands and 1,174 acres of other waterbodies within the Koktuli Conservation Area.

Table 6-3. Comparison of Project Impacts and Koktuli Conservation Area Wetland and Other Waters by Hydrogeomorphic Class (acres)

HGM Classification	Project Impacts		Koktuli Conservation Area
	Direct	Indirect	
Coastal Fringe	24.4	115.1	–
Depressional	51.5	107.4	577.8
Flat	9.9	23.2	23.3
Lacustrine	0.1	59.7	200.8
Lacustrine Fringe	0.2	10.3	8.1
Marine	–	0.3	–
Riverine	132.9	127.9	3,528.6
Slope	1,960.4	1,026.5	24,720.7
Total [a]	**2,179.4**	**1,470.3**	**29,059.1**

Notes: HGM: hydrogeomorphic

[a] Values may not sum due to rounding

The Koktuli Conservation Area will preserve a total of 3,823.3 acres of regionally important wetlands and 30,047.5 acres of special aquatic sites compared to total direct and indirect impacts to 414 acres of regionally important wetlands and 3,560 acres of special aquatic sites from the Project (Table 6-4). As described in Section 5.2, regionally important wetlands and special aquatic sites are found in higher frequency in the Koktuli Conservation Area (14 percent of wetlands are regionally important wetlands and 27 percent of all areas are special aquatic sites) than in areas impacted by the Project (13 percent of wetlands are regionally important wetland and 16 percent of all areas special aquatic sites).

Table 6-4. Project Impacts and Koktuli Conservation Area Regionally Important Wetlands and Special Aquatic Sites (acres)

Type	Project Impacts		Koktuli Conservation Area
	Direct	Indirect	
Regionally Important Wetlands			
Riparian wetlands[a]	132.5	123.3	3,480.2
Forested wetlands[b]	4.8	28.9	80.0
Estuarine wetlands[c]	0.1	2.4	–
Fens[d]	71.8	50.0	263.1
Total Regionally Important Wetlands [i]	**209.3**	**204.6**	**3,823.3**
Special Aquatic Sites[e]			
Wetlands[e]	2,089.8	1,196.1	27,885.5
Mudflats[f]	28.6	84.5	391.1
Vegetated shallows[g]	2.1	0.6	9.1
Riffle and pool complexes[h]	46.2	112.1	1,761.8
Total Special Aquatic Sites [i]	**2,166.8**	**1,393.3**	**30,047.5**

Notes: Selection of regionally important wetlands and special aquatic sites followed methodology provided in USACE 2020a. Specific details by type provided below. Note that sanctuaries or refuges will not be impacted by the Project.

[a] All wetlands where HGM is Riverine

[b] All wetlands where ENWI begins with PFO (Deciduous or Evergreen Forest)

[c] All wetlands where ENWI is in estuarine system (E)

[d] All wetlands where VEG is OWLSF (open willow low shrub fen)

[e] All wetlands; these areas represent the same wetland impacts quantified in Table 6-1, above.

[f] Areas where ENWI class includes US3 (unconsolidated shore with mud substrate)

[g] Areas where ENWI class includes AB (aquatic bed)

[h] Area of upper perennial stream habitats (ENWI class begins with R3) are used as a proxy for riffle and pool presence

Type	Project Impacts		Koktuli Conservation Area
	Direct	Indirect	

[i] Values may not sum due to rounding

The Project will directly impact 105.4 miles of streams including 8.5 miles of anadromous streams, and indirectly impact 79.6 miles of streams. In contrast, the Koktuli Conservation Area will preserve 814 miles of streams. These include approximately 106 miles of anadromous streams and 77 acres of anadromous lakes, including the North Fork and South Fork Koktuli rivers, the mainstem Koktuli River, and nine tributary watersheds (Giefer and Blossom 2020). Relative to the aquatic resources impacted, these streams provide substantially higher quality and use habitat for all five species of Pacific salmon. In addition to the preservation of fish habitats within the streams, the Koktuli Conservation Area will also preserve the surrounding wetlands, uplands, and waterbodies that make up the approximately 19,000-acre Koktuli riparian corridor and that drain into the Koktuli River and its tributary drainages. The EPA recognized the "diverse array of streams, wetlands, lakes, and ponds that are relatively free from human-induced alteration and provide extensive and heterogeneous habitats for fishery resources" as aquatic resources of national importance (EPA 2019). The preservation of these aquatic resources, in conjunction with associated upland habitats, will promote the continued ecological sustainability of the Koktuli watershed.

This mitigation is appropriate because the Koktuli River watershed is currently in an almost entirely undisturbed state that supports long-term ecological sustainability for a variety of fish and wildlife species, as well as subsistence and recreational purposes. In order to keep the dynamic Koktuli River system functioning as self-sustaining over time, the preservation of a substantial percentage of existing landforms, soils, land use conditions, and hydrology (both surface and groundwater flows) is required. The riparian corridor of the mainstem Koktuli River has function and value as an intact and undeveloped landscape feature, and the preservation of 112,445 acres will allow the Koktuli watershed ecosystem to continue to respond dynamically to natural variability in a resilient and adaptable manner presently and in the long-term.

The amount of mitigation provided satisfies the requirements of 33 CFR 332.3(f) as mitigation is provided at a mitigation ratio substantially greater than one-to-one. The proposed preservation has a high likelihood of success and will not require restoration or enhancement of aquatic resources. The wetland types and functions performed by aquatic resources within the Koktuli Conservation Area are similar to, but of generally higher value, than those lost due to Project impacts. The proposed mitigation plan requirements will be completed prior to Project impacts and the Koktuli Conservation Area is in the same watershed and downstream from the Project impact site. The permanent preservation of aquatic resources and associated upland habitats in the Koktuli River watershed will support the long-term sustainability aquatic resources of national importance and the Pacific salmon and caribou that those aquatic resources support.

7 Mitigation Work Plan (33 CFR 332.4(c)(7))

The Koktuli Conservation Area will be protected in its existing pristine condition. The mitigation work plan involves the executing the Site Protection Instrument (detailed above) and the Long-term Management Plan (Section 11). The geographic boundaries of the Koktuli Conservation Area will be determined as further described in the Long-term Management Plan by a boundary survey completed by a registered surveyor and documented according to methods acceptable to the State of Alaska. PLP will conduct a site visit within 1 year of the establishment of the Site Protection Instrument to document baseline conditions. A report from this visit will be compiled to include photographs and a description of the site. This report will serve as the first monitoring report.

8 Maintenance Plan (33 CFR 332.4(c)(8))

Preservation of the Koktuli Conservation Area is anticipated to be self-sustaining, eliminating the need for regular maintenance activities. Therefore, there are no plans for active maintenance of the area. Actions to maintain compliance with the Site Protection Instrument are contained in the Long-term Management Plan Section (Section 11), including any maintenance needed as result of observations made during site visits.

9 Performance Standards (33 CFR 332.4(c)(9))

PLP's proposed Site Protection Instrument for the Koktuli Conservation Area will be established concurrently with, or prior to, the activities authorized in the DA permit. Overall, the Performance Standards consist of monitoring, enforcement, and documentation of the requirements of the Site Protection Instrument.

As described in Section 2, Objectives (33 CFR 332.4(c)(2)), the objective of preservation of the Koktuli Conservation Area is to maintain the long-term ecological sustainability of the Koktuli River watershed through the preservation of aquatic resources and associated upland habitats within the Koktuli Conservation Area. The aquatic resources and associated upland habitats within the conservation area are currently in reference condition (Section 5, Baseline Information), and no work is proposed within the conservation area (Section 7, Mitigation Work Plan).

As a result, success of the preservation project will be the prevention of new surface disturbances prohibited by the Site Protection Instrument (Section 4, Site Protection Instrument (33 CFR 332.4(c)(4)) relative to conditions documented during the initial site visit (Year 0). Because the objective of the preservation project is to maintain the long-term ecological sustainability of the Koktuli River watershed, natural variability, such as meandering stream channels or ecological changes due to natural disturbance or succession, is anticipated and considered a positive sign of a naturally functioning system. As a result, the aerial location and extent of aquatic resources may shift over time and is not a performance standard.

10 Monitoring Requirements (33 CFR 332.4(c)(10))

Monitoring is required by the 2008 Rule to determine if a mitigation project is meeting the established performance standard (33 CFR 332.6). Prior to establishment of the Site Protection Instrument, PLP will contract a third-party or parties to document baseline conditions of the Koktuli Conservation Area. This will include a boundary survey conducted by a registered surveyor to establish the boundaries for inclusion in the Site Protection Instrument and a baseline condition survey that will document all current disturbances. Once the Site Protection Instrument is in place, a third party will evaluate compliance with the Site Protection Instrument through documentation of new disturbances prohibited by the Site Protection Instrument. Monitoring of the Koktuli Conservation Area will occur in Year 5 (Table 10-1).

Table 10-1. Schedule of Monitoring Activities

Activity	Responsible Party	Schedule [a]
Year 0 Baseline Documentation		
Conduct Boundary Survey	Third party or parties contracted by PLP	Following approval of the CMP by USACE
Collect Aerial Photography		Q2/Q3
Analyze Aerial Photography		Q2/Q3
Conduct Site Visit		Q2/Q3
Baseline Documentation Report to USACE		Q4 prior to December 1
Year 1		
Site Protection Instrument	PLP	Following completion of the boundary survey and Baseline Documentation Report
Year 5 Monitoring		
Collect Aerial Photography	Third party or parties contracted by PLP	Q2/Q3
Analyze Aerial Photography		Q2/Q3
Conduct Site Visit		Q2/Q3
Year 5 Report to USACE		Q4 prior to December 1

Notes: PLP: Pebble Limited Partnership; CMP: Compensatory Mitigation Plan; USACE: U.S. Army Corps of Engineers; Q2: second quarter; Q3: third quarter; Q4: fourth quarter

[a] Represents a typical schedule, taking into consideration seasonal variability with spring breakup.

Existing aquatic resources were delineated in August 2020 as described in the Koktuli Conservation Area Wetland and Waterbody Delineation Report (Attachment A). This survey and report serve to document the existing conditions of the wetlands and streams, including vegetation, hydrology, and soils, of the Koktuli Conservation Area.

Prior to establishment of the Site Protection Instrument (i.e., Year 0), A third party-entity contracted by PLP will complete a boundary survey of the Koktuli Conservation Area according to methods acceptable to the State of Alaska for the purpose of clearly identifying the boundaries of the Koktuli Conservation Area. The survey is expected to closely resemble the boundaries represented in this CMP and will be used to establish the property boundaries for the Site Protection Instrument and Long-term Management Plan. The survey will also specifically define the boundaries of the areas that have been excluded from the Koktuli Conservation Area, such as native allotments.

A third party-entity contracted by PLP will also collect aerial imagery prior to the establishment of the Site Protection Instrument (i.e., Year 0). The scale of aerial imagery collection will be sufficient to capture an overview of the site and monitor for potential manmade disturbances prohibited by the Site Protection Instrument. A third party entity will then interpret the imagery for disturbed conditions that appear to be in conflict with the Site Protection Instrument. In addition, a third party entity will also conduct a site visit to document baseline conditions within the Koktuli Conservation Area. The site visit will likely be helicopter-supported and will involve flying transects of the Koktuli Conservation Area. The estimated spacing of transects is 1 mile. The site visit may also include a limited number of landings to collect GPS points and ground-level photographs of existing disturbance observed on aerial imagery and/or during the transect surveys. The aerial imagery data collection and the site visits will occur between May 1 and October 1.

The third party will compile information from the site visits and aerial imagery, including a description of the site and ground-level photographs, into a Baseline Documentation and Monitoring Report that will be submitted to the USACE. The report shall be submitted to the USACE before December 1 of that calendar year and will include the aerial imagery, the procedure for analysis of the aerial imagery for future years, the boundary survey, and other relevant information collected over the first year. A similar report format would be used for subsequent monitoring and long-term management, documenting any changes at the site relative to baseline conditions. PLP proposes that the Baseline Documentation and Monitoring Report include the following specific sections:

1. Introduction and Plan Purpose
2. Third Party and Responsibilities
3. Summary of Implementation of Mitigation Plan
    a. Site Protection Instrument
        i. Permitted and prohibited actions
        ii. Third-party and State of Alaska coordination
    b. Monitoring and Long-Term Management Activities
4. Current Koktuli Conservation Area Monitoring
    a. Monitoring Methods
        i. Aerial imagery
        ii. Site visits
    b. Results
        i. Existing land use and disturbance
        ii. Baseline physical, biological, and hydrological conditions
    c. Comparison to Baseline Conditions (monitoring report only)
        i. Evidence of prohibited activities
        ii. Force majeure exclusions
    d. Adaptive Management Status
    e. Funding Account Balance

The Koktuli Conservation Area is currently pristine, and it is anticipated that all existing disturbances identified during the Year 0 survey will be documented and allowed to remain in place. These disturbances will not be subject to future enforcement actions by PLP. However, any additions or modifications to these existing disturbances that violate the terms of the Site Protection Instrument will be subject to enforcement.

In Year 5 following establishment of the Site Protection Instrument, a third party will confirm compliance with the Site Protection Instrument (Section 4, Site Protection Instrument (33 CFR 332.4(c)(4)) and document any variances from the baseline conditions established in the Year 0 survey. This will include acquisition of current aerial imagery and review for evidence of new manmade influences including but not limited to fills, structures, and other anthropogenic disturbances beyond the range of natural environmental processes. In addition, the third party will conduct a site visit following the same protocols described for the Year 0 baseline survey. If new disturbance determined to be caused by human activities and prohibited by the Site Protection Instrument are observed, either through analysis of aerial imagery or during the site visit, the disturbance will be documented and the third party will implement adaptive management procedures. Authorities including the USACE and the State of Alaska will be informed, as well as the party responsible for the disturbance.

