

DRAFT ENVIRONMENTAL BASELINE STUDIES

2004 PROGRESS REPORTS

CHAPTER 17. VISUAL AESTHETICS

JUNE 2005

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ACRONYMS

ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADOT/PF	Alaska Department of Transportation and Public Facilities
agl	above ground level
AHRS	Alaska Heritage Resource Survey
ANCSA	Alaska Native Claims Settlement Act
APE	area of potential effect
ASTt	Arctic Small Tool tradition
BBNA	Bristol Bay Native Association
BLM	Bureau of Land Management
BP	before present
¹⁴ C	Carbon 14
CRM	cultural resources management
DEM	digital elevation model
EIS	environmental impact statement
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FR	Federal Register
GIS	geographic information system
GMU	Game Management Unit
GPS	global positioning system
GLM	general linear model
LIDAR	light detection and ranging
M.A.	Master of Arts
MCHTWG	Mulchatna Caribou Herd Technical Working Group
mi ²	square mile(s)
MMS	Minerals Management Service
MODIS	moderate resolution imaging spectroradiometer
mph	miles per hour
NASA	National Aeronautics and Space Administration
NDM	Northern Dynasty Mines Inc.
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NPS	National Park Service
NRCS	Natural Resource Conservation Service

NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
PSD	Prevention of Significant Deterioration
QA	quality assurance
QAPP	quality assurance project plan
SHPO	State Historic Preservation Officer
SRB&A	Stephen R. Braund & Associates
SWE	snow water equivalent
USC	United States Code
USDA	United States Department of Agriculture
USFS	United States Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VHF	very high frequency

17. VISUAL AESTHETICS

17.1 Introduction

This report presents work completed during 2004 for the visual aesthetics analysis of the Pebble Project. This work includes a visual impact assessment of proposed facilities and infrastructure improvements proposed by Northern Dynasty Mines Inc. (NDM). Facilities and infrastructure generally include the mine and its associated operation and storage areas, processing facilities, tailings ponds, roadways, and a possible slurry pipeline. Two other major elements are an access road and port on Cook Inlet, and a power-transmission line.

17.2 Study Objectives

The objective was to develop a baseline photo library of existing visual resources before the proposed development proceeds. This baseline information will be used for a visual assessment that will include determination of viewed areas, evaluation of constituents, evaluation of constituent sensitivities, and mapping of landscape character, distance zones, and scenic integrity. Based on this information, an analysis will be conducted to determine the impacts to the landscape elements that will occur from development of the proposed mine project.

17.3 Study Area

The study area is centered north of Lake Iliamna, from the western edge of the lake to the Cook Inlet Coast on the east, and from the center of the lake on the south to Port Alsworth to the north (Fig. 17-1).

The study area encompasses the area that will be used during mine develop, including infrastructure, as well as areas from which the mine and its infrastructure could be seen by area constituents including visitors to Lake Clark National Park and Preserve, other recreational visitors to the affected area, communities within the affected area, lodges, air traffic, boat traffic, and subsistence users.

17.4 Scope of Work

The research and field work for this study were conducted during 2004. The study was conducted by Dwayne Adams and Shelley Elliott of Land Design North according to the approach described in the *Draft Environmental Baseline Studies, Proposed 2004 Study Plan* (Northern Dynasty Mines Inc., 2004). Specific work tasks included the following:

- Initial contact with NDM personnel to determine potentially affected parties in order to determine site-visit needs.
- Field trip to the project site and documentation of areas potentially affected by project components.
- GIS mapping of key project issues.

- Further determination of key affected parties and contact via telephone with several of those parties.

17.5 Methods

An analysis was undertaken to gain an understanding of the sensitivities of individuals and groups within the study area. Based on that analysis, a plan was developed for traveling in the area to document existing visual conditions at locations and altitudes that would be of most concern to key parties. Dwayne Adams and Shelley Elliott then traveled to the project area to document the existing visual conditions of the proposed mine site and appurtenant structures and infrastructure components including proposed roads, a power-transmission line, a possible slurry line, and candidate port locations. Travel was by helicopter to document landscape character and views using a digital camera and global positioning system (GPS) (Fig. 17-2). Photographs were catalogued and mapped.

