

# Mining and Fish

Can't we all just get along?

Juneau, Alaska  
April 7, 2011

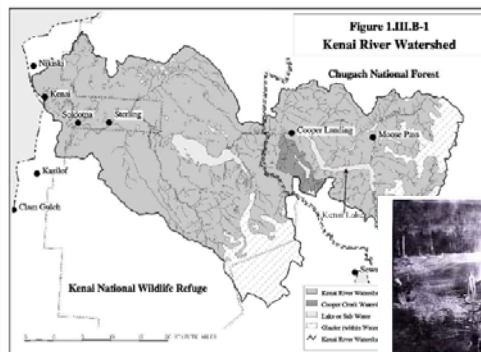


**PacRim Coal, LP**  
Dan Graham, PE, Chitna Project Manager

## Historic Examples of Mining in and around Fish habitat in Alaska

1890's to present

### Cooper Creek, Kenai River Drainage



Gold discovery reported by Joseph Cooper in 1884

Hand and hydraulic mining from 1894 to 1917, 1930's and 1950's



Recreational mining allowed since 1980

### Salmon River, Goodnews Bay Area



Mining began in 1926 with draglines

Dredge operations operated by Goodnews Bay Mining Co. from 1937 to 1975

In excess of 7 miles of stream mined through, including headwaters

Still populated by salmon (ADF&G Anadromous Stream Catalogue)



## Anvil Creek, Snake River (Nome)



Mined from 1898 through to today

Mid-1990's, efforts started to restore salmon habitat

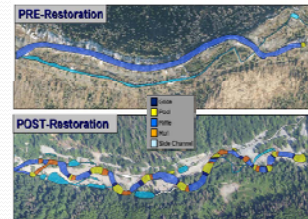
Coho salmon population growing as a result of recent efforts

## Resurrection Creek, Kenai Peninsula



- Over six miles of stream mined dating back to early 1900's
- Restoration efforts conducted in 2005 to reconstruct 1 mile of stream
- Follow-up studies by USFS show efforts successful – all 5 species of salmon using new river channel

### Sample Meander Construction



## Middle Fork Red Dog Creek

Before Mining →



After Mining →



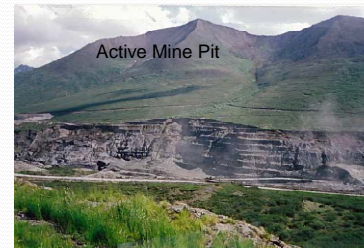
- Mine constructed in 1980's
- Stream had limited fish activity pre-mining due to natural elevated metals
- By mid-1990's, ADF&G documented increased fish usage of local streams below mine
- Periphyton and Invertebrate communities now present (were absent before mining)



## Valdez Creek, Denali Highway



- Operations dating back to early 1900's
- Early 1990's mine targeted a deposit 180 feet below a 2 mile stretch of the main channel of Valdez Creek.
- Operation encompassed an pit 2 miles long, up to 1200 feet wide and 180-200 feet deep
- Reclamation included reconstruction of the main creek channel
- New channel and final lake pit is home to a healthy fish population today



## Fish Creek, Ft. Knox Mine

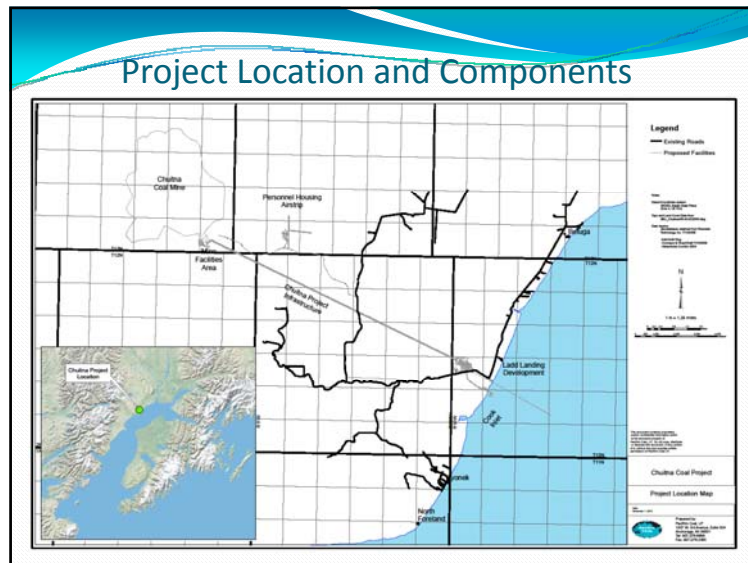


- Placer operations dating back to early 1900's and continued on and off through 1995
- Stream listed as impaired by EPA and State of Alaska
- Construction of Ft. Knox mine began in 1995
- Reclamation goal included improving fish habitat in Fish Creek below mine
- Current wetlands below mine are highly productive fish habitat

