

Data and Information Needs for Hydrokinetic Energy Development

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ACEP
Alaska Center for Energy and Power

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Outline

- **AHERC goals and objectives**
- **AHERC projects in-progress and in-development**
 - **Project activities and findings**
- **Information and data needs to facilitate development of hydrokinetic energy in Alaska**

AHERC Structure & Purpose

- Resides within ACEP which reports to the INE director
- Focused on developing technology, methods, and information to facilitate the development of an environmentally compatible hydrokinetic power industry in Alaska
 - Hydrokinetic power resource assessment
 - Evaluation of interactions between aquatic environment and hydrokinetic turbines.
 - Develop technology and methods to mitigate challenges
 - Develop and disseminate data and information needed by stakeholders to make informed decisions
- Provide a statewide research and information resource
- Strategic plan developed and creating an advisory council
 - Industry, resource agencies, regulatory agencies, utilities and power advocates

AHERC Projects and Activities

- **Projects in-progress**
 - **Tanana River characterization at Nenana (AEA)**
 - The river environment & its potential impact on hydrokinetic devices (hydrodynamics, debris, fish, sediment, ice, river bed morphology)
 - **Debris mitigations study and technology development (AP&T/Denali Commission)**
 - Debris characterization and mitigation technology development
 - Fish
 - New Energy Turbine technology assessment (with ABS)
 - **Subsurface debris flow characterization in the Tanana River at Nenana (ORPC/ Denali Commission)**
- **Projects in-development**
 - **Hydrokinetic power generation device technology development, assessment, and demonstration**
 - Vortex Hydro
 - Pulse Tidal
 - Boschma Engineering
 - Baker Hughes

