

**DRAFT ENVIRONMENTAL BASELINE STUDIES  
2005 STUDY PLANS**

**CHAPTER 10. WETLANDS**

**NOVEMBER 2005**

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# ACRONYMS

AASHTO	American Association of State and Highway Transportation Officials
ABA	acid-base accounting
ACHP	Advisory Council on Historic Preservation
ACL	alternative cleanup level
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ADNR	Alaska Department of Natural Resources
agl	above ground level
AHRS	Alaska Heritage Resource Survey
AKNHP	Alaska Natural Heritage Program
ANOVA	analysis of variance
APE	area of potential effect
AS	alpine rock and dwarf scrub habitat
ASCI	Alaska Stream Condition Index
ASTM	American Society for Testing and Materials
BEESC	Bristol Environmental & Engineering Services Corporation
BMR	baseline monitoring report
°C	degrees Celsius
CAD	computer-aided drafting
CC	comprehensive stations with continuous-stage monitoring
CIR	color infrared
CQ	continuous discharge
CWOC	comprehensive stations without continuous-stage monitoring
DECD	Alaska Department of Economic and Community Development
DEM	digital elevation model
DNR	Alaska Department of Natural Resources
DO	dissolved oxygen
DOT&PF	Alaska Department of Transportation & Public Facilities
DQOs	data quality objectives
EBD	environmental baseline document
EC	environmental consequences
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EROS	Earth Resources Observation System
FAA	Federal Aviation Administration

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FHWA	Federal Highway Administration
FSP	field sampling plan
GIS	geographic information system
GPS	global positioning system
HDR	HDR Alaska, Inc.
HGM	hydrogeomorphic
IEE	Initial Environmental Evaluation
IM	initial monitoring station
L	liter(s)
LCNPP	Lake Clark National Park and Preserve
LDN	Land Design North
LM	lowland wet graminoid, moss meadow habitat
LS	lowland low and tall alder/willow scrub habitat
m	meter(s)
MCHTWG	Mulchatna Caribou Herd Technical Working Group
MDC	mine development concept
mg	milligram(s)
ML/ARD	metal leaching/acid rock leaching
mm	millimeter(s)
MODIS	moderate resolution imaging spectroradiometer
MRL	method reporting limit
µm	micrometer(s)
NASA	National Aeronautics and Space Administration
NDM	Northern Dynasty Mines Inc.
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic & Atmospheric Administration
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORP	oxidation reduction potential
PJD	preliminary jurisdictional determination
PSD	prevention of significant deterioration
psi	pounds per square inch
QA	quality assurance
QAPP	quality assurance project plan
QC	quality control

RS	riverine willow scrub habitat
SHPO	State Historic Preservation Officer
SLR	SLR Alaska
SOP	standard operating procedure
SRB&A	Stephen R. Braund & Associates
SS	subalpine dwarf, low, and tall scrub habitat
SWANCC	Solid Waste Agency of Northern Cook County v. U.S. Army Corp of Engineers
SWE	snow/water equivalent
3PP	Three Parameters Plus
TIN	triangulated irregular network
TOC	total organic carbon
TPH	total petroleum hydrocarbons
UF	upland dwarf scrub, lichen flats habitat
US	upland dwarf, low, and tall scrub habitat
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
WMC	Water Management Consultants
WMP	water monitoring plan
WQ	water quality

## 10. WETLANDS

The objectives, process, and deliverables are the same for the mine site, the road corridor, and the port options except where noted below. Work in the mine area and at the road and port locations meets the stated objectives of the wetlands work program. Three Parameters Plus (3PP) will lead the wetlands work in the mine study area while providing oversight of the wetlands work for the road and port, and HDR Alaska, Inc. (HDR) will complete wetlands work for most of the road corridor and for the port site.