Looking West  
Photographed in 1999

## Chuitna Coal Project

(Under permitting review process since 2006 and counting)



## Revised Fish Protection Plan





### Stream 2003 Weir



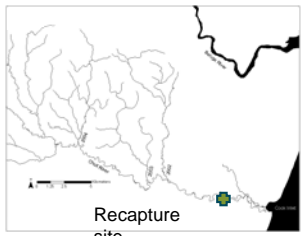
### Stream 2003 Weir

Weir necks down to a funnel that traps fish in a live box until sampled

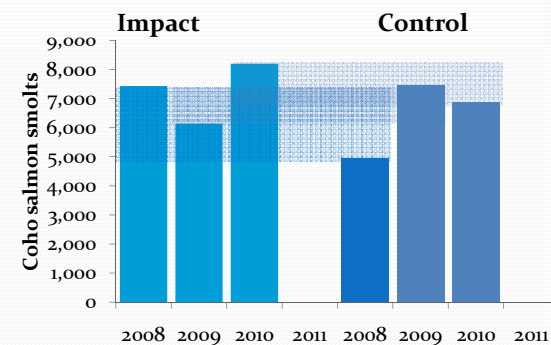


Video chute operates 24/7 to monitor any upstream migrants, or smolts that avoid the live box

### Smolts were recaptured downstream in the Chuit river using rotary screw traps



### Results (2010 data is preliminary)



Overall Chuit River smolt outmigration from above screw traps estimated at 37,000 to 45,000

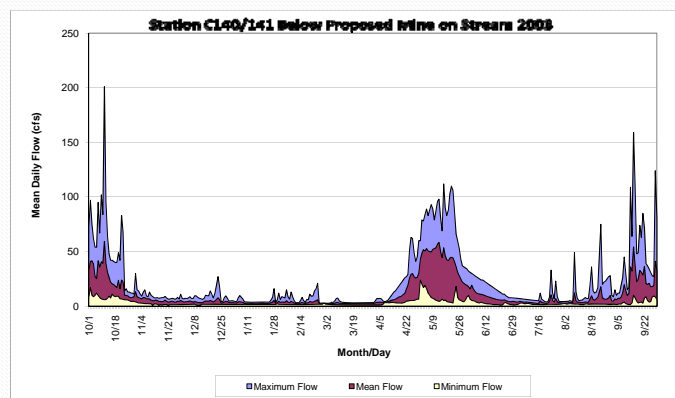
## Water Management Goals of Water Management Plan

- Maintain historic baseflow levels in below mine area and in adjacent tributaries
- Design peak discharge outflows from mine area to be at or below historic peak flow levels
- Quality of discharge water to meet APDES permit limits with existing water quality considered

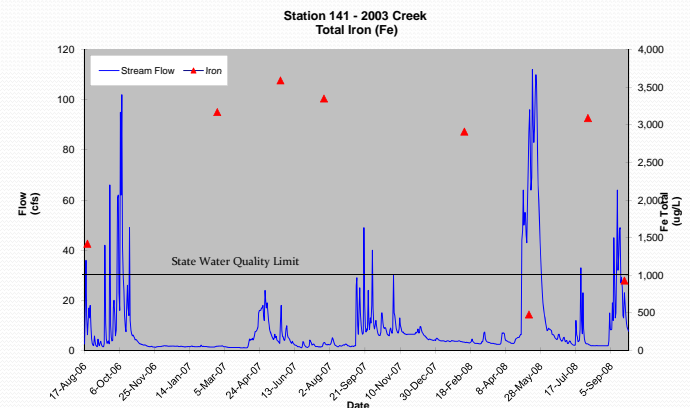
## Water Management Sources of Water from Mining Area

- Precipitation and Runoff
  - Rainfall (Stormwater)
  - Snowmelt
- Groundwater
  - Dewatering of gravels above coal formation
  - Reduce Hydrostatic Head in Sub Red 1 Sand Formation
- There is no processing of the coal needed for this project. It will be excavated, crushed and shipped to the port.

