



***Pebble Project EBD***

***Wetlands & Vegetation***

***Mine Study Area***

***2004-Present***



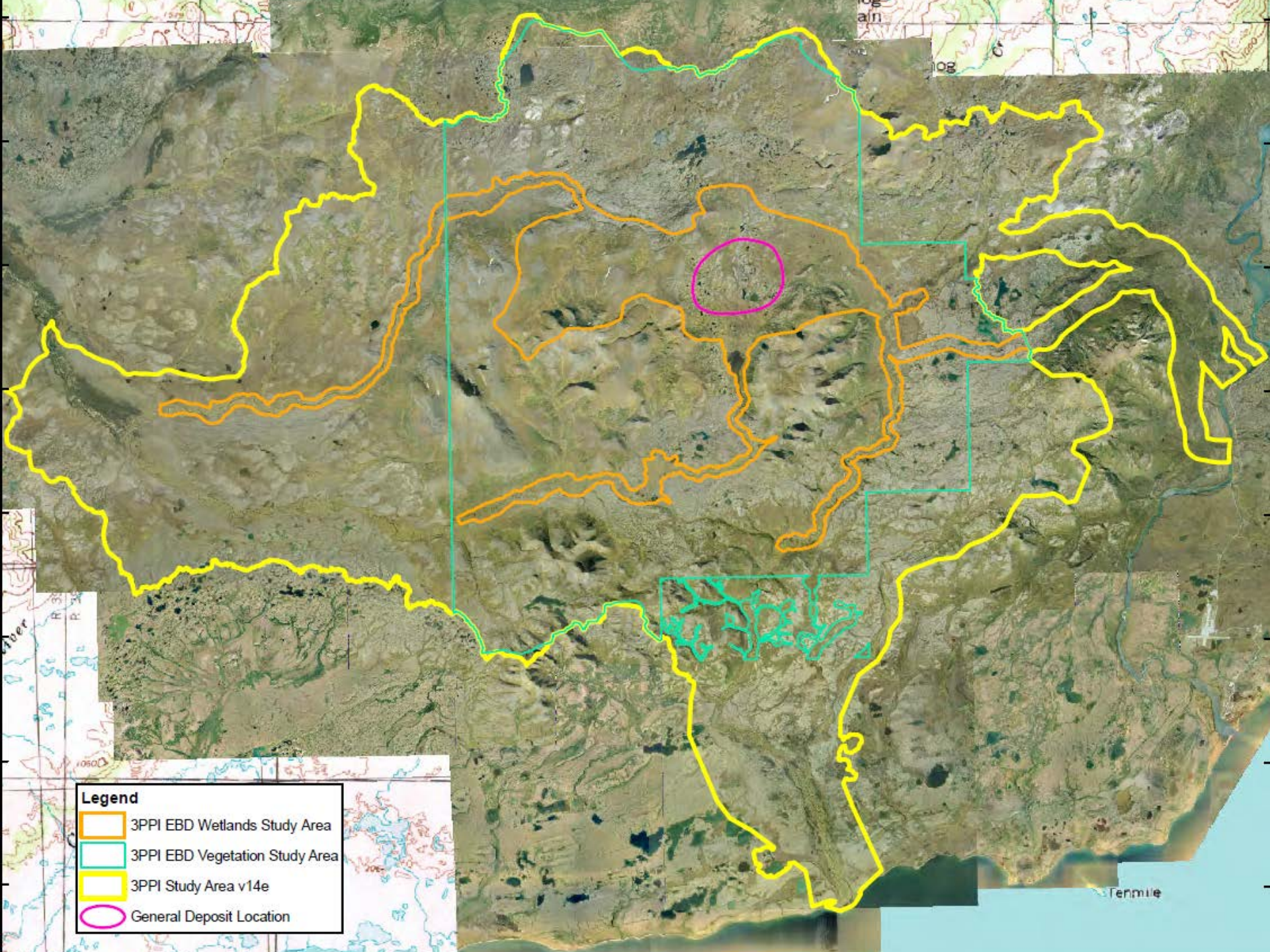


## ***Pebble Project Wetlands & Vegetation Study Areas***

***2004-Present***

***249,414 Acres Mine Study Area***

***19,917 Acres Transportation Corridor Study Area***



**Legend**

- 3PPI EBD Wetlands Study Area
- 3PPI EBD Vegetation Study Area
- 3PPI Study Area v14e
- General Deposit Location

# Pebble Project Wetlands Study



## ***Wetlands are Regulated under Section 404 of the Clean Water Act***

*The regulatory definition of a wetland, as defined by the US Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) is:*

***“Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.”***

# Major Study Components

## Wetland Delineation & Vegetation Classification

*Based on Criteria and Indicators Found in the 1987 Corps Wetland Delineation Manual, 2006 Interim Manual, the 2007 Regional Supplement for the Alaska Region, and Viereck's Vegetation Classification System for AK.*

## Classify Wetlands to Generally Assess Their Functions

*Hydrogeomorphic (HGM)/Cowardin Classifications (National Wetlands Inventory)*



Field Data  
Collection\*



Data QC/  
Validation\*

Line  
Drawing\*

Polygon  
Coding &  
QC\*

Field  
Review

## Wetland Delineation

Wetlands and Other Waters of the U.S.

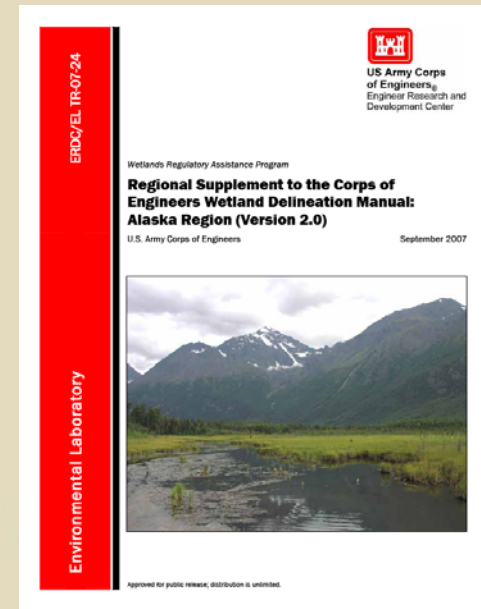
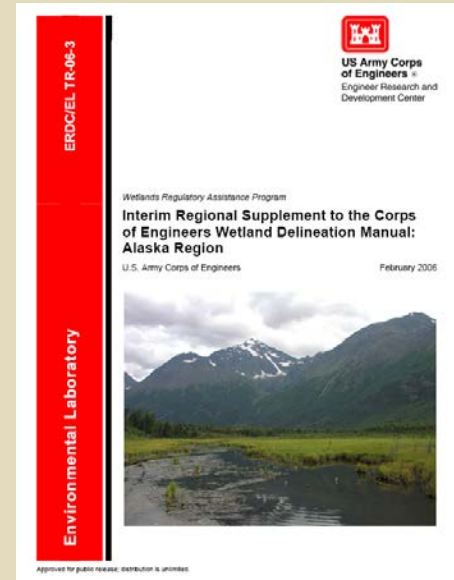
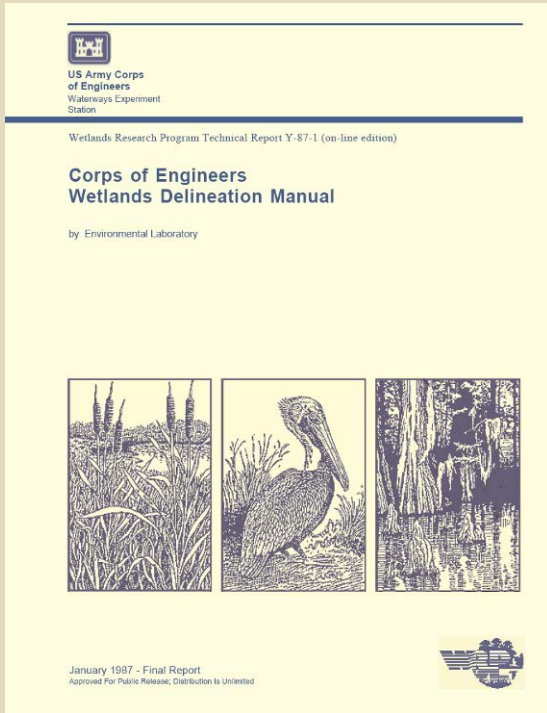
2004

2005

2006

2007

2008



*At the end of the 2008 field season, approximately 77% of the Wetland Determination plots had data collected under both methodologies.*

# Field Data Study Types

## WD = Wetland Determination Plots

1/10<sup>th</sup> Acre Sampled

List all Plants/Cover

Hydrology Indicators

20-24" Soil Profile

Wildlife Use Notes

Photographs (3)

If Wetland, FA Data



# Field Data Study Types

## **FA = Functional Assessment Plots**

Wetland Status Not in Question

1/10<sup>th</sup> Acre Sampled

16-20" Soil Pit

24 Variables Evaluated

Photographs (3)



# Field Data Study Types

## SH = Shrub Height

Dominant Shrub Species Recorded

Dominant Shrub Heights Recorded

Hydrology Indicators

16-20" Soil Pit

Photographs (3)

*If Wet,*

24 FA Variables



# Field Data Study Types

**WB = Waterbody**

**Limited Data Collection Site**

Vegetation/Cover Type (typically open water)

Micro/Macro Topography

Aspect

Photographs (2)

*Post Field*

24 FA Variables

Elevation/Landform



# Field Data Study Types

**SC = Stream Crossing Limited Data Collection Site**

Vegetation Type (banks)

Gradient

pH, EC (late 2005 on)

Aspect

Photographs (3)

*Post Field*

24 FA Variables

Elevation/Landform



# Field Data Study Types

## **RU = Representative Upland Photo Point**

Non-Wetland Status Not in Question

Vegetation Type

Micro/Macro Topography

Aspect

Photographs (2)

*Post Field*

Elevation/Landform



# Field Data Study Types

## **RW = Representative Wetland Photo Point**

Wetland Status Not in Question

Vegetation Type, HGM Type, Cowardin

Micro/Macro Topography

Aspect

Photographs (2)

*Post Field*

24 FA Variables

Elevation/Landform



# Field Data Study Types

## PP = Misc. Photo Point Types

Ancillary Data Observations

Vegetation Type

Micro/Macro Topography

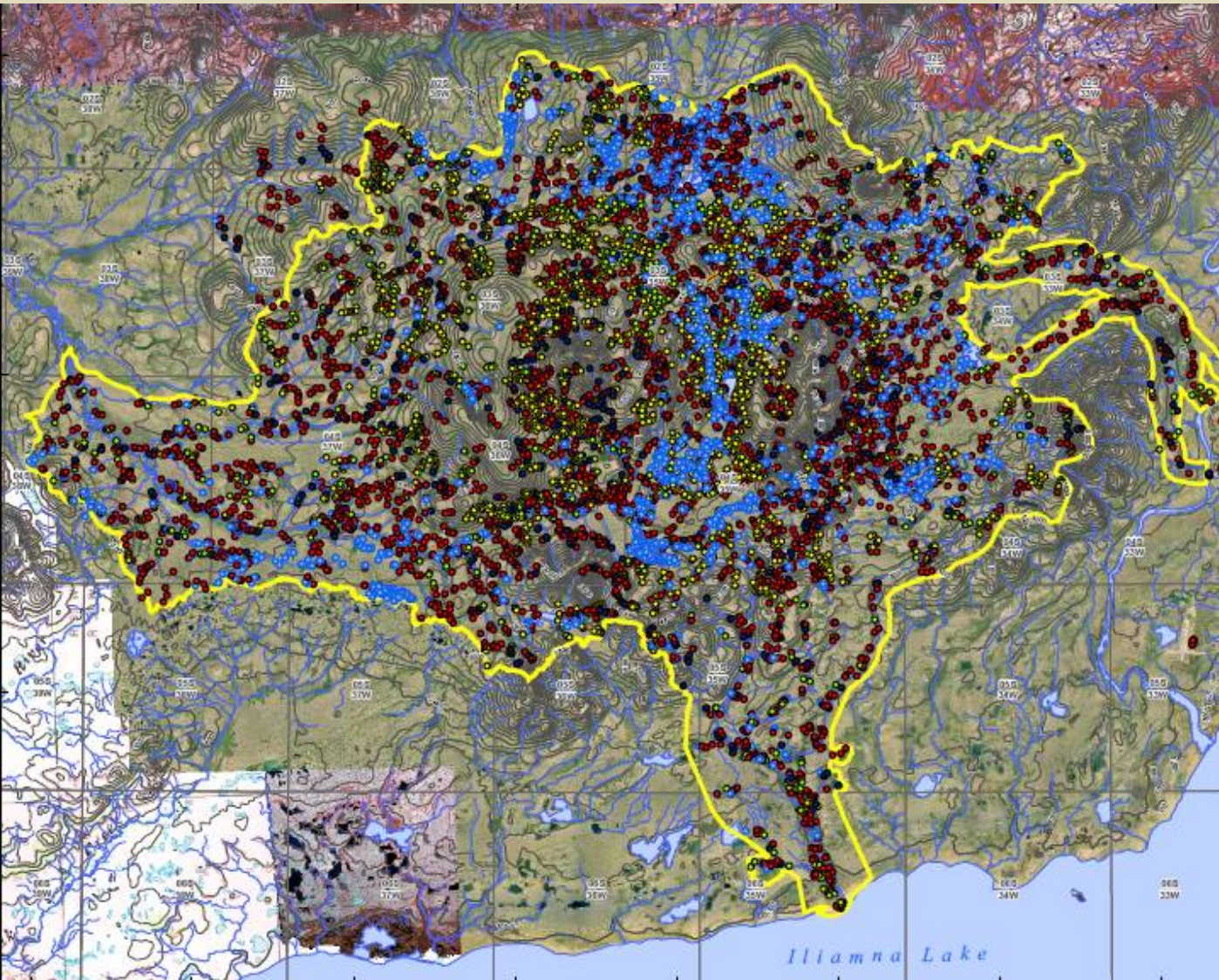
Aspect

Photographs (2)