### 10.1 Objectives of Study

The main objective of the wetlands study is to collect baseline data necessary to prepare and submit legally defensible preliminary-jurisdictional-determination reports to the regulatory branch of the U.S. Army Corps of Engineers (USACE). These documents, one for the mine and one for the road and port, will be prepared and submitted to the USACE when project plans and options have been adequately defined and evaluated.

### 10.2 Proposed Study Plan

#### 10.2.1 Study Area/Scope

Existing data for both the mine and transportation areas will be compiled in the project geographic information system (GIS) for approximately 750,000 acres between the port site on Iniskin Bay and the upper Kaktuli watershed. Chapter 19 (Data Management and GIS) provides additional information on this effort. Work completed or underway to support the wetlands program includes digital presentation of the following:

- Existing National Wetlands Inventory (NWI) mapping.
- Existing U.S. Geological Survey topographic mapping.
- Earth Resources Observation System and cover mapping, and vegetation/land-cover types associated with the Bristol Bay Land Management Plan.
- Vegetation mapping/cover classes found on the Lake Clark National Park website.
- Ortho-photo-mosaic coverage of the 1978 color infrared photography from the National Aeronautics and Space Administration (NASA).
- IKONOS satellite imagery of portions of the road corridor.
- True color ortho-photography and associated contour data (2 to 10 feet, depending on the complexity of the terrain) for the mine area, port site, and road corridor.
- Watershed boundaries as previously determined by the Bristol Bay Native Corporation.
- Exploratory soil-survey data and other data sources related to soil types and parent materials.
- Land ownership information.

In 2004, multiple crews of wetland scientists collected data from hundreds of representative sites in the mine and road/port study areas. Because of the timing of project start-up, field work was done before any preliminary digital mapping of wetlands or vegetation types had been completed. Preliminary wetland and vegetation-type mapping for areas to be investigated in 2005 will be done before the summer field season to the extent possible.

Digital mapping of areas visited in 2004 is presently underway. However, final mapping for all evaluation areas is not expected to be complete until early 2006.

The 2004 field data collection for the mine study area, approximately 73,000 acres in size, focused on the following:

- Preliminary tailings-disposal sites and associated water-management structures (e.g., water-storage reservoirs, diversion ditches).
- Preliminary mill site locations.
- The ore body.
- Mine-rock storage areas.
- Possible access routes for roads within the mine area.
- Two alternative access routes between the mine site and the Newhalen River.

The 2005 field verification of preliminary mapping at the mine site will focus on the following:

- Collecting additional data for jurisdictional determination and functional assessment in vegetation types that were not consistently wetland or upland during the 2004 field season.
- Collecting additional functional-assessment data in small wetlands that had not been identified during the 2004 field season.
- Reviewing digital mapping completed after the 2004 field season.

Figure 10-1 shows the field evaluation area the 3PP wetlands teams evaluated during the 2004 field season. Minor modifications to this study area may be made as the 2005 field season progresses. The exact area will be determined after the initial analysis of the mine development options is complete and the practicability of the various tailings options and potential on-site mitigation features has been determined. The sampling area shown includes approximately 73,000 acres.

The 2004 field verification area for the road corridor and port sites, approximately 40,000 acres in size, comprised:

- Approximately 3,300-foot-wide corridors centered on two potential road alignments selected by the Alaska Department of Transportation and Public Facilities (DOT&PF) from the Newhalen River to Iniskin and Iliamna Bays of Cook Inlet, including some minor variants.
- A potential port site and an adjacent potential development area on Iniskin Bay.

These areas are shown on Figure 10-2.

Two areas estimated to total 4,000 acres have been added for field verification in 2005:

- A potential port support area in the mouth of the “Y Valley” between Iniskin and Iliamna Bays.
- Any material sites or other facilities that are identified by DOT&PF or Northern Dynasty Mines (NDM) between Cook Inlet and the mine site.

Field work to be done in 2005 also includes:

- Limited re-visit of areas visited in 2004 to observe hydrologic conditions in a wetter year.
- Limited additional sampling within the corridors sampled in 2004 to fill data gaps.