Landscape-unit mapping was created in a geographic information system (GIS) based on ecological units digitized by Nowaki et al. (2001) of the U.S. Geological Survey (USGS) which were derived from units defined by Bailey (1994) (Fig. 17-3). That information was combined with the protocol for landscape aesthetics used by the United States Forest Service (USFS) to create landscape units (Fig. 17-4). Three levels of detail are included to show a hierarchy of ecosystems. The largest ecosystems are “domains,” which are groups of related climates and which are differentiated based on precipitation and temperature. “Divisions” represent the climates within domains and are differentiated based on precipitation levels and patterns as well as temperature. Divisions are subdivided into “provinces,” which are differentiated based on vegetation or other natural land covers. The Iliamna Lake study area, as completed by Bailey (1994), is located in one domain, two divisions, and three provinces based on the map ecoregions and subregions of the United States. The provinces were broken down into smaller landscape units based on refined analysis of natural features such as vegetation, slope, etc. Ecoregion units are based on newly available datasets and the field experience of ecologists, biologists, geologists, and regional experts..

Phone calls were made to airlines that travel to, from, and across the study area to determine flight patterns and areas of interest. A phone call to Iliamna Air Taxi (Hornberger and Laport, pers. comm., 2004) helped determine the extent of the study area. This research is not yet complete and we are awaiting the spring field season results from the subsistence and recreational use interviews.

17.6 Results and Discussion

Discussions with NDM personnel familiar with the project area identified a number of potentially affected parties and their sensitivity levels. Key parties were residents of local communities, hunters and fishermen, recreational visitors to Lake Clark National Park and Preserve, and travelers by boat and air. Also, numbers of subsistence users transit the area. Based on discussions that NDM has had with many of the parties, it appears there is a high level of sensitivity on the part of many in the area and that the project’s possible effects to the area’s visual resources is of some concern to many, particularly those that operate flight-seeing services, fly-in fishing operations, or hunting camps.

Work on the visual aesthetics study will require close cooperation with those providing analysis of recreation and cultural resources. Since those individuals will be collecting information from both subsistence users and recreational service providers, they should be able to shed light on specific concerns

and specific locations that may be of issue. This will probably result in identification of additional contacts that need to be made should initial interviews reveal other data needs.

Landscape-character summaries were determined for the study area. The area was divided into units based on key attributes found consistently throughout each unit. This provided an overview of the landform patterns, hydrology, vegetation, and cultural elements. The study area was initially divided into three ecological units based on the ecological framework described by Bailey (1994) (Fig. 17-3). These three units then were divided further into nine units based on visual landscape characteristics, land use, and other natural features. These areas then were mapped in a GIS (Fig. 17-4) and a catalogue of pictures of those units was organized.

Based on the evaluation of the landscape, the nine landscape units and a summary of their characteristics are shown in Table 17-1.

TABLE 17-1
Pebble Project Area Landscape Units

Unit #	Unit Name	Location Description	Eco-Region (Bailey 1995)	Sub-Region (Bailey 1995)	Elevation	Hydrology
1	Cook Inlet Coastline	Located east of Lake Iliamna and comprising the coastlines of Iliamna, Cottonwood, and Iniskin bays of Cook Inlet	Aleutian Meadows	Alaska Peninsula	0-2750'	Ocean coast, river mouths/drain ages
2	North Valley, Iliamna River	Located west of Iniskin Bay on Cook Inlet and East of Lake Iliamna in the Chamita Mountains	Alaska Range Transition and Aleutian Meadows	Alaska Range	50-3100'	River valley
3	Summit Lakes/ Williams Creek Valley	Located east of the Lake Iliamna, west of Iliamna Bay, and is part of the Chamita Mountains	Aleutian Meadows	Alaska Peninsula	400-3200'	Lakes and rivers
4	Knudson Mountain Uplands	Located north of eastern Lake Iliamna above Knudson, Pedro, and Pile bays	Alaska Range Transition	Alaska Range	350-4250'	Lakes and streams
5	Pedro Bay	Encompasses the eastern portion of Lake Iliamna from west of Chekok to just east of Pile Bay	Alaska Range Transition and Aleutian Meadows	Alaska Range	50-500'	Lakes and streams
6	Iliamna	Includes the town of Iliamna, the Lake Iliamna coast from west of Iliamna to Chekok Bay to the east, and the area around Roadhouse Mountain	Alaska Range Transition	Lime Hills and Alaska Range	50-650'	Lakes, streams, and lake coast