The results of analysis of the aerial imagery and site visit will be documented in a Monitoring Report following the outline provided for the Baseline Documentation and Monitoring Report submitted in Year 0. The report will document any variances from the baseline conditions established in the Year 0 survey, adaptive management actions taken, and other management activities performed within the monitoring period. An estimate of monitoring and reporting costs is provided in Attachment B.

11 Long-term Management Plan (33 CFR 332.4(c)(11))

This Long-term Management Plan outlines how the Koktuli Conservation Area will be monitored, managed, and maintained for its long-term ecological sustainability. Existing conditions were delineated in August 2020 as described in the Koktuli Conservation Area Wetland and Waterbody Delineation Report (Attachment A), and baseline conditions will be established as outlined in Section 10, Monitoring Requirements. The Koktuli Conservation Area will be managed through legal protections and prohibition of activities identified in the Site Protection Instrument, enforced by PLP in accordance with the Site Protection Instrument (Section 4). Under the provisions of this Long-term Management Plan, PLP will implement methods to restrict activities prohibited by the Site Protection Instrument in the Koktuli Conservation Area. PLP would retain the ultimate responsibility of ensuring that the Koktuli Conservation Area is preserved, maintained, and monitored per the Long-term Management Plan and the Site Protection Instrument.

To meet the requirements of 33 CFR 332.4(c)(11), a third party will conduct monitoring activities and submit reports to confirm compliance with the Site Protection Instrument. These activities will occur every 5 years following the completion of monitoring activities described in Section 10, Monitoring Requirements (33 CFR 332.4(c)(10)), starting in Year 10 (5 years after completion of the monitoring period) and continuing through Year 95.

Site review will occur using methods similar to those described for the Year 5 monitoring period. A third party will qualitatively review publicly available aerial imagery for evidence of new manmade influences including but not limited to fills, structures, and other anthropogenic disturbances. In addition, the third party will conduct a site visit using methods similar to those described for the Year 5 monitoring period. If new disturbances prohibited by the Site Protection Instrument are observed, the third party will document the disturbance and will implement adaptive management procedures. If new imagery is not available for a reporting period, the third party will file a report stating that the aerial imagery has not been updated since the previous report. However, if new imagery is not available prior to the subsequent reporting period, new aerial imagery will be acquired. PLP assumes acquisition of 9 years of aerial imagery during long-term management

(Years 15, 25, 35, etc.) in addition to aerial imagery acquired during the monitoring period (Years 0 and 5). Table 11-1 summarizes anticipated long-term management activities by year.

Table 11-1. Schedule of Long-Term Management Activities

Activity	Timeframe
Review of publicly available aerial imagery Conduct site visit	Years 10, 20, 30, 40, 50, 60, 70, 80, 90
Collect aerial imagery (unless publicly available imagery is available from within previous 10 years) Conduct site visit	Years 15, 25, 35, 45, 55, 65, 75, 85, 95
Adaptive management	As needed

Following monitoring activities, the third party will be responsible for preparing monitoring reports in each reporting period describing the observed conditions of the Koktuli Conservation Area, noted differences from the baseline conditions, and recommended management actions, if applicable. The third party will specifically describe if there have been any new surface disturbances prohibited by the Site Protection Instrument that would change the status of the Koktuli Conservation Area's conservation values, including disturbances to wetlands, other waters, and streams. The 5-year monitoring reports will follow the same outline described for the Baseline Documentation and Monitoring Report in Section 10, Monitoring Requirements (33 CFR 332.4(c)(10)). The reports will be available to USACE upon request.

Long-term management activities will be financed by a long-term management fund that will be established and financed by PLP and used specifically for conducting site monitoring and reporting activities under the terms of the Site Protection Instrument. A financing mechanism such as a performance bond or escrow account will be established by PLP to cover these costs, which are estimated at $1,525,000. A breakdown of the long-term monitoring costs is included in Attachment B.

PLP will not be responsible for changes to the site conditions attributable to forces majeures such as flood, fire, drought, disease, regional pest infestation, and others that are beyond their reasonable control. Active management will not be required for ecological changes that result from processes such as climate change, river level variation, and sedimentation due to overbank flood deposits that may affect the Koktuli Conservation Area's wetlands. The Koktuli Conservation Area was identified for floodplain and adjacent riparian area preservation due to the dynamic and successional processes of the area; these processes may affect stream channels, aquatic functions, or total wetland acreages and are indicative of a healthy, self-sustaining ecological system. The success of the Long-term Management Plan will not be evaluated based on quantitative measures such as acres of wetlands or length of stream miles; instead, the Koktuli Conservation Area will be evaluated at the same watershed level scale used to determine its suitability as appropriate compensatory mitigation.

PLP and the third party will work with the State of Alaska to manage proposed activities within the Koktuli Conservation Area and those activities' compliance with the requirements of the Site Protection Instrument. This will include preventing activities that are specifically prohibited by the Site Protection Instrument.

12 Adaptive Management Plan (33 CFR 332.4(c)(12))

Adaptive management is a mechanism for dealing with the uncertainty of the monitoring and long-term management processes. Adaptive management allows for problem solving and adjustments based on observed conditions, supporting development of solutions to the challenges of unforeseen circumstances while enforcing the terms of the Site Protection Instrument. Adaptive management supports the Site Protection Instrument by planning and implementing restoration or rehabilitation of areas disturbed by unauthorized activities. This Adaptive Management Plan provides PLP and USACE a process by which to address these unforeseen issues through identification of roles and responsibilities of involved parties. Activities that would necessitate adaptive management include unauthorized fill placement, establishment of drainage structures, and establishment of hardened roads, trails, walkways, and others identified in the Site Protection Instrument.

If a violation of the Site Protection Instrument is observed by PLP or its third party at any time, development of a Corrective Action Plan will be initiated by the third party. Violations may be observed during routine monitoring events, through reports from area users, or from other sources not directly related to the monitoring plan events. The Corrective Action Plan will be developed through cooperation with the third party, State of Alaska, and PLP, and submitted to USACE for review and approval within 60 days of the observed violation. The Corrective Action Plan will include descriptions of the violation, proposed measures to cease the activity, proposed measures to ensure that the activity does not reoccur, and proposed measures to restore/rehabilitate the area impacted by the violation. The Corrective Action Plan will include a schedule and note responsibility for implementation of the proposed adaptive management activities.

Site changes are expected to occur only due to natural events (e.g., weather, wildfire, floods, natural ecological disturbance, and succession). The Adaptive Management Plan will be applied if necessary to correct alterations due to prohibited activities listed in Section 4, Site Protection Instrument (33 CFR 332.4(c)(4)). While USACE has the responsibility for approval of the resulting Corrective Action Plan, PLP retains the responsibility to restore or rehabilitate the affected area. Financial responsibility for implementing the Corrective Action Plan will remain with PLP. PLP has developed an estimate for adaptive management costs based on the assumption of need for corrective action once every 20 years. Based on that assumption, a contingency allowance of $1,665,000 will be included in the long-term management fund to address adaptive management actions if required (see Attachment B).

Additionally, the Site Protection Instrument's covenants and restrictions run with the land and will be enforceable against any party violating the terms of the instrument.

13 Financial Assurances (33 CFR 332.4(c)(13))

PLP agrees to establish the Koktuli Conservation Area in advance of the construction activity. Following submittal of the Baseline Documentation and Monitoring Report and Establishment of the Site Protection Instrument PLP will provide a performance bond or establish an escrow account in the amount required to fund the future monitoring and long term management costs, as well as contingency funding to address potential adaptive management requirements as outlined in Sections 11 and 12. Attachment B includes an estimate of these costs, which would be updated prior to provision of the financial assurance. The current total for the financial assurance is estimated at $3,190,000.

14 Other Information (33 CFR 332.4(c)(14))

No other information is provided.

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FIGURES

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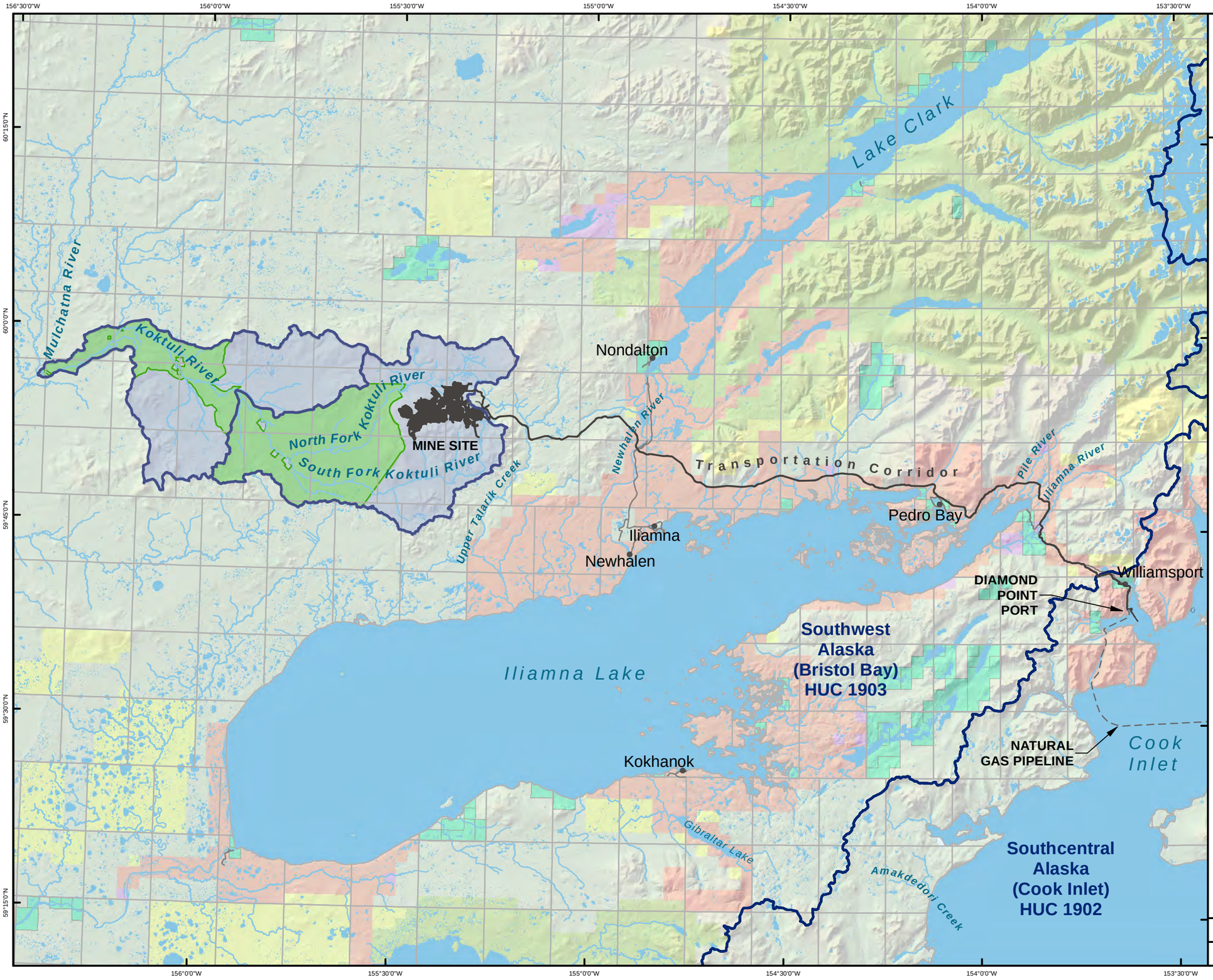

THE pebble PARTNERSHIP

FIGURE 1-1

Project Overview

- Project Features
- Transportation Corridor
- Natural Gas Pipeline
- Local Roads
- Township Boundary
- HUC 4 Watershed
- Koktuli River HUC 10 Watersheds
- Koktuli Conservation Area

General Land Status

- State Patented, Tentatively Approved or Other State Acquired Lands
- ANCSA Patented or Interim Conveyed
- Overlapping State and ANCSA
- Bureau of Land Management Public Lands
- National Park System
- Municipal or Other Private Parcels