NDM has identified two corridors that are under consideration for a transportation alternative and for an electrical transmission corridor (Figure 10-2). The need to use these corridors has not yet been established. In 2005, the following will be done to support potential future analysis of these corridors:

- Fly-over reconnaissance of an approximately 3,300-foot-wide corridor centered on a potential road route along the west side of the Newhalen River, stretching north from Lake Iliamna to where it would intersect road routes to the mine sampled in 2004 by 3PP.
- Extension of digital data compilation eastward to include the Iniskin Peninsula, specifically, georeferencing and rectifying existing NWI mapping for that area.
- Fly-over reconnaissance of an approximately 3,300-foot-wide corridor centered on one or two potential transmission line routes from Chinitna Bay to where they would merge with potential road corridors in the upper Iliamna River drainage or at Iliamna Bay.

## 10.2.2 Methods/Approach

As part of this effort, the wetlands team will perform the following tasks:

- Determine the extent of existing soil/vegetation disturbance in the study area in order to ascertain if there are any outstanding compliance issues that need resolution (so as to expedite future permit-application processing).
- Determine the extent and types of jurisdictional wetlands found in the study area.
- Describe the predominant vegetation types found in the study area, and determine the normal prevalence of hydrophytic plant species in each. Vegetation types also will be correlated with the habitat types for the terrestrial wildlife study, and where appropriate, fish-habitat data.
- Describe the predominant soil types found in the study area and their hydric characteristics/status. Contribute data to soil salvage and suitability studies.
- Determine the predominant hydrogeomorphic (HGM) class of wetlands identified in the study area, and describe the primary functions associated with each.
- Apply a quantitative method for determining the functions of wetlands identified in the study area. The methodology being used, as directed by the USACE, is the *Rapid Procedure for Assessing Wetland Functional Capacity, Based on Hydrogeomorphic Classification* (Magee,



1998). If necessary, this method will be modified to better address specific conditions in the study area, but only in consultation with USACE representatives.

- Develop strategies to avoid or minimize potential impacts to wetlands associated with proposed project facilities.
- With input from other study team members, develop wetland sections of a draft compensatory mitigation plan. Later, this compensation concept will be expanded to include the information described in guidance found in the Alaska District USACE *Special Public Notice 04-07, Final Alaska District Compensatory Mitigation Guidelines* (USACE, 2004).

### 10.2.3 Major Activities

The approach to mapping wetlands and vegetation for the Pebble Project area is relatively simple, but involves several major steps:

- Collection and review of data from existing sources, including construction of a GIS to analyze, track, and evaluate a variety of data sources and to prepare high-quality map products.
- Preliminary mapping of wetlands and waterbodies, or prospective sampling locations, on aerial photographs (where available) or in the GIS.
- Identification in the GIS and on field maps or photos of representative sites for sampling in the field, focusing on complex wetland/upland boundary areas, areas with questionable boundary locations, and areas where multiple sample points can be easily accessed.
- Field verification of preliminary mapping and sampling of representative sites using criteria and indicators found in the 1987 Corps of Engineers *Wetland Delineation Manual* (USACE, 1987) and subsequent regulatory guidance related to wetland determinations.
- Collection of data sufficient to conduct a wetland function assessment according to the Magee method (Magee, 1998).
- Photography of any incidental observations of important habitat features, streams, cultural resources, new or existing disturbances, etc.
- Photography and recording of the locations of any rare or sensitive plant species encountered during field evaluations.
- Entry of data from jurisdictional wetland determinations and wetland functional assessments into a web-based/accessible relational database. This will allow the data to be analyzed and evaluated much faster, with more built-in quality control measures/options. These data will be integrated into the overall data management system for the mine and will provide baseline data on conditions in the study area over the life of the project.
- Field review with regulatory and resource management agency staff during the summer 2005 field season. The purposes of this review will be to familiarize agency reviewers with the study area, discuss the mapping process in more detail, and discuss how problem areas will be addressed during the final mapping process.
- Final mapping of wetlands and waterbodies on digital true-color ortho-rectified photography in the GIS. Final mapping is expected to include designation of mosaics of wetland types (with

respect to HGM classes and vegetation types) and wetlands and uplands. Cowardin classification will not be provided unless specifically requested by the regulatory agencies.