*Post Field*

Elevation/Landform





Three Parameters Plus, Inc.  
3PPI and HDR 2004 - 2008  
Field Plot Locations  
**DRAFT**

### Legend

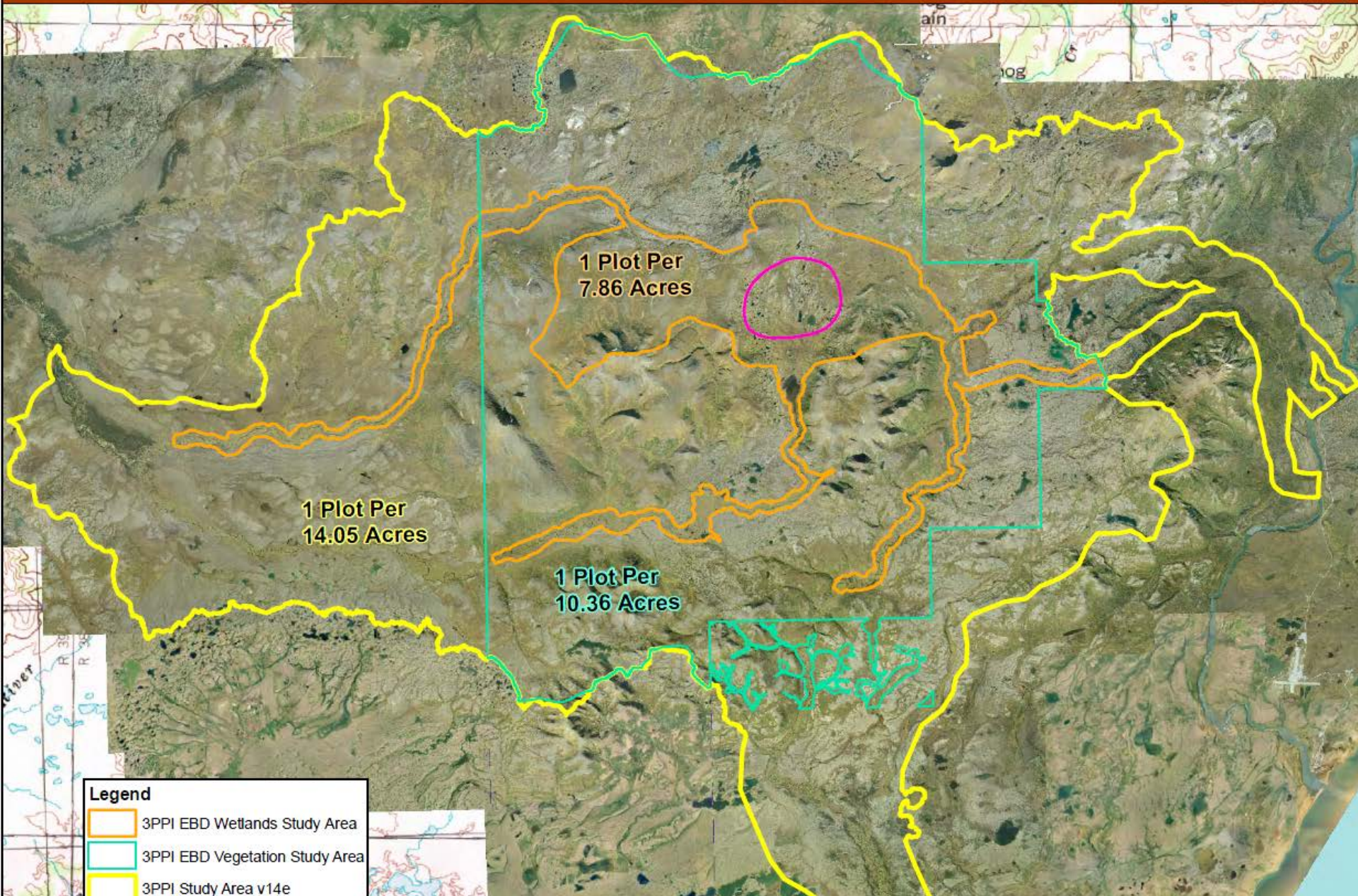
3PPI and HDR 2004 - 2008  
Field Plot Locations (10/28/2008)

- JD (Count 4,584)
- SH (Count 2,467)
- FA (Count 932)
- SC (Count 1,570)
- WB (Count 2,237)
- Other Photo Points (Count 6,685)
- 2008 3PPI Study Area
- General Deposit Location



# Three Parameter +

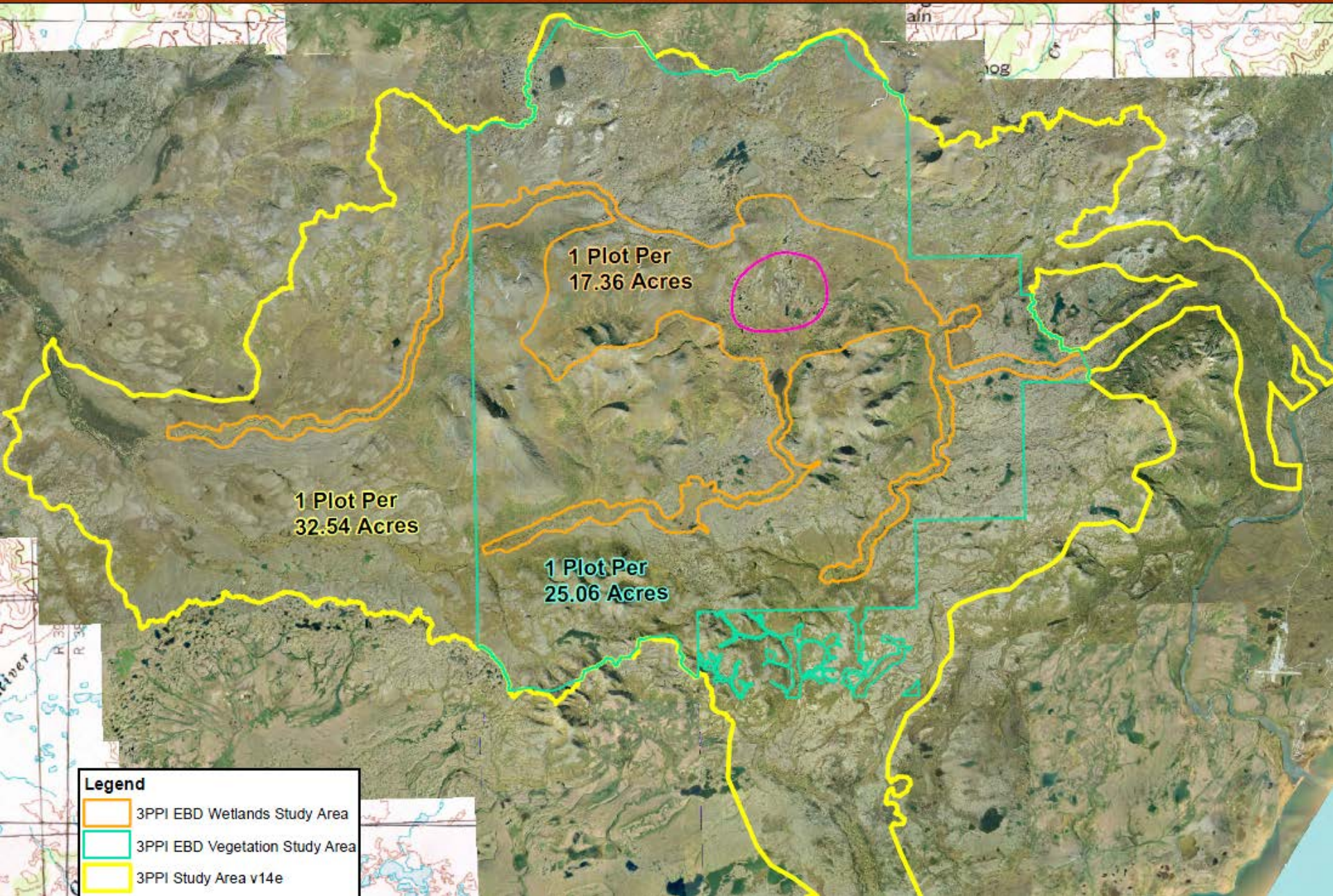
All Field Plots  
Plot Density by Study Area Boundary



# Three Parameter +

## JD. SH and FA Field Plots

### Plot Density by Study Area Boundary



#### Legend

- 3PPI EBD Wetlands Study Area
- 3PPI EBD Vegetation Study Area
- 3PPI Study Area v14e



Field Data  
Collection

Data  
Validation

Line  
Drawing ←

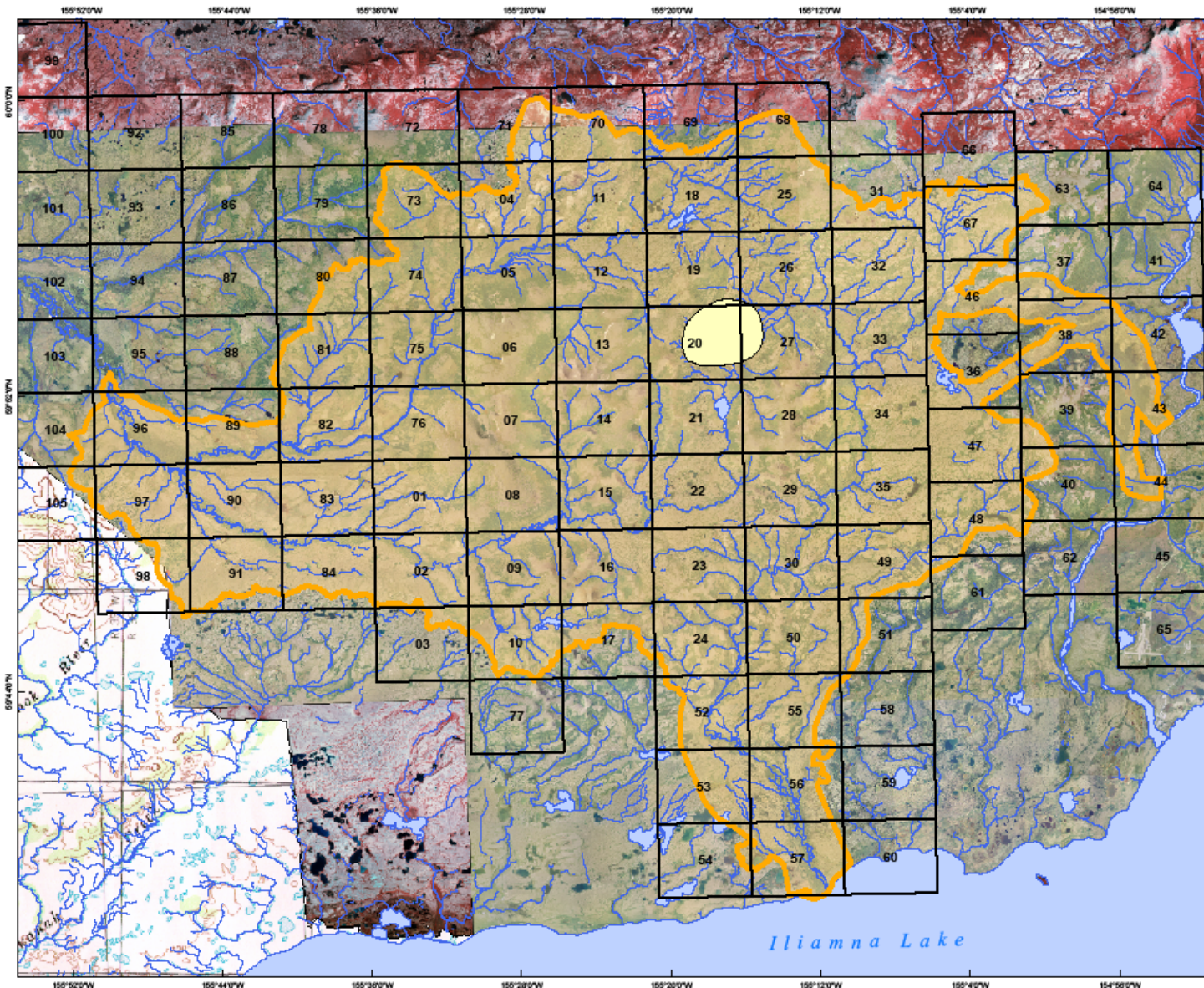
Polygon  
Coding ←

Field  
Review

## Air Photo Delineation

Wetlands and Other Waters of the U.S.