0 8.5 17 Miles

N

Scale 1:538,560

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_1-1_ProjectOverview.mxd	Date: 9/28/2020
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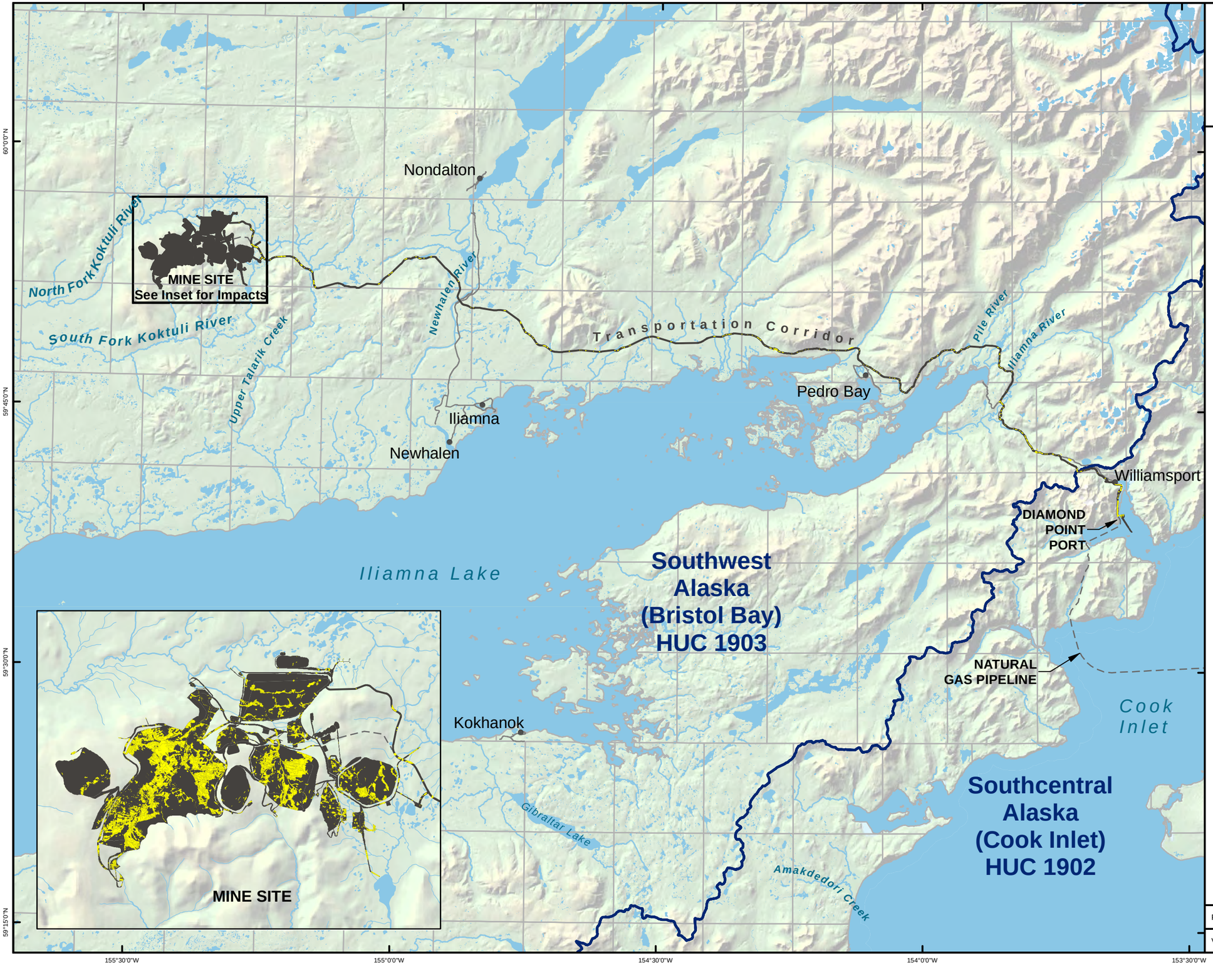

THE pebble PARTNERSHIP

FIGURE 2-1

Project Impacts to Wetlands and Other Waters

- Project Features
- Transportation Corridor
- Natural Gas Pipeline
- Local Roads
- Township Boundary
- HUC 4 Watershed
- Direct Impacts to Wetlands and Other Waters

Scale 1:400,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_2-1_ProjectImpacts.mxd	Date: 9/28/2020
Version: x	Author: HDR

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156°0'0"W

155°30'0"W

60°0'0"N

59°45'0"N

Mulchatna River

Koktuli River

Lower
Koktuli River
190303021305

Outlet
Koktuli
River

Unnamed
190303021104

North Fork Koktuli River

MINE SITE

Middle
Koktuli River
190303021105

South Fork Koktuli River

Headwaters
Koktuli
River

Upper
Koktuli River
190303021102

THE pebble PARTNERSHIP

FIGURE 2-2

Koktuli Conservation Area Overview

- Project Features
- Transportation Corridor
- Natural Gas Pipeline
- Township Boundary
- Native Allotments
- Koktuli Conservation Area
- Koktuli Riparian Corridor
- Mapped Wetlands
- Mapped Other Waters
- Mapped Streams
- Mapped Streams
- HUC 10 Watersheds
- HUC 12 Watersheds

0 2 4 6 8 Miles

N

Scale 1:200,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_2-	Date: 10/30/2020
Version: x	Author: HDR

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156°0'0"W

155°30'0"W

60°0'0"N

59°45'0"N

Mulchatna River

Koktuli River

North Fork Koktuli River

South Fork Koktuli River

MINE SITE

THE pebble PARTNERSHIP

FIGURE 3-1

Koktuli Conservation Area: Anadromous Habitat

- Project Features
- Township Boundary
- Native Allotments
- Koktuli Conservation Area
- Koktuli Riparian Corridor
- Koktuli River (North Fork, South Fork, Main Stem)
- Anadromous Tributaries
- Probable Anadromous Tributaries
- Other Streams

0 1.5 3 4.5 6 Miles

N

Scale 1:200,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_3-	Date: 9/28/2020
Version: x	Author: HDR

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156°0'0"W

155°30'0"W

60°0'0"N

59°45'0"N

Mulchatna River

Koktuli River

North Fork Koktuli River

South Fork Koktuli River

MINE SITE

THE pebble PARTNERSHIP

FIGURE 3-2

Koktuli Conservation Area: Mining Claims

- Project Features
- Transportation Corridor
- Township Boundary
- Native Allotments
- Koktuli Conservation Area
- Inactive Mining Claims in Conservation Area
- Active Mining Claims in Conservation Area
- Mineral Closing Order 393

0 2 4 6 8 Miles

N

Scale 1:200,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_3-	Date: 9/28/2020
Version: x	Author: HDR

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156°0'0"W

155°30'0"W

60°0'0"N

59°45'0"N

Mulchatna River

KR

KR 1.0

Koktuli River

Outlet Koktuli River

NFK-E

NFK-D

NFK-C

North Fork Koktuli River

NFK-B

NFK-A

MINE SITE

Headwaters Koktuli River

South Fork Koktuli River

SFK-C

SFK-B

SFK-A

THE pebble PARTNERSHIP

FIGURE 3-3

Koktuli Conservation Area: Spawning Reaches

- Project Features
- Transportation Corridor
- Township Boundary
- Native Allotments
- Koktuli Conservation Area
- Koktuli Riparian Corridor
- Spawning Reaches KR and KR 1.0
- Spawning Reaches NFK-A, NFK-C, NFK-E, and SFK-B
- Spawning Reaches NFK-B, NFK-D, NFK-F, SFK-A, and SFK-C
- HUC 10 Watersheds

0 2 4 6 8 Miles

N

Scale 1:200,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_3-	Date: 9/28/2020
Version: x	Author: HDR

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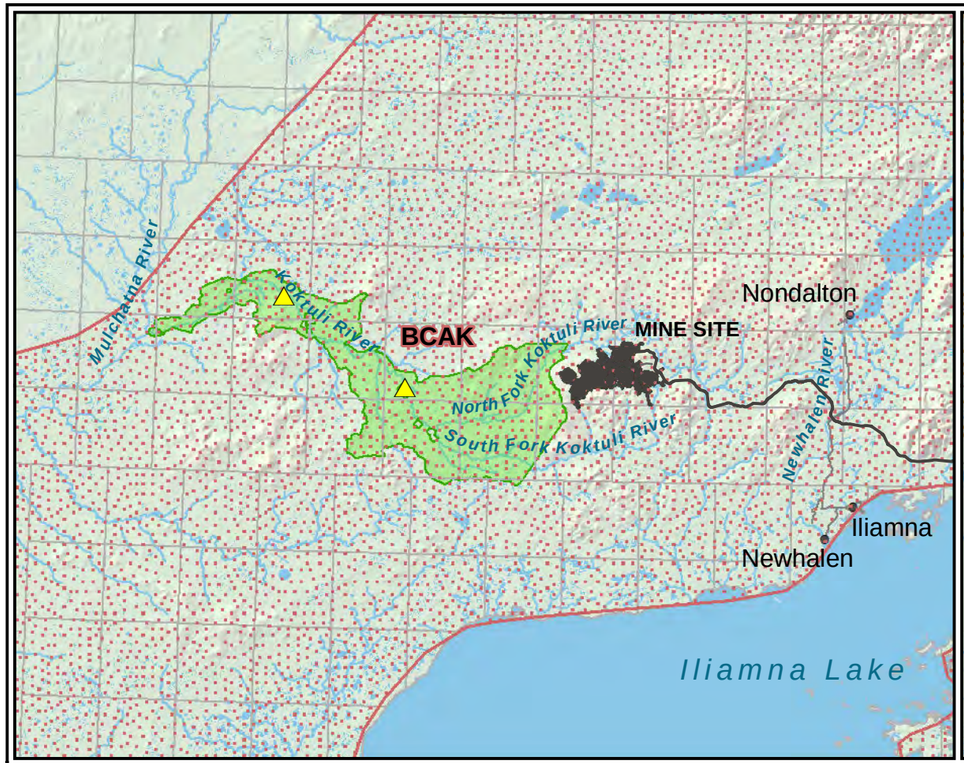