- Polygon coding with respect to potential regulatory exemption per *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (SWANCC) based on connectivity of each polygon to a navigable waterbody (or tributary thereof) in an NDM or U.S. Geological Service GIS stream coverage or to wetlands that abut such waters as shown in the NDM-produced wetland coverage.
- Analysis of wetland functional data and creation of a “rating” layer in the GIS.
- Documentation to support the Pebble Project environmental baseline document (EBD) and the project preliminary jurisdictional determinations.

Throughout the project, wetland scientists will provide input to the evaluation of mine, road, and port alternatives, primarily from a wetland conservation and regulation perspective. These discussions, and follow-up memoranda, will include recommendations on avoidance and minimization measures, including measures to avoid adverse effects on wetlands perceived as having higher functional capacity than others based on the results of the functional assessment and professional judgment. The memoranda may also include professional opinions regarding tradeoffs among resource impacts that will play into developing the least environmentally damaging practicable alternative.

Definition of appropriate compensatory mitigation measures will continue throughout 2005 and until project permitting is complete. The amount and type of compensatory mitigation will be defined by the USACE and other decision-making agencies, with technical input and proposals from the NDM team. Determining the type and quantity of compensation will employ information on acreage, types, and locations of wetlands impacted; the types of impacts; the wetlands’ functional ratings; and the compensation opportunities available. Opportunities will be defined through observation in the field, discussions with regulatory and resource agencies, contacts with Native groups and local governments, the scoping and public-involvement processes of the environmental impact statement process, and contacts with conservation groups. Means of compensation may include restoration or cleanup of human-disturbed areas, enhancement of natural areas to increase their functional capacity, development or dissemination of knowledge to aid in ecosystem management, and preservation of important natural areas.

### 10.3 Deliverables

Deliverables for both the mine area and transportation options include the following:

- ArcView polygon shape file with the following attributes for each polygon—disturbed (yes or no), jurisdictional wetland status (i.e., wetland, waterbody, or non-wetland), vegetation type, HGM classification (wetlands only), functional assessment rating (wetland polygons only), and any potential for exemption from jurisdiction under guidance related to the SWANCC court decision (yes or no).
- ArcView arc (line) shape file that delineates streams too small to be mapped as polygons and drainages that likely carry surface-water flow at least some time during the year.
- ArcView point file that contains the locations of all field sample/photo points. This file will be linked to the digital photos taken at each site, such that the GIS user can view the photos by

clicking on the button where they were taken. The attribute file for each point will include a variety of information collected at each sample point.

- Field photographs of each sample/evaluation point and any nests, dens, stream crossings, rare plant observations, or cultural resource observations encountered during the extensive field evaluations.
- Routine on-site jurisdictional-wetland-determination forms and associated photographs.
- Numerical results from quantitative functional assessments.
- Vegetation-type descriptions, maps, and representative photographs suitable for inclusion in the Pebble Project environmental baseline document.
- Basic soil descriptions (not including engineering/soil testing data) and representative photographs suitable for inclusion in the environmental baseline document. Contributions to soil salvage/suitability mapping as requested by NDM.
- Jurisdictional wetland descriptions, maps, and representative photographs suitable for inclusion in the environmental baseline document.
- Integrated resource-specialist input into the review of mine and transportation-component options, feasibility of construction (mine area only), economic practicability (mine area only), discussion and comparison of impacts, recommendation of wetland impact avoidance and minimization measures, and the selection of least damaging environmental alternatives.
- Integrated resource-specialist input into the selection of potential mitigation options; drafting of wetland sections of the compensatory mitigation plan; and long-term support in design, implementation, and monitoring of compensatory mitigation measures.