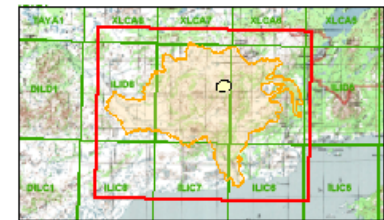
**Pebble Project**  
NORTHERN DYNASTY MINES INC.

Three Parameters Plus, Inc.  
2007 Study Area/Tile Grid

**DRAFT**

**Legend**

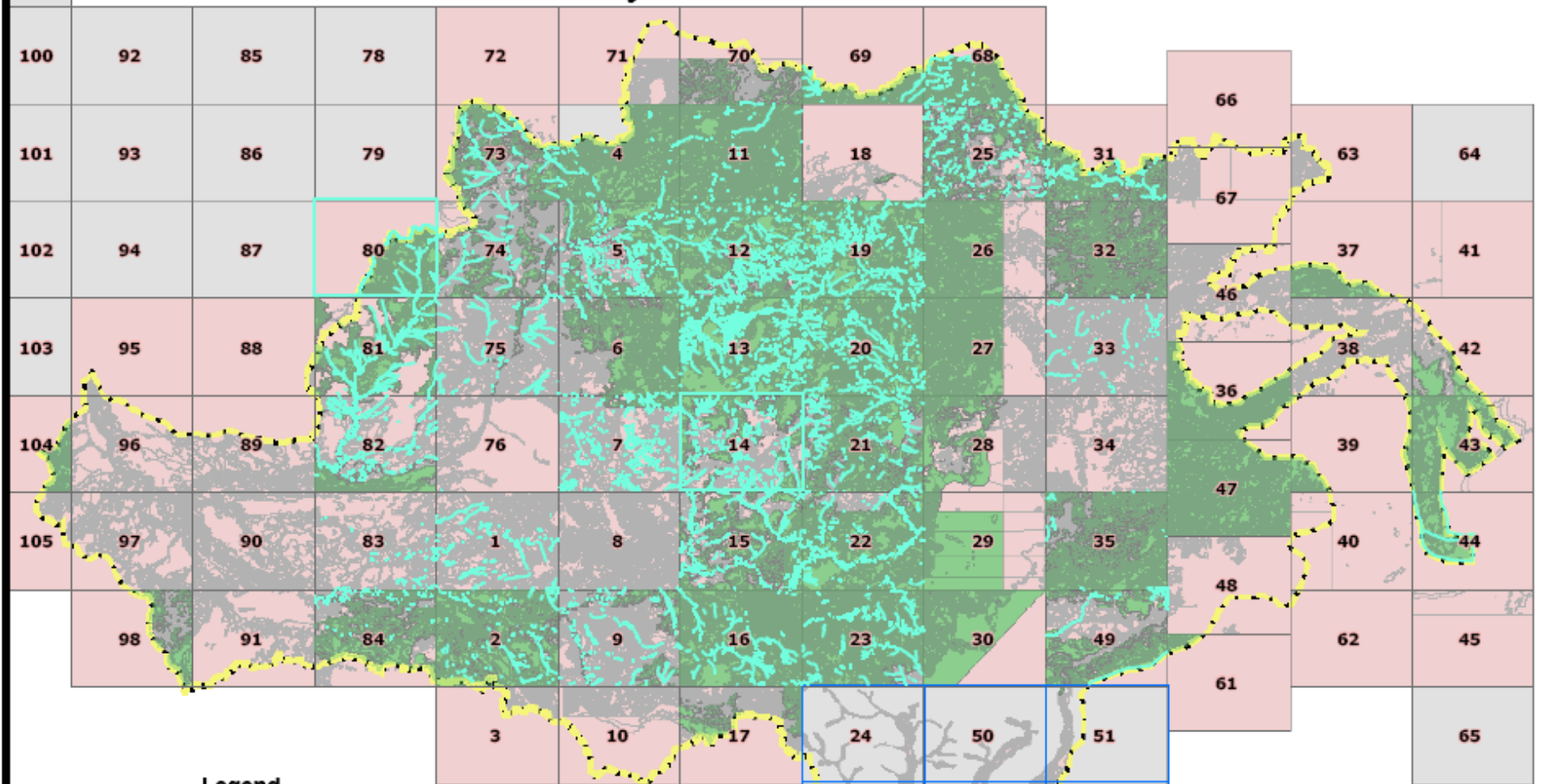
-  General Deposit Location
-  3PPI 2007 Field Study Area
-  1:15,000 Scale Tile Grid










Scale 1:190,000  
Alaska State Plane Zone 5 (units feet)  
1983 North American Datum

# Pebble - 3PPI Digital Mapping Status

## Thursday, November 13, 2008



### Legend

-  stdyarea\_v14d (Acres: 249,407)
-  Has JD\_WET code
-  No JD\_WET code
-  Has JD\_WET code
-  No JD\_WET code
-  plt\_15k\_v07 polygon
-  Riverine Tiles

Total Polygon Count: 236,368  
 Total Poly Coded Count: 95,535  
 Total ARC Count: 15,403  
 Total Arc Coded Count: 0,000

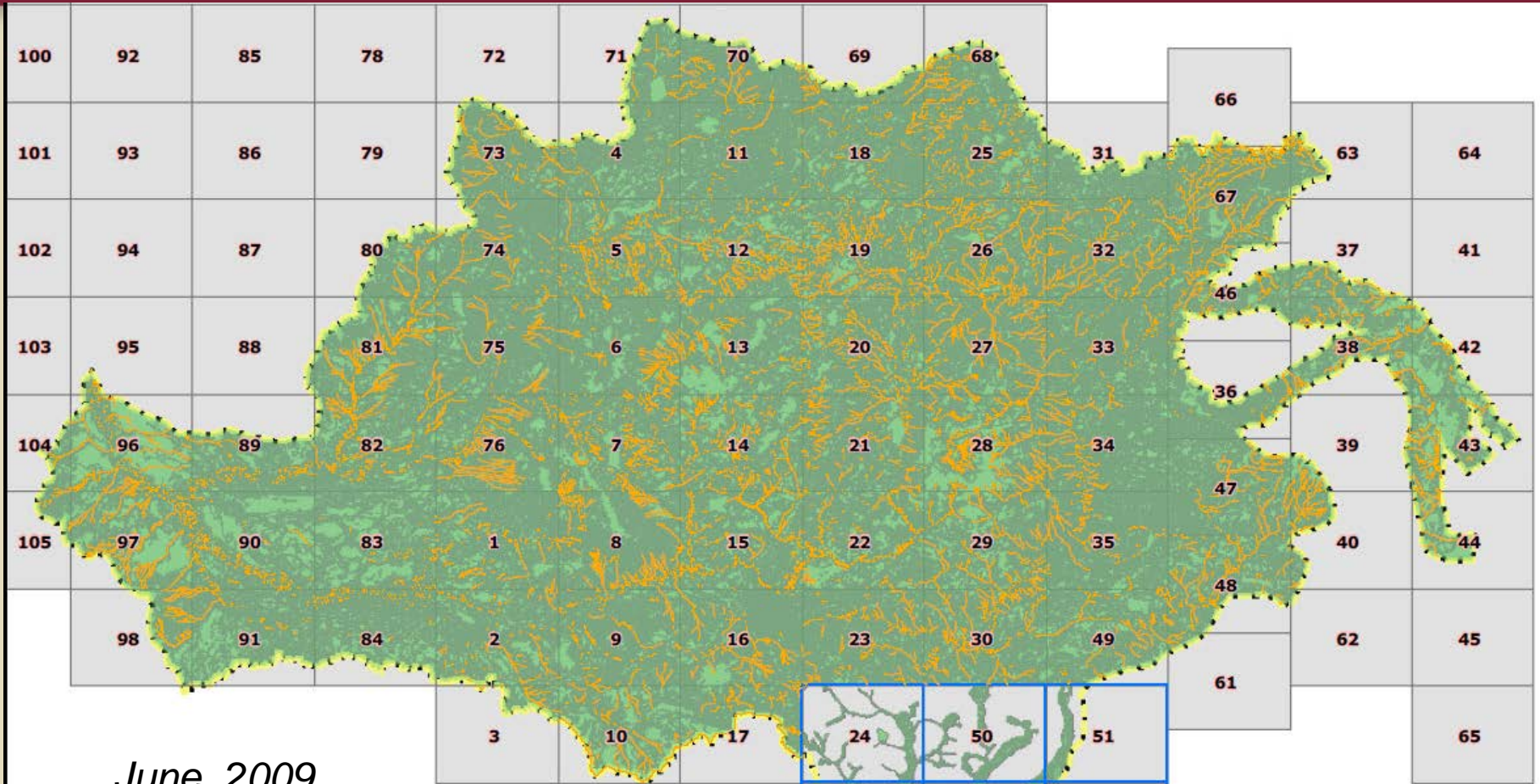


# Pebble Polygon Attributes

- JDWet\_Code =  
Wetland Determination
- JDWet\_Comment =  
Status Issues, Coder Notes
- Veg\_Code =  
Project Vegetation/Cover Code
- HGM\_Class =  
HGM Classification
- ENWI\_Code = Enhanced  
Cowardin; Hydrologic Regime
- Disturbance =  
Polygon Disturbed (Y/N)



*Our 2007 Summer Mapping Room, Iliamna*



June, 2009

### POLYGONS

| Legend |                                     |
|--------|-------------------------------------|
|        | 2008 stdyarea_v14e (Acres: 249,414) |
|        | Polygon with JDWET code             |
|        | Polygon with no JDWET code          |
|        | Stream ARCS with JDWET code         |
|        | Stream ARCS with no JDWET code      |

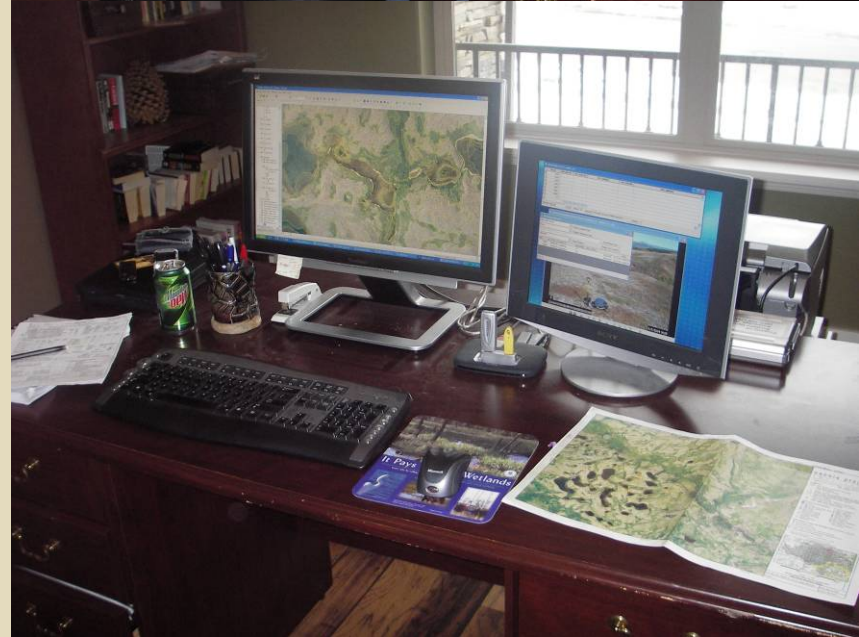
Total Polygon Count: 279,886  
 Total Poly Coded Count: 279,857  
 Percent Polygons Coded: 99.99%  
 Total Approved Mapping Acres: 232,538  
 Total Acres Coded: 232,439  
 Percent of Acres Coded: 99.96%  
 Percent of Acres QC'd: 0.00%