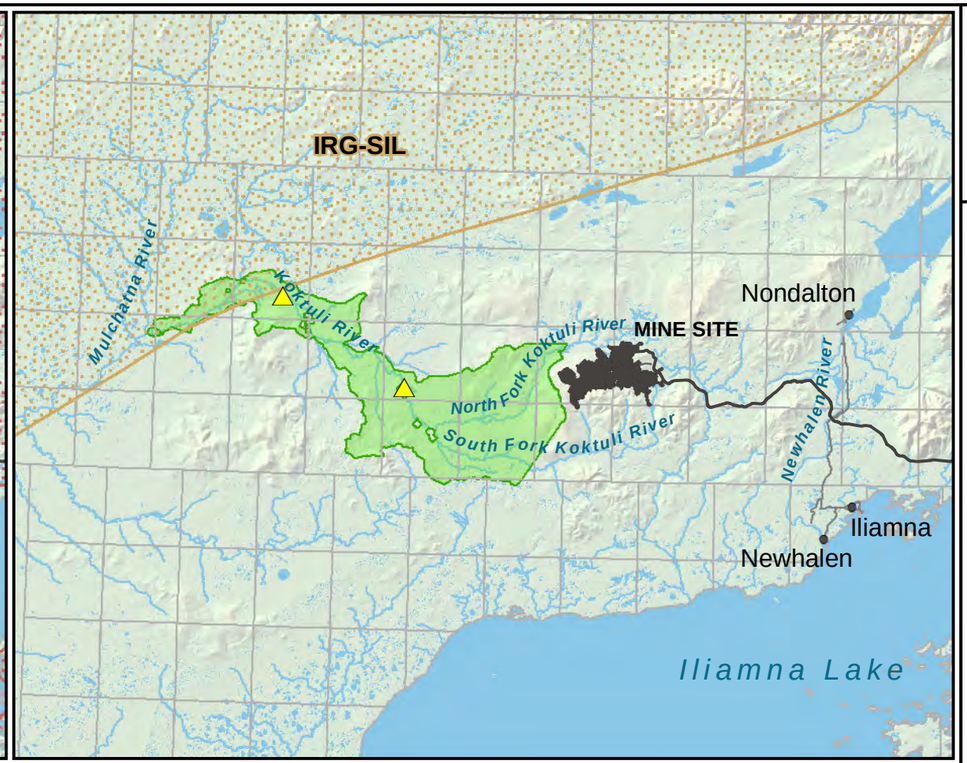

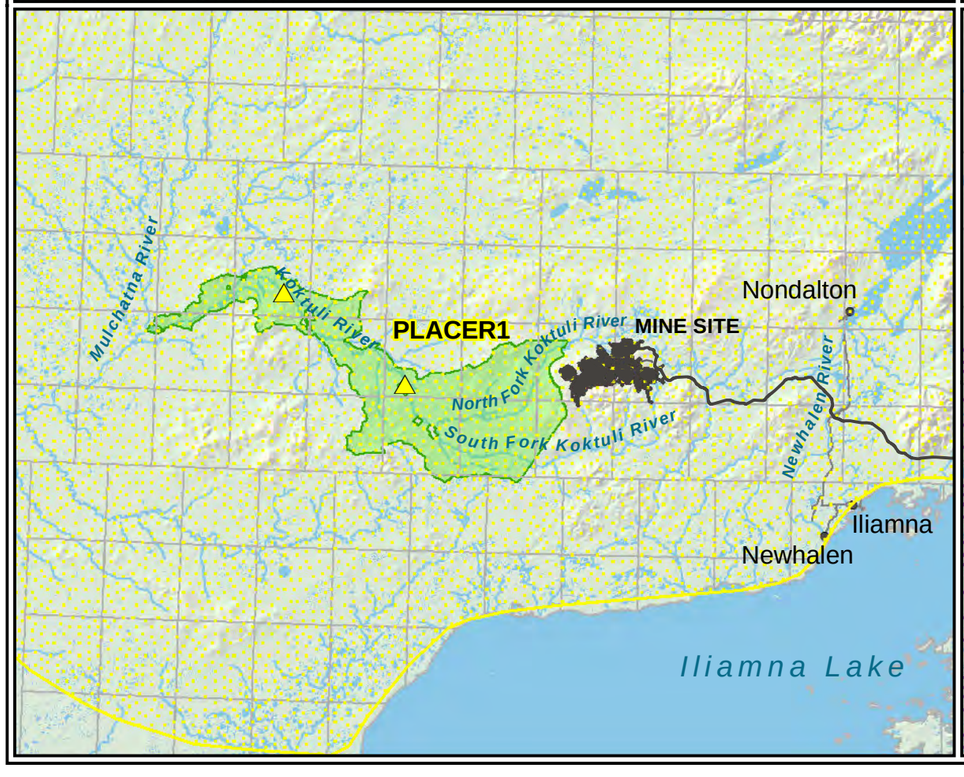

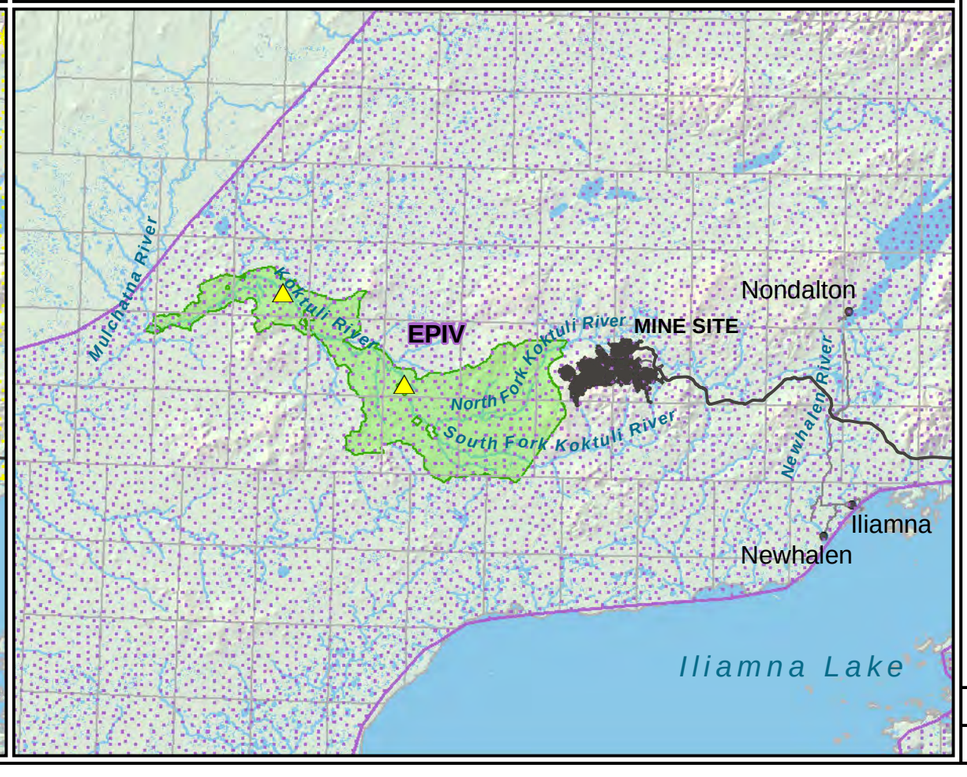

THE pebble PARTNERSHIP

FIGURE 3-4

Koktuli Conservation Area: Mineral Potential

- Project Features
- Transportation Corridor
- Local Roads
- Township Boundary
- Koktuli Conservation Area
- Permissive for porphyry copper
- Permissive for shallow to intermediate level intrusion related gold deposits
- Permissive for placer gold
- Permissive for epithermal vein deposits

0 6 12 18 24 Miles

N

Scale 1:750,000

Alaska State Plane Zone 5 (units feet)
1983 North American Datum

File: PLP_CMP_3-	Date: 9/28/2020
Version: x	Author: HDR

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ATTACHMENT A

KOKTULI CONSERVATION AREA WETLAND AND WATERBODY DELINEATION REPORT

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ATTACHMENT B

MONITORING AND LONG-TERM MANAGEMENT COSTS

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ATTACHMENT A

KOKTULI CONSERVATION AREA WETLAND AND WATERBODY DELINEATION REPORT

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FINAL REPORT

Pebble Project – Koktuli Conservation Area

Wetlands and Waterbodies Delineation Report

PREPARED FOR
U.S. Army Corps of Engineers – Alaska District, Regulatory Division

PREPARED BY

November 2020

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CONTENTS

Tables

Appendices

ACRONYMS AND ABBREVIATIONS

ADF&G	Alaska Department of Fish and Game
APT	Antecedent Precipitation Tool
BBMP	Bristol Bay Management Plan
CFR	Code of Federal Regulations
DEM	Digital Elevation Model
ENWI	Enhanced National Wetlands Inventory
FA	Functional Assessment
FAC	Facultative
FACW	Facultative Wetland
GIS	Geographic Information System
GPS	Global Positioning System
HGM	Hydrogeomorphic
NRCS	Natural Resources Conservation Service
NWI	National Wetlands Inventory
OBL	Obligate
ORP	Oxidation-reduction Potential
PI	Prevalence Index
PLP	Pebble Limited Partnership
PP	Representative Photo Point
QC	Quality Control
RU	Representative Upland
RW	Representative Wetland
SC	Stream Crossing
SH	Shrub Height
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

USGS	U.S. Geological Survey
WB	Waterbody
WD	Wetland Determination

1. Introduction

The Pebble Limited Partnership (PLP) submitted a Department of the Army application, pursuant to Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899, to the U.S. Army Corps of Engineers (USACE) on December 22, 2017, for the Pebble Project (Project) (POA-2017-271). A final Department of the Army application was submitted to USACE on June 8, 2020. The Applicant proposes the development of a copper-gold-molybdenum porphyry deposit as a surface mine in Southwest Alaska. Project construction requires discharge of fill into 2,179.5 acres of jurisdictional wetlands and other waters (unvegetated lakes, ponds, estuarine and marine waters) and 105.4 miles of streams. Project operations will indirectly affect an additional 1,470.3 acres of jurisdictional wetlands and other waters and 79.6 stream miles. Environmental effects of the Project were evaluated by the USACE under the National Environmental Policy Act through development of a Final Environmental Impact Statement published July 24, 2020 (USACE 2020a).

PLP submitted a Compensatory Mitigation Plan (PLP 2020) to the USACE in fulfillment of the requirements established by the Compensatory Mitigation for Losses of Aquatic Resources Final Rule (2008 Rule) issued by the USACE and the U.S. Environmental Protection Agency (EPA) on April 10, 2008 (33 Code of Federal Regulations [CFR] 332). The Project comprises four primary elements: the mine site at the Pebble deposit, a port site in Iliamna Bay in Cook Inlet, a road corridor connecting the mine site and the port, and a natural gas pipeline and fiber optic cable connecting to existing infrastructure on the Kenai Peninsula.

To appropriately compensate for these permanent and unavoidable impacts to aquatic resources associated with the mine site and transportation corridor, PLP is proposing preservation of the 112,445-acre Koktuli Conservation Area in the Koktuli River watershed. The objective of the Koktuli Conservation Area is to maintain the long-term ecological sustainability of the Koktuli River watershed. The Koktuli Conservation Area will protect a substantial and contiguous portion of a riverine ecosystem to allow large-scale and self-sustaining riverine system functions to continue over the long term without threat of human-induced surface impacts. This riverine system, along with associated wetland and other aquatic areas, will continue to support a variety of functions and services, including support for fish and wildlife populations, critical to the sustainability of the Koktuli River watershed and the larger Bristol Bay region.

PLP has contracted HDR Engineering, Inc. (HDR), to prepare a Wetland and Waterbodies Delineation Report (Delineation Report) for the Koktuli Conservation Area to support the Compensatory Mitigation Plan. This Delineation Report identifies locations within the areas proposed for preservation, hereafter referred to as the study area, that are potentially subject to USACE jurisdiction under authority of Section 404 of the Clean Water Act of 1972 (as amended) or Section 10 of the Rivers and Harbors Act of 1899. The Delineation Report does not assume or propose preliminary jurisdiction of the wetlands and waterbodies presented herein.

2. Study Area Description

The Koktuli Conservation Area is in southwestern Alaska, approximately 200 miles southwest of Anchorage and 60 miles west of Cook Inlet on lands owned by the State of Alaska, within the Lake and Peninsula Borough and Dillingham Census Area (Appendix A, Figure 1). The closest communities are the villages of Iliamna, Newhalen, and Nondalton, each approximately 20 miles from the Koktuli Conservation Area. The Koktuli Conservation Area is in the Koktuli River watershed, which is defined as the Headwaters Koktuli River and the Outlet Koktuli River Hydrologic Unit Code 10 watersheds. The Koktuli Conservation Area is comprised of wetlands, other waters, streams and rivers (including portions of the North Fork Koktuli River, South Fork Koktuli River, and almost the entirety of the mainstem Koktuli River), and associated wetland and upland habitats. A key feature of the Koktuli Conservation Area is preservation of the Koktuli riparian corridor, an approximately 19,000-acre floodplain across which the Koktuli River meanders. The Koktuli

riparian corridor consists of a complex mixture of forested, shrub, and herbaceous wetlands; uplands; and stream features including flood channels, gravel bars, and abandoned channels.

The Koktuli Conservation Area will preserve 39 percent of the total acreage of the Koktuli River Hydrologic Unit Code 10 watersheds: the Headwaters Koktuli River (1903030211), where Project impacts are proposed to occur, and the Outlet Koktuli River (1903030213).

The study area is located in the townships, ranges, and sections listed in Table 1 and shown on Figure 2, Appendix A. Approximate latitude and longitude coordinates at the Koktuli Conservation Area are North 59.85397° and West 155.864487° (North American Datum 83).

Table 1. Townships, Ranges, and Sections for the Study Area

Township	Range	Section(s) [a]
2 South	39 West	22, 23, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35
2 South	40 West	15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
2 South	41 West	13, 14, 22, 23, 24, 25, 26, 27, 33, 34, 35, 36
3 South	36 West	7, 8, 9, 16, 17, 18, 19, 20, 29, 30, 31, 32
3 South	37 West	9, 10, 11, 12, 13, 14, 15, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
3 South	38 West	18, 19, 20, 21, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
3 South	39 West	2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, 24, 25, 26, 27, 34, 35, 36
3 South	40 West	1, 2, 3, 4, 5, 8, 9, 12
3 South	41 West	3, 4, 5, 6, 7, 8, 9
3 South	42 West	1, 12
4 South	36 West	4, 5, 6, 7, 8, 9, 17, 18, 19, 30
4 South	37 West	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36
4 South	38 West	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 30, 34, 35, 36
4 South	39 West	1, 2, 11, 12, 13, 14, 15, 22, 23, 24, 25, 26, 27
5 South	37 West	4, 5, 6
5 South	38 West	1, 2, 3, 4, 5

[a] Located in the Seward Meridian.

3. Methods

3.1 Background Data

Existing data were compiled to create Project-specific Geographic Information System (GIS) layers of the study area. In addition, PLP commissioned several captures of aerial imagery. The following data sets were compiled by HDR and PLP for digital presentation and review for this Delineation Report:

- Soil Survey Geographic (SSURGO) database for Bristol Bay – Northern Alaska Peninsula, North and Bordering Areas, Alaska (U.S. Department of Agriculture [USDA] Natural Resources Conservation Service [NRCS]; see Appendix A, Figure 4) (NRCS 2020a).
- National Wetlands Inventory (NWI) mapping (U.S. Fish and Wildlife Service [USFWS]; see Appendix A, Figure 5) (USFWS 2020).
- U.S. Geological Survey (USGS) topographic mapping (NRCS 2018a).
- Fall season aerial photography acquired in September 2008. The aerial photography (1:20,000) was ortho-rectified by Dudley Thompson Mapping Corporation, Inc., at a scale of 1-foot pixels.
- Color aerial photography acquired in July 2004 by Eagle Mapping at 1:20,000. This aerial photography was ortho-rectified at a scale of 1.5-foot pixels.
- A Digital Elevation Model (DEM) acquired in September 2008 by Dudley Thompson Mapping Corporation, Inc., at a scale of 8-foot pixels, derived from planimetric data that were processed into a terrain model. Ten-foot topographical contours derived from this DEM were also used.
- A DEM acquired in July 2004 at a scale of 1:4800 by Kodiak Mapping Inc. and Eagle Mapping Ltd., and processed into a 12x12 grid from original AutoCAD files (144 total) containing planimetric vector features tagged with elevation by Resource Data, Inc. Ten-foot topographical contours derived from this DEM were also used.
- ESRI World imagery (ESRI 2020) and Bing Maps (ESRI 2013) – Aerial web services were used in a small portion of the southwest extent of the mapping area where other project imagery did not provide coverage.
- USGS National Hydrography Database, Best Resolution for Alaska State, USGS (2020).
- Alaska Department of Fish and Game (ADF&G) Anadromous Waters Catalog, Anadromous water bodies data derived from the ADF&G's GIS shape files for the *Catalog of Waters Important for Spawning, Rearing or Migration of Anadromous Fishes* (ADF&G 2020).

3.2 Field Data Collection

3.2.1 Background

Wetland scientists from 3PP, HDR, and Stantec conducted extensive field surveys for wetlands and waterbodies in 2007, 2008, 2012, and 2020, as shown in Table 2. The field work occurred within the NRCS-recommended growing seasons for the Lake and Peninsula Borough and Dillingham Census Area, which range from April 29 to October 4 at the Iliamna, Alaska, WETS station and from May 16 to September 21 at the Port Alsworth, Alaska, WETS station, respectively (NRCS 2020c). Field studies have been conducted on varying study areas over time, which resulted in some data being collected outside of the Delineation Report study area. Only data collected within the study area of this Delineation Report are presented here and were used as the principal basis for the mapping. Data collected outside of the study area that are not presented here were available to wetland scientists as an additional reference dataset to assist in the study area mapping.

