

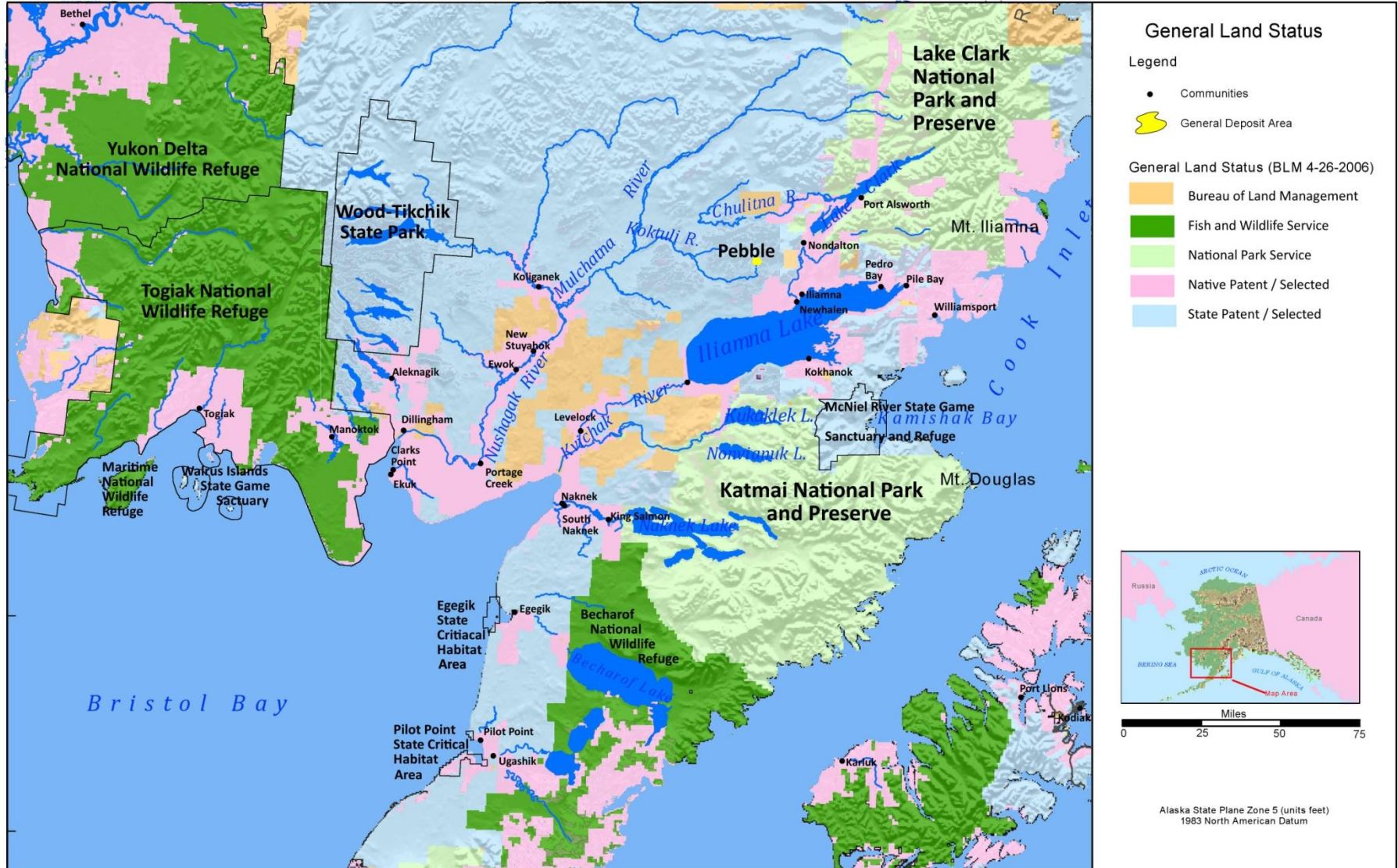


The Pebble Project and its Environmental Studies

**Alaska State Legislature
February 16, 2012**

**Ken Taylor
Vice-President, Environment**

Project Location



Study Locations

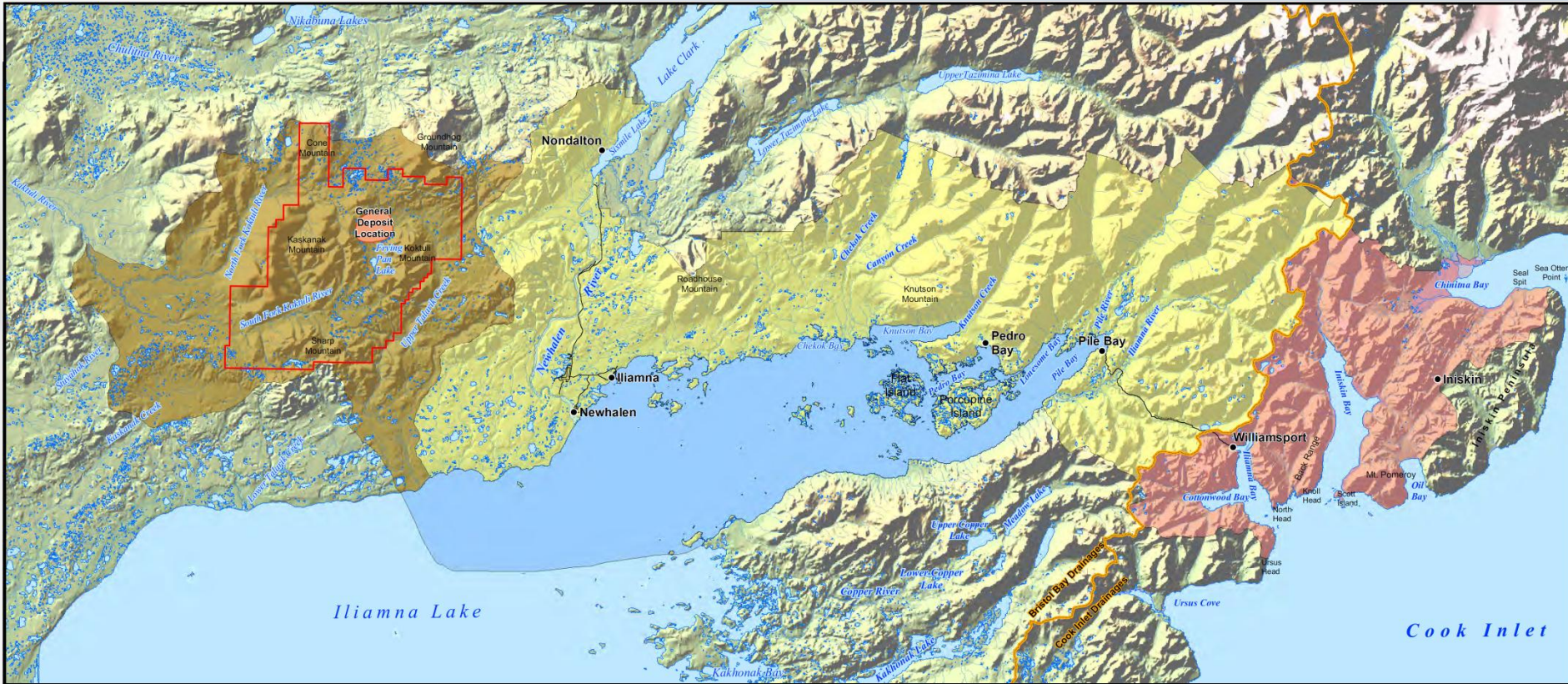


Figure 1-4
Pebble Project
Environmental Baseline Studies
Generalized Study Areas

Legend

- General Deposit Location
- Pebble Claim Block
- Mine Study Area
- Bristol Bay Transportation Corridor Study Area
- Cook Inlet Study Area
- Iliamna Lake Study Area
- Bristol Bay/Cook Inlet Drainages Boundary
- Communities
- Existing Roads



0 5 10 15 20 Miles
0 5 10 15 20 25 30 Kilometers

Scale 1:400,000

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

Environmental Study Requirements

- Quality Assurance Project Plan
- Three levels of quality assurance/quality control
- Annual study plans from each consultant

Physical Environment

- Climate
- Geology
- Physiology
- Soils
- Geochemistry
- Noise

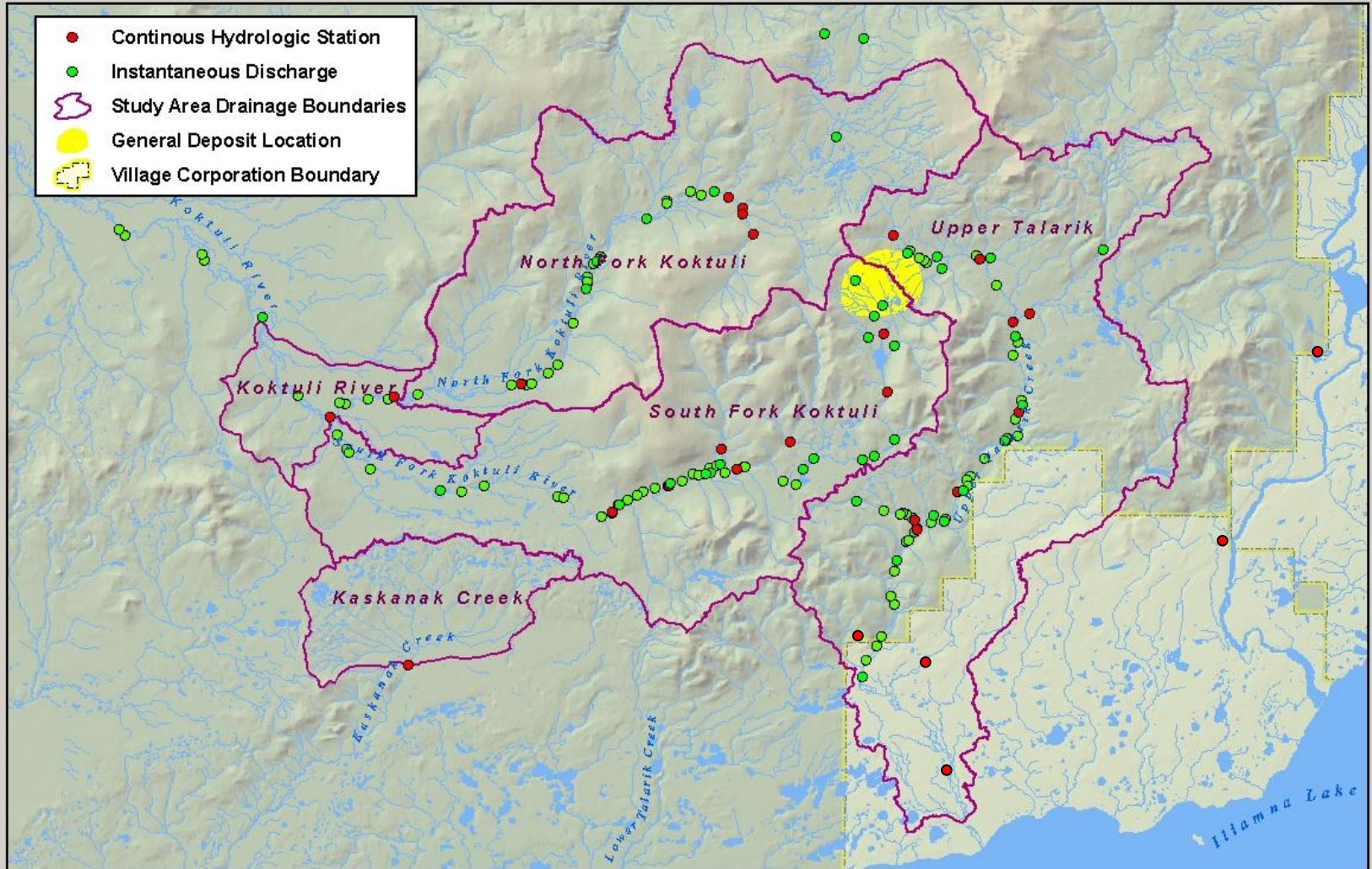


- Geotechnical/Seismic
- Surface Water Hydrology
- Ground Water Hydrology
- Water Quality
- Trace Elements