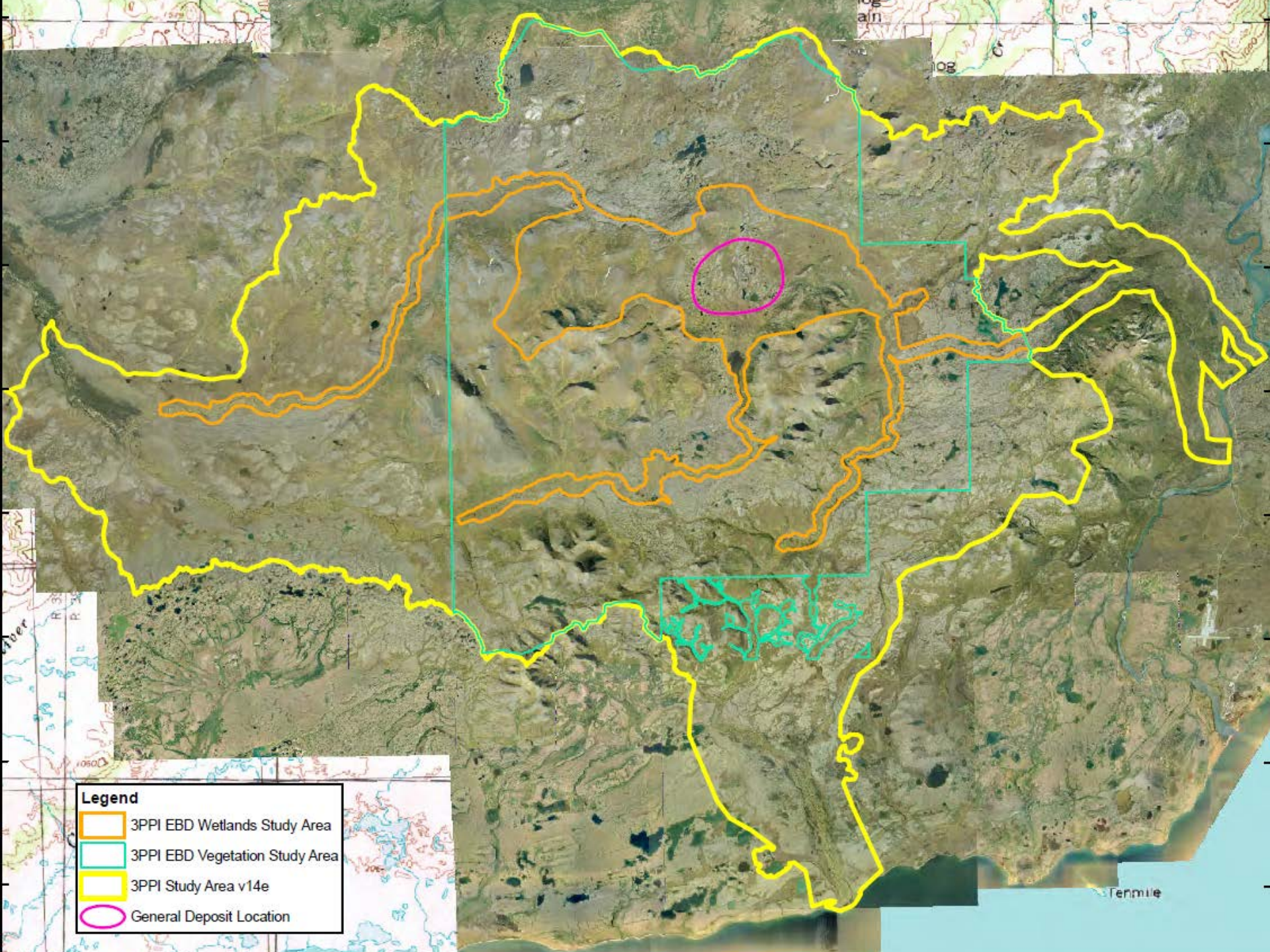
### ARCS

Total ARC Count: 24,798  
 Total Arc Coded Count: 0,217  
 Percent Arcs Coded: 0.88%  
 Linear Miles of Arcs: 2,001.0  
 Linear Miles of Arcs Coded: 0,010.0  
 Percent of Acres QC'd: 0%

## ***The Final QC Process (Polygons)***

- 1. Sr. Staff who are experts in particular classifications QC those attributes.*
- 2. Typically three people review each polygon and two people review each arc before they are final.*
- 3. While doing QC work, staff are constantly using the field data within the database, field map notes, and statistical analysis reports on trends in less predictable vegetation types.*
- 4. Final QC team members also have access to PLP's 2008 Fall Orthophotography, which better enables shrub types to be differentiated through photo interpretation.*
- 5. When all Individual Tiles Are Complete, the Boundaries of Completed Tiles Are "Stitched" Together to Verify Code Consistency Across Tiles.*
- 6. Finally, the merged file will be reviewed once again against field data using a specialized tool.*





**Legend**

- 3PPI EBD Wetlands Study Area
- 3PPI EBD Vegetation Study Area
- 3PPI Study Area v14e
- General Deposit Location

Tenmile

## ***Pebble Project EBD Wetland Mapping Results***

***Wetland Final Mapping  
29,429.7 Acres***

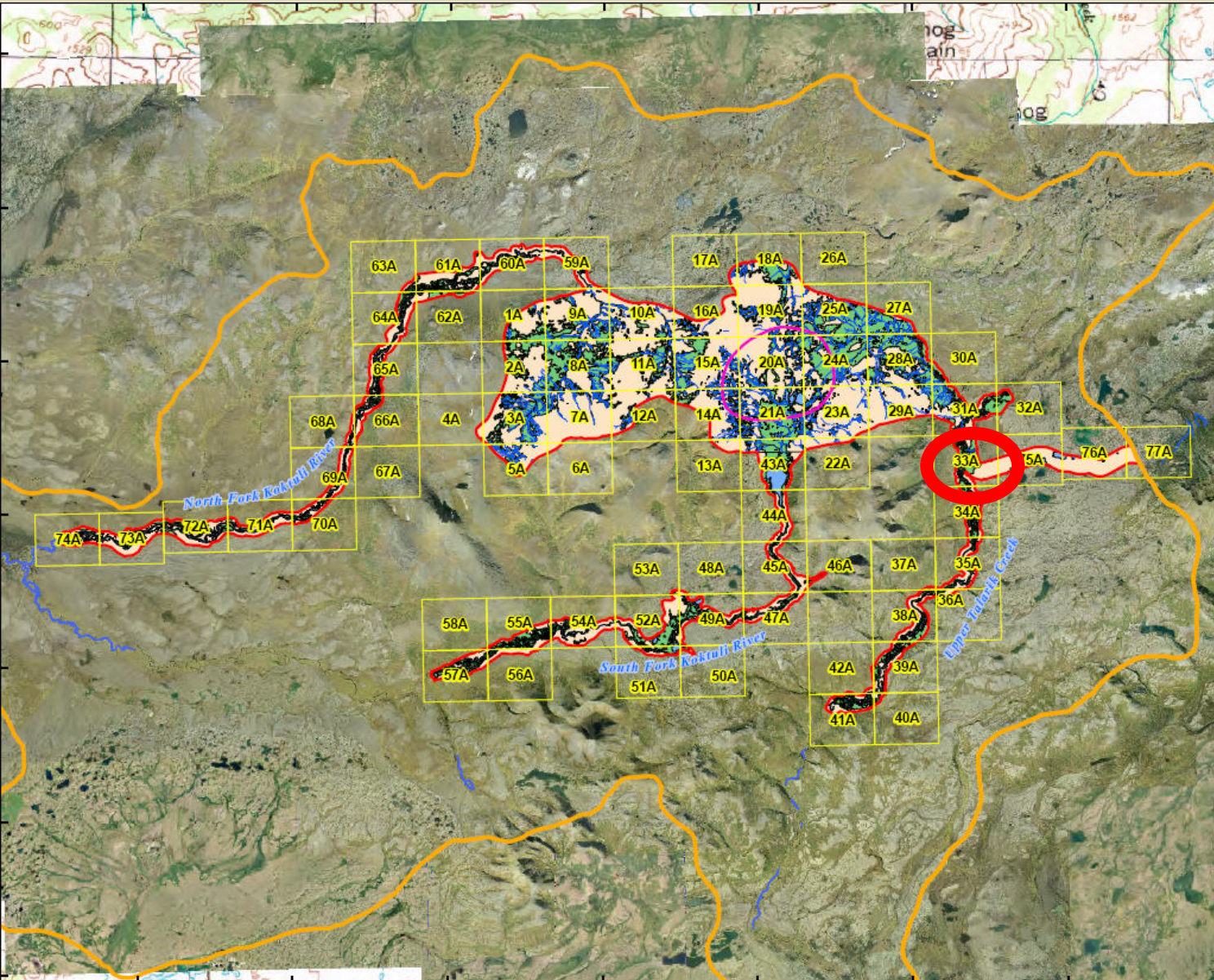
- ***Wetlands = 29.4%***
- ***Waters = 4.0 %***
- ***Non-Wetlands = 66.6%***

***On a statewide basis, wetlands occupy  
app. 43.3% of Alaska's surface area  
(Hall et al. 1994)***





**Figure 14.1-3**  
**Overview**  
**Wetlands Mapping, Mine Study Area,**  
**2004-2008**



**Legend**

- Mine Mapping Area
- Mine Study Area
- General Deposit Location
- Grid for Detailed Mapping Tiles
- Wetlands Mapping Classification**
- Majority Wetlands
- Majority Non-wetlands
- Waterbodies
- Gravel Bars/Seasonal Ponds

Note: For detailed wetlands mapping, see individual tiles in this figure series.



0 1 2 3 4 5 Miles

0 1 2 3 4 5 Kilometers

Scale 1:140,000


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

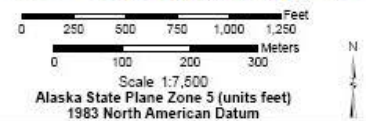
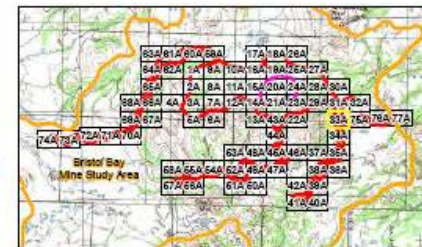


**Figure 14.1-3**  
**Tile 33A**

**Wetlands Mapping, Mine Study Area, 2004-2008**

**Legend**

-  Mine Mapping Area
  -  Mine Study Area
  -  General Deposit Location
- Wetlands Mapping Classification**
-  Wetland (<1% Non-wetland Inclusions)
  -  Wetland (Up to 10% Non-wetland Inclusions)
  -  Wetland (Up to 20% Non-wetland Inclusions)
  -  Wetland (Up to 40% Non-wetland Inclusions)
  -  Non-wetland (Up to 40% Wetland Inclusions)
  -  Non-wetland (Up to 20% Wetland Inclusions)
  -  Non-wetland (Up to 10% Wetland Inclusions)
  -  Non-wetland (<1% Wetland Inclusions)
  -  Waterbodies
  -  Gravel Bars/Seasonal Ponds



## Pebble Project Wetlands EBD Cowardin Classification System Mapping Results

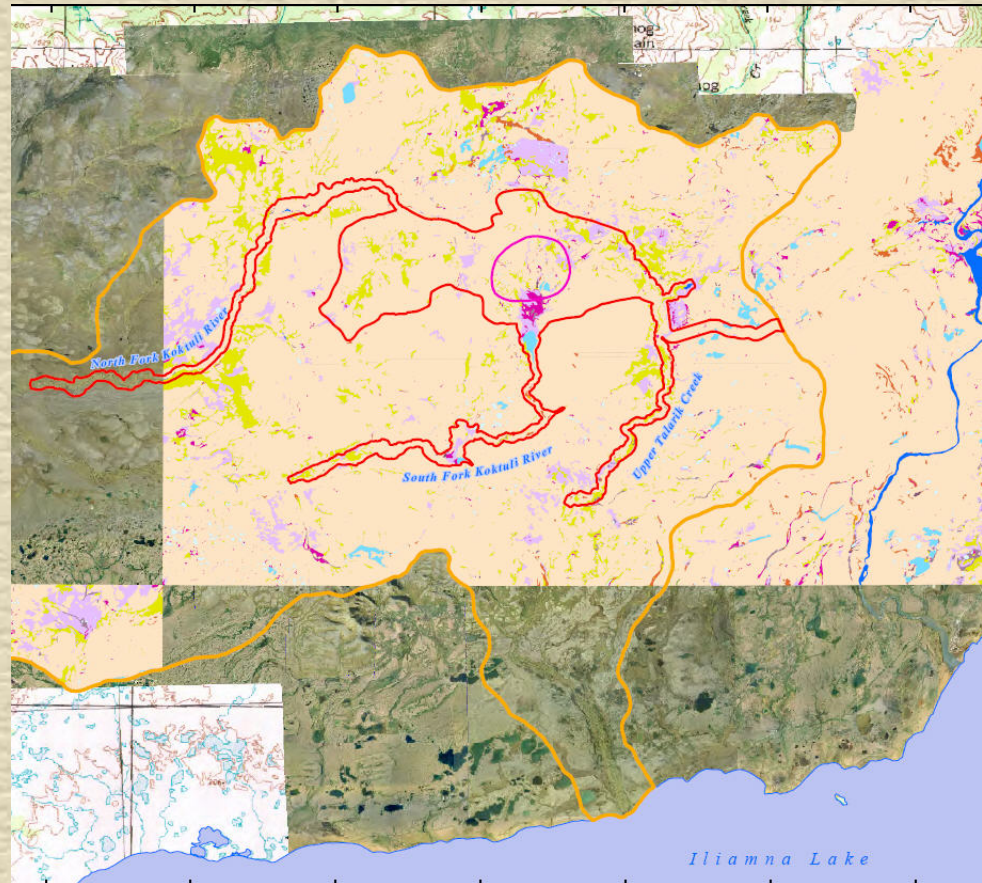
**Prior Mapping by  
USFWS – NWI 1985**

**Wetlands = 19.8%**

**Waters = 2.0 %**

**Non-Wetlands = 74.7%**

**No NWI Coverage = 3.6%**



**Figure 14.1-2  
U. S. Fish and Wildlife Service  
National Wetlands Inventory Mapping  
for the Mine Study Area**

- Legend**
- Pebble Project Mine Mapping Area
  - Pebble Project Mine Study Area
  - General Deposit Location
  - USFWS National Wetlands Inventory Group
  - Forested
  - Forested/Scrub Shrub
  - Scrub Shrub/Forested
  - Scrub Shrub Dominated Wetlands
  - Flooded Shrublands
  - Scrub Shrub/Herbaceous Dominated Wetlands
  - Herbaceous/Scrub Shrub Dominated Wetlands
  - Herbaceous Dominated Wetlands
  - Emergent Herbaceous Dominated Wetlands
  - Aquatic Herbaceous Dominated Wetlands
  - Freshwater Ponds
  - Lacustrine (Lakes)
  - Riverine (Rivers/Streams)
  - Non-wetlands

Note: Based on non-digital National Wetlands Inventory maps obtained from the U.S. Fish and Wildlife Service (USFWS).