Unit #	Unit Name	Location Description	Eco-Region (Bailey 1995)	Sub-Region (Bailey 1995)	Elevation	Hydrology
7	Roadhouse Mountain	Located northeast of Iliamna, north of Lake Iliamna, and on the boundary of Lake Clark National Preserve	Alaska Range Transition	Lime Hills	1000-2800'	Streams
8	Groundhog Mountain and Sharp Mountain	Located north/northwest of Iliamna and west of Nondalton and Sixmile Lake	Alaska Range Transition	Lime Hills	50-2550'	Streams and lakes, bogs
9	Talarik Creeks	Includes the northwestern shore of Lake Iliamna	Alaska Range Transition and Aleutian Meadows	Lime Hills and Alaska Peninsula	50-850'	Lakes, streams, and lake coast

17.7 Summary

Work to date has included a site visit and documentation of existing conditions. Base mapping has been imported and has served as the basis for depiction of both photography locations and landscape units. Landscape-unit compilation has been conducted based on vegetation and ecological unit descriptions as described by biological study and in-house analysis.

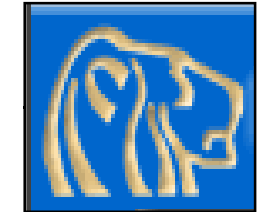
Based on our observations, much of the mine site itself will not be visible except from the air, and much of that will be from remote locations. Project infrastructure will be readily visible from locations in Pedro Bay. Secondary project elements that may be evident from different locations will be possible warm air venting that may emanate from the mine site and dust plumes that may occur associated with roadway traffic.

Work on the visual aesthetics study will require continued and additional coordination with both cultural-resources and recreation-resource specialists for identification of user groups that could be affected by the project. Work will also require further definition of secondary project components such as venting/steam plumes and roadway fugitive dust. Further identification of affected parties will require coordination with community relations personnel who will receive public comment as the project evolves.

17.8 Bibliography

- Bailey, R.G. 1994. Ecoregions of the United States, U.S. Department of Agriculture (USDA), Forest Service (scale 1:7,500,000, revised 1994).
- . 1995. Description of the Ecoregions of the United States, 2d ed. USDA, Forest Service Miscellaneous Publication 1391, Washington, D.C., 108 pp. With separate map at 1:7,500,000.
- Hornberger, G., and T. Laport. 2004. Iliamna Air Taxi, personal communications. October 18 and 19.
- Nowaki, G., P. Spence, T. Brock, M. Fleming, and T. Jorgenson. 2001. Ecoregions of Alaska and Neighboring Territory. U.S. Geological Survey. <ftp://agdcftp1.wr.usgs.gov/pub/projects/fhm/akecoregions.htm> (accessed October, 2004).
- USDA, U. S. Forest Service (USFS). 1995. Landscape Aesthetics: A Handbook for Scenery Management.