Table 2. Field Survey Summary

Field Year	Month	Number of WDs	Number of PPs	Wetland Scientists [a]
2007	June	14	1	Jeffrey Mason, Jon Hall, Justin Miner, Karyn Noyes, Tom Ryon
	July	74	113	Ed Hall, Greg Everts, Jon Hall, Lily Lewis, Michelle Nixon, Pat Murphy
	August	9	8	Jeffrey Mason, Jon Hall
	September	0	13	Jessica Moody
	October	0	25	Lily Lewis, Meredith Borenstein
2008	July	190	547	Bryan Strong, Denise Herzog, Greg Everts, Jeffrey Mason, Jessica Moody, Jon Hall, Kai Rains, Karyn Noyes, Lily Lewis, Meaghan Shaffer, Rachael Puttman, Rebecca Wachter, Steve Reidsma, Tim DeMasters, Tom Ryon, William Kleind
	August	353	658	Bryan Strong, Greg Everts, Jason Mercer, Jeffrey Mason, Jessica Moody, Justin Miner, Karyn Noyes, Lily Lewis, Meaghan Shaffer, Rachael Puttmann, Rebecca Wachter, Tom Ryon, William Kleind
	September	220	327	Allison Stanton, Bryan Strong, Jason Mercer, Jeffrey Mason, Jon Hall, Justin Miner, Kai Rains, Karyn Noyes, Lily Lewis, Meaghan Shaffer, Rachael Puttmann, Rebecca Wachter, Tom Ryon, William Kleind
2012	August	5	17	Chris Wrobel, Mike Wallace
2020	August	1,048	1,462	Zach Halstead, Mac Salway, Mike Witter, James Young, Erin Cunningham, Greg Mazer, Jessica Tisdale, Ben Moorhead, Valerie Watkins, Steve Reidsma, Zach Baer
	September	10	18	Erin Cunningham, Greg Mazer, Jessica Tisdale
	Total	**1,923**	**3,189**	

Note: WD = Wetland Determination Plot; PP = Representative Photo Point.

[a] Only wetland scientist field leads are shown.

3.2.2 Field Data Collection Types

At each sample site, wetland scientists determined the appropriate field data to be collected using the protocols described in the following list of study plots:

- **Wetland Determination (WD) Plots**. At WD plots, investigators recorded detailed descriptions of vegetation, hydrology, soils, and—at wetland plots—indicators of wetland functions. Data forms for the WD plots were based on standard forms in the *Corps of Engineers Wetland Delineation Manual* (1987 Manual; USACE 1987), but were expanded to record more data to support the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region* (2007 Alaska Regional Supplement; USACE 2007) requirements, described further in Table 3. Wetland status for each plot was determined and recorded on the data forms. Photographs were taken at each WD plot.
- **Functional Assessment (FA) Plots**. Functional assessment data were collected in 2007 and 2008 when sites were clearly wetland (presence of primary indicators for vegetation, soil, and hydrology) and the wetland type had already been sampled with detailed WD plots sufficiently to characterize the vegetation type.
- **Shrub Height (SH_W and SH_U) Plots**. Shrub height forms were used during 2007 and 2008 in addition to WD field data collection in shrub communities. Scientists targeted willow and alder communities on hillsides and within floodplains to rapidly determine the vegetation type and collected an abbreviated suite of hydrology and soils variables. The dominant shrub species were recorded, but understory plant species in the plots were not. SH plots were assigned either a wetland

status (SH_W) or an upland status (SH_U), if conclusive. If plots were not conclusive based on the abbreviated data collected, a note was placed in the database stating that a full WD plot should be conducted at the site. The SH plots were conducted to provide ground truthing of alder and willow shrub types to support vegetation and wetland mapping efforts.

- **Representative Photo Points (RU and RW)**. Representative photo points were collected when scientists encountered vegetation communities and landscape positions that were clearly wetland (presence of primary indicators for vegetation, soil, and hydrology) or non-wetland (absence of indicators for one or more of vegetation, soil, or hydrology). Photographs were taken at representative uplands (non-wetlands; RU plots) and representative wetlands (RW plots). Photo points were also used to document notable plant species and incidental observations of cultural resources, new ground disturbance, and wildlife habitat features. Photo points presented in the appendices include not only RU and RW, but also FA, WB, SC, SH_U, and SH_W.
- **Waterbodies (WB) and Stream Crossings (SC)**. These photo points were collected when the scientists encountered streams, rivers, ponds, and lakes. Photographs of the streams and rivers were taken upstream, downstream, and across. Two photographs were taken at waterbodies, showing two views in differing directions. In the database, scientists recorded the Project vegetation type adjacent to streams or rivers if it could be determined off-site, and if the area adjacent to the stream was determined to be wetlands. At WB plots, the vegetation type recorded in the database represents the aquatic vegetation within the waterbody, not adjacent to it.

For detailed data collection sites (WD), scientists recorded the full array of field data on forms. At photo points (FA, RW, RU, SH_W, SH_U, WB, and SC), scientists recorded a limited suite of essential data on paper forms or in digital instruments, or both.

3.3 Wetlands and Waterbodies

Wetlands and waterbodies analysis and mapping involved an evaluation of existing data, field work, data entry, digital mapping (line work and coding), characterization of wetlands in the study area, and Quality Control (QC) review. The identification and aerial photography-based delineation of wetlands required interpretation of the three parameters used for wetland determinations: vegetation type, soil type, and hydrologic characteristics. Where problematic parameters were observed, additional data and analysis were considered before a final wetland determination was made.

Wetland scientists used the 1987 Manual (USACE 1987), *Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Alaska Region* (2006 Interim Alaska Regional Supplement; USACE 2006), and 2007 Alaska Regional Supplement (USACE 2007) to delineate wetlands and waterbodies using three parameter methods described for routine wetland determinations. To be considered a wetland, an area must have hydrophytic vegetation, hydric soils, and wetland hydrology. The manual(s) used for each field season are described in Table 3.

Table 3. Wetland Delineation Manuals Used, by Field Season

Field Season(s)	Delineation Manual Used for Wetland Determinations	Notes / Other Manuals Used
2007	1987 Manual [a]	Data were also collected per the 2006 Interim Alaska Regional Supplement, 1988 Wetland Plant List [b], and 2006 Hydric Soils List [c]
2008	1987 Manual [a]	Data were also collected per the 2007 Alaska Regional Supplement, 1988 Wetland Plant List [b], and 2006 Hydric Soils List [c]

Table 3. Wetland Delineation Manuals Used, by Field Season

Field Season(s)	Delineation Manual Used for Wetland Determinations	Notes / Other Manuals Used
2012	1987 Manual [a]	Data were also collected per the 2007 Alaska Regional Supplement, 2012 Wetland Plant List and 2010 Hydric Soils List [c]
2020	2007 Alaska Regional Supplement	Used the 2018 Wetland Plant List [b] and 2018 Hydric Soils List [c]

Sources: USACE (1987, 2006, 2007)

[a] Vegetation dominance was calculated using the 50/20/20 rule as described in Section 3.3.1.

[b] Wetland Plant List refers to the USFWS National List of Plant Species that Occur in Wetlands (Reed 1988; Lichvar 2012; Lichvar et al. 2016; USACE 2020d). The plant list current at the time of the field visit was used to determine the wetland indicator status. See Section 3.3.1 for more details.

[c] The current version, including errata, of the Field Indicators of Hydric Soils in the United States available at the time of the field visit was used (NRCS 2006a, 2010, 2018b).

Other waters of the U.S. mapped included unvegetated ponds, lakes, streams, rivers, gravel bars, and shorelines. Ponds and lakes were mapped based on aerial photo interpretation of surface water. Perennial and intermittent streams were mapped by examining aerial photography for direct evidence of surface water as well as the contour datasets for topographic evidence of a channel. Shorelines and gravel bars were mapped through aerial photograph interpretation. Non-water and non-wetland areas are those areas that do not meet the definition of a wetland, waterbody, or other waters, and were mapped as uplands.

3.3.1 Vegetation

Determining the Presence of Hydrophytic Vegetation

Consistent with the 1987 Manual (USACE 1987), 2006 Interim Alaska Regional Supplement (USACE 2006), and 2007 Alaska Regional Supplement (USACE 2007), investigators collected vegetation data to determine whether the surrounding plant community was dominated by hydrophytes. Detailed species and cover estimates on 0.1-acre plots (unless otherwise indicated) were recorded within representative stands of vegetation. Vegetation data collected at each plot generally included absolute percent coverage of all observed vascular plant species, estimated tree height, and estimated diameter at breast height. Absolute cover of each vascular plant species was determined by ocular estimate; species with less than 3 percent cover were recorded on data forms as trace. In 2020, species with less than 1 percent cover were recorded as trace to allow for species with 1 or 2 percent cover to be included in the Prevalence Index (PI) calculations. In many plots, total cover estimates of mosses and lichens were also recorded, along with their names, if known. Numerous taxonomic references and field guides were used to identify trees, shrubs, forbs, and graminoids over the course of the field surveys. These included:

- Alaska Trees and Shrubs (Viereck and Little 1972)
- Flora of Alaska and Neighboring Territories (Hultén 1968)
- Plants of the Pacific Northwest Coast (Pojar and MacKinnon 1994)
- Plants of the Western Boreal Forest and Aspen Parkland (MacKinnon et al. 1995)
- Willows of Southcentral Alaska (Collet 2002)
- Willows of Interior Alaska (Collet 2004)
- Wetland Sedges of Alaska (Tande and Lipkin 2003)
- Flora of North America, Volume 23: Cyperaceae (FNAEC 2002)
- Flora of North America, Volume 24: Poaceae Part 1 (FNAEC 2007)

- Flora of North America, Volume 25: Poaceae Part 2 (FNAEC 2003)
- A Field Guide to Alaska Grasses (Skinner et al. 2012)

Scientists assigned each plant species a wetland indicator status from the USFWS National List of Plant Species that Occur in Wetlands (Reed 1988; Lichvar 2012; USACE 2020d). The plant list current at the time of the field visit was used as described in Table 3. A list of the plants observed within the study area is in Appendix B and includes the wetland indicator status for each field season.

A plant community is considered hydrophytic when more than 50 percent of dominant species are obligate (OBL), facultative-wetland (FACW), or facultative (FAC) based on the current Wetland Plant List (USACE 1987) used at the time of the determination. Dominant species are calculated from each vegetation stratum based on the "50/20 rule" recommended in the 1987 Manual and the current industry standard. The standard 50/20 rule was modified for determination of dominance for this Project, and the USACE approved this modification (June 2004), known as the "50/20/20" rule. The 50/20/20 rule for calculating dominant species and then determining whether the vegetation is hydrophytic includes the following steps:

1. Assign the current Wetland Plant List indicator status and stratum to each species. The strata used for this study area include tree, shrub (includes saplings), and herb.
2. Estimate the absolute percent cover of each species.

    - Assign as "dominant" all individual species with a percent cover value greater than or equal to the absolute value "20 percent."

For each stratum:

3. Sum the percent cover values to obtain the total percent cover value for each stratum.
4. Determine 20 percent and 50 percent of this total percent cover value.

    - Assign as "dominant" all species with a percent cover value greater than or equal to 20 percent of the total percent cover for that stratum.

5. Determine whether additional species must be included as dominants.

    - If the sum of the percent cover values for all dominant species within a stratum is greater than 50 percent of the total percent cover for that stratum, no other species are included as dominants in the stratum.
    - If the sum of the percent cover values for all dominant species within a stratum is less than or equal to 50 percent of the total percent cover for that stratum, additional species must be designated as dominant. Include species within that stratum in decreasing order of percent cover value incrementally until the sum of the percent cover for dominant species within this stratum exceeds 50 percent of the total percent cover for that stratum.

6. Combine the lists of dominant species across all strata. Note that a species may be dominant in more than one stratum (e.g., a tall woody species may be dominant in both the tree and shrub strata). Calculate the percentage of species that are FAC, FACW, or OBL. If that percentage exceeds 50 percent, the vegetation community is hydrophytic.

In the 2006 Interim Alaska Regional Supplement, the USACE recommended the PI method for determining whether vegetation is hydrophytic, rather than the 1987 Manual method, which considers the indicator statuses of only the dominant species. PI and dominance are both used in the 2007 Alaska Regional Supplement. The PI, as described in the 2006 Interim and 2007 Alaska Regional Supplements (USACE 2006, 2007), was also retroactively calculated in the database for each plot visited prior to the USACE guidance on using the PI method.

Following the procedures and manuals described above the presence of hydrophytic vegetation is based on the following for each field season:

- 2007 to 2012: 1987 Manual – dominance test (50/20/20 rule)
- 2020: 2007 Alaska Regional Supplement – dominance test (50/20 rule) and/or PI

Vegetation Type

Scientists assigned Field Vegetation Types to each plot described in Section 4.1. Final Project vegetation codes were assigned to GIS polygons using a combination of the Project aerial photography signature guides (3PP 2008) and available field data, including site photography.

Field data were accessible via a relational database during mapping to assist in interpretation and assignment of Project Vegetation Types to GIS polygons. At individual sites, the data collected in the field may not always match the final vegetation type assigned to that area. This is the result of heterogeneity of vegetation that cannot always be reliably detected or practically mapped on aerial photography, or because the field plot was placed in a small inclusion of another type of vegetation within a larger vegetation mapping unit.