0 1 2 3 4 5 Miles  
0 1 2 3 4 5 Kilometers  
Scale 1:180,000  
Alaska State Plane Zone 5 (units feet)  
1983 North American Datum

File: RDI\_BPP\_EBD\_Fig14.1-2\_NWI\_11X17L\_top\_D04.mxd Date: May 3, 2011  
Version: 4 Author: RDI-LS



## ***Pebble Project Wetlands EBD Cowardin Classification Mapping Results***

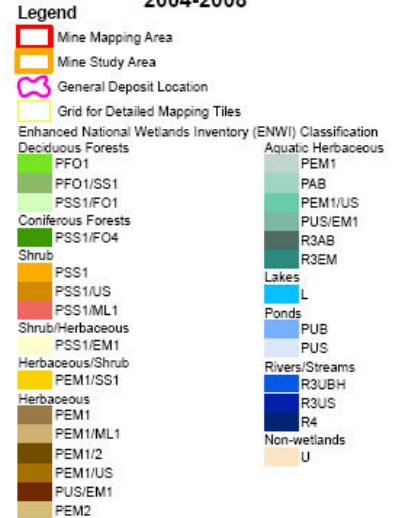
***Enhanced NWI vs. NWI  
29,429.7 Acres vs. 28,383.7***

- ***Shrub Types = 22.6 vs. 17.1%***
- ***Herbaceous Types = 6.8 vs. 2.7%***
- ***Forested Types = 0.0 vs. 0.0%***
- ***Waters = 4.0 vs. 2.0%*  
*(lakes, ponds, rivers, gravel bars)***
- ***Non-Wetlands = 66.6 vs. 74.7%***

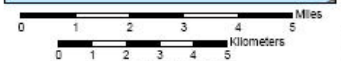
***(NWI had no coverage for 3.6% of the area)***



**Figure 14.1-4  
Overview  
Enhanced National Wetlands  
Inventory Mapping, Mine Study Area,  
2004-2008**



Note: For detailed ENWI mapping, see individual tiles in this figure series.  
For full names of classification and descriptions of codes, see Table 14.1-4.



Scale 1:140,000  
Alaska State Plane Zone 5 (units feet)  
1983 North American Datum



## ***HYDROGEOMORPHIC (HGM)***

### ***CLASSIFICATION***

- ***Water is the primary controller of what wetland systems do (i.e., their functions).***
- ***HGM system classifies wetlands based on features of water (e.g., source), topography, and geological setting.***

## ***Pebble Project Wetlands EBD***

### ***HGM Classes***

- *Depressional*
- *Slope*
- *Riverine*
- *Flat*
- *Lacustrine Fringe*
  
- *Lacustrine*
- *Riverine Channel*



## ***Pebble Wetlands EBD HGM Mapping 29,429.7 Acres***

### ***Riverine HGM Example***

- ***Slope*** = 21.0%
- ***Riverine*** = 7.2 %
- ***Riverine Channel*** = 1.7 %
- ***Flat*** = 1.6 %
- ***Lacustrine*** = 1.0 %
- ***Depressional*** = 0.8 %
- ***Lacustrine Fringe*** = 0.1 %
  
- ***Non-Wetlands*** = 66.6%





**Figure 14.1-5  
Overview**

**Hygeomorphic Classification  
Mapping, Mine Study Area,  
2004-2008**

**Legend**

- Mine Mapping Area
- Mine Study Area
- General Deposit Location
- Grid for Detailed Mapping Tiles
- Hygeomorphic (HGM) Classification**
- N/A - Non-wetlands
- Slope
- Flat
- Depressional
- Riverine
- Riverine Channel
- Lacustrine
- Lacustrine Fringe

Note: For detailed HGM mapping, see individual tiles in this figure series.

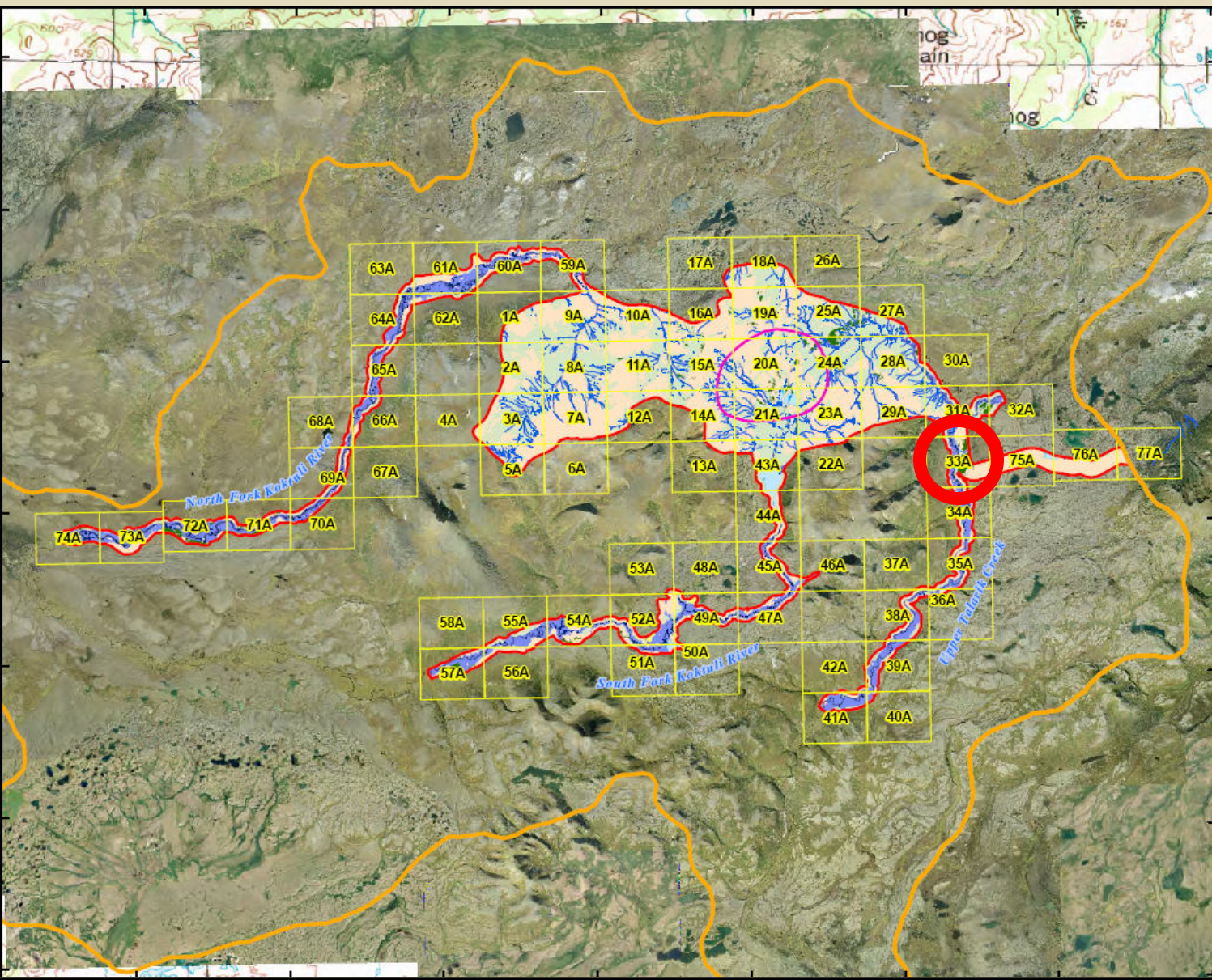
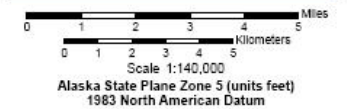




Figure 14.1-5  
Tile 33A

## Hydrogeomorphic Classification Mapping, Mine Study Area, 2004-2008

### Legend

Mine Mapping Area

Mine Study Area

General Deposit Location

### Hydrogeomorphic (HGM) Classification

N/A - Non-wetlands

Slope

Flat

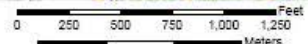
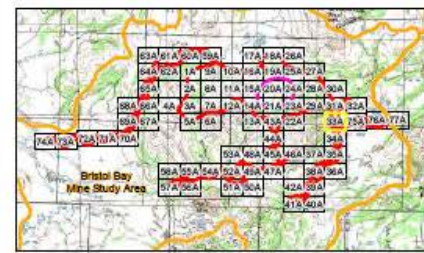
Depressional

Riverine

Riverine Channel

Lacustrine

Lacustrine Fringe



Scale 1:7,600  
Alaska State Plane Zone 5 (units feet)  
1983 North American Datum

***Questions Before We Move on to Vegetation?***



NE

@040907205303N5954985W15516578G

9/7/2004 12:59



***Pebble Project EBD***

***Vegetation Study***

***Mine Study Area***

***2004-Present***



SE

@060714012306N5954757W15512760G

7/13/2006 5:26pm 8

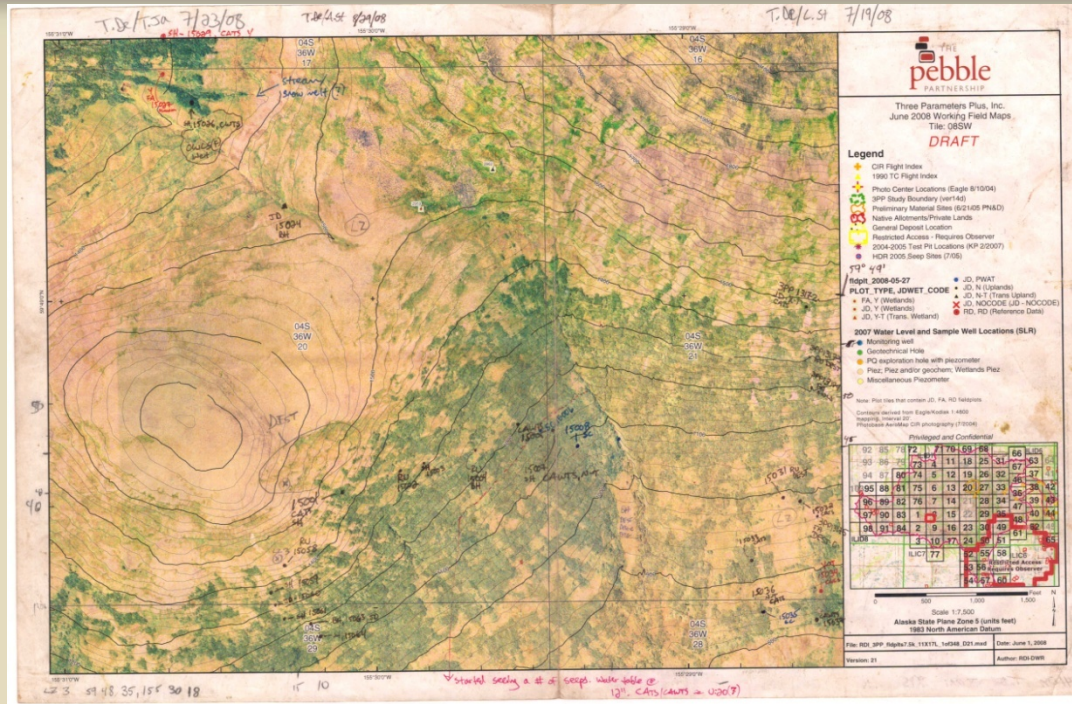
## ***Pebble Project Vegetation EBD***

### ***Study Objectives***

- *Customize an existing vegetation classification system to include Project Vegetation Types amenable to photo-interpretation*
- *Provide descriptions of Project Vegetation Types*
- *Map Project Vegetation Types*
- *Compile and Document information on plant species observed*

*including incidental observations:*

- Nonvascular plant species (e.g., moss and lichen).*
- Species considered rare according to the Alaska Natural Heritage Program*