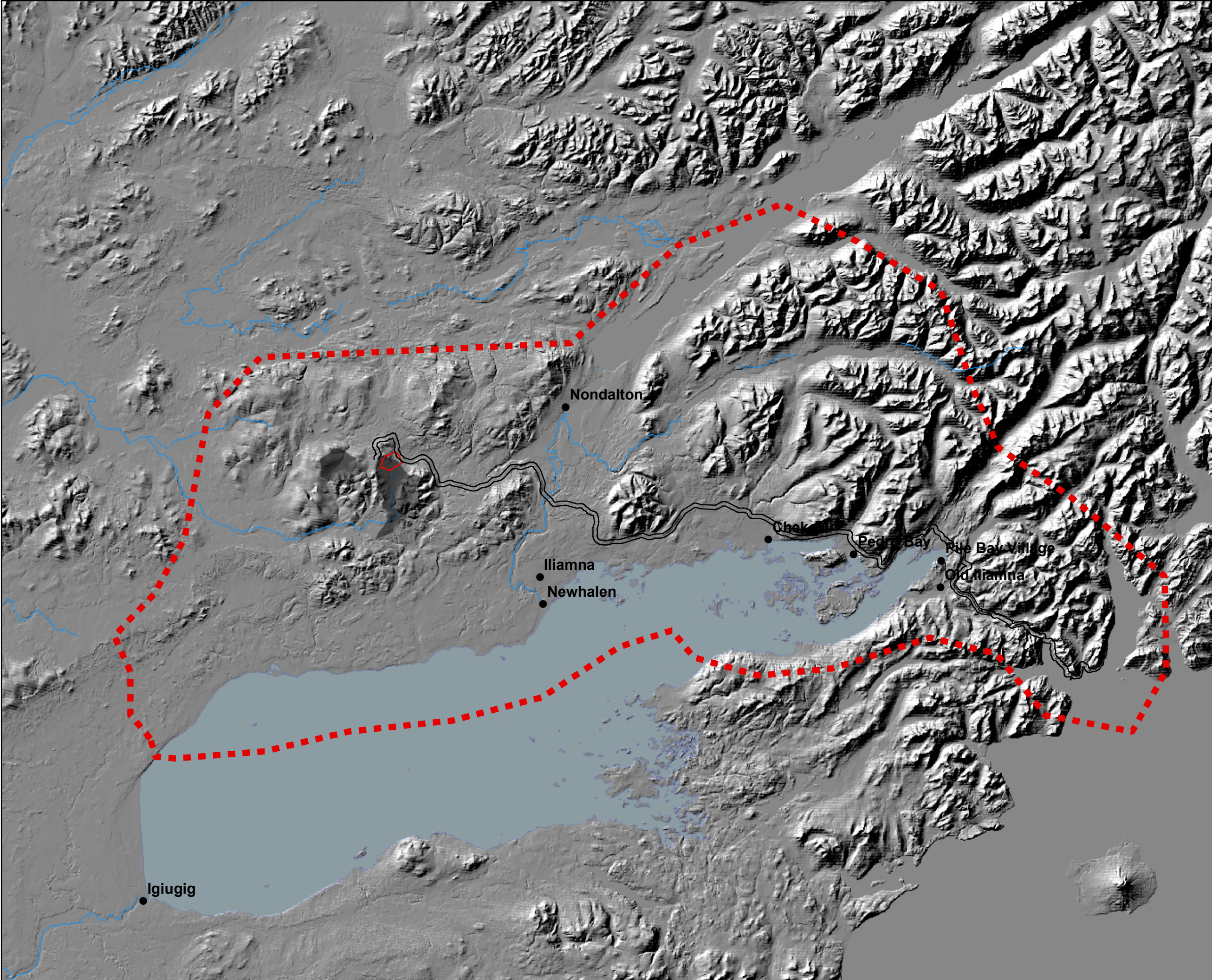
FIGURES



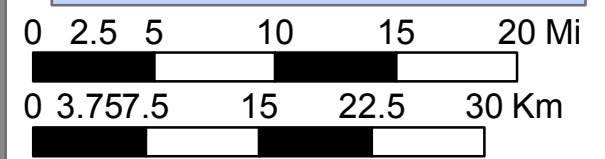
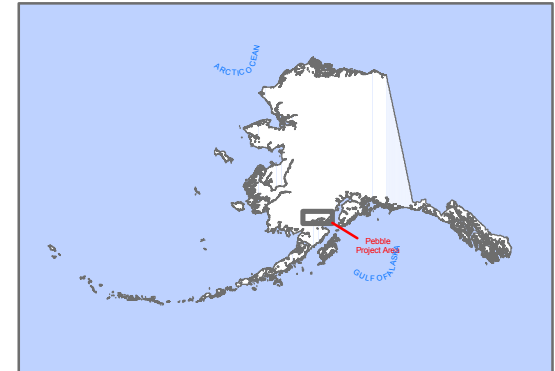
Pebble Project
Visual Analysis Study Area
Land Design North
Figure 17-1