Hydrologic Studies



All Flow Measurement Locations

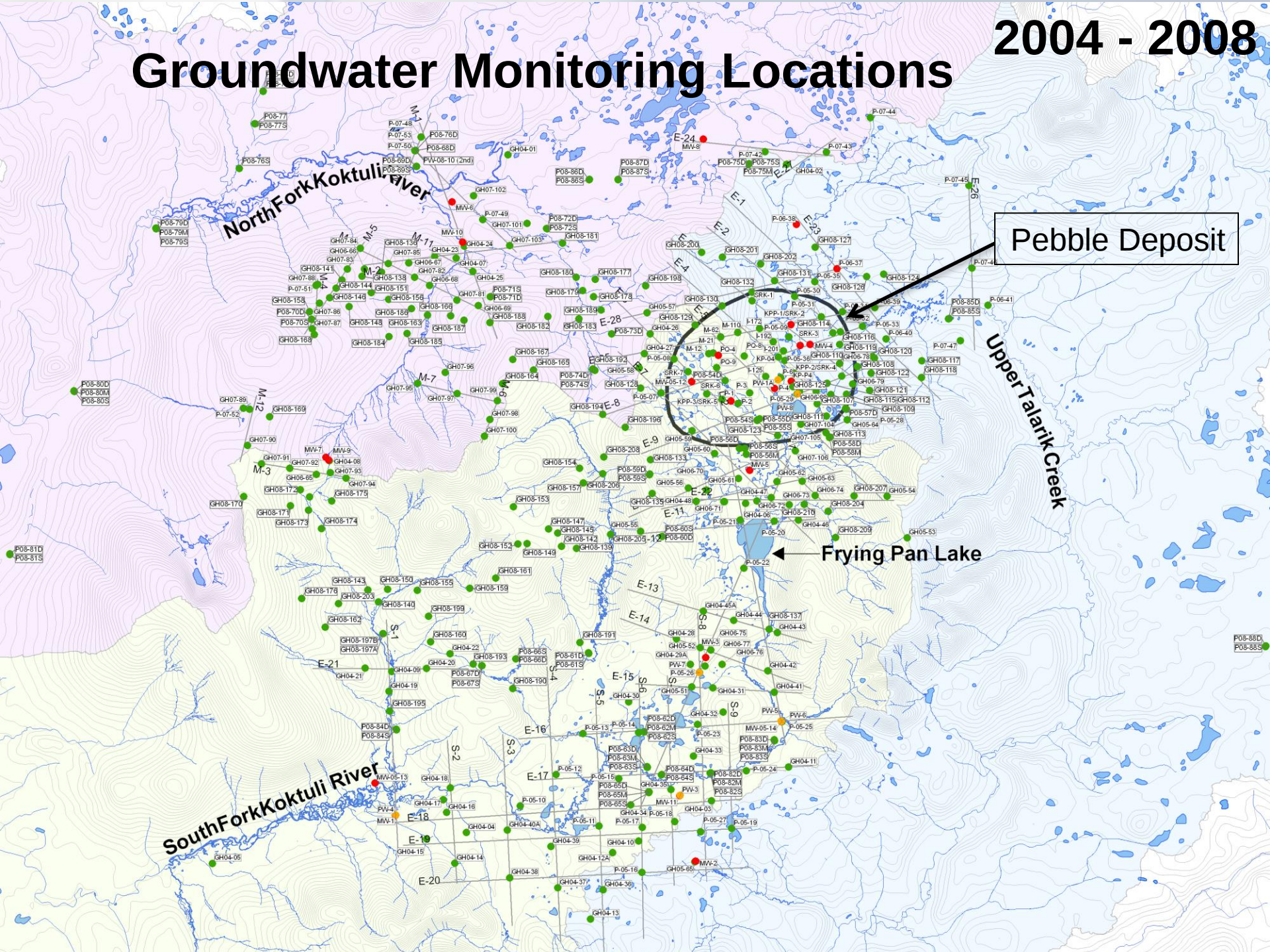


Hydro Field Activities

- **29 Continuously Gauged Stations**
- **>125 Instantaneous Measurement Sites**
- **Scheduled Monthly (now quarterly) Field Visits**
 - **41 Sites**
 - **29 - all continuously gauged stations (rating curve development)**
 - **27 - Water Quality Stations**
 - **12 Measurements per year per station**



Groundwater Monitoring Locations 2004 - 2008



Summary of Piezometer Installations

DRAINAGE	2004	2005	2006	2007	2008	TOTAL
South Fork Kaktuli in deposit area	31	31	6	8	26	102
South Fork Kaktuli remainder	37	41	3	-	61	142
North Fork Kaktuli	12	1	4	29	70	116
Upper Talarik	6	11	13	5	27	62
Small Pools Study	-	21	-	29	-	50
Total	86	105	26	71	184	472
Total Groundwater Level Measurements						14,787

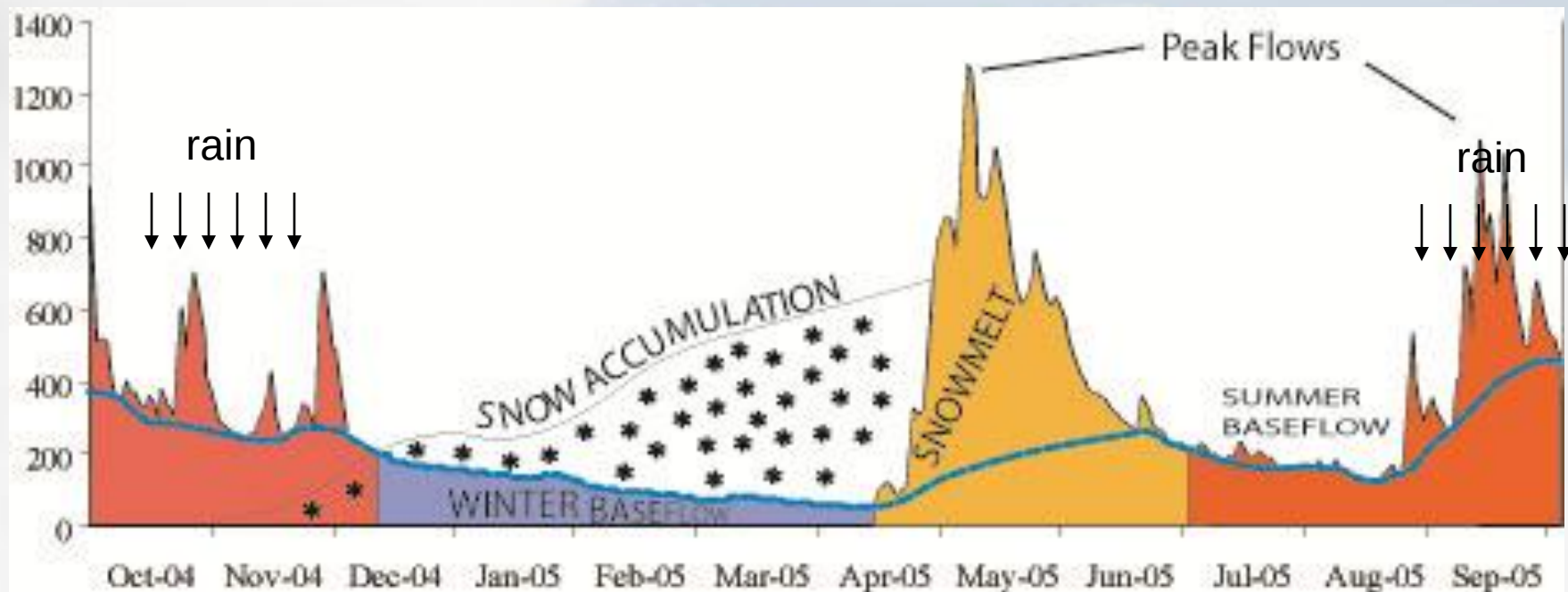


Snow Surveys 2004-2008

- Critical component for water balance modeling
- Snow cores up to 120 inches extracted and weighed, with snow-water equivalent as high as 46 inches.

Baseflow Fieldwork

- 41 Stations
- Instantaneous Measurements



Water Quality Program History and Scope

- Seven years of water quality data
 - Monthly data (winter was slightly less frequent in early years), quarterly in 2010
- Approximately 49 sampling events per site at the long term sites
- Number of stations changes over time, range of 20-30 stations
- Extensive list of parameters

WQ Parameters

Streams, Seeps, GW

- *Discontinued Effective April 2009
(streams only):*
 - As, B, Ba, Be, Bi, Ca, Co, Cr, Mg, Mo, Ni, K, Se, Si, Ag, Na, Tl, Sn, V,
 - Specific conductance,
 - acidity,
 - ammonia,
 - chloride,
 - total cyanide,
 - fluoride,
 - nitrite, nitrate,
 - phosphorus,
 - sulfate,
 - thiocyanate
- *Being retained:*
 - Al, Sb, Cd, Co, Cu, Fe, Hg, Pb, Mn, Ni, Zn.
 - Weak Acid Dissociable cyanide
 - pH,
 - hardness,
 - Total Dissolved Solids,
 - Total Suspended Solids,
 - Dissolved Organic Carbon
 - Total Organic Carbon

Water Quality

	Environmental Baseline Program Samples Collected per Year							Total # Samples	Total Lab Results
	2004	2005	2006	2007	2008	2009	2010		
Total Surface Water Quality Samples	418	600	556	1,260	651	440	97	3,395	116,623
Total Groundwater Quality Samples	60	160	177	169	185	156	138	751	73,976
Total Marine Water Quality Samples	9				32			41	1,774
Total Water Quality Samples	487	760	733	1,429	868	596	235	4,187	192,373

Trace Element Analyses

	Environmental Baseline Program Samples Collected per Year							Total # Samples	Total Laboratory Results
	2004	2005	2006	2007	2008	2009	2010		
Soil and Sediment	321	270	124	85	333	0	2	1,135	29,729
Plants	296	253	338	387	12	0	0	1,286	38,869
Fish	316	311	60	83	119	0	3	892	11,785
Shellfish	15	9	7	1	10	0	0	42	750
Total	948	843	529	556	474	0	5	3,355	81,133

Biological Environment



- Vegetation
- Wetlands
- Fish
- Aquatic Invertebrates

- Wildlife
 - Habitat
 - Mammals
 - Birds
 - Amphibians
- Threatened and Endangered Species