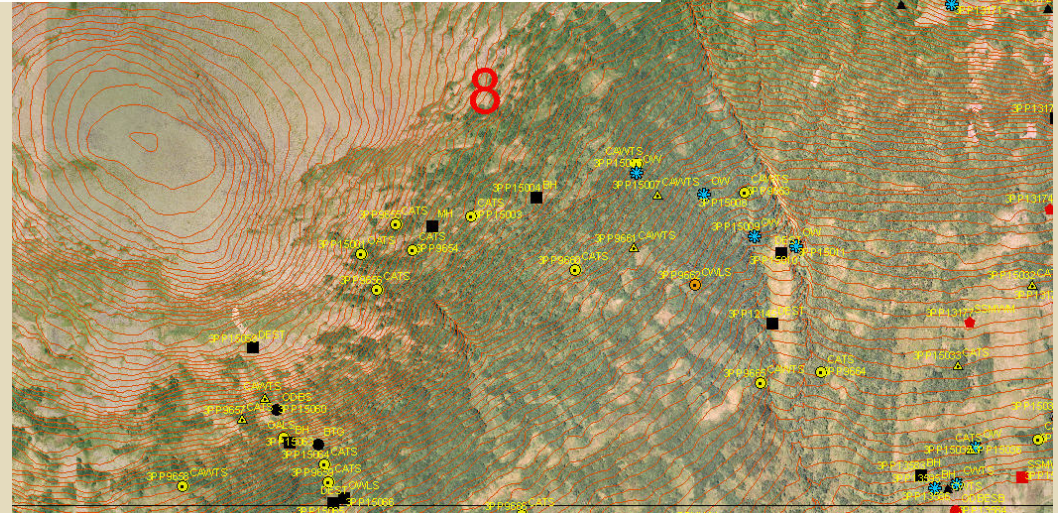


**Field Work**

**Use of Aerial Image**

**Identify and Sample Distinct Vegetation Signatures**

**Pebble Project Vegetation EBD**



# Three Parameters +

***In the field, getting from points --***

***A to B to C to D to E to F to G to H to I to J to K to L to M to N***

***Can be slow....***

***Especially when Cheryl has you loaded up like a Sherpa...***



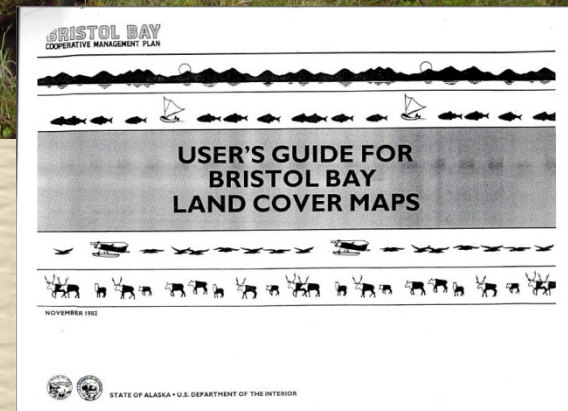
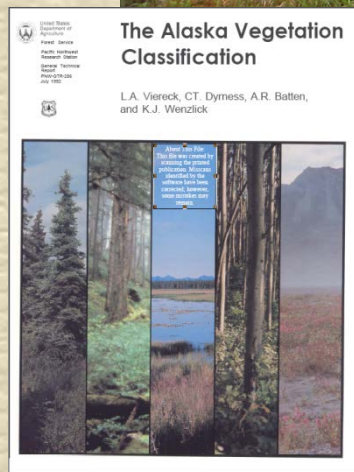
## Pebble Project Vegetation EBD

### Vegetation Characterization

- 1/10 Acre Plot
- Percent Cover-  
Vascular Species
- Calculate Dominates
- Record Trace Species
- Record Species of Concern

### Classification

- Field Type
  - BBMP and/or  
AVC Level 4



## ***Pebble Project Vegetation EBD Study Sites***

### ***Detailed Data Collection Plots***

*Wetland Determinations*

*Functional Assessments*

### ***Limited Data Collection Plots***

***Shrub Height Plots***

*Stream Crossings*

*Waterbody*

*Representative Upland*

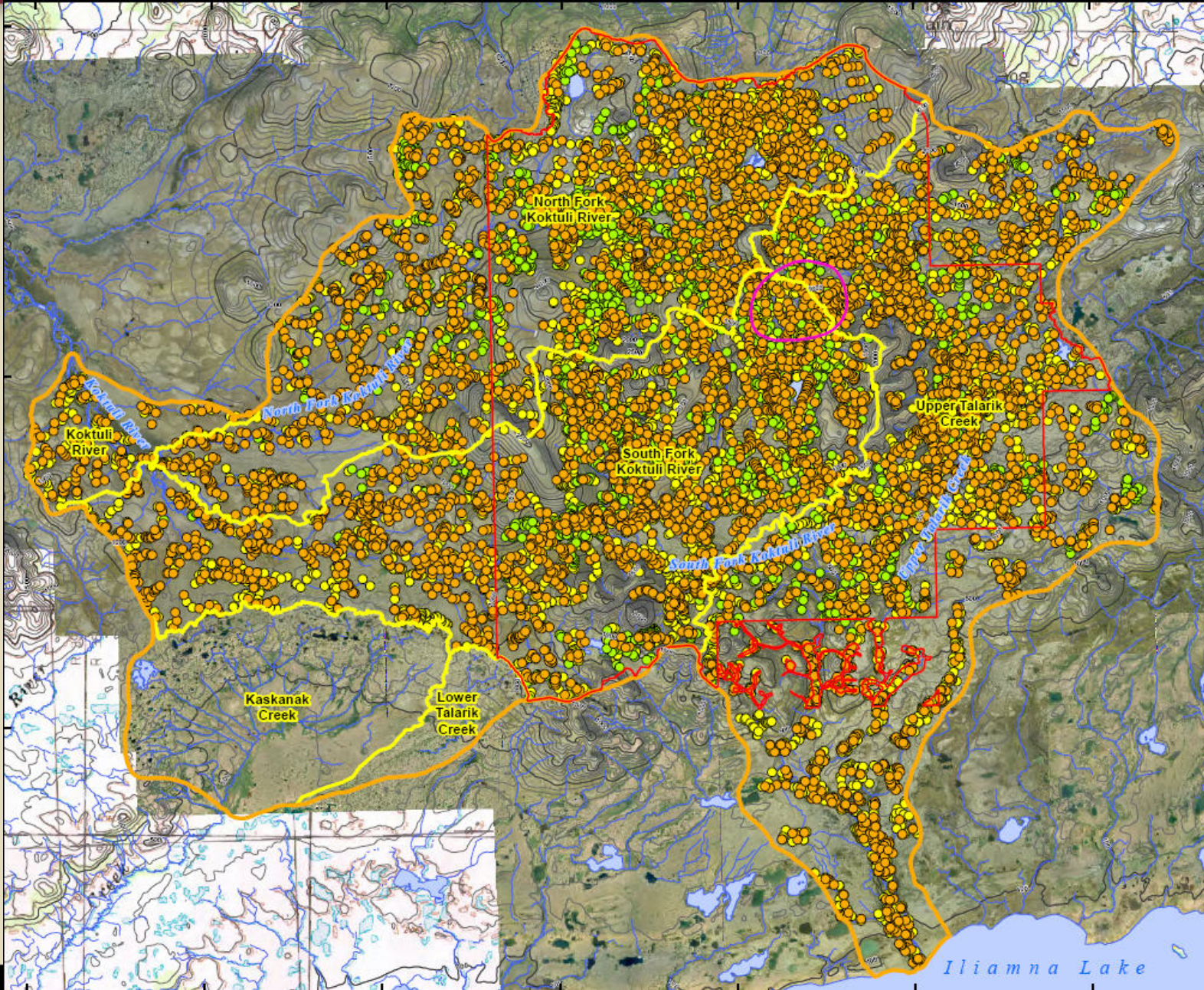
*Representative Wetland*

*Photo Point Habitat Observations*

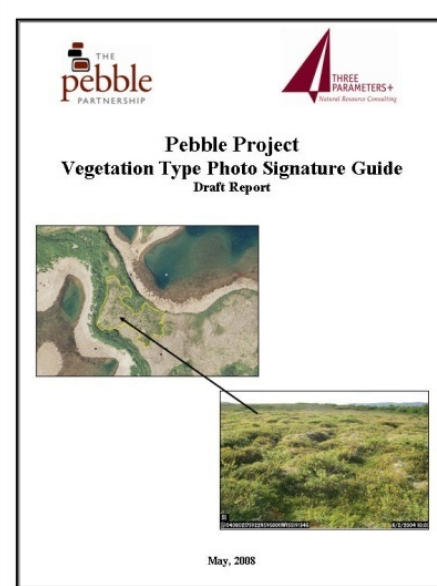


## **Pebble Project Vegetation EBD**

**16,000+  
sites visited**



## Pebble Project Vegetation EBD 45 Project Vegetation Types in EBD Mine Study Area



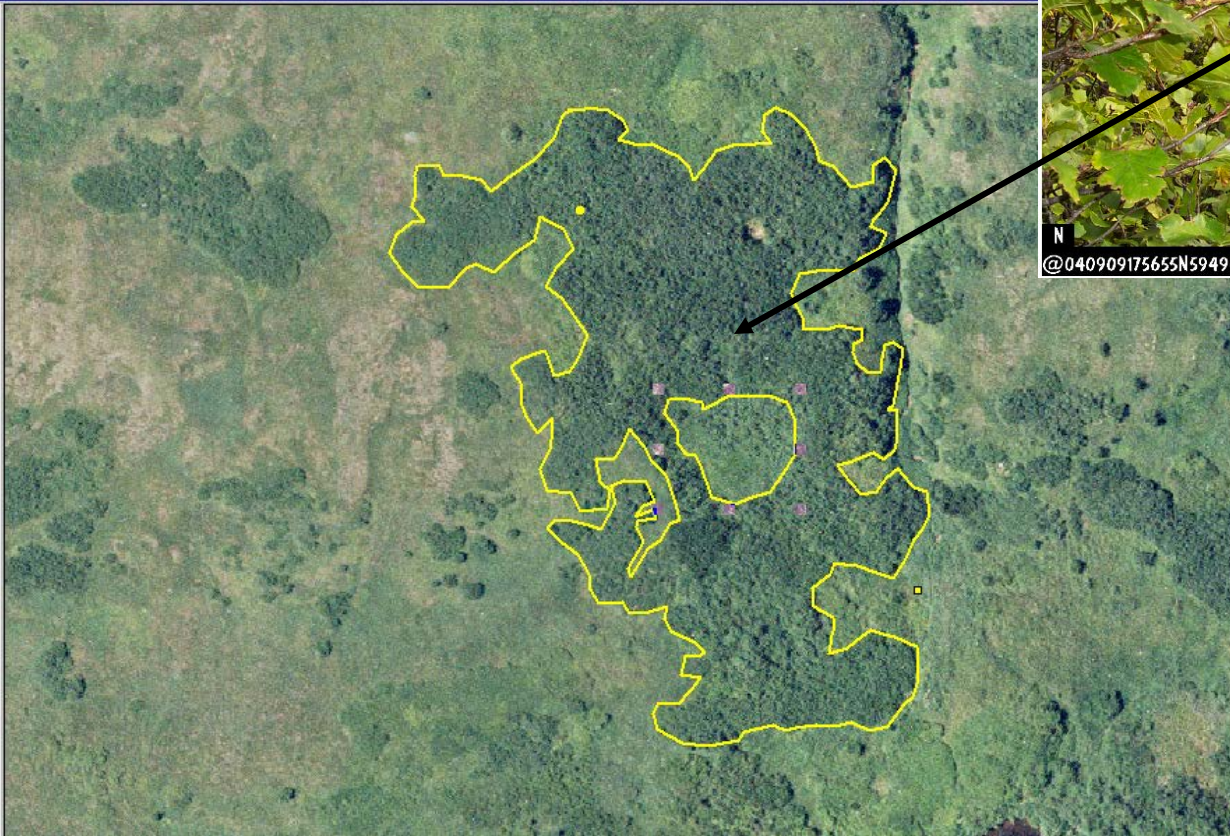
| Cover Types  | Field Camera Code | Field Vegetation Type Viereck level IV or types not recognized by Viereck | Viereck Level IV code | Project Mapping Vegetation Type          | 3PPI Project Mapping Code |
|--|-------------------|---|-----------------------|--|---------------------------|
| Low Shrub, Open Canopy<br><5 feet tall ≥25% - <75% cover | MSSTT             | Mixed Shrub Sedge Tussock Tundra  | 2C2A                  | Open Mixed Shrub Sedge Tussocks          | OMSST                     |
|  | MSSTB             | Mixed Shrub Sedge Tussock Bog   | 2C2B                  |  |                           |
|  | MSBES             | Mesic Shrub Birch Ericaceous Shrub  | 2C2C                  | Open Dwarf Birch Shrub                   | ODBS                      |
|  | ODBS              | <i>Open Dwarf Birch Shrub</i>   | 2C2                   |  |                           |
|  | LEST              | <i>Low Ericaceous Shrub Tundra</i>  | 2C2                   |  |                           |
| >10% BENA<br><10% BENA                                   | ODBESSB           | Open Dwarf Birch Ericaceous Shrub Sphagnum Bog                            | 2C2D                  | Open Dwarf Birch Ericaceous Sphagnum Bog | ODBESSB                   |
|  | ESSB              | Ericaceous Shrub Sphagnum Bog   | 2C2E                  | Ericaceous Shrub Bog                     | ESB                       |
|  | ODBWLS            | Open Dwarf Birch Willow Low Shrub   | 2C2F                  | Shrub Birch Willow                       | SBW                       |
|  | OWLS              | Open Willow Low Shrub   | 2C2G                  | Open Willow Low Shrub                    | OWLS                      |
|  | OWLSF             | Open Willow Low Shrub Fen   | 2C2Gx                 | Open Willow Low Shrub Fen                | OWLSF                     |
|  | >10% Sweetgale    | OSGB  | Open Sweetgale Bog    | Open Sweetgale Bog                       | OSGB                      |
|  | OAWLS             | Open Alder Willow Low Shrub   | 2C2K                  | Open Alder Willow Low Shrub              | OAWLS                     |
|  | OALS              | Open Alder Low Shrub  | 2C2L                  | Open Alder Low Shrub                     | OALS                      |
| < 25% BENA   | DEST              | <i>Dwarf Ericaceous Shrub Tundra</i>                                      | 2C1,2                 | Dwarf Ericaceous Shrub Tundra            | DEST                      |
|  |                   | Dryas, Dryas Sedge Tundra   | 2C1A,B                |  |                           |
|  |                   | Vaccinium, Crowberry Tundra   | 2C2B,C                |  |                           |
|  | DEST-EQ           | <i>Dwarf Ericaceous Shrub Tundra-Equisetum</i>                            | 2C1,2                 | Dwarf Ericaceous Shrub Tundra-Equisetum  | DEST-EQ                   |
|  | DEST-C            | <i>Dwarf Ericaceous Shrub Tundra-Carex</i>                                | 2C1,2                 | Dwarf Ericaceous Shrub Tundra-Carex      | DEST-C                    |