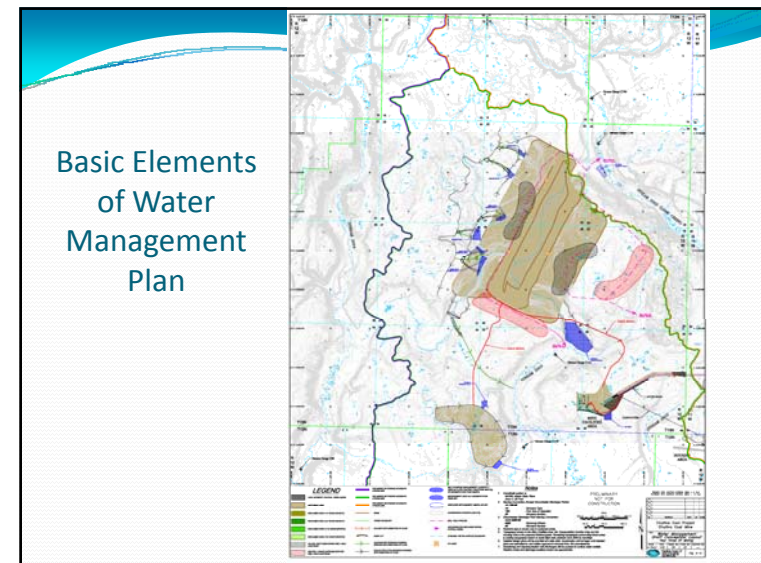
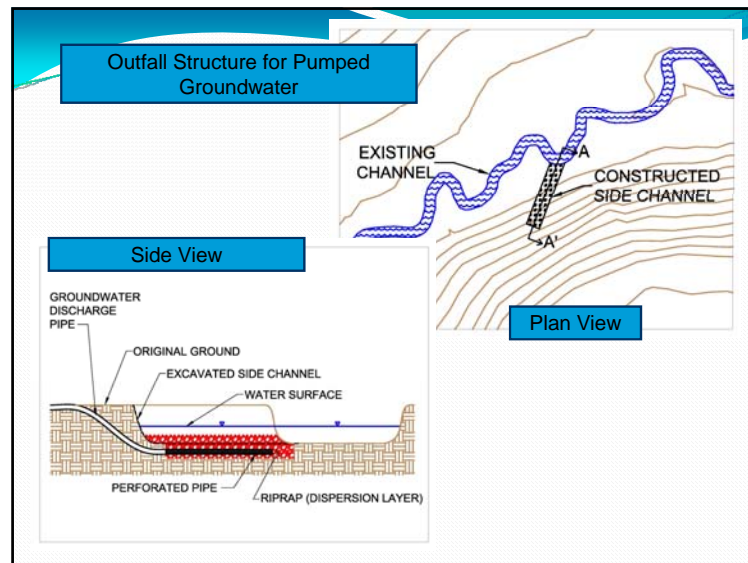
## Flow Targets for Discharge