Wetlands Studies

17,000
field plot
surveys
completed
in project
area

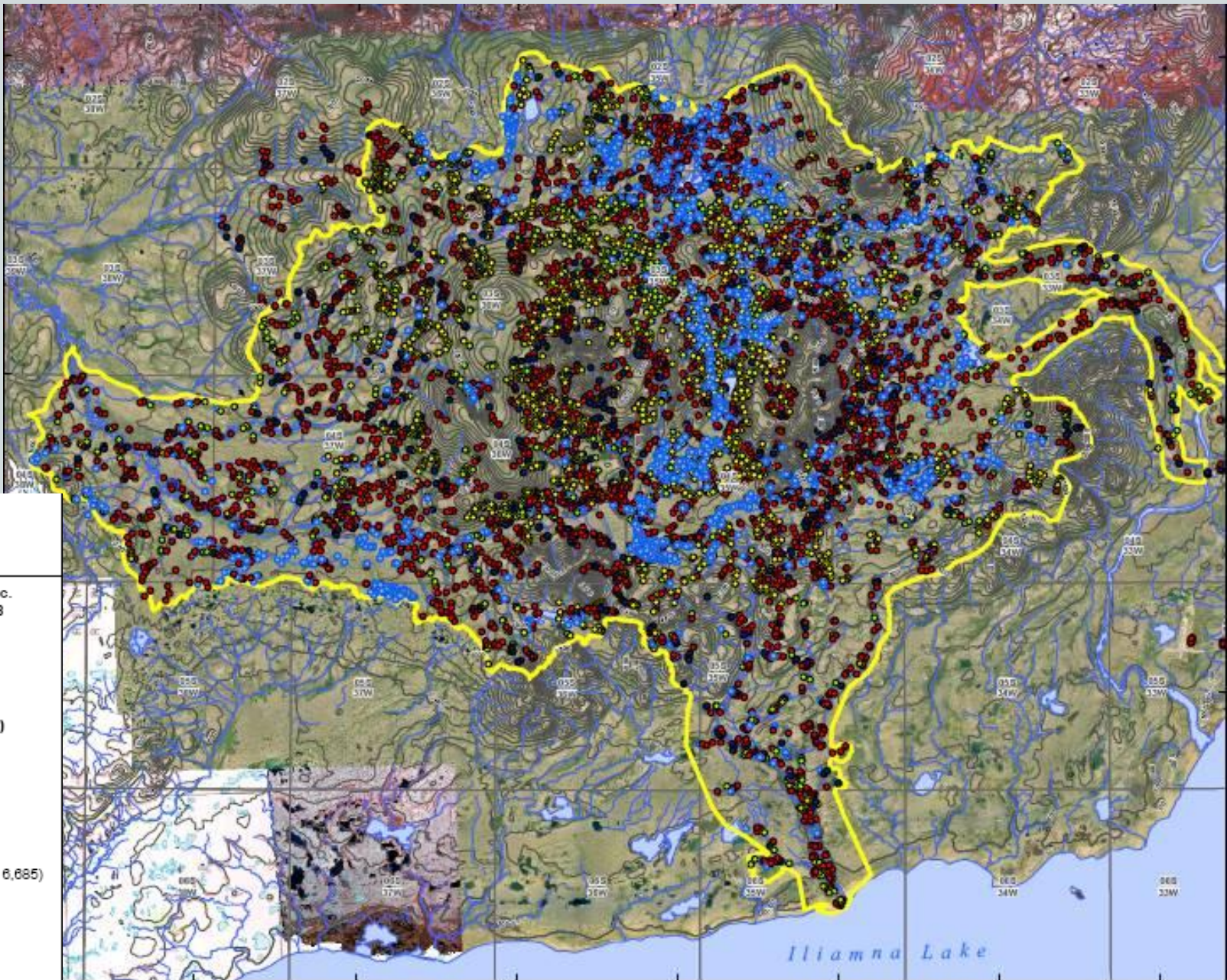


Three Parameters Plus, Inc.
3PPI and HDR 2004 - 2008
Field Plot Locations
DRAFT

Legend

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

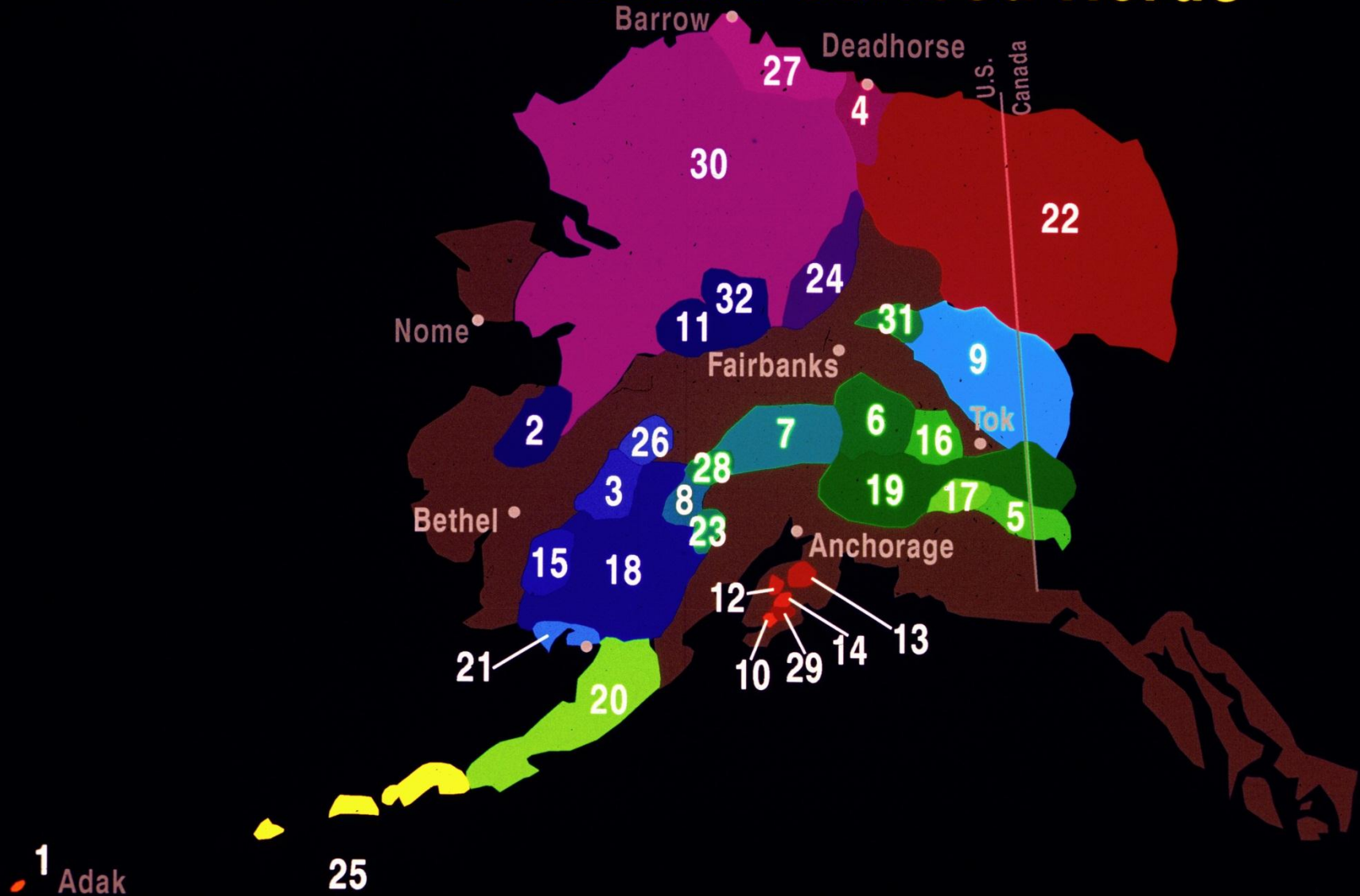
- JD (Count 4,584)
- SH (Count 2,467)
- FA (Count 932)
- SC (Count 1,570)
- WB (Count 2,237)
- Other Photo Points (Count 6,685)
- 2008 3PPI Study Area
- General Deposit Location



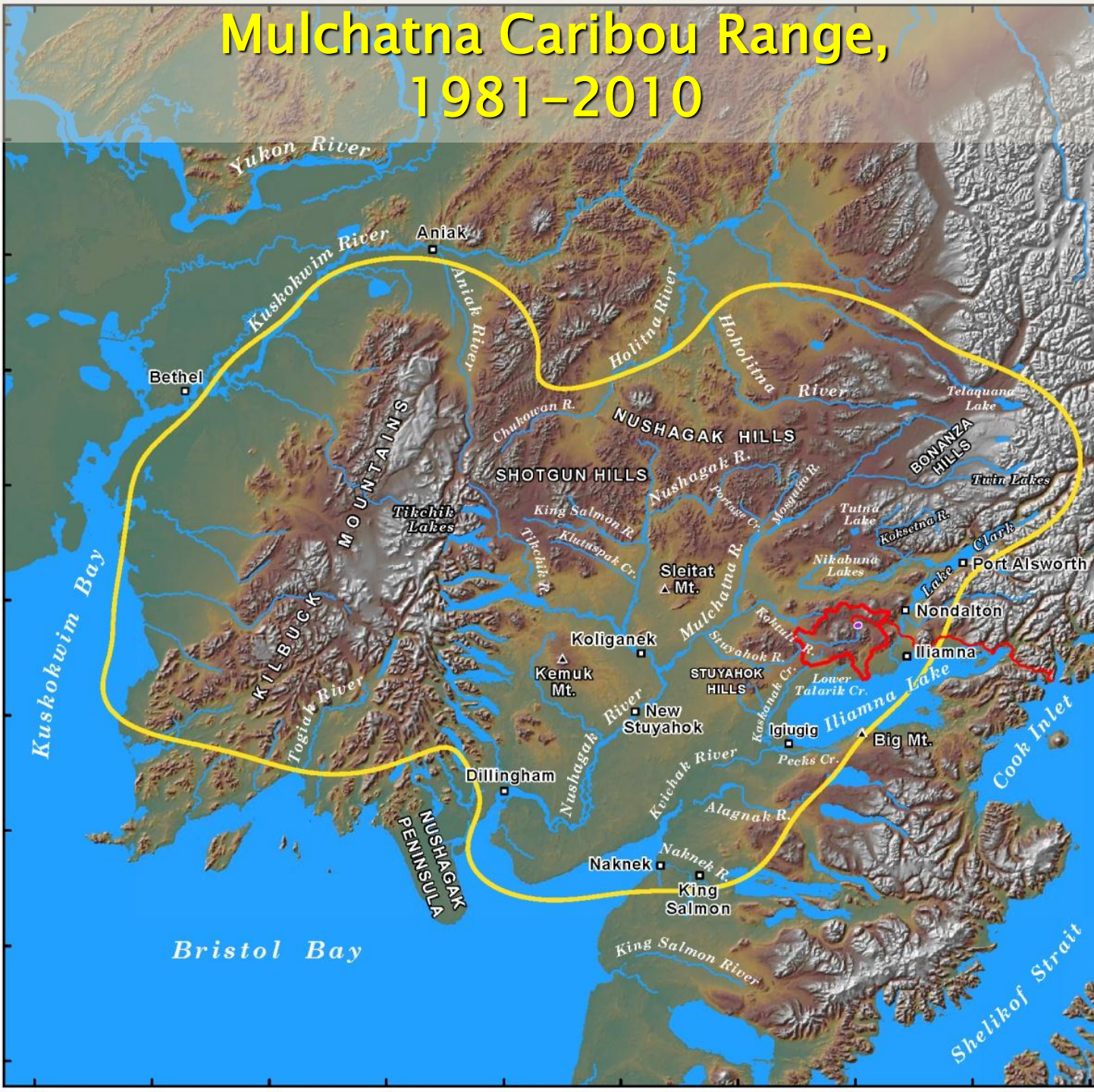
Wildlife



Location of Alaskan Caribou Herds



Mulchatna Caribou Range, 1981–2010



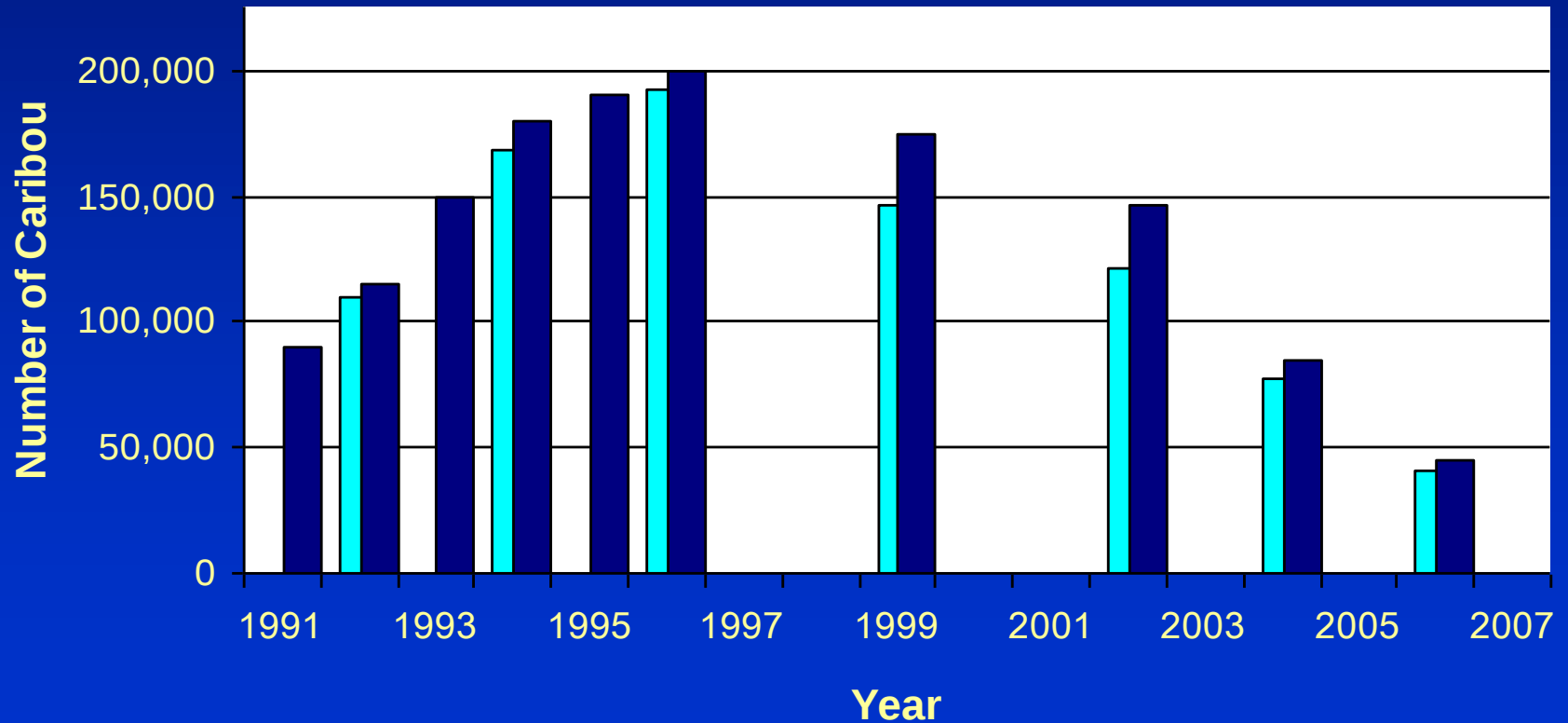
402 VHF collars

25 satellite collars

9,644 locations

Mulchatna Caribou Herd size, 1991–2006

dark blue = estimates
light blue = aerial photocensus counts



Mulchatna Caribou Herd: Summer Range Use

Summer (June 11–September 7) Areas of Concentrated Use

- High Density
- Medium Density
- Low Density
- Greater Mine Area
- General Deposit Location
- Possible Road Alignment