## ***Pebble Project Vegetation EBD***

*Closed Tall Shrub Canopy*



*Closed Alder Tall Shrub*



## Pebble Project Vegetation EBD -- Pebble Project Database

- Data Entry
- QA/QC
- Analysis
- Data Storage

### Routine Wetland Determination

Last Saved:  Show Menu:  Plot:  QC Status:  Find Plot:  Go Type:  Status:

| Site Location | Vegetation | CRYP-AK06 | MORPH-AK06 | HYD-87 | HYD-AK06 | Soil Profile | Other Soil | Determination | Assessment | Stratum | Stratum Status | Cover | Dom. | Height (ft) | Tree DBH (in) | Shrub Stratum | Animal Food | Subsist. Food | Delete                   | Rare |
|---------------|------------|-----------|------------|--------|----------|--------------|------------|---------------|------------|---------|----------------|-------|------|-------------|---------------|---------------|-------------|---------------|--------------------------|------|
| SAFU          |            |           |            |        |          |              |            |               |            | S       | FACW           | 10    | Y    |             |               | SS            | Y           | Medicine      | <input type="checkbox"/> | No   |
| BENA          |            |           |            |        |          |              |            |               |            | S       | FAC            | 5     | Y    |             |               | SS            | Y           | Food          | <input type="checkbox"/> | No   |
| VAOX          |            |           |            |        |          |              |            |               |            | S       | OBL            | 7     | N    |             |               | DS            | Y           | Food & Med    | <input type="checkbox"/> | No   |
| SAPL1-S       |            |           |            |        |          |              |            |               |            | S       | FACW           | 7     | N    |             |               | SS            | Y           | Medicine      | <input type="checkbox"/> | No   |
| VAUL          |            |           |            |        |          |              |            |               |            | S       | FAC            | 7     | N    |             |               | DS            | Y           | Food          | <input type="checkbox"/> | No   |
| CAAQ          |            |           |            |        |          |              |            |               |            | H       | OBL            | 30    | Y    |             |               | SH            | Y           |               | <input type="checkbox"/> | No   |
| ERAN          |            |           |            |        |          |              |            |               |            | H       | OBL            | 30    | Y    |             |               | SH            | Y           | Food          | <input type="checkbox"/> | No   |
| ERSC          |            |           |            |        |          |              |            |               |            | H       | OBL            | 20    | Y    |             |               | SH            | Y           | Food          | <input type="checkbox"/> | No   |
| CACA          |            |           |            |        |          |              |            |               |            | H       | FAC            | 8     | N    |             |               | SH            | Y           |               | <input type="checkbox"/> | No   |
| POPA1         |            |           |            |        |          |              |            |               |            | H       | OBL            | 5     | N    |             |               | SH            | Y           |               | <input type="checkbox"/> | No   |
| SPHA-SP       |            |           |            |        |          |              |            |               |            | B       | NA             | 90    | N    |             |               | ML            | N           | Medicine      | <input type="checkbox"/> | No   |

% of Dominant Species that are OBL, FACW, or FAC (excluding FAC-):  Calculated:

VEGETATION REMARKS

MISC. VEGETATION DATA

Project Veg Type:

Field BBMP Veg Type:

Viereck Code:  ABR Hab Code:

Field JD Wet Code:  Field ENWI Code:

Field EROS Veg. Type:

Eros GIS:

Trace <= (%):  Method:  Total Percentage of Animal Food Plants (Calculated):

Proportion of Subsistence Food Plants (Calculated):

Percentage of Animal Food Species (Calculated):

INDICATOR 1: PREVALENCE INDEX (AK MANUAL)

| Total % Cover of (A)                | Multiplied by (B)          |
|-------------------------------------|----------------------------|
| OBL Species: <input type="text"/>   | x 1 = <input type="text"/> |
| FACW Species: <input type="text"/>  | x 2 = <input type="text"/> |
| FAC Species: <input type="text"/>   | x 3 = <input type="text"/> |
| FACU Species: <input type="text"/>  | x 4 = <input type="text"/> |
| UPL Species: <input type="text"/>   | x 5 = <input type="text"/> |
| Column Totals: <input type="text"/> | <input type="text"/>       |

Prevalence Index = B/A =  Calculated:

HYDROPHYTIC VEGETATION INDICATORS

2006 1987

Prevalence Index - Indicator 1

Wetland Cryptogams - Indicator 2

Morphological Adaptations - Indicator 3

Meets Requirements for Problematic Wetland Situation?

Hydrophytic Vegetation Present?

% BY STRATUM (MAGEE - WETLANDS ONLY)

## Pebble Project Vegetation EBD

### Species of Concern - ANHP

#### Routine Wetland Determination

Last Saved: Plot is read only.

Show Menu:

Plot: 3PP9789

QC Status: QC Complete

Find Plot: 3PP

Go

Type: RP

Status: Y

Site Location | Vegetation | CRYP-AK06 | MORPH-AK06 | HYD-87 | HYD-AK06 | Soil Profile | Other Soil | Determination | Assessment

Show Model | Main Menu

Yellow highlighting indicates a species of interest. If the species is rare, the rare species form may be access by clicking on the link in the 'rare' column.

| Acronym | Latin Name             | Common Name           | Stratum | Ind. Status | % Cover | Dom. | Height (ft) | Tree DBH (in) | Magee Stratum | Animal Food | Subsis. Food | Delete                   | Rare |
|---------|------------------------|-----------------------|---------|-------------|---------|------|-------------|---------------|---------------|-------------|--------------|--------------------------|------|
| SAPL1-S | Salix pulchra (shrub)  | Diamond-leaf willow   | S       | FACW        | 10      | Y    |             |               | SS            | Y           | Medicine     | <input type="checkbox"/> | No   |
| PRTS    | Primula tschuktschorum | Chukch primrose       | H       | FACW*       | 5       | Y    |             |               | SH            | Y           |              | <input type="checkbox"/> | Yes  |
| SPHA-SP | Sphagnum sp.           | Unkeyed sphagnum moss | B       | N/A         | 50      | N    |             |               | ML            | N           | Medicine     | <input type="checkbox"/> | No   |
|         |                        |                       |         |             |         |      |             |               |               |             |              | <input type="checkbox"/> | No   |
|         |                        |                       |         |             |         |      |             |               |               |             |              | <input type="checkbox"/> | No   |
|         |                        |                       |         |             |         |      |             |               |               |             |              | <input type="checkbox"/> | No   |
| WATER   | Water                  | Water                 | N/A     | N/A         | 5       | N    |             |               | N/A           | N           |              | <input type="checkbox"/> | No   |

% of Dominant Species that are OBL, FACW, or FAC (excluding FAC-): 50 Calculated: 50% Calculate Species Removed by Extrapolation

5 Add Rows Delete Species

#### VEGETATION REMARKS

PRTS confirmed by C. Parker (UAF) 2008.  
PRTS specimen transferred to UAF Herbarium by KCR 10/2010

#### MISC. VEGETATION DATA

Project Veg Type: Subarctic Sedge Moss Wet Meadow  
Field BBMP Veg Type: Subarctic Lowland Sedge-Moss Bog Meadow (L2)  
Viereck Code: IIIA3k ABR Hab Code: Hgwsmb  
Field JD Wet Code: W Field ENWI Code: PEM1/SS1B

#### INDICATOR 1: PREVALENCE INDEX (AK MANUAL)

| Total % Cover of (A)                | Multiplied by (B)          |
|-------------------------------------|----------------------------|
| OBL Species: <input type="text"/>   | x 1 = <input type="text"/> |
| FACW Species: <input type="text"/>  | x 2 = <input type="text"/> |
| FAC Species: <input type="text"/>   | x 3 = <input type="text"/> |
| FACU Species: <input type="text"/>  | x 4 = <input type="text"/> |
| UPL Species: <input type="text"/>   | x 5 = <input type="text"/> |
| Column Totals: <input type="text"/> | <input type="text"/>       |

Prevalence Index = B/A =   
Calculated: 2

## Pebble Project Vegetation EBD

## Plant Species of Concern

Six Species Identified

Three Confirmed

Twelve Populations



### Rare Plant Details

**GENERAL INFORMATION**

Scientific Name:

Person Completing AKNHP Report:

Contact Information: Phone:  Email:

Date of Survey:  Specimen Collected:  Collection#:  Museum/Herb:

**LOCATION INFORMATION**

Borough:  Site Location Photo:

USGS Quad #:

GPS Lat:

GPS Long:

Elevation:

GPS Datum:

Watershed:

Township:  Range:   1/4 of  1/4 Section

Observed area or length occupied:  Units:  Was the extent of the occurrence completely surveyed?

if No, about:  % of potential habitat was surveyed. The species occupied about  % of potential habitat surveyed.

Is this a new Location record?  If not, compared to last visit:

**POPULATION DESCRIPTION**

# individuals/stems:  if < 30 indicate the quantity:

Population Distribution:

Does this population occur naturally at this site?  Is this population re-introduced?

Phenologic Stages:  % dormant/senescent  % vegetative  % reproductive

Overall Occurrence Quality:

Comments:

**IDENTIFICATION OF TAXON**

ID is about  % certain.

Keyed in reference:

Compared w/photo/drawing in:

Compared with specimen at:

## ***Pebble Project Vegetation EBD: Observations of Plants Species Tracked by AKNHP***

| <b>Latin Name</b>  | <b>Common Name</b>      | <b>AKNHP Ranks<br/>(Global and State)</b> | <b>Project Vegetation<br/>Type(s)</b>   | <b>Approximate<br/>Location</b>               |
|--|-------------------------|---|---|---|
| <b><i>Taxonomy confirmed, Voucher Donated to Herbarium</i></b> |                         |   |   |   |
| <i>Carex crawfordii</i>  | Crawford's sedge        | G5S3                                      | Bluejoint Herb  | Two miles SE of Crazy Lady Lake               |
| <i>Primula tschuktschorum</i>                                  | Chukchi primrose        | G2G3<br>S2S3                              | Subarctic Sedge Moss<br>Wet Meadow; Bluejoint<br>Herb                                 | Near Kaskanak<br>and Cone<br>Mountains        |
| <i>Rumex beringensis</i>                                       | Bering Sea Dock         | G3S3                                      | Mesic Herb and Partially<br>Vegetated shorelines;<br>Dwarf Ericaceous Shrub<br>Tundra | Upper Talarik<br>River; Koktuli<br>confluence |
| <b><i>Taxonomy unconfirmed (Voucher Unavailable)</i></b>       |                         |   |   |   |
| <i>Carex bebbii</i>  | Bebb's sedge            | G5S1                                      | Bluejoint Herb  | North of<br>Kaskanak Mt.                      |
| <i>Eriophorum viridicarinatum</i>                              | Green-keel cotton grass | G5S2                                      | Subarctic Sedge Moss<br>Wet Meadow  | NE of Sharp Mt                                |
| <i>Stellaria umbellata</i>                                     | Umbellate starwort      | G5<br>S2S3                                | Open Willow Low Shrub   | North Fork Koktuli                            |