## Water Quality – Existing Quality

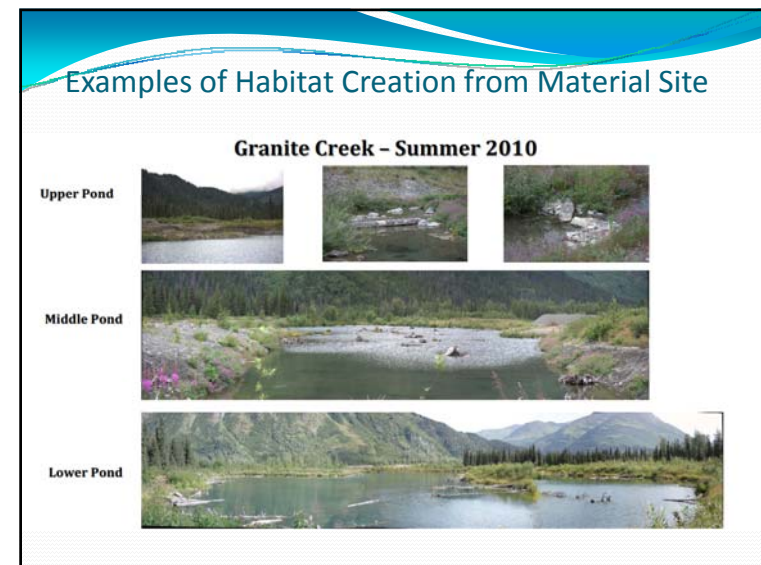






**Proposed Fish Protection  
Creation of Habitat and Habitat Reconstruction**

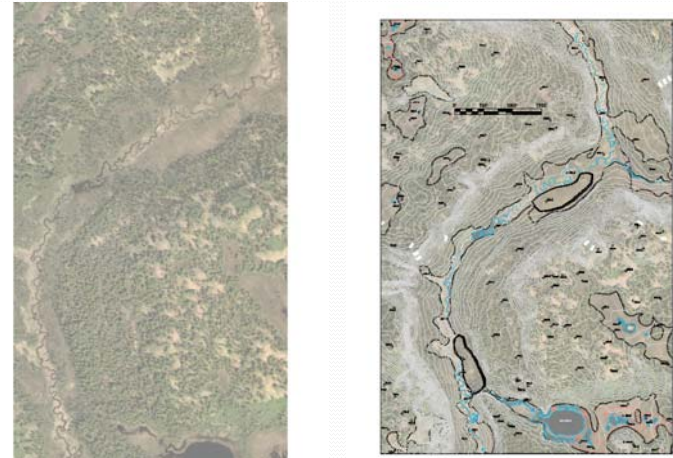
- During Mining
  - Create side channel habitat below mine area (rearing and spawning)
  - Nutrient Addition
  - Monitor and Adjust as needed
  - Alternative plan options (ARED)
- After Mining
  - Reconstruct channel in reclaimed mine area
  - Leave mitigation channels below mine area
  - Leave sedimentation ponds as lake feature
- There will be as much or more habitat after mining than exists before mining





Example of a constructed side channel  
(Illabot groundwater channel, Skagit River,  
WA)

### Potential Material Sites or Rearing Ponds



### Nutrient Addition

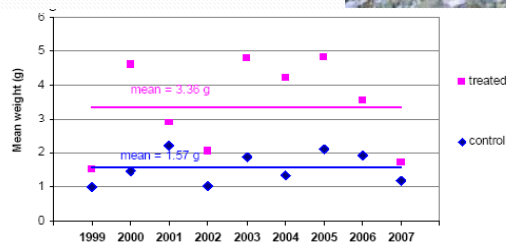


Figure 22. Mean weights of steelhead/rainbow fry captured in the upper two sites in Grise Creek from 1999 to 2007.

### Salmon Carcass Analog

#### Revillagigedo Island, Southeast Alaska

Year: 2002

(Only option that provides direct food source  
For juveniles)

Pink salmon were added to artificial channels on Revillagigedo Island, southeast Alaska in five treatments.

Each treatment differed in pink salmon carcass concentration (0-4 carcasses/m<sup>2</sup>).

Each channel was then stocked with age-0 coho salmon to document if there was an increase in growth rates from carcass additions.



#### RESULTS

Results indicated that the coho significantly increased in size and weight; however, incremental increases sharply diminished at carcass-loading levels above 1 carcass/m<sup>2</sup>.

Cutthroat trout and Dolly Varden grew significantly faster during the period when carcasses were added to the system compared to the control reaches.

Source: Whipfli, M.S., J.P. Hudson, J.P. Caouette, and D. T. Chaloner. 2002. Marine Subsidies in Freshwater Ecosystems: Salmon Carcasses Increase the Growth Rates of Stream-Resident Salmonids. Trans. Am. Fish. Soc. Vol. 132, No. 2, pp. 371-381.



## ARED System

Alaska Resource & Economic Development, Inc.  
730 Case Ave., Ste., 3; PO Box 559; Wrangell, AK 99929



## ARED System

Developed and distributed by Brian Ashton (Wrangell, Alaska)

Has been employed in Alaska streams (Anvil Creek near Nome, Moose Creek near Sutton)

Key Premise – designed to use existing wild salmon stock in a stream to enhance system fish population by improving survival of the early life stages

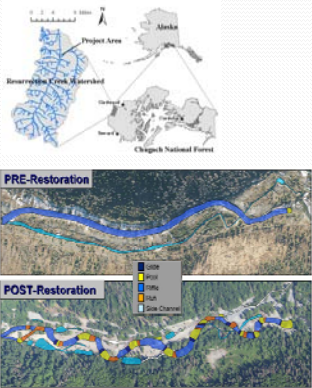
Sample of Calculation and how gains are made:

Normal Salmon spawning success rate: 5-10%  
 Survival of eggs to fry stage – 5-30%  
 Fry to Smolt survival rate – 10-20%  
 Smolt to Adult Return rate – 10-30%


ARED concentrates on the initial stages, increase success rate to near 100% and egg to fry survival to up to 80%

Conclusion: Only need small portion of the natural returning population to sustain and boost population

## Post-Mine Channel Reconstruction



Sample Meander Construction



*It is not a choice of a coal mine **or** fish – that is not an option.*

*It **MUST** be and **IS** being designed to accommodate a mine **AND** fish*