## 10.4 References

Magee, D. 1998. Rapid Procedure for Assessing Wetland Functional Capacity, Based on Hydrogeomorphic Classification. Prepared for U.S. Army Corps of Engineers.

U.S. Army Corps of Engineers (USACE). 1987. Corps of Engineers Wetlands Delineation Manual. Wetlands Research Program Technical Report Y-87-1. Department of the Army Waterways Experiment Station. January 1987.

U.S. Army Corps of Engineers (USACE). 2004. Special Public Notice 04-07, Final Alaska District Compensatory Mitigation Guidelines. [http://www.poa.usace.army.mil/reg/SPN\\_Scanned/SPN-2004-07.pdf](http://www.poa.usace.army.mil/reg/SPN_Scanned/SPN-2004-07.pdf)

## FIGURES



Pebble Project

Three Parameters Plus - 2005 Study Plan

Figure 10-1

Legend

3PP 2005 Study Area

3PP 2004 Field Plots

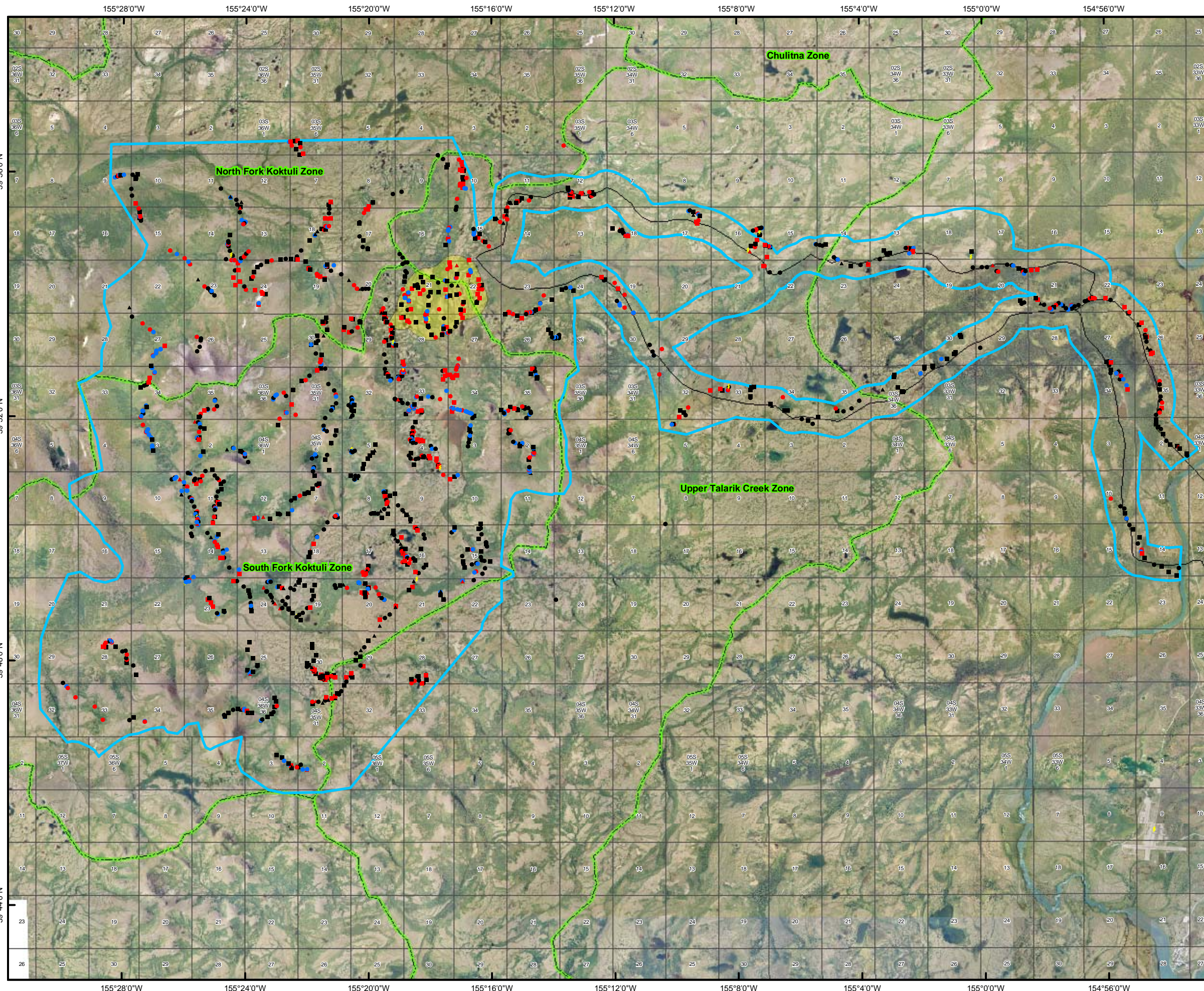
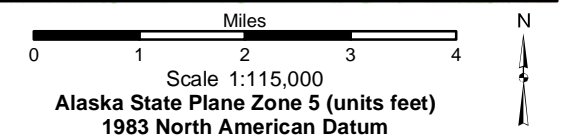
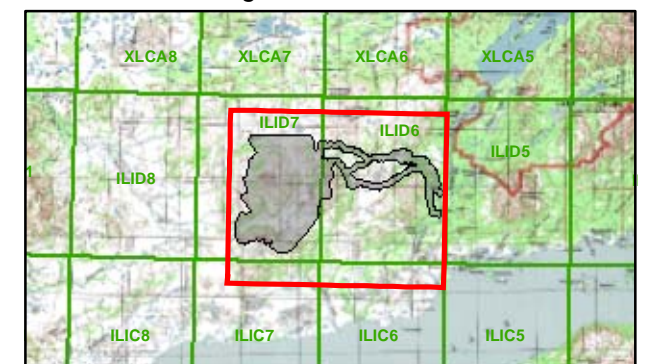
- Non-Wetland Field Plot
- ▲ Non-Wetland Transitional Field Plot
- Representative Upland Field Photographs
- Wetland Field Plot
- ▲ Wetland Transitional Field Plot
- Representative Wetland Field Photographs
- Stream Crossing Photos
- ⚡ Other Photo Points