Enhanced National Wetlands Inventory Code

As part of the data collection and mapping inventory, waters of the U.S., including wetlands, and uplands were classified by an appropriate Enhanced National Wetlands Inventory (ENWI) classification code. During the field data collection phase, ENWI classification codes were applied to the vegetation communities at plot sites. The ENWI classification codes were also applied to every vegetation and waterbody mapping unit during the mapping phase. These classification codes are based on the Classification of Wetlands and Deepwater Habitats of the United States (Cowardin et al. 1979) and NWI Mapping Conventions (USFWS 1995). ENWI classification codes differ from NWI conventions by acknowledging non-wetland inclusions in predominantly wetland mapping units. Mosaics dominated by non-wetlands (uplands [U]) are coded U:x, where x is the ENWI classification code for the wetland inclusions, while mosaics dominated by wetlands are coded x:U. Based on the 2020 field work, only three remaining polygons were attributed with mosaic codes in the study area. These three polygons were attributed as mosaics of uplands and freshwater ponds (U:PUBC), described further in Section 3.3.7.

NWI mapping may also group large wetland systems of different vegetation types under a single mapping unit. NWI-mapped features in the study area are shown on Figure 5 in Appendix A. ENWI mapping prepared for this Project first separates mapping units by Project Vegetation Types as described in Section 4.1. ENWI classification codes observed in the study area are listed in Table 4.

Table 4. Enhanced National Wetland Inventory Classification Codes Observed in the Study Area [a]

ENWI Group	ENWI Code	Description
Deciduous Forests	PFO1	Palustrine broad-leaved deciduous forested wetland
	PFO1/4	Palustrine broad-leaved deciduous/needle-leaved evergreen forested wetland
	PFO1/SS1	Palustrine broad-leaved deciduous forested/broad-leaved deciduous shrub wetland
Evergreen Forests	PFO4	Palustrine needle-leaved evergreen forested wetland
	PFO4/1	Palustrine needle-leaved evergreen/broad-leaved deciduous forested wetland
	PFO4/SS1	Palustrine needle-leaved evergreen forested/broad-leaved deciduous shrub wetland

Table 4. Enhanced National Wetland Inventory Classification Codes Observed in the Study Area [a]

ENWI Group	ENWI Code	Description
Shrubs	PSS1	Palustrine broad-leaved deciduous shrub wetland
	PSS1/3	Palustrine broad-leaved deciduous/broad-leaved evergreen shrub wetland
	PSS1/4	Palustrine broad-leaved deciduous/needle-leaved evergreen shrub wetland
	PSS1/EM1	Palustrine broad-leaved deciduous shrub/persistent emergent wetland
	PSS1/FO1	Palustrine broad-leaved deciduous shrub/broad-leaved deciduous forested wetland
	PSS1/FO4	Palustrine broad-leaved deciduous shrub/needle-leaved evergreen forested wetland
	PSS1/ML1	Palustrine broad-leaved deciduous shrub/moss wetland
	PSS1/US	Palustrine broad-leaved deciduous shrub/unconsolidated shore wetland
	PSS3	Palustrine broad-leaved evergreen shrub wetland
	PSS3/1	Palustrine broad-leaved evergreen/broad-leaved deciduous shrub wetland
	PSS3/EM1	Palustrine broad-leaved evergreen shrub/persistent emergent wetland
	PSS3/US	Palustrine broad-leaved evergreen shrub/unconsolidated shore wetland
	PSS4	Palustrine needle-leaved evergreen shrub wetland
	PSS4/1	Palustrine needle-leaved evergreen/broad-leaved deciduous shrub wetland
	PSS4/EM1	Palustrine needle-leaved evergreen/persistent emergent wetland
	PSS4/SS1	Palustrine needle-leaved evergreen/broad-leaved deciduous shrub wetland
Herbaceous	PEM1	Palustrine persistent emergent wetland
	PEM1/FO1	Palustrine persistent emergent wetland/broad-leaved deciduous forested wetland
	PEM1/ML1	Palustrine persistent emergent/moss wetland
	PEM1/SS1	Palustrine persistent emergent/broad-leaved deciduous shrub wetland
	PEM1/SS3	Palustrine persistent emergent/broad-leaved evergreen shrub wetland
	PEM1/US	Palustrine persistent emergent/unconsolidated shore wetland
	PEM2	Palustrine non-persistent emergent wetland
Moss-Lichen	PML1	Palustrine moss wetland
	PML1/EM1	Palustrine moss/persistent emergent wetland
Aquatic Bed Ponds	PAB	Palustrine aquatic bed

Table 4. Enhanced National Wetland Inventory Classification Codes Observed in the Study Area [a]

ENWI Group	ENWI Code	Description
Ponds	PUB	Palustrine unconsolidated bottom
	PUB/AB	Palustrine unconsolidated bottom/aquatic bed
	PUS	Palustrine unconsolidated shore
	PUS/EM1	Palustrine unconsolidated shore/persistent emergent wetland
Lakes	L1UB	Lacustrine limnetic unconsolidated bottom
	L2UB	Lacustrine littoral unconsolidated bottom
	L2US	Lacustrine littoral unconsolidated shore
Rivers/Streams	R3UB	Riverine upper perennial unconsolidated bottom
	R3US	Riverine upper perennial unconsolidated shore
	R4SB	Riverine intermittent streambed
Pond Mosaics	U:PUB	Upland and palustrine unconsolidated bottom pond mosaic
Uplands	U	Uplands

Sources: Cowardin et al. (1979); USFWS (1995)

[a] Modifiers for "water regime" and "special modifiers" were also used as part of the ENWI coding but are not included in this table.

Hydrogeomorphic Classification Characterization

Hydrogeomorphic (HGM) mapping was completed for the study area. HGM map coding was based on *A Hydrogeomorphic Classification for Wetlands* (Brinson 1993). When polygons were designated as both wetlands and uplands (mosaic), the HGM designation applied only to the wetland portion of the mapped polygon. The following HGM types were observed in the study area:

- Riverine wetlands
- Slope wetlands
- Depressional wetlands
- Flat wetlands
- Lacustrine fringe wetlands
- Lacustrine waters; this HGM map code is specific to the Pebble Project. While lacustrine fringe wetlands occur adjacent to lakes, the lakes themselves are classified as lacustrine waters.
- Riverine channel waters; this HGM map code is specific to the Pebble Project. Small wetlands and flowing waters of the U.S. contained within an active channel are classified as riverine channel waters. This class includes bare sand and gravel bars, bars supporting pioneer vegetation, channel areas with non-persistent vegetation or aquatic vegetation, and unvegetated flowing water. Riverine channel waters are bounded on the landward side by upland, the channel bank, or wetlands.

3.3.2 Hydrology

Data collected for indicators of wetland hydrology included surface observations at the sampling point and subsurface observations in the soil pit and soil profile. At least one primary indicator or two secondary indicators are required to confirm the presence of wetland hydrology consistent with the 1987 Manual

(USACE 1987), 2006 Interim Alaska Regional Supplement (USACE 2006), and 2007 Alaska Regional Supplement (USACE 2007).

Wetland determinations are most straightforward when direct wetland hydrology indicators are present at the time of data collection. Primary indicators of wetland hydrology (flooding, saturated soil, or a water table within 12 inches of the surface) are most likely to be observed at the beginning of the growing season and during the summer rain season, although in drier-than-normal years, the indicators may not be observed, even at the wetter times. Secondary indicators of wetland hydrology may be considered in the absence of direct observation of wetland hydrology. The secondary indicator, "microtopographic relief," was used only when investigators interpreted the features to be a result of inundation or shallow water table for long periods each year.

Based on the procedures and manuals described above, the presence of wetland hydrology is based on the following for each field season:

- 2007 to 2012: 1987 Manual primary and secondary indicators. Additional hydrology indicators described in the 2006 Interim Alaska Regional Supplement and 2007 Alaska Regional Supplement were considered together as a single valid secondary indicator under "Other" in the 1987 Manual's hydrology section.
- 2020: 2007 Alaska Regional Supplement primary and secondary indicators.

3.3.3 Soils

Many of the Project methods for sampling and documenting soils followed the *Field Book for Describing and Sampling Soils* (Schoeneberger et al. 2002, 2012). Soils were examined by excavating a soil pit at the center of the field plot and recording data for each soil horizon, including:

- **Horizon thickness.** For all soils, the depths of the upper and lower boundaries of each horizon were recorded in inches.
- **Horizon designation.** Horizons were named as described in Schoeneberger et al. (2002, 2012).
- **Matrix color (hue, value, and chroma) and percent abundance.** All colors were based on Munsell® Color Charts and were described for moist soils.
- **Redoximorphic features and other mottles or inclusions.** Color (based on Munsell® Color Charts), percent abundance, type (concentration, depletion, or reduced matrix), location (pore lining, root channel, matrix, or mass), abundance (few, common, or many), size (fine, medium, or coarse), and contrast (faint, distinct, or prominent), generally according to Schoeneberger et al. (2002, 2012).
- **Texture.** For the fine earth fraction (≤2 millimeters), evaluated by feel for the proportions of sand, silt, and clay.
- **Coarse fragments.** Percent by volume of gravels, cobbles, stones, and boulders.
- **Structure.** The naturally occurring arrangement of soil particles into aggregates was described from 2004 to 2010 as either (1) having structure, described as granular, angular blocky, subangular blocky, platey, prismatic, or columnar; or (2) being structureless, described as single-grained or massive.
- **Roots.** Quantity (few, common, or many) of each size (very fine, fine, medium, coarse, and very coarse) recorded from 2007 to 2008.
- **Soil pH.** As determined using a Truog method test kit recorded from 2007 to 2008.
- **Response to alpha-alpha-Dipyridyl solution**. Alpha-alpha-Dipyridyl solution was used to confirm the presence of ferrous (Fe++) iron in soils. When the chemical was applied to a freshly exposed, moist soil material, a bright pink (or red) color developed within a few seconds if Fe++ was present at adequate concentration levels. This reaction indicated that the soil was reduced at the time of application (USACE 1987, 2007).

Other soil data recorded based on observations from the entire soil pit or applicable horizons, not necessarily at every soil horizon, included:

- **Total depth of all organic horizons.**
- **Depth to permafrost or seasonal frost,** where applicable.
- **Soil temperature.** Recorded with a calibrated soil thermometer (in degrees Fahrenheit) 20 inches below the surface. Scientists recorded the actual depth of measurement when seasonal frost or high-water table prevented data collection at 12 inches.
- **Oxidation-reduction potential (ORP).** From 2007 to 2008, at sites with marginal or no hydric soil indicators, but with hydrophytic vegetation and wetland hydrology, investigators measured ORP using an IQ 150 or 170 Waterproof Meter (manufactured by IQ Scientific Instruments, Carlsbad, California). The measurements were made in at least three separate soil samples from a single horizon, typically from the horizon suspected to be reduced. ORP was measured in approximately 1:1 slurries of soil samples and deionized water. ORP must be interpreted in relationship to soil pH. Scientists averaged the measurements (minimum of three samples within a 25-millivolt range) taken within a horizon. They then plotted the average pH measurements and ORP readings (measured in millivolts) to determine whether the soil sample was aerobic, anaerobic, or reduced (NRCS 2007). These data were then entered into the Project database, where a standard field measurement correction of 200 millivolts was added to the average reading. This reading is used, along with the soil pH, to determine whether reducing conditions were present in the soil at the time of observation, per the National Technical Standard (NRCS 2007).
- **Restrictive layer.** Investigators recorded type and depth of a restrictive layer, if present in the soil profile. Restrictive layers in the soil, such as permafrost, a layer of clay or silt, or dense glacial till may slow or prevent the infiltration of water.
- **Special soil characteristics** pertinent to engineering or interpretation of hydric soil indicators. These included (1) thixotropic soils, which exhibit liquid properties upon excavation, and (2) cryoturbated soils, which exhibit mixing of horizons as a result of freezing and thawing.

Investigators interpreted the data described above to record the following additional information:

- **Soil drainage class**, ranging from Excessively Drained to Very Poorly Drained. Soil drainage class was determined in the field based on guidance provided in an NRCS technical note (NRCS 2003).
- **Soil taxonomy**, based on the interpretation of soil characteristics observed in the field within the upper 18 to 24 inches of the soil profile, or less if there was seasonal frost in the profile. Soil taxonomy, based on *Keys to Soil Taxonomy* (NRCS 2006a), was determined for most plots in 2007 and 2008.
- **USACE hydric soil indicators** (USACE 1987). Presence and application of hydric soil indicators is subject to interpretation by the investigator, based on the conditions at the time of sampling and all other information available to the scientist. For this Project:
  - The "reducing conditions" indicator was met under any of three conditions observed in the upper 12 inches of the mineral soil: a positive response to alpha-alpha-Dipyridyl, ORP measurements that are determined to be reduced, or sulfidic odor.
  - The "aquic moisture regime" indicator was linked to "reducing conditions" in 2007 (Wakeley 2007), and the database was changed retroactively for plots sampled in prior years. In short, for the aquic moisture regime to be positive, an indicator of reducing conditions must have been present.
  - Scientists interpreted the "gleyed and low-chroma" indicator considering NRCS data showing that many soils in Alaska meeting the 1987 Manual description of this indicator are not hydric. Investigators did not consider soils to have this indicator if they had a low-chroma parent

material or contained substantial organic matter unless there was additional evidence that the soil was hydric.
  - In each year of field study, investigators determined whether each soil profile had any indicators described in the most current NRCS Field Indicators of Hydric Soils (NRCS 2006b, 2010, 2018b). For sites completed from 2007 to 2012, a soil with one of these indicators was not considered hydric unless it also had a hydric soil indicator described in the 1987 Manual.