Legend

- Communities
- ⋯ Visual Analysis Study Area
- Road Corridor
- Pit_v03



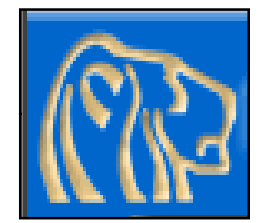
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Alaska State Plane Zone 5 (units feet)
1983 North American Datum







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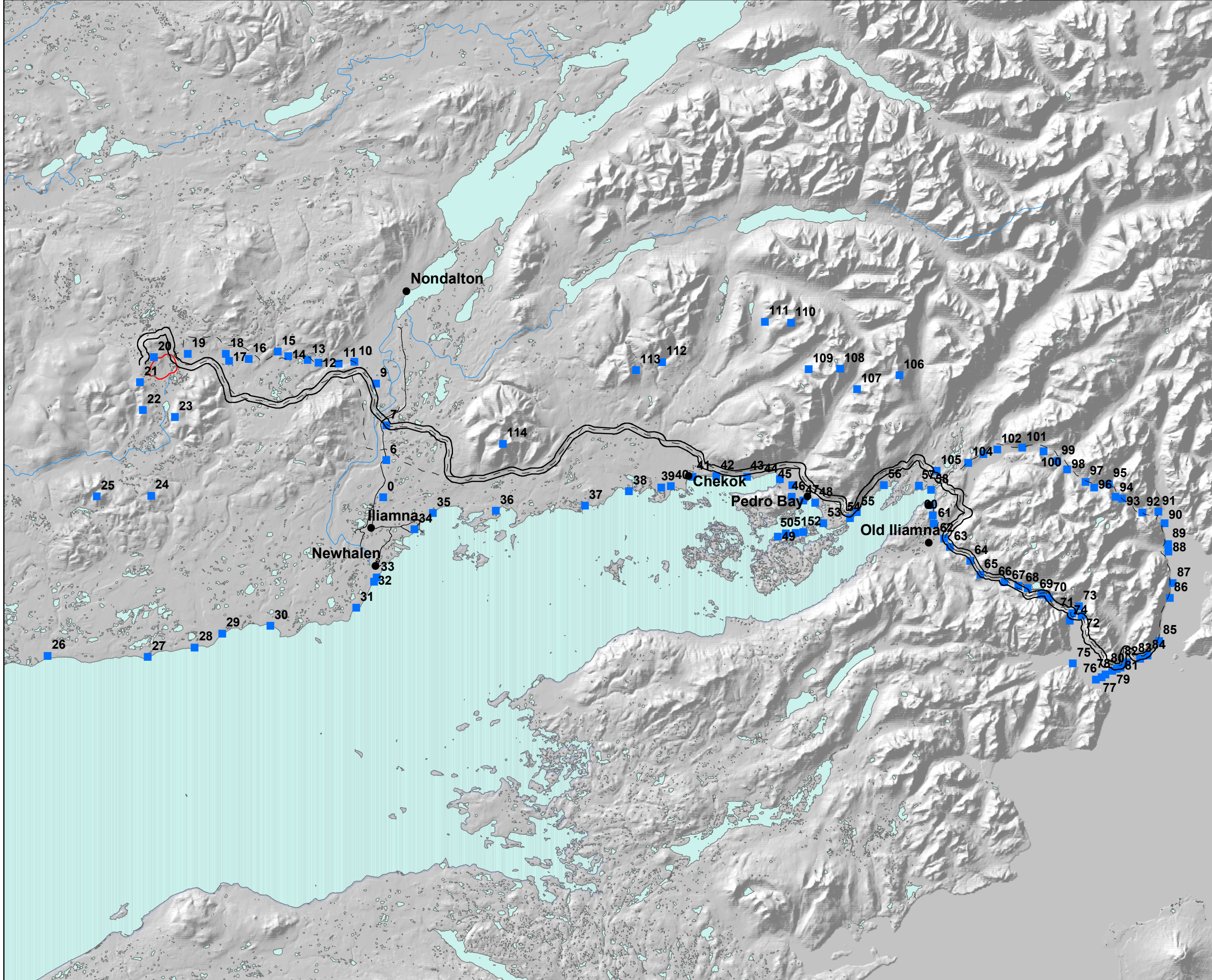