NDM Catchments Basins

Pit Outline

DOT&PF Proposed Road Routes (7/27/04)

Privileged and Confidential



Northern Dynasty Mines Inc.



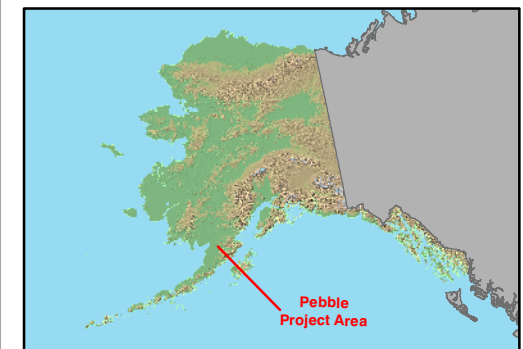
**Pebble Project**  
2004-2005  
Wetlands Field Verification Areas  
Transportation Components  
Figure 10-2

**Legend**

- Proposed Port Site
- Proposed Port Laydown Area
- DOT&PF - Proposed Road Corridors
- Potential Road Corridor  
Reconnaissance Only
- Conceptual Electric Corridors  
Reconnaissance Only

The DOT& PF road corridors are the study area for jurisdictional wetland mapping, vegetation mapping, HGM typing, and quantitative wetland functional assessments.

*Privileged and Confidential*



0 1.5 3 6 9 12 15 Miles

0 2 4 8 12 16 20 Kilometers

1:500,000

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

File: Studyplan2005_Fig10_2.mxd	Date: April 13, 2005
Version: 2	Author: HDR-DS