- **Alaska Regional Supplement Manual** (USACE 2006, 2007) **indicators and considerations**. In 2007 to 2012, field investigators noted whether a soil would be hydric based on the indicators and procedures described in the 2006 Interim Alaska Regional Supplement or 2007 Alaska Regional Supplement. Again, a soil that would be considered hydric under these procedures was considered hydric for this Project if it also had a hydric soil indicator described in the 1987 Manual. For 2020, investigators used the procedures outlined in the 2007 Alaska Regional Supplement to identify hydric soils. Regional hydric soil indicators approved for testing (NRCS 2018b) were applied when identifying hydric soils in problematic situations (USACE 2020b).

Based on the procedures and manuals described above, the presence of hydric soils is based on the following for each field season:

- 2007 to 2012: 1987 Manual hydric soil indicators; *Field Indicators of Hydric Soils* (NRCS 2006b, 2010).
- 2020: 2007 Alaska Regional Supplement hydric soil indicators (USACE 2007), including updates to the indicators as described in *Field Indicators of Hydric Soils* (NRCS 2018b).

3.3.4 Other Data

Elevation was generally determined with both the Global Positioning System (GPS) and a barometric altimeter. Field investigators collected additional data, including slope gradient, aspect, and slope shape (linear, convex, or concave, described across slope and down slope). Major landforms, macro-topography, and micro-topography were assigned on the ground at field plots using the definitions described in the *Vegetation Type Photo Signature Guide* (3PP 2008). Disturbance to soil, vegetation, or both were noted in the mapping if there was evidence from field data or if it was visible on aerial photography.

3.3.5 Wetland Determinations

Wetland status was assigned to each GIS polygon after careful review of WD data forms, PPs, site photos, and other available data within the polygon. Data from plots in nearby or similar polygons were also evaluated when wetland status was assigned. If plot data or best professional judgment of the investigator suggested that a vegetation type was consistently associated with either non-wetland or wetland, this information was also considered. Wetland status assigned by investigators is based solely on criteria found in the 1987 Manual or the 2007 Alaska Regional Supplement, not on subsequent court cases pertaining to surface water connections, referred to as jurisdictional wetlands. Nomenclature used for the wetland determination for the sampling points included the following:

- **Wetlands** – Sampling points were within a wetland when wetland criteria for all three parameters—hydrophytic vegetation, wetland hydrology, and hydric soils—were met.
- **Upland** – Sampling points were upland when the wetland criterion for at least one parameter was not met.
- **Transitional Wetland** – Transitional wetland was used when all three wetland criteria were met, but at least one or more of the parameters was marginal; i.e., secondary hydrology indicators were used. The designation of transition areas is used to alert mappers that the sampling points are possibly near a wetland/upland transition boundary.

- **Transitional Upland** – Transitional upland generally was used when at least two of the wetland parameters were positive and the third parameter was negative, or when one or more indicators were marginal; i.e., a score of 50 percent for the percent dominance test for hydrophytic vegetation.
- **Wetland/Upland Mosaic** – Mosaics are those areas that include a mixture of wetland and upland areas in which each type is typically less than 0.1 acre in size. Based on the results of the 2020 field effort and review of existing field data, few mosaics were identified in the study area (three polygons totaling 14.4 acres). As described in the vegetation discussion in Section 3.3.1, mosaics were denoted as part of the ENWI code. Procedures used to identify mosaics are described in Section 3.3.7.

3.3.6 Waterbody Determinations

Additional nomenclature for waterbodies was also used to denote the navigability of waterbodies based on field data and GIS mapping. The navigability is relevant to USACE jurisdiction under Section 10 of the Rivers and Harbors Act. The waterbodies nomenclature included the following terms:

- **WAT1** – Navigable waters that are listed on the USACE Alaska District's Navigable Waters list (USACE 2020c) and are defined as those waters that are subject to the ebb and flow of the tide and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce (33 CFR 329.4). These waterbodies also include large lakes that could support large vessels (e.g., float plane), but may not be connected to downstream waters.
- **WAT2** – Non-navigable waters that are connected downstream to a WAT1, or small lakes and ponds that are not connected to other waterbodies.

3.3.7 Problem Area Wetlands and Difficult Situations

Both the 1987 Manual and the 2007 Alaska Regional Supplement (USACE 1987, 2007) describe difficult wetland situations that include problem areas, atypical situations, and normal circumstances. When a difficult wetland situation was encountered in the field, wetland scientists used the appropriate procedures outlined in the manuals and described the situation in detail on the data forms.

Existing Project mapping and field data were available for approximately 55,000 acres of the eastern portion of the study area; however, the existing dataset had numerous polygons attributed as mosaics. HDR completed a review of the existing mapping and field data, and revised the mapping according to the wetland/upland status of the existing field data points within this area. Based on review of the field data, two polygons were determined to be true mosaics; all other polygons within this area were remapped and classified as either entirely upland, wetland, or waterbody.

As a result of the 2020 field effort, one polygon that was visited in the field was determined to be a true mosaic. Investigators used the procedures described in Chapter 5 of the 2007 Alaska Regional Supplement (USACE 2007) to evaluate true upland/wetland mosaic situations.

The three polygons determined to be true upland/waterbody mosaics were comprised of a mixture of hummocky dwarf ericaceous shrub tundra (Project Vegetation Code DEST-H) or bluejoint-herb (Project Vegetation Code BH) with bare ground exhibiting evidence of inundation present in microtopographic lows with unconsolidated bottoms. The percent composition of waterbody was determined for each polygon by a digital line transect completed in GIS. The three polygons attributed with true mosaic codes are represented by data points HDR_4055_2020, HDR_4056_2020, 3PP11166, and 3PP11398. The combined acreage of all true mosaic polygons is 14.4 acres. The percentage of waterbody or wetland identified in each mosaic polygon is retained in the JDWET attribute in the GIS database.

3.4 Data Entry

Data from the GPS units, digital cameras, wetland determination field forms (WD, RU, RW, SC, WB, FA, SH), and field notebooks were uploaded or entered by hand into a web-based relational database and related to the plot location in the GIS database. As plot locations were generated in GIS upon uploading, some fields of the database were auto-populated by incorporating geographic information already in the database, such as quadrangle names and section numbers. Upon completion of the data entry and applicable QC processes, data were made available in GIS for use in vegetation, wetland, and waterbody mapping.

3.5 Digital Mapping and Aerial Photo Interpretation

As described in Section 3.1, aerial photography was acquired several times during the collection of baseline data. Fall season aerial photography acquired in September 2008 at a scale of 1-foot pixels, and color aerial photography acquired in July 2004 at a scale of 1.5-foot pixels were the basis for updated mapping efforts in 2020. Wetland and waterbody mapping were digitized on aerial photography at a scale ranging between 1:1,200 and 1:1,500; open water was digitized at a scale of 1:400 with a minimum polygon size of approximately 0.05 acre.

Topographic clues visible from elevation contours were also used to assist in delineation of wetlands and waterbodies. Topographic depressions, toe slopes, or flat areas were used to identify potential wetlands, while convex slopes were indicative of potential well-drained non-wetlands. Topographic patterns were also used to assess hydrologic connectivity between wetlands and streams, land surface elevations relative to nearby water surfaces, and potential locations of groundwater seeps. The results from the 2020 field efforts, along with existing Project data, were used to revise previously mapped mosaic polygons that were not visited in the field. Existing Project field data containing mosaic codes were left unmodified, and the overall wetland or upland status of those sites was determined through reevaluation of observed indicators of hydrophytic vegetation, wetland hydrology, and hydric soils, as indicated on individual data forms. The data collected in 2020 supersedes existing Project field data where these data collection locations overlap. Topography and LIDAR (light detection and ranging) imagery were used to identify incised areas on the landscape indicative of stream channels. Using these data combined with field observations, the centerlines of smaller streams (generally less than 10 feet wide) as well as the OHW (both right and left banks) of larger streams were mapped.

4. Summary of Wetland Indicators

The vegetation, hydrology, and soil conditions described below are based on extensive field investigations conducted between 2007 and 2020 within the Delineation Report study area. Wetlands were identified in the field where scientists observed indicators of hydrophytic vegetation, wetland hydrology, and hydric soils.

4.1 Vegetation

Scientists assigned Field Vegetation Types to each plot based on two existing classification systems: the *Alaska Vegetation Classification* (Viereck et al. 1992) and the *Bristol Bay Management Plan* (BBMP; Wibbenmeyer et al. 1982). Scientists reviewed vegetation field data collected to date and developed Project Vegetation Types (3PP 2008). The Project Vegetation Types were developed as the standard vegetation classification system for the Project to ensure that vegetation mapping was consistent among all wetland scientists. Field Vegetation Types that could not be easily distinguished from each other on aerial photography were combined. Other Project Vegetation Types common in the study area that were not well described in the BBMP or the *Alaska Vegetation Classification* were refined and added to the list of Project Vegetation Types. Table 5 summarizes the vegetation types identified in the study area. Note that vegetation types were attributed to only wetland or waterbody polygons in the mapping and not to uplands.

Table 5. Summary of Wetland and Waterbody Vegetation Types in the Study Area

Vegetation Code	Abbreviation
Forest (≥ 10% cover of trees more than 10 feet in height)	
Open Black Spruce Forest	OBSF
Open White Spruce Forest	OWSF
White Spruce Woodland	WSW
Black Spruce Woodland	BSW
Closed Broadleaf Forest	CBF
Open Broadleaf Forest	OBF
Broadleaf Woodland	BW
Open Mixed Forest	OMF
Mixed Forest Woodland	MFW
Scrub (< 10% cover of trees more than 10 feet in height, > 25% shrub cover)	
Dwarf Black Spruce Scrub	DBSS
Dwarf White Spruce Scrub	DWSS
Closed Willow Tall Shrub	CWTS
Closed Alder Tall Shrub	CATS
Closed Alder-Willow Tall Shrub	CAWTS
Open Alder Tall Shrub	OATS
Open Alder-Willow Tall Shrub	OAWTS
Open Willow Tall Shrub	OWTS
Open Dwarf Birch Scrub	ODBS
Closed Willow Low Shrub	CWLS
Closed Alder-Willow Low Shrub	CAWLS
Closed Alder Low Shrub	CALS
Open Sweetgale-Graminoid Bog	OSGB
Open Mixed Shrub-Sedge Tussock	OMSST
Open Dwarf Birch-Ericaceous Shrub Bog	ODBESB
Ericaceous Shrub Bog	ESB
Low Ericaceous Shrub Tundra	LEST
Shrub Birch-Willow	SBW
Open Willow Low Shrub	OWLS
Open Willow Low Shrub Fen	OWLSF

Table 5. Summary of Wetland and Waterbody Vegetation Types in the Study Area

Vegetation Code	Abbreviation
Open Alder-Willow Low Shrub	OAWLS
Open Alder Low Shrub	OALS
Dwarf Ericaceous Shrub Tundra	DEST
Dwarf Ericaceous Shrub Tundra - Hummocks	DEST-H
Dwarf Ericaceous Shrub Tundra - *Equisetum*	DEST-EQ
Dwarf Ericaceous Shrub Tundra - *Carex*	DEST-C
Dwarf Ericaceous Shrub-Lichen Tundra	DESLT
Herbaceous (< 10% of tree cover and < 25% of shrub cover)	
Bluejoint Tall Grass	BTG
Bluejoint-Herb	BH
Subarctic Sedge-Moss Wet Meadow	SSMWM
Fresh Herb Marsh	FHM
Fresh Sedge Marsh	FSM
Mesic Herb	MH
Aquatic Herbaceous	AH
Other	
Partially Vegetated	PV
Barren	BARE
Open Water	OW

Source: Modified from 3PP (2008)