1981–1989

1990–1999

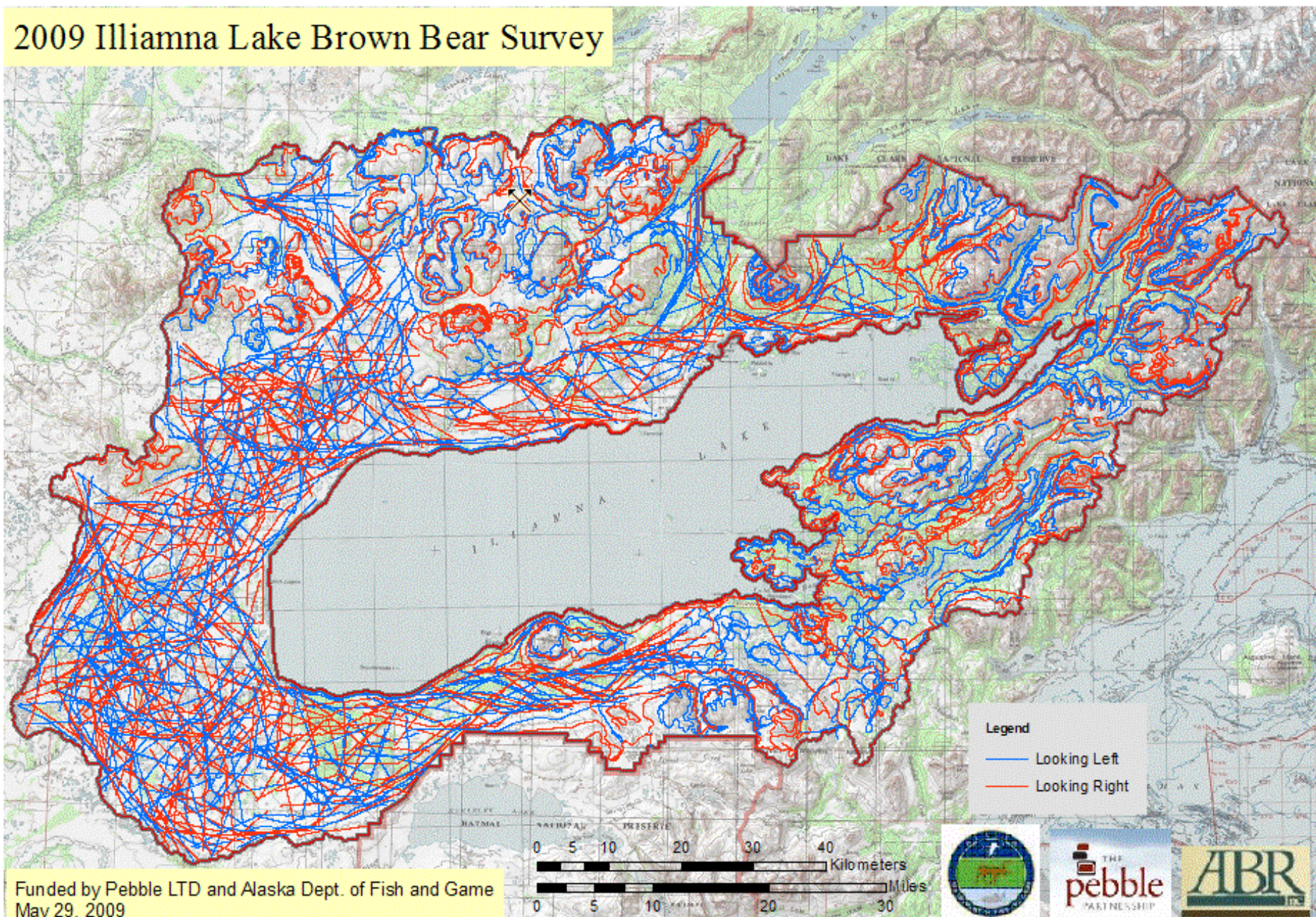
2000–2008

All Years

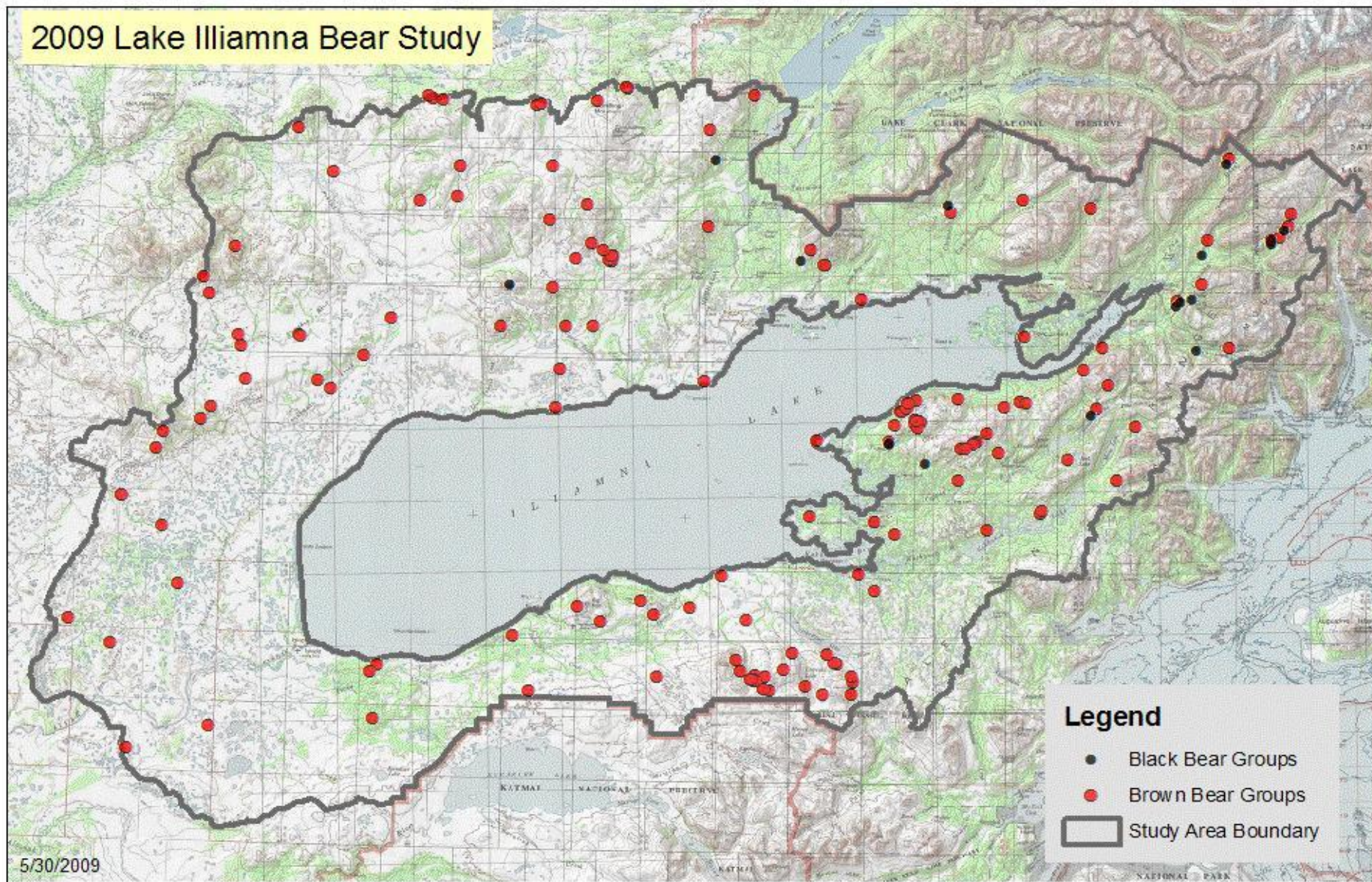
2009 Brown Bear Survey



2009 Illiamna Lake Brown Bear Survey



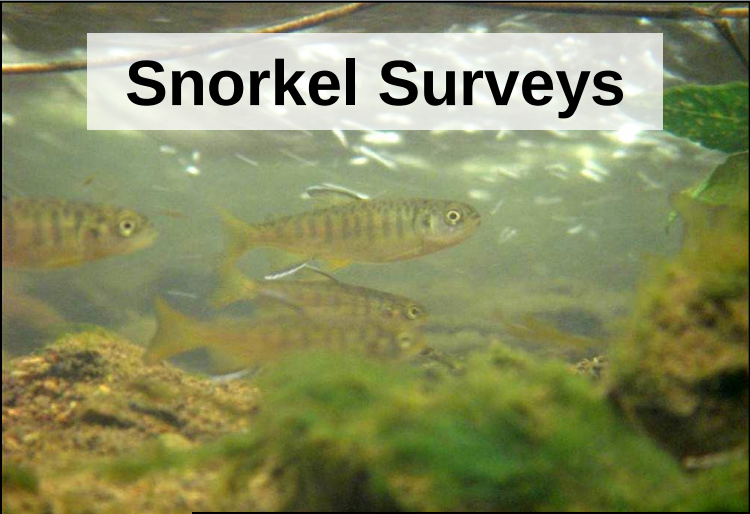
2009 Lake Illiamna Bear Study



Fish



Aerial Surveys



Snorkel Surveys



Count Towers



Radio Tracking

Document stream channel & valley form characteristics



- Largely single-thread, gravel-bedded, low gradient channels
- Influenced by glaciation: old lake deposits & glacial outwash
- High flows typically overtop stream banks
- Riparian, wetlands, & off-channel habitats extend into the valley

Aquatic Habitat Surveys



Objective 2

Characterize riverine habitat types & document distribution



Objective 3

Document locations of special habitat features



- Seeps & springs
- Beaver ponds & dams
- Intermittent flow reaches
- Lakes & ponds
- Tributaries



Objective 4

Describe quantity & types of off-channel habitats

- Beaver ponds & outlet channels, alcoves, isolated ponds, side channels, & percolation channels



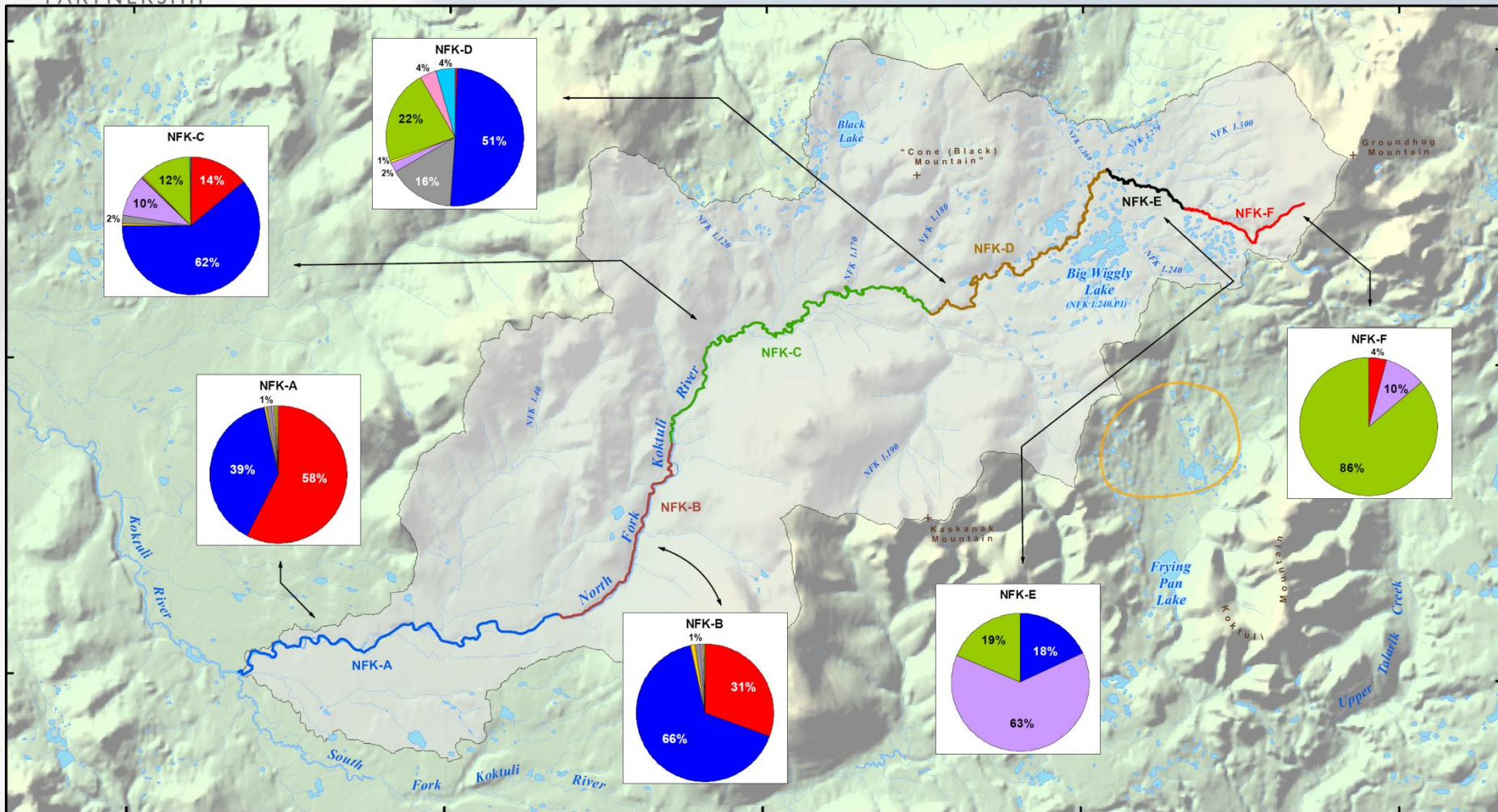
Objective 5

Describe patterns of fish distribution & abundance in mainstem, tributary, & off-channel habitats

- 3,000 sampling locations (NFK, SFK, UT, & KR)
- Snorkeling, electrofishing, minnow trapping, seining, tangle netting, angling, and dipnetting



Fish Species Composition in NFK



Legend



Objective 6

Compare fish densities among habitat types

- Number of fish per 100 m²
 - (total number of fish/total area surveyed for each species & habitat type)
- Snorkeling & electrofishing
- Representative of freshwater rearing stages



Objective 7

Describe the distribution and abundance of spawning anadromous salmon



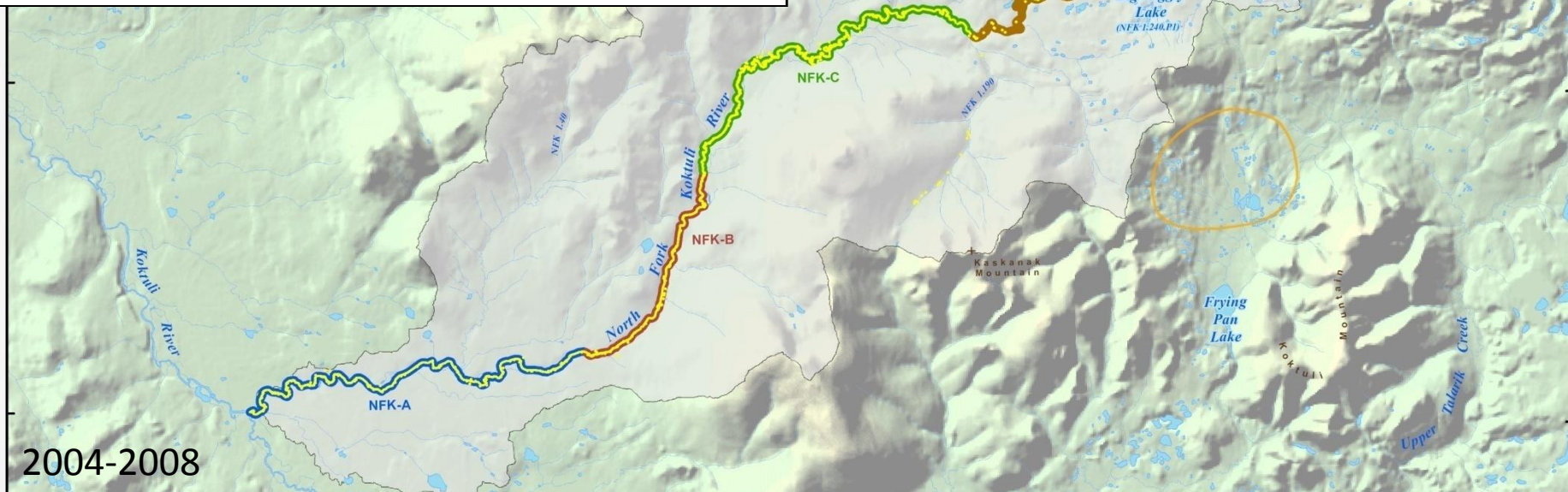
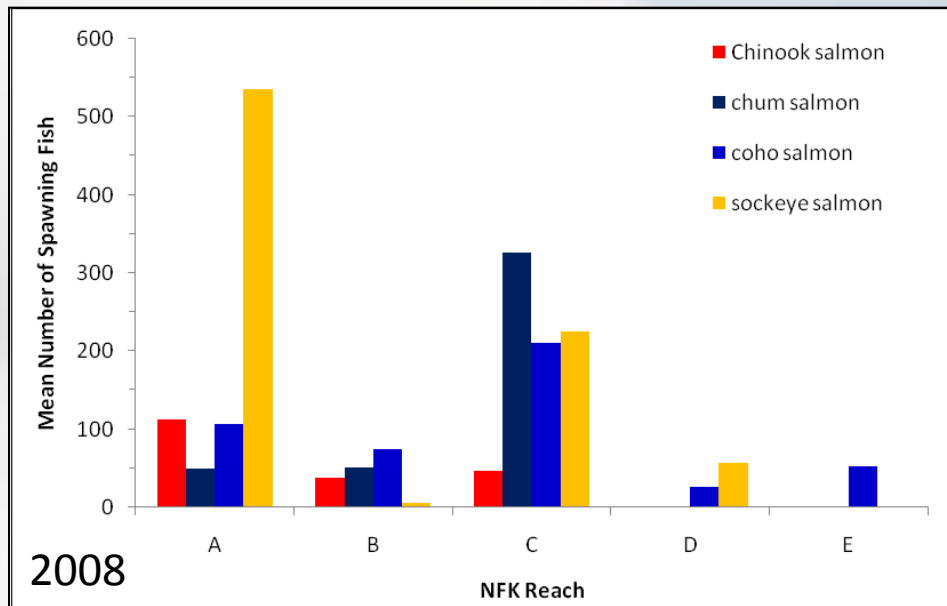
- Chinook
- Coho
- Sockeye
- Chum