Pebble Project

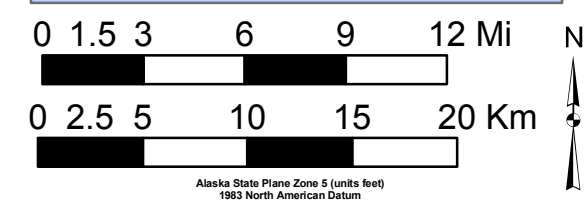
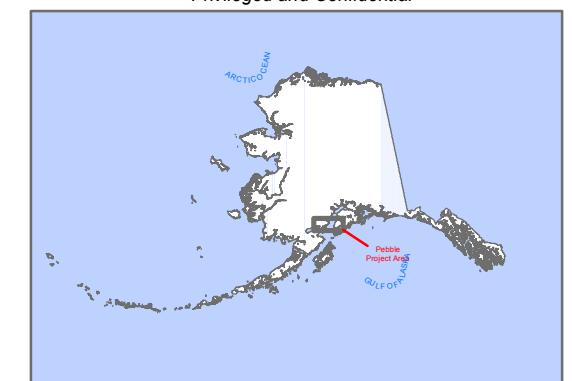
Photo Locations
Land Design North
Figure 17-2

Legend

-  Road Corridor
-  Picture Locations
-  Pit_v03
-  Communities

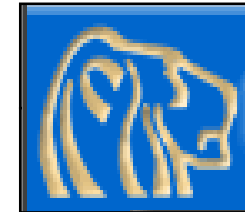


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Alaska State Plane Zone 5 (units feet)
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Version: 1	Author: LDN