## *Pebble Project Vegetation EBD*

## *Mapping*

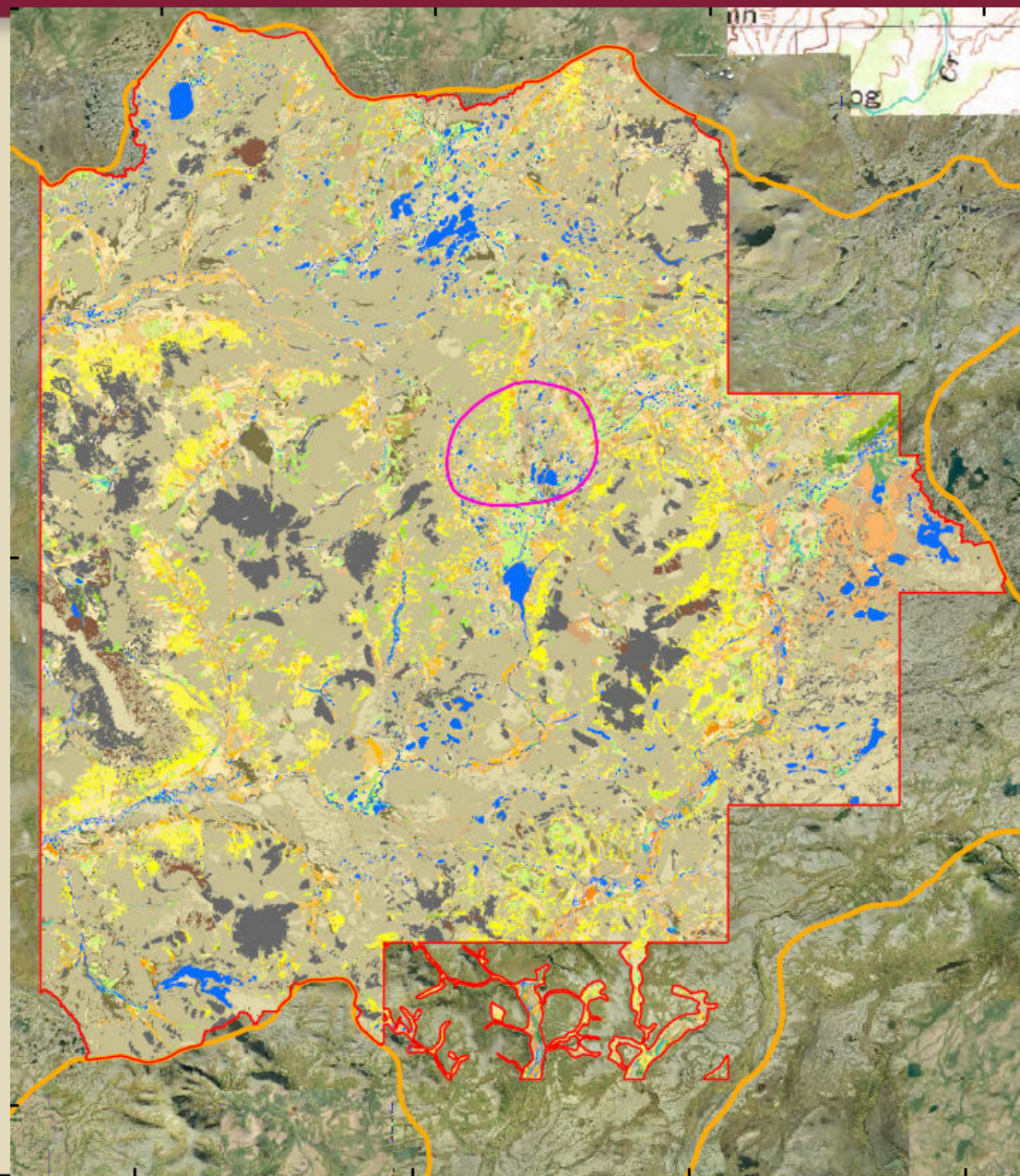


## Pebble Project EBD

## Vegetation Mapping

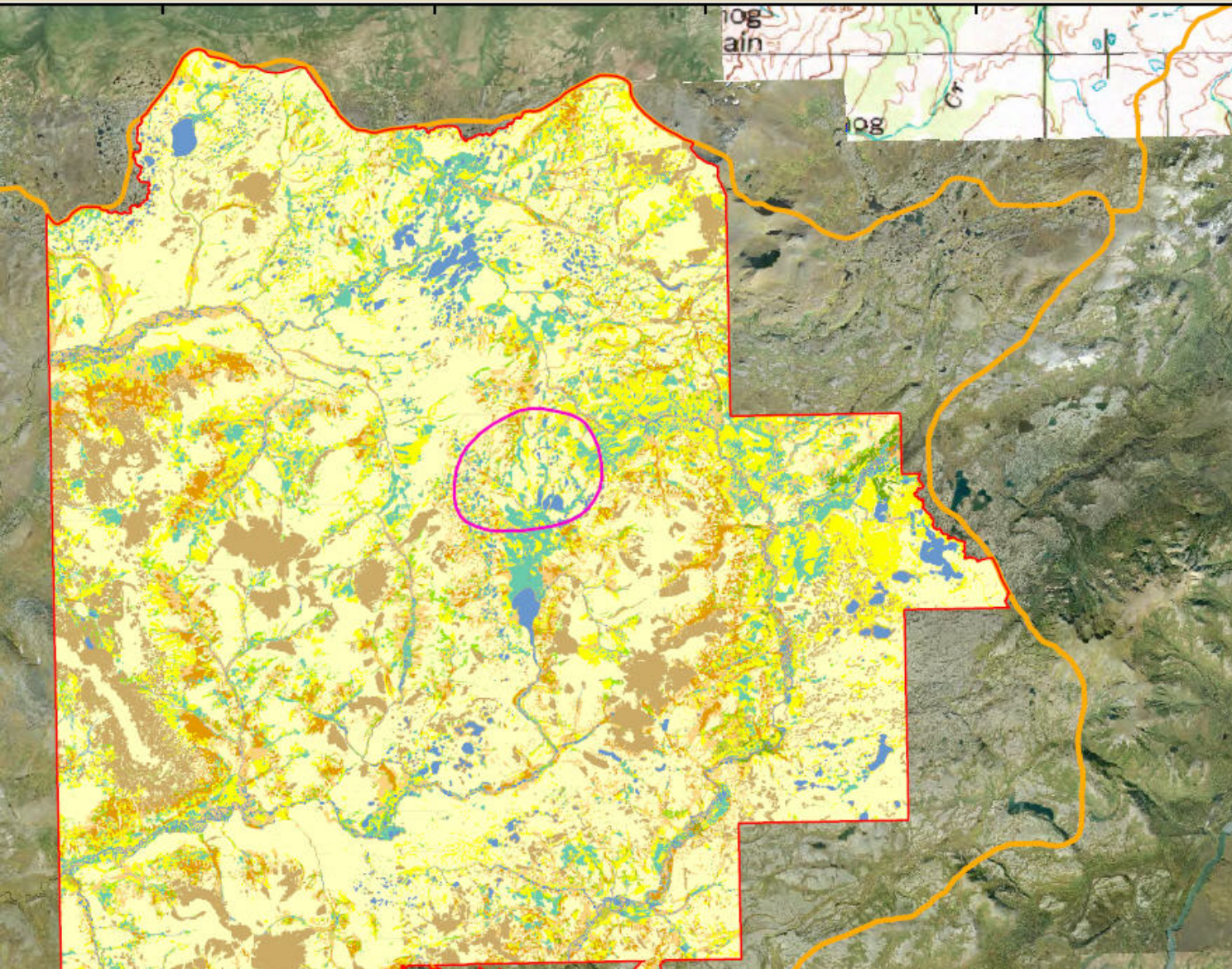
## 45 Project Vegetation Types

Mapped Coverage Ranges from .1 acres to 12,931.5 acres



| PROJECT VEGETATION TYPE (ACRES)         |            |
|---|------------|
| <b>Forested Types</b>                   |            |
| Open White Spruce Forest                | (49.4)     |
| White Spruce Woodland                   | (127.3)    |
| Closed Broadleaf Forest                 | (18.5)     |
| Open Broadleaf Forest                   | (185.1)    |
| Broadleaf Woodland                      | (16.8)     |
| Open Mixed Forest                       | (36.6)     |
| Mixed Forest Woodland                   | (4.9)      |
| Dwarf Black Spruce Scrub                | (0.1)      |
| Dwarf White Spruce Scrub                | (0.2)      |
| <b>Shrub Types</b>                      |            |
| Closed Willow Tall Shrub                | (2,837.2)  |
| Closed Alder Tall Shrub                 | (5,177.6)  |
| Closed Alder Willow Tall Shrub          | (4,401.3)  |
| Open Willow Tall Shrub                  | (2,979.3)  |
| Open Alder Tall Shrub                   | (1,088.7)  |
| Open Alder Willow Tall Shrub            | (1,075.9)  |
| Closed Willow Low Shrub                 | (1,433.7)  |
| Closed Alder Low Shrub                  | (43.9)     |
| Closed Alder Willow Low Shrub           | (134.6)    |
| Open Mixed Shrub Sedge Tussock          | (548.7)    |
| Open Dwarf Birch Shrub                  | (1,116.1)  |
| Low Ericaceous Shrub Tundra             | (1,065.7)  |
| Open Dwarf Birch-Ericaceous Shrub Bog   | (1,500.2)  |
| Ericaceous Shrub Bog                    | (1,567.9)  |
| Shrub Birch Willow                      | (1,607.6)  |
| Open Willow Low Shrub                   | (7,980.5)  |
| Open Willow Low Shrub Fen               | (999.2)    |
| Open Sweetgale Graminoid Bog            | (5.1)      |
| Open Alder Willow Low Shrub             | (240.9)    |
| Open Alder Low Shrub                    | (126.7)    |
| Dwarf Ericaceous Shrub Lichen Tundra    | (12,931.5) |
| Dwarf Ericaceous Shrub Tundra           | (48,873.9) |
| Dwarf Ericaceous Shrub Tundra-Hummocks  | (4,219.1)  |
| Dwarf Ericaceous Shrub Tundra-Carex     | (1,259.3)  |
| Dwarf Ericaceous Shrub Tundra-Equisetum | (295.6)    |
| <b>Herbaceous Types</b>                 |            |
| Bluejoint Tall Grass                    | (2,897.9)  |
| Bluejoint Tall Grass Herb               | (2,912.1)  |
| Subarctic Sedge Moss Wet Meadow         | (4,309.8)  |
| Fresh Sedge Marsh                       | (321.1)    |
| Mesic Herb                              | (896.7)    |
| Fresh Herb Marsh                        | (37.7)     |
| Aquatic herbaceous                      | (26.5)     |
| <b>Land Cover Types</b>                 |            |
| Bareground/Barren                       | (2,002.9)  |
| Partially Vegetated                     | (7,093.9)  |
| Open Water                              | (3,234.4)  |
| Snow                                    | (91.9)     |

## Pebble Project EBD Vegetation Mapping



**Figure 13.1-3**  
Grouped Vegetation Mapping  
in the Mine Mapping Area,  
2004-2008

### Legend

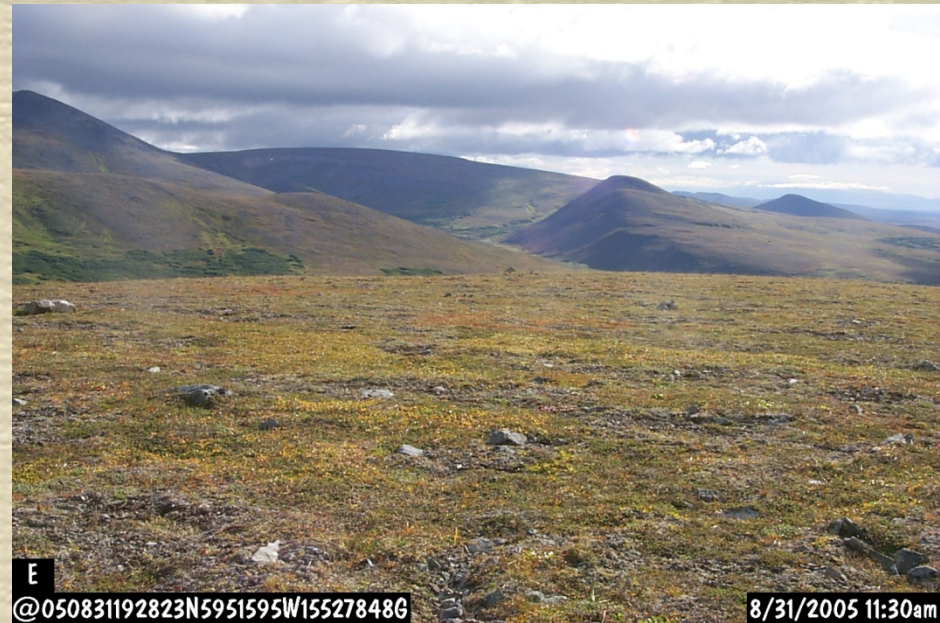
-  Mine Mapping Area
-  Mine Study Area
-  General Deposit Location
- Grouped Vegetation Types
  -  Open/Closed Forest
  -  Open Tall Shrub
  -  Closed Tall Shrub
  -  Open Low Shrub
  -  Closed Low Shrub
  -  Dwarf Shrub
  -  Dry to Moist Herbaceous
  -  Wet Herbaceous
  -  Open Water
  -  Other (Bare, Snow, etc.)



## ***Pebble Project Vegetation EBD Mapping Results***

***Vegetation Mapping for  
127,773.9 Acres***

- ***Shrub Types = 81% Cover  
(Dwarf Shrubs = 53% Cover)***
- ***Herbaceous Types = 9 % Cover***
- ***Forested Types = 0.3% Cover***
- ***Other Types = 10% Cover  
(Water, Barren, PV)***



# Questions?