Aerial Surveys

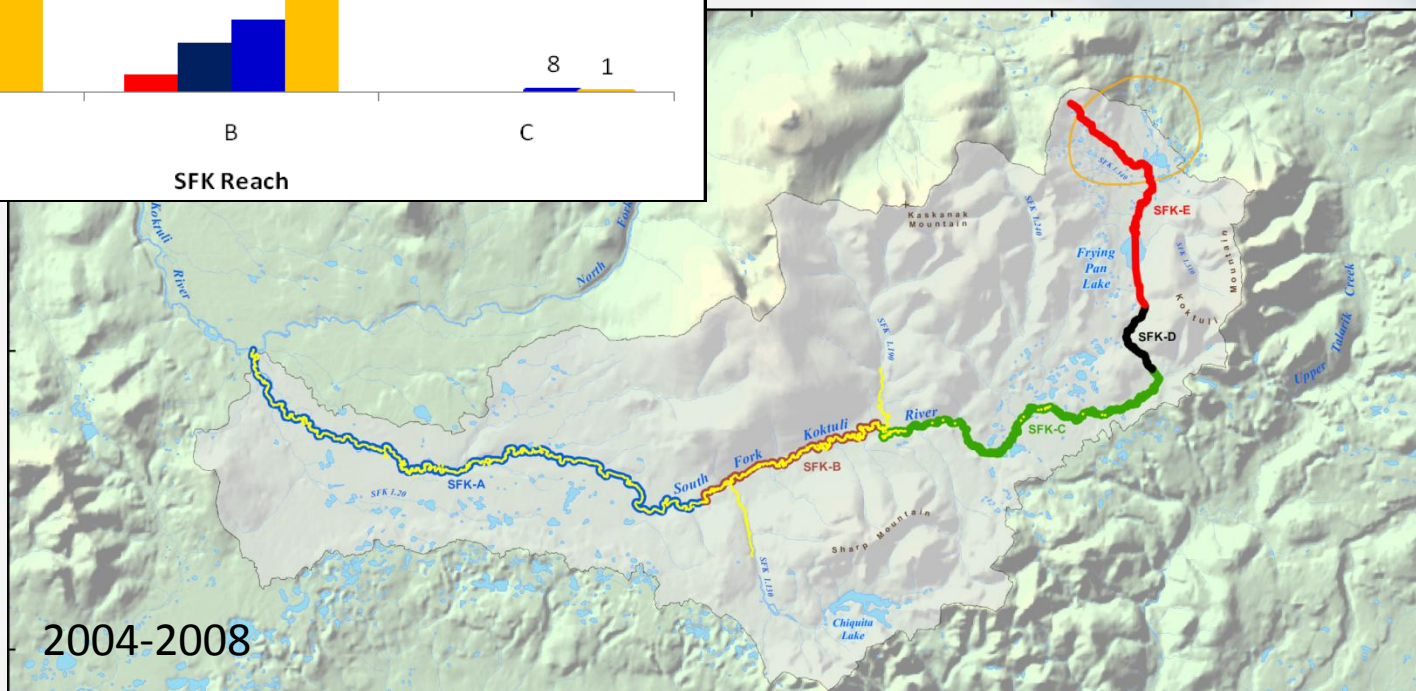
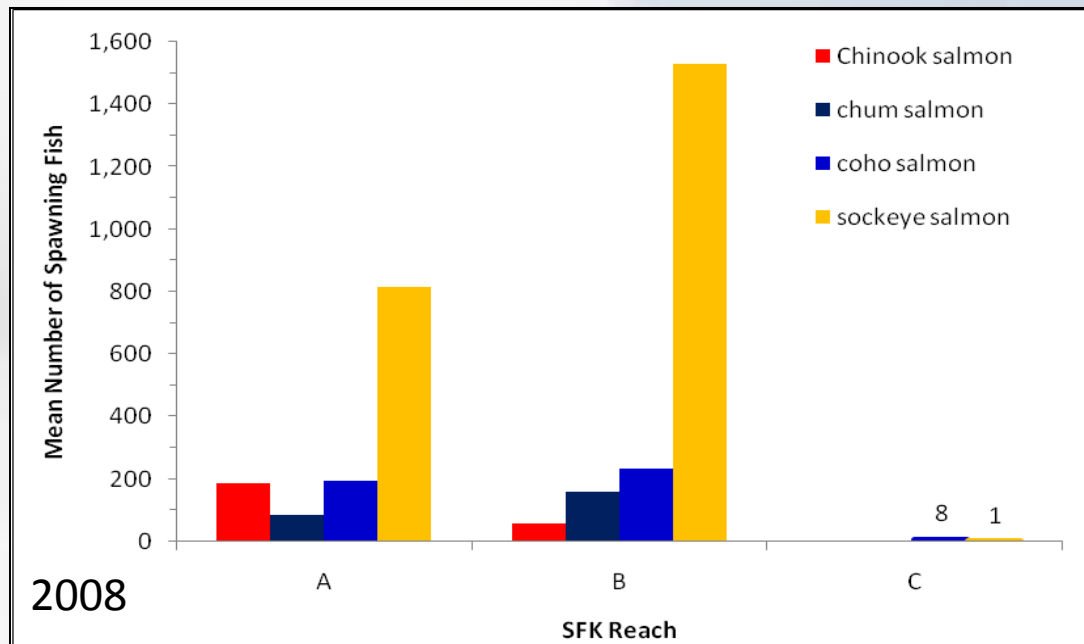
- July – October (November in 2008)
- Surveys repeated throughout spawning season
- Tower counts added in 2009 – Otter Creek & UT mainstem upstream of Otter Creek



NFK Spawning Distribution

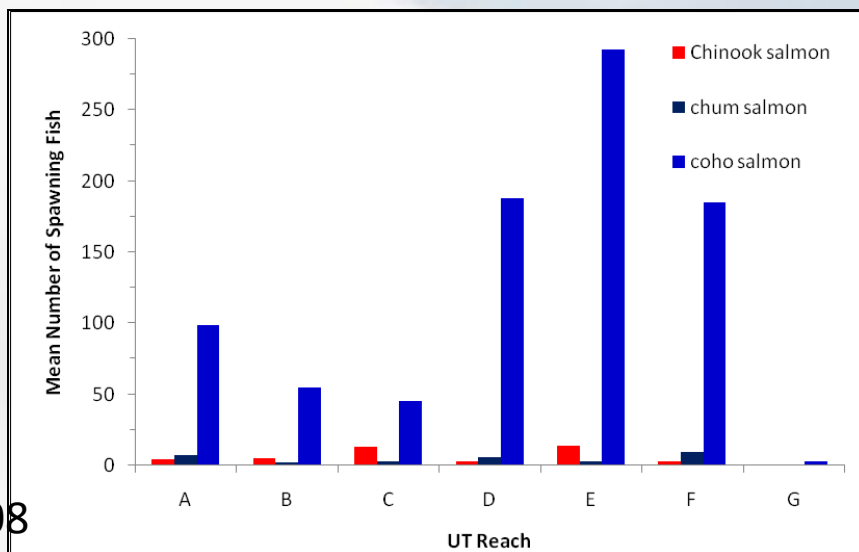


SFK Spawning Distribution

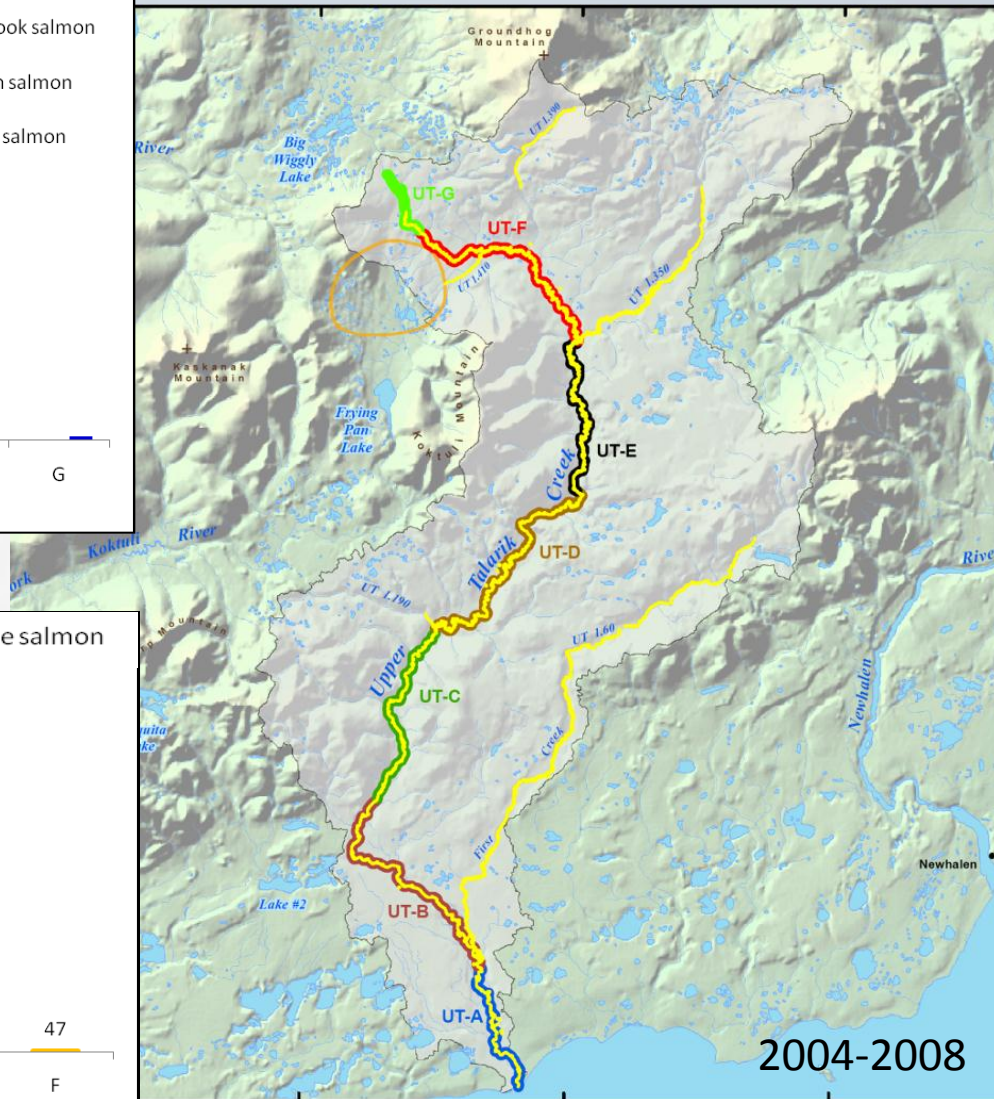
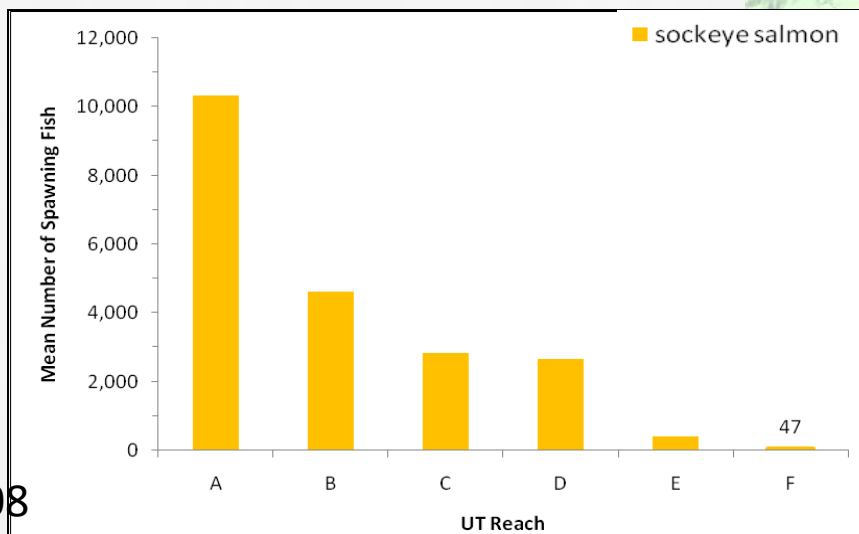