Pebble Project

Ecological Units
Land Design North
Figure 17-3

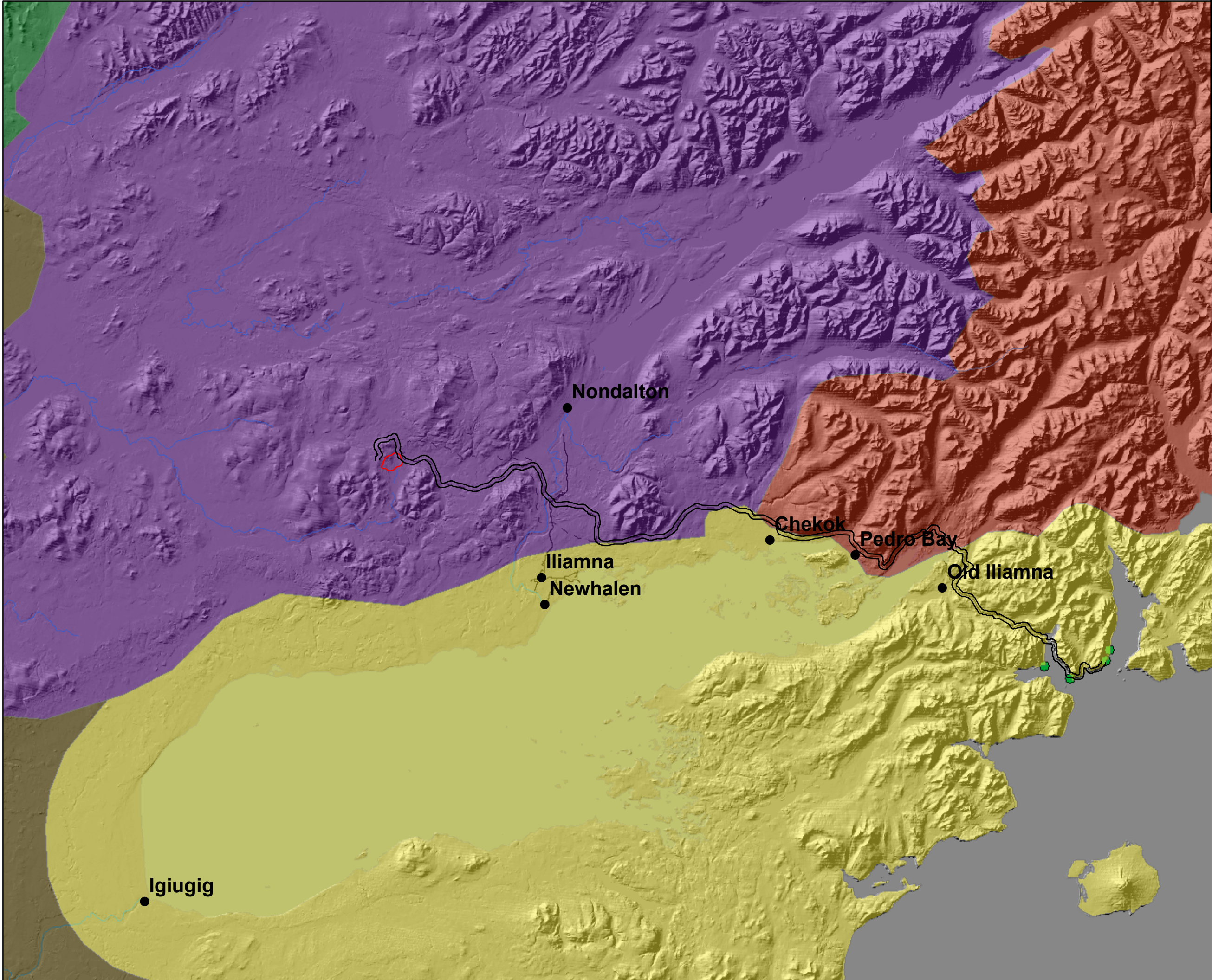
Legend

Ecological Units (Bailey, 1994)

-  Alaska Range
-  Alaska Peninsula
-  Lime Hills

 Road Corridor

 Pit_v03



Nondalton

Iliamna
Newhalen

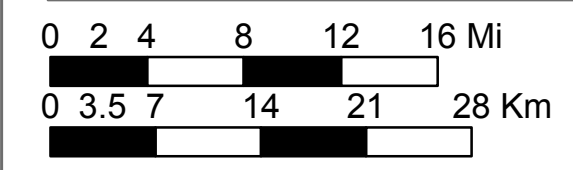
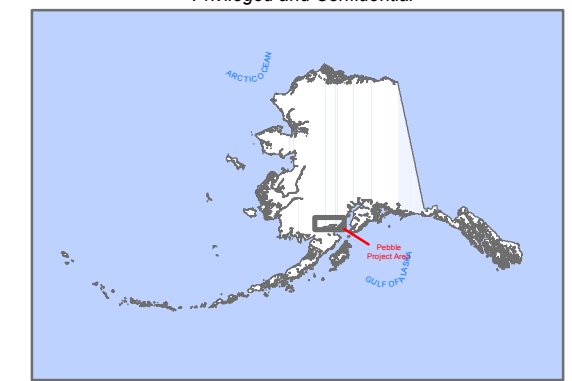
Chekok

Pedro Bay

Old Iliamna

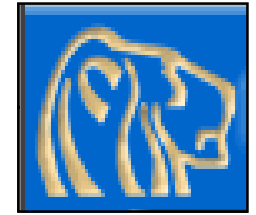
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Alaska State Plane Zone 5 (units feet)
1983 North American Datum