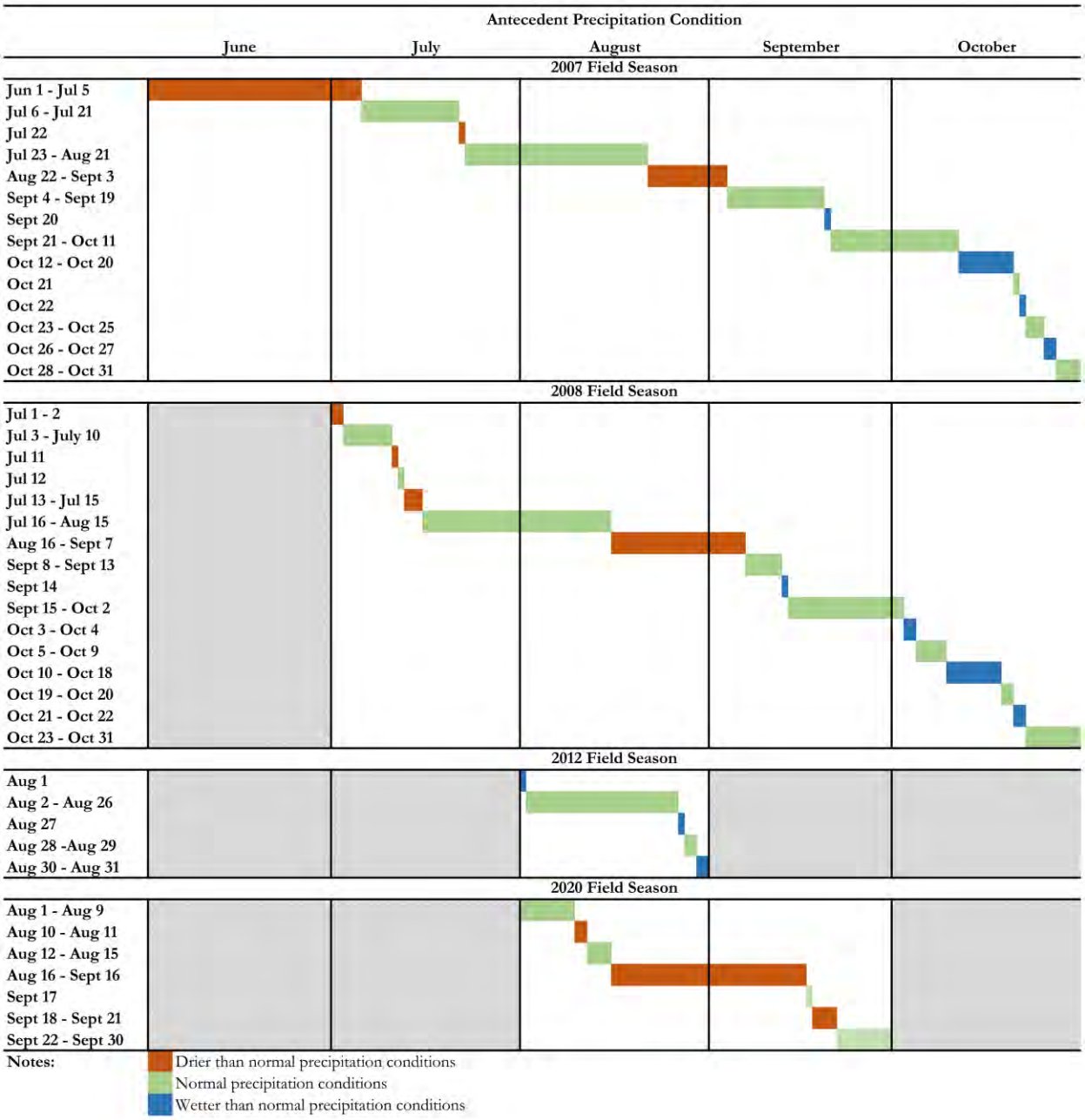
4.2 Hydrology

The USACE Antecedent Precipitation Tool (APT) was used to determine the degree to which any recent climatic events (e.g., abnormally wet or dry conditions) may have influenced hydrology conditions during the time of the field investigations. The APT utilizes 30 years of data on precipitation, drought, and other climatic factors to determine "normal" conditions (Deters 2020). The latitude and longitude used in the assessment correlates to the center of the Koktuli Conservation Area study area. Precipitation trends from this data source location is assumed to be representative of trends across the entire study area.

Hydrologic indicators observed during each field visit would be expected to correlate with the APT output for the specific field day. For example, if precipitation is drier than normal, hydrologic indicators (such as high-water table) may not be present and could result in a false negative determination for wetland hydrology observed during that field day. If climatic conditions resulted in problematic conditions at a specific wetland, these are indicated on the wetland data sheets. Table 6 illustrates the number of days each month that were calculated by the APT as drier than normal, normal, or wetter than normal conditions. The daily condition was used to compare field observations to climatic conditions on a given field day. The APT data set that includes only the days where conditions changed from one condition to another (e.g. from drier than normal to normal) is included in Appendix C.

APT data is useful to generally correlate current site conditions with antecedent precipitation conditions for a particular timeframe. However, during field surveys the wetland survey crews reviewed precipitation data for the three months prior to the field survey as well as conditions on the ground to make a determination on the data sheet regarding antecedent precipitation conditions. For example, during the 2020 field season APT outputs varied between normal and drier than normal (Table 6). Site conditions on the ground indicated drier than normal conditions for the entirety of the 2020 field season. Therefore, forms collected during 2020 were indicated as having drier than normal conditions.

Table 6. Antecedent Precipitation Condition for the 2007, 2008, 2012, 2020 Field Seasons



4.3 Soils

Soils in the study area are mapped according to the *Bristol Bay-Northern Alaska Peninsula, North and Bordering Areas, Alaska (AK636)* (NRCS 2020a), and are shown in Figure 4 of Appendix A and described in Table 7. The soils map is updated regularly on the Web Soil Survey (NRCS 2020b) virtual platform, with the most recent updates occurring in June 2020. The mapping identifies the types of soils and their variability across the area. The hydric soil status of mapped soil types in the area are described in the Web Soil Survey (NRCS 2020b) and noted in Table 7.

Table 7. Summary of Soils in the Study Area

Soil Map Unit	General Location of Soil Map Unit in Study Area	Soil Description	Hydric Soil Status
Boreal and Western Maritime Glaciated Plains, Undulating	Small, northern portion of the study area	Well-drained soils that occur on sloped, glaciated plains. Parent material consists of mossy organic material over coarse-loamy eolian deposits and coarse-loamy eolian deposits over gravelly till.	Not hydric
Boreal Flood Plains and Terraces, High	Long, narrow portion within the western and middle parts of the study area	Well-drained soils with high organic matter content in the surface horizon. Occurs on terraces and flood plains.	Not hydric
Boreal Flood Plains and Terraces, Low	Small portion within the western part of the study area	Poorly drained soils with parent material that consists of grassy organic material over coarse-silty or coarse-loamy alluvium.	Hydric
Boreal Flood Plains, Mid	Small, most western tip of the study area	Moderately well drained soils that occur on flood plains.	Not hydric
Boreal Plains and Western Maritime Flood Plains	Middle portion of the study area	Well-drained soils that occur on plains. Parent material consists of mossy organic material over coarse-loamy eolian deposits or coarse-loamy cryoturbate.	Not hydric
Boreal Terraces	Two small portions of the western part of the study area	Well-drained soils that occur on terraces. Parent material consists of organic material over coarse-loamy alluvium over gravelly alluvium.	Not hydric
Western Maritime Eolian Plains, Sloping	Several large portions spanning the study area	Soils with high organic matter content in the surface horizon. Occurs on plains.	Not hydric
Western Maritime Glaciated Hills and Plains	Far northeast corner and southwest corner of the eastern part of the study area	Well-drained soils that occur on plains. Soils are not flooded or ponded.	Not hydric
Western Maritime Glaciated Plains	Large portion of the eastern part of the study area	Occurs on glaciated plains. Soils are well-drained, not flooded, and not ponded.	Not hydric

Table 7. Summary of Soils in the Study Area

Soil Map Unit	General Location of Soil Map Unit in Study Area	Soil Description	Hydric Soil Status
Western Maritime Glaciated Plains and Kettle Lakes	Small most southern portion of the study area	Well-drained soils that occur on plains and glaciated plains. Parent material consists of coarse-loamy eolian deposits over gravelly till; and mossy organic material over coarse-loamy cryoturbate over coarse-loamy eolian deposits.	Not hydric
Western Maritime Glaciated Plains, Rolling	Small portion in the middle part of the study area	Well-drained soils that occur plains. Soils are not flooded.	Not hydric
Western Maritime Mountains	Several portions spanning the study area	Well-drained soils that occur on hills and plains. Soils are not flooded or ponded.	Not hydric
Western Maritime Organic and Glaciated Plains	Very small northern portion of the western part of the study area	Major components are a mix of poorly drained and well-drained soils. Occurs on plains and glaciated plains.	Hydric
Western Maritime Terraces, Very Wet	Very small southern portion within the western part of the study area	Occurs on terraces and depressions on terraces. Parent material consists of mossy organic material over coarse-loamy alluvium and organic material over coarse-loamy eolian deposits.	Hydric

Sources: (NRCS 2020a, 2020b)

5. Mapping Results

Maps of the delineated wetlands and waterbodies are provided in Appendix A. Summary tables, data forms, and photographs are provided in the following appendices:

Appendix B. Plant List and Indicator Status Summary

Appendix C. Antecedent Precipitation Tool Results for 2007, 2008, 2012, and 2020 Field Seasons

Appendix D. Summary of 2007-2012 WD Sites

Appendix E. Summary of Wetland Indicators at 2007 to 2012 WD Sites

Appendix F. Summary of 2020 Stantec WD Sites

Appendix G. Summary of Wetland Indicators at 2020 Stantec WD Sites

Appendix H. Summary of 2020 HDR WD Sites

Appendix I. Summary of Wetland Indicators at 2020 HDR Sites

Appendix J. Summary of 2007 to 2012 PP Sites

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Appendix M. Wetland Mapping Acreage Summary Table

Appendix N. Data Forms and Photographs at 2007 to 2012 WD Sites

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Appendix P. Data Forms and Photographs at 2020 Stantec WD Sites

Appendix Q. Data Forms and Photographs at 2020 Stantec PP Sites

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Appendix S. Data Forms and Photographs at 2020 HDR PP Sites

5.1 Wetlands

Overall, wetlands totaling 27,885.5 acres were identified in the study area. Wetlands were identified at field plots where the investigator observed indicators of hydrophytic vegetation, wetland hydrology, and hydric soils. If any of these three requirements are not met under normal conditions, the site does not meet the USACE criteria for being classified as a wetland.

5.2 Waterbodies

Overall, waterbodies totaling 3,140.8 acres were identified in the study area. Waterbodies consist of freshwater ponds, lakes, rivers, and streams, including their active shorelines and gravel bars. These do not meet the definition of "wetlands" used by the USACE because they lack hydric soil or hydrophytic vegetation. They are, however, potential waters of the U.S. Rivers and streams mapped in the study area include both perennial and intermittent streams. Ponds and lakes were mapped throughout the study area, and ponds were characterized as seasonal or perennial.

5.3 Summary

In total, 31,026.3 acres, or 28 percent of the study area, is determined to be wetlands and waterbodies.

Uplands are locations where one or more of the three required parameters for a wetland are not met. Uplands comprised 81,418.6 acres, or 72 percent of the study area.

A summary of the wetlands by ENWI groupings is shown in Table 8. The groupings reflect the wetland and waterbody mapping in Appendix A and are used for cartographic purposes. The full ENWI code is included in the data set provided to the USACE as part of this Delineation Report.

Table 8. Summary of Wetlands, Waterbodies, and Uplands Identified in the Study Area

ENWI Grouping	Acres in the Study Area [a]
Palustrine emergent wetlands	10,759.0
Palustrine scrub-shrub wetlands	17,046.4
Palustrine forested wetlands	80.0
Palustrine moss-lichen wetlands	0.1
Total Wetlands	**27,885.5**

Table 8. Summary of Wetlands, Waterbodies, and Uplands Identified in the Study Area

ENWI Grouping	Acres in the Study Area [a]
Aquatic bed lakes and ponds	8.2
Total Aquatic Bed Waterbodies	**8.2**
Lakes and ponds	1,159.0
Pond mosaics	14.4
Rivers/Streams	1,959.2
Total Fresh Waterbodies	**3,132.6**
Total Waterbodies	**3,140.8**
Total Wetlands and Waterbodies	**31,026.3**
Uplands	81,418.6
Total Acreage in Study Area	**112,444.9**

[a] All values are rounded to the nearest 0.1 acre.

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Appendix A:
Figures

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ATTACHMENT B

MONITORING AND LONG-TERM MANAGEMENT COSTS

Koktuli Conservation Area
Monitoring and Long-Term Management Costs

Long Term Management Costs

	Units	Frequency	Cost/Unit	Total Cost	Notes
Aerial Imagery Analysis (every 10 years)					
Collect/process aerial imagery	event	1	$35,000	$35,000	resurvey on existing control
Office labor - imagery analysis	hrs	40	$175	$7,000	
Total				**$42,000**	
Field Inspection (every 5 years)					
Helicopter to fly transects	hrs	16	$1,500	$24,000	Hughes 500 or similar - wet rate, 250 survey miles @ 25mph, 6 hours mob/demob)
Field labor - fly transects	hrs	24	$175	$4,200	2 field days @ 12 hours
Field Expenses (accomadation/other)	event	1	$2,000	$2,000	accommodation/other
Office labor - planning and reporting	hrs	100	$175	$17,500	
Field contingency (25%)	event	1	$7,550	$7,550	Weather delays etc.
Total				**$55,250**	
Average cost - 5 year reporting				**$76,250**	
Long Term Management Plan Implementation Cost				**$1,525,000**	**20 inspections over 99 years (includes year 5 maintanence visit)**

Adaptive Management Costs

Corrective Action - Estimated Cost (every 20 years)					
Office labor - develop Corrective Action Plan	hrs	100	$175	$17,500	
Helicopter field support	hrs	56	$2,500	$140,000	A Star - wet rate - 10 days @ 5 hrs/day, 6 hours mob/demob
Equipment, Supplies, Expenses	event	1	$50,000	$50,000	Waste disposal, stabilization supplies, BMPs, accomadation etc
Field labor	hrs	480	$25	$12,000	4 staff/12 hrs/10 days
Field Supervision	hrs	120	$175	$21,000	12 hrs/15 days
Monitoring of corrective action (5 times)	event	5	$15,000	$75,000	1 day helicopter and labor
Office Labor - reporting and monitoring	hrs	100	$175	$17,500	
Total				$333,000	
Adaptive Management Assurance Cost				**$1,665,000**	**5 events over 99 years**