UT Spawning Distribution

2008



2008



2004-2008

Upper Extent of Fish Distribution in each Tributary



FLUVIAL GEOMORPHOLOGY

- Analysis of Channel Forming Flows
(Data from radiotelemetry studies of radio-tagged rocks)
- Assess Project Related Effects on Channel Forming Flows
- Spawning Gravel Quality

Spawning Gravel Characterization

- Pre-spawning Analysis
 - Six (6) Substrate samples collected from known spawning areas (54 samples total)
 - North Fork Koktuli – 3 sites x 6 samples
 - South Fork Koktuli – 3 sites x 6 samples
 - Upper Talarik Creek – 3 sites x 6 samples
- Post-spawning Analysis
 - Three (3) Substrate samples collected from each of the same sites (27 samples total)



Instream Flow Habitat Modeling

Models include factors such as:

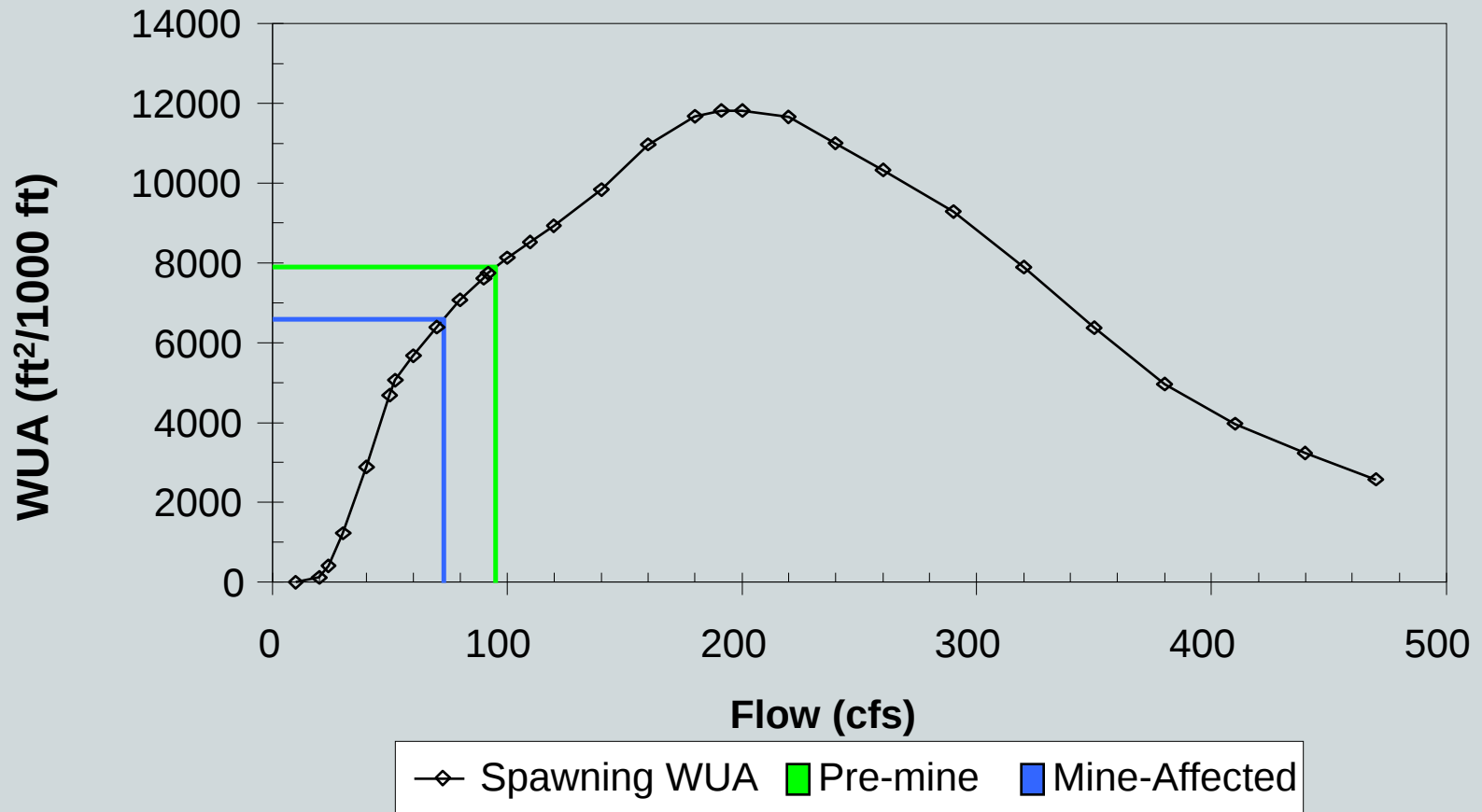
- Water surface elevations
- Water depth
- Discharge
- Velocity
- Substrate
- Channel geometry
- Cover
- Fish presence
- Habitat type:
 - Glide, run, riffle, pool, cascade, island complex



05-SFK2-RN7

Average Year

Chinook Spawning

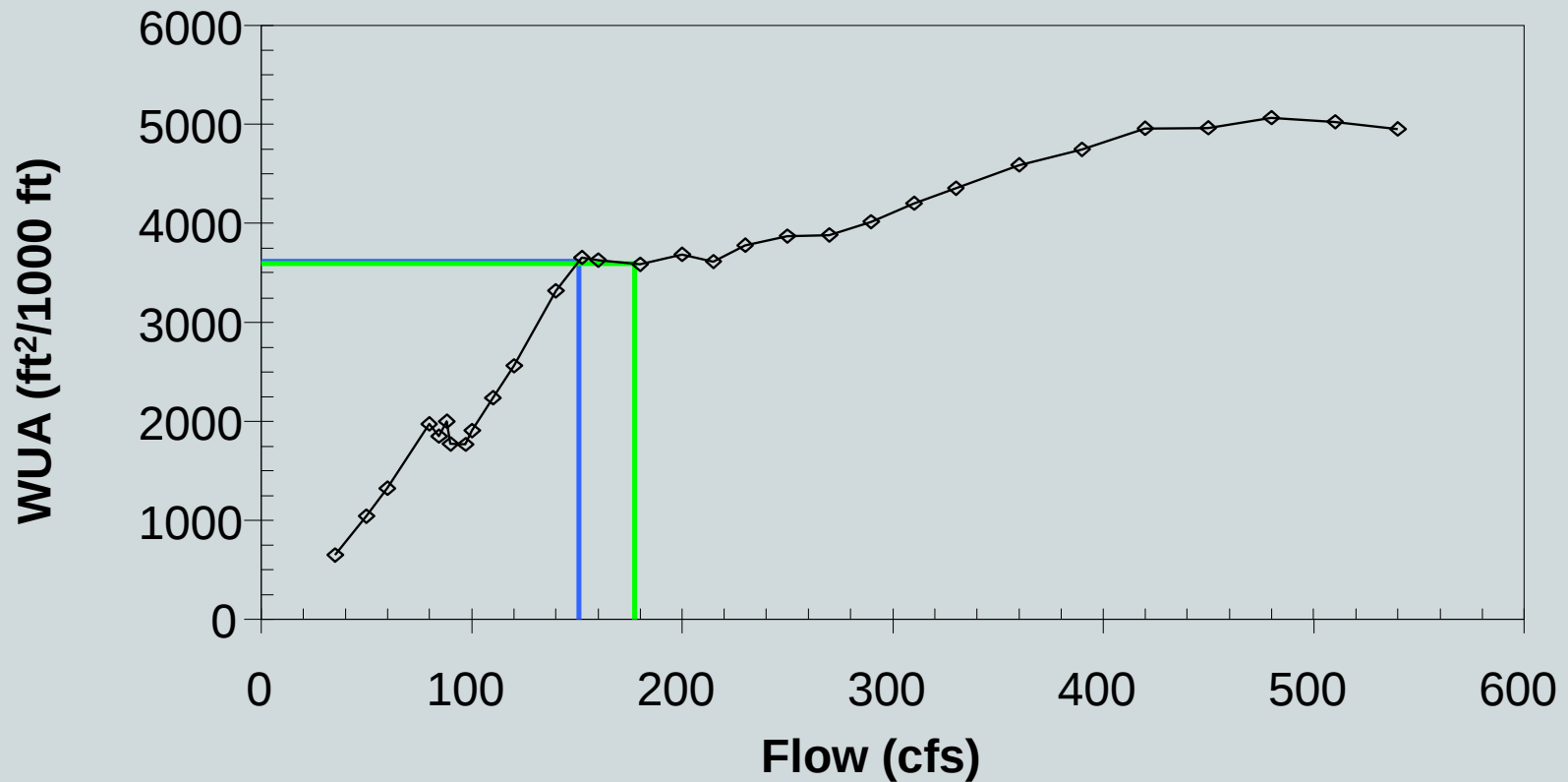


Preliminary – Subject to Revision November 2010

05-NFK1-RF1

Average Year

Coho Juvenile



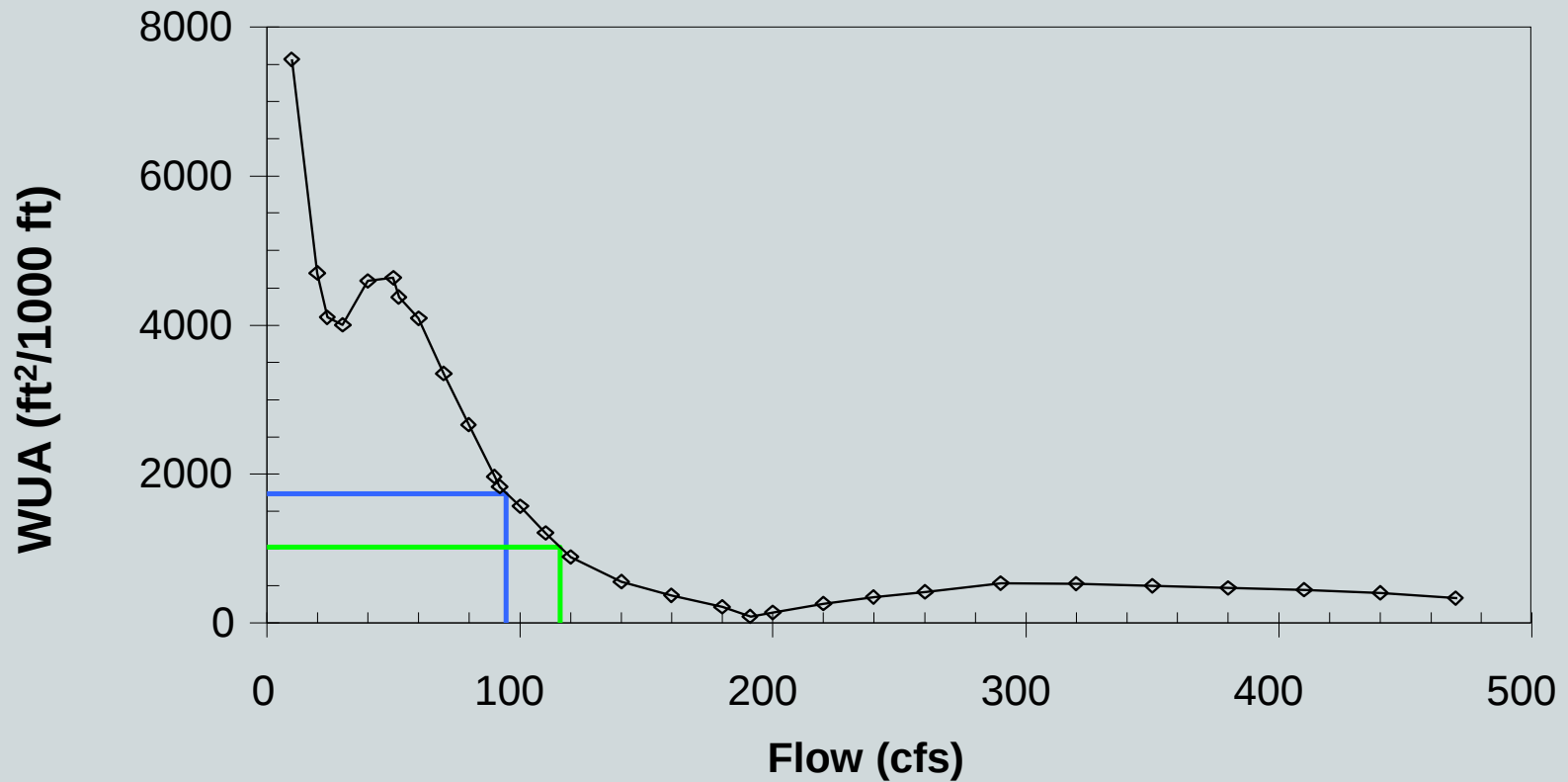
—◇ Spawning WUA ■ Pre-mine ■ Mine-Affected