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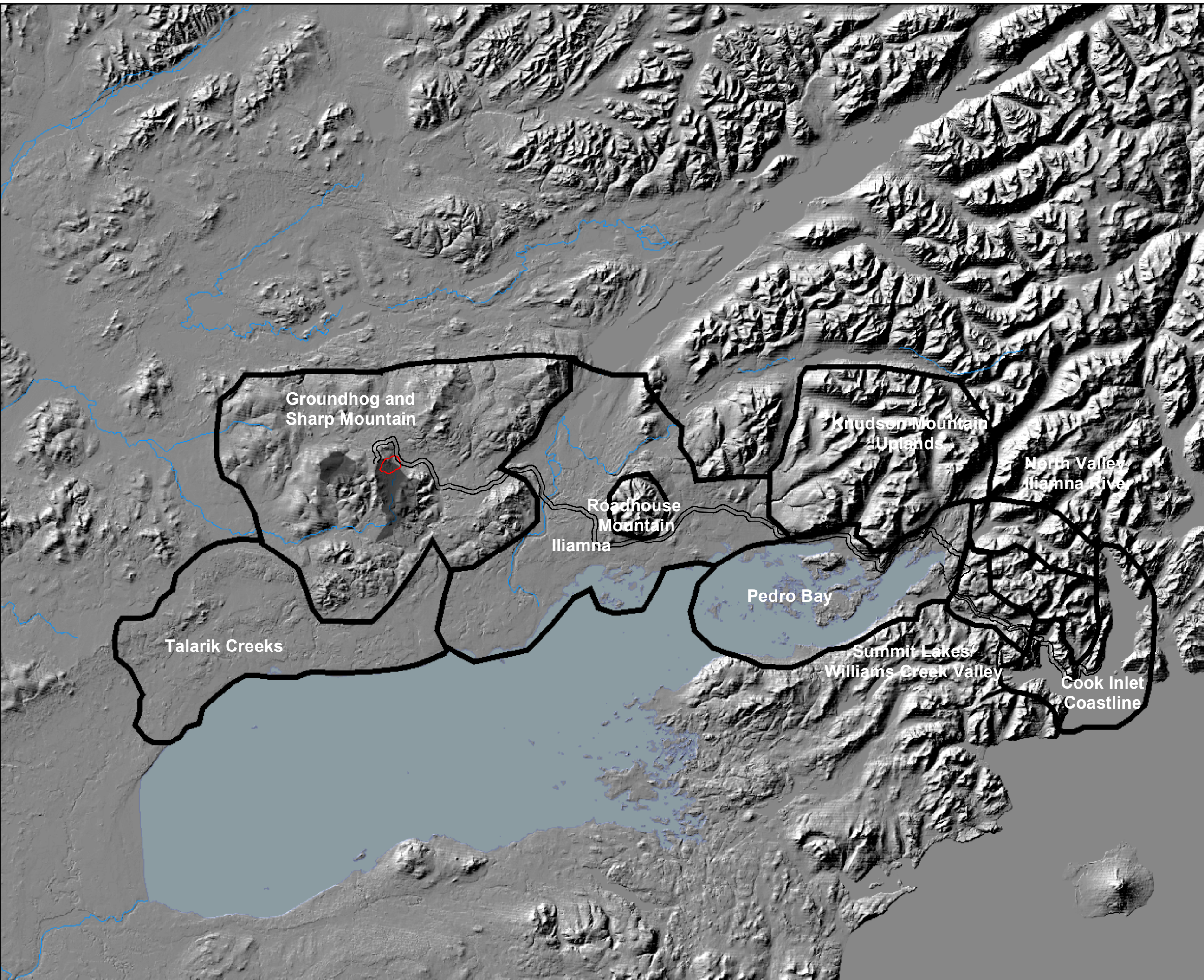


Pebble Project

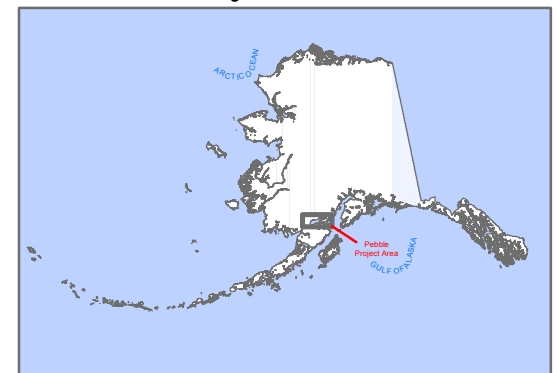
Preliminary Landscape Units
Land Design North
Figure 17-4

Legend

-  Road Corridor
-  Landscape Units_v03
-  Pit_v03



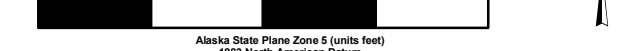
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0 2.5 5 10 15 20 Mi N



0 3.75 7.5 15 22.5 30 Km



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

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