Preliminary – Subject to Revision November 2010

05-SFK2-RN7

Average Year

Coho Juvenile



—◇ Spawning WUA ■ Pre-mine ■ Mine-Affected

Preliminary – Subject to Revision November 2010

Human Environment

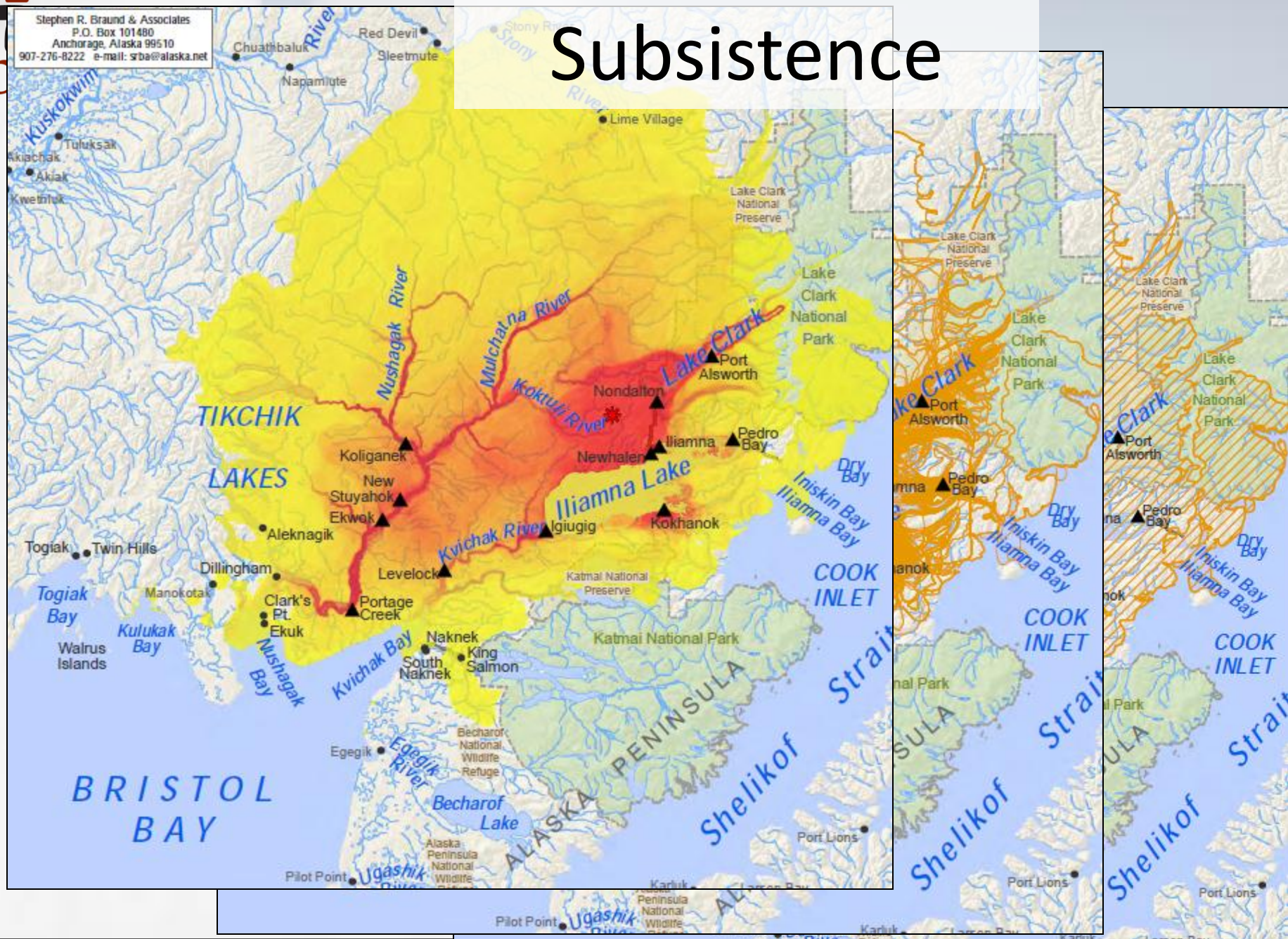
- Socioeconomics
- Cultural Resources
- Subsistence
- Visual Resources



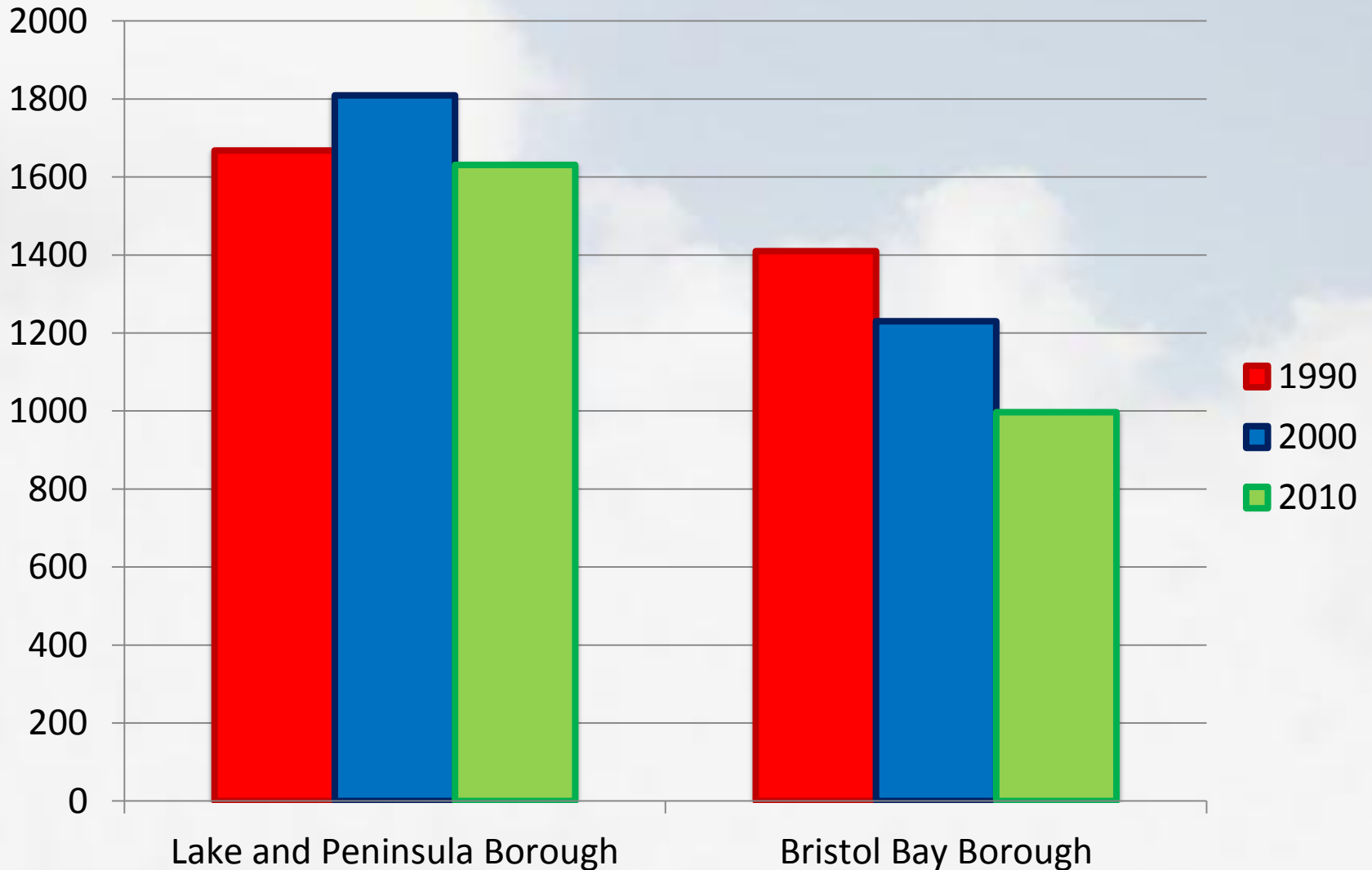
- Land Use
- Transportation
- Power
- Recreation



Subsistence

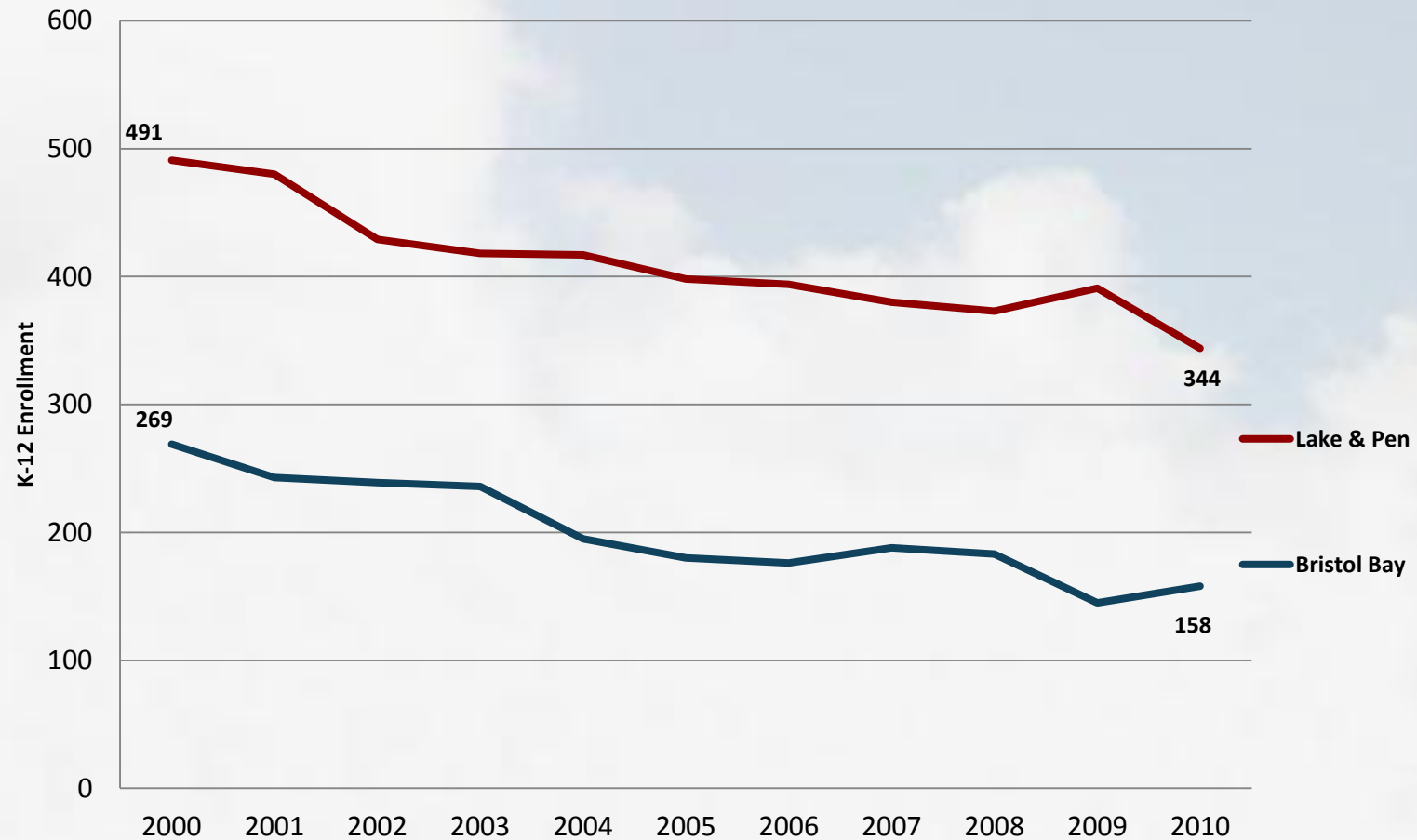


Region Population



Source: US Census Bureau

Region School Enrollment



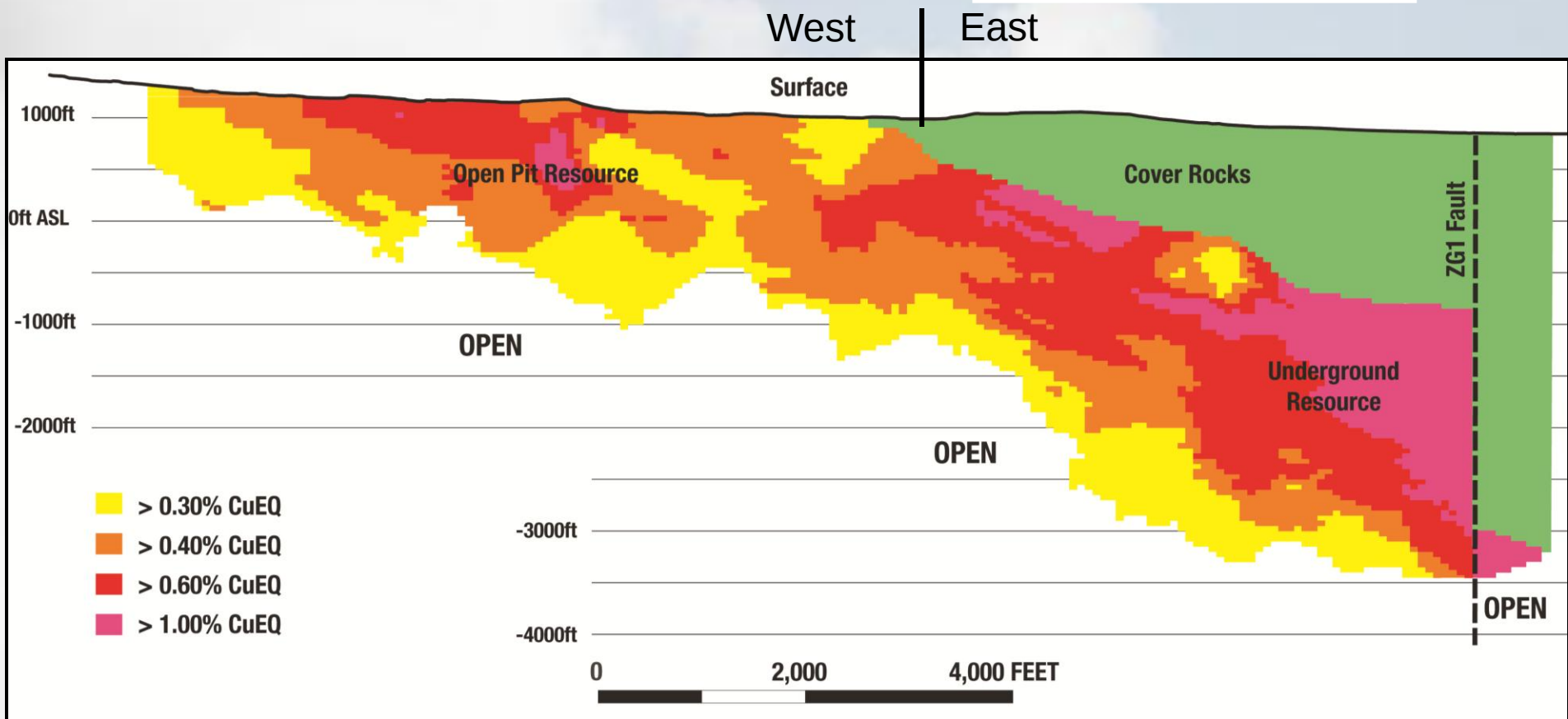
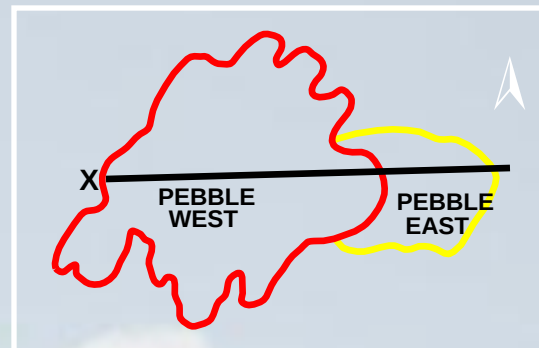
Data from AK Dept. of Education & Early Development. Enrollment as of Oct. 1 each year
<http://www.eed.state.ak.us/stats/>

Pebble Environmental Baseline Document, 2004-2008

- Consists of 53 chapters
- Contains over 100 sections and appendices
- Well over 20,000 pages
- 9,000 maps and figures
- Released to Agencies December 2011
- Released to Alaska public January 2012

Pebble Deposit

Total In-Situ Resource: 80.6B lbs Copper,
107.4M ounces Gold &
5.6B lbs Molybdenum.



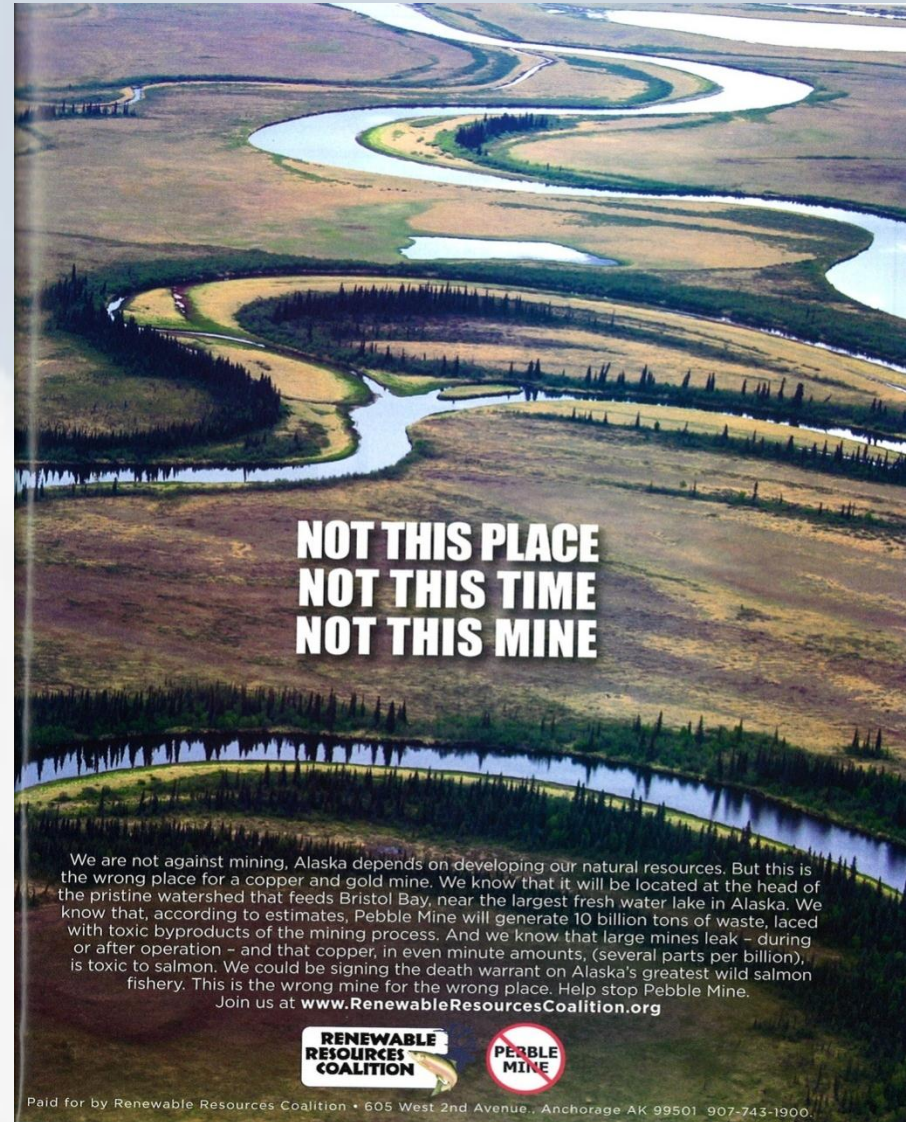
Point to Ponder.... the “politicization” of science.

“The truth is that many environmental issues we fought for ten years back are as good as solved. Even so, the strategy continues to focus on the assumption that ‘everything is going to hell’. ”

Greenpeace

(quoted in “The Skeptical Environmentalist” 1998, Bjorn Lomborg)

FACT vs. FICTION



**NOT THIS PLACE
NOT THIS TIME
NOT THIS MINE**

We are not against mining, Alaska depends on developing our natural resources. But this is the wrong place for a copper and gold mine. We know that it will be located at the head of the pristine watershed that feeds Bristol Bay, near the largest fresh water lake in Alaska. We know that, according to estimates, Pebble Mine will generate 10 billion tons of waste, laced with toxic byproducts of the mining process. And we know that large mines leak – during or after operation – and that copper, in even minute amounts, (several parts per billion), is toxic to salmon. We could be signing the death warrant on Alaska's greatest wild salmon fishery. This is the wrong mine for the wrong place. Help stop Pebble Mine.

Join us at www.RenewableResourcesCoalition.org

Paid for by Renewable Resources Coalition • 605 West 2nd Avenue, Anchorage AK 99501 907-743-1900.

Here's the real Pebble picture



Reclamation begins immediately

Minimal impact – flying out human waste



No Single Permit to Mine

FACT: Types of permits, reviews, authorizations

STATE (Some Examples)

- Plan of Operations (DNR)
- Reclamation and Bonding (DNR)
- Waste Management Permits and Bonding (ADEC)
- Section 402 APDES Water Discharge Permit
- Air Quality Permits (ADEC)
- Certification of ACOE Wetland Permits (ADEC)
- Sewage Treatment System Approval (ADEC)
- Fish Habitat and Fishway Permits (DNR)
- Water Rights (DNR)
- Right of Way/Access (DNR/DOT)
- Tidelands Leases (DNR)
- Dam Safety Certification (DNR)
- Cultural Resource Protection (DNR)
- Monitoring Plan (Surface/Groundwater/Wildlife) (DNR/DEC)
- Coastal Zone Consistency Determination (DNR)

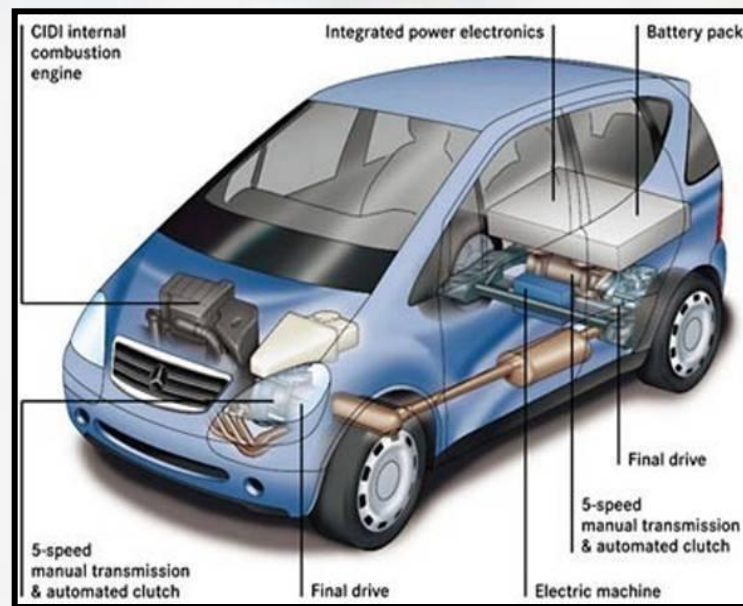
FEDERAL (Some Examples)

- US EPA Air Quality Permit review
- US EPA Safe Drinking Water Act (UIC Permit)
- US ACOE Section 404 Dredge and Fill Permit
- US ACOE Section 10 Rivers and Harbors Act
- US ACOE Section 106 Historical and Cultural Resources Protection
- NMFS Threatened and Endangered Species Act Consultation
- NMFS Marine Mammal Protection Act
- NMFS Essential Fish Habitat
- NMFS Fish and Wildlife Coordination Act
- USFWS Threatened and Endangered Species Act Consultation
- USFWS Bald Eagle Protection Act Clearance
- USFWS Migratory Bird Protection
- USFWS Fish and Wildlife Coordination Act

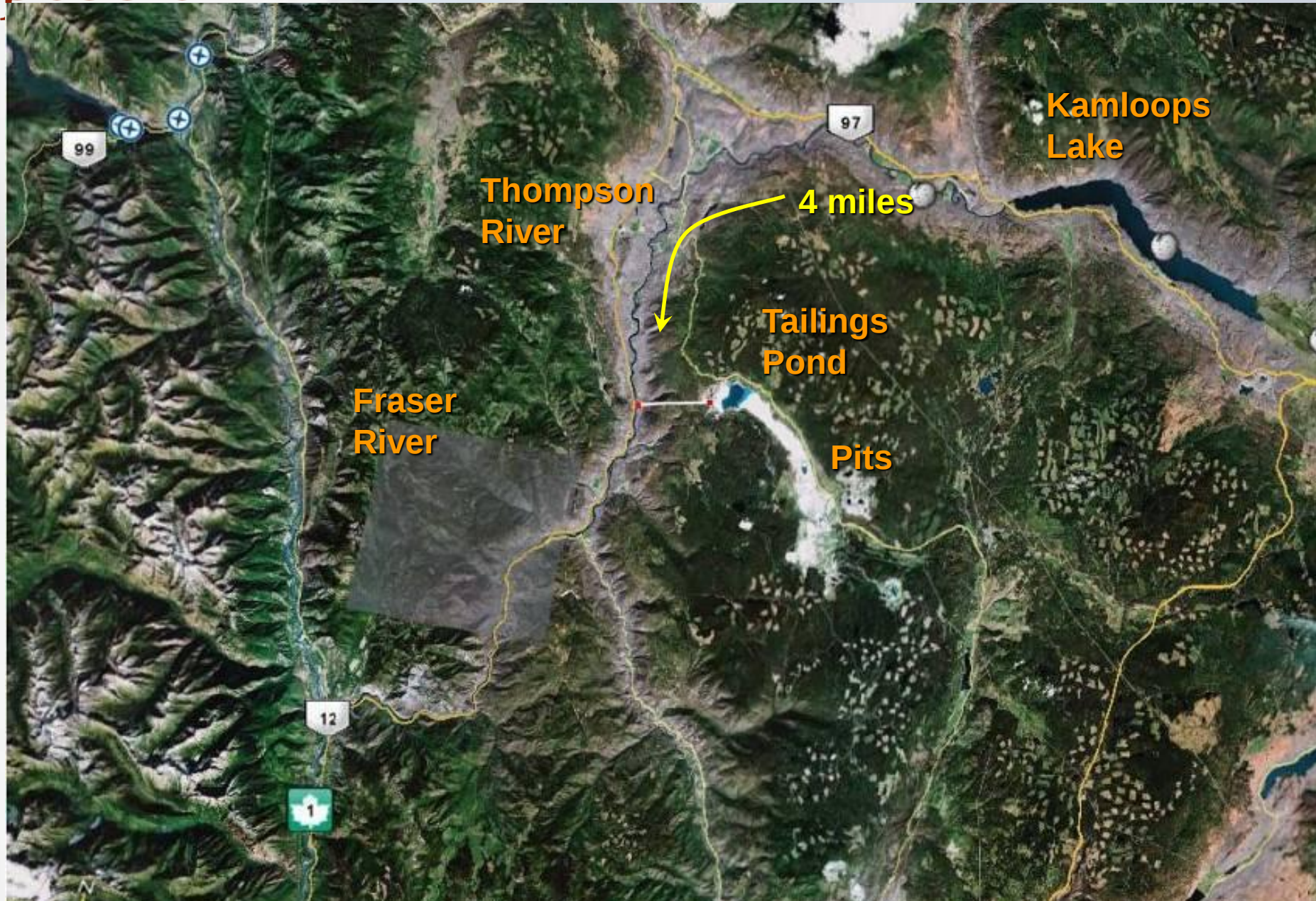
Copper – Building Block for Green Economy



- **Hybrid car** nearly 2X the copper – 42lbs vs. 78lbs
- **3MW Wind turbine** nearly 5 tons of copper
- **Solar panels** up to 60% copper



Highland Valley Mine



Thank You

Questions?