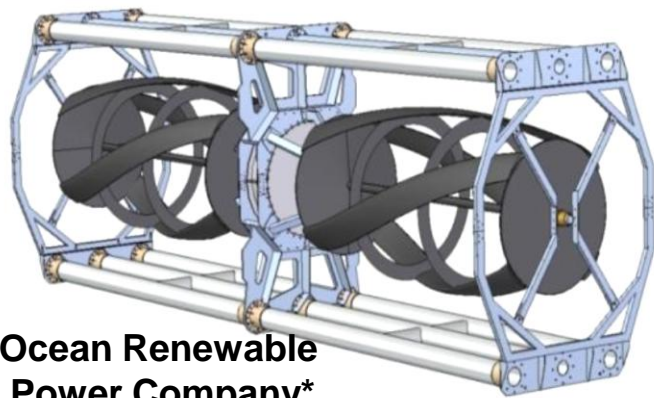
Hydrokinetic Generation Devices

Cross-flow turbines

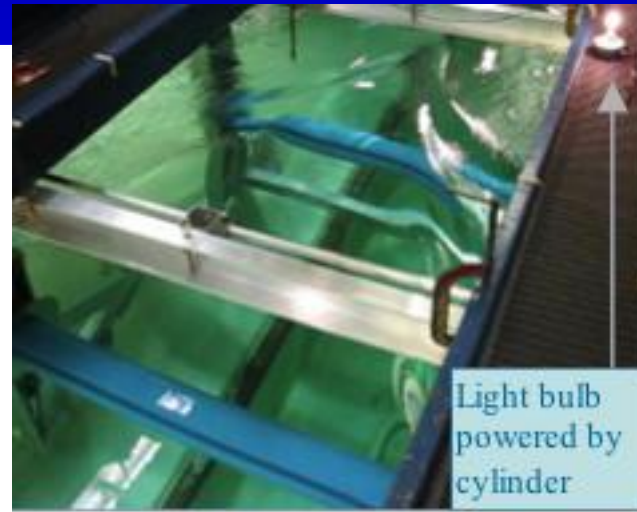
New Energy*: Encurrent



Pulse tidal* hydrofoil



Ocean Renewable Power Company*



VIVACE*: vortex induced vibration

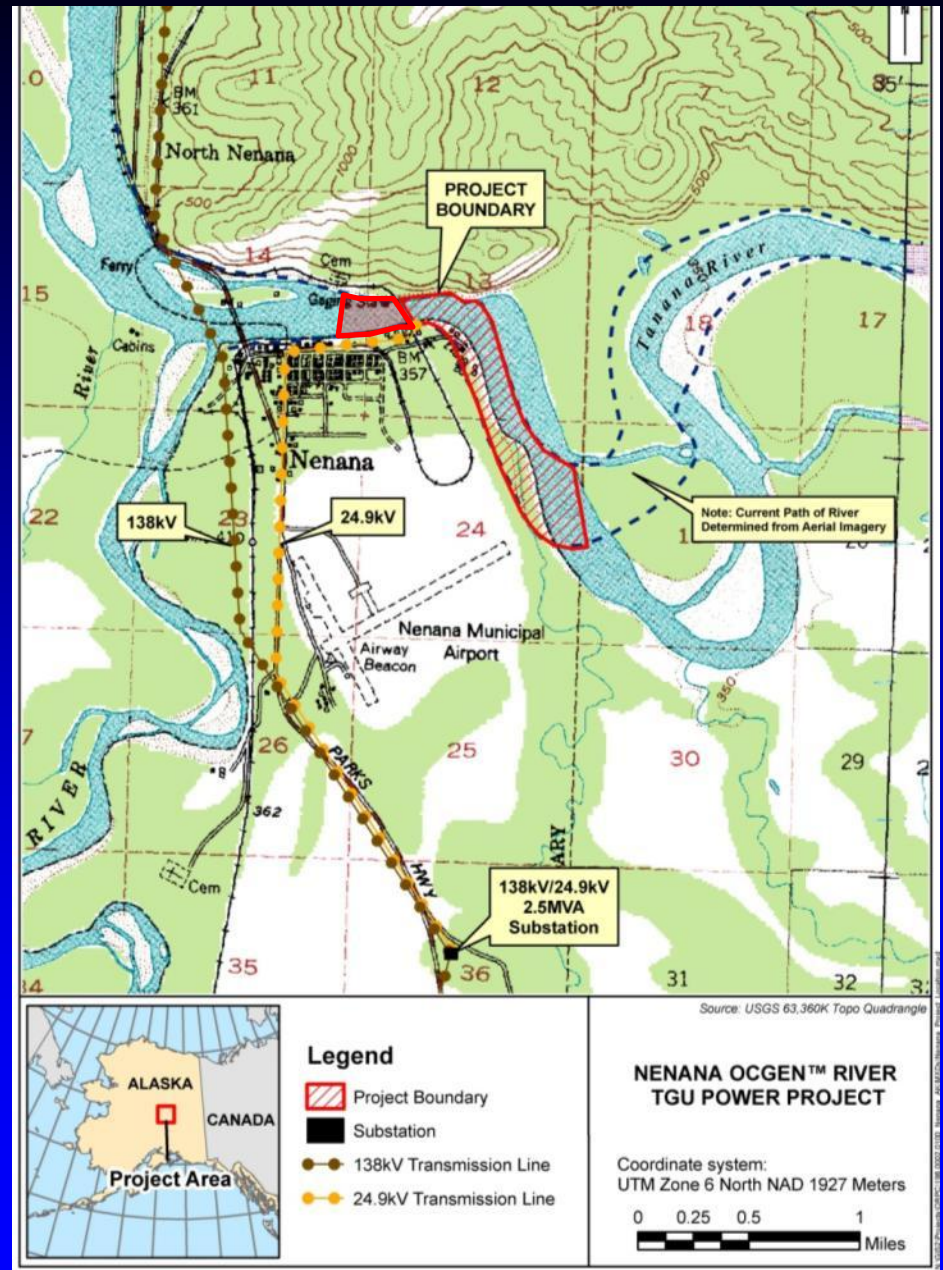
Light bulb powered by cylinder

- **Tanana River Test Site Development** (Nenana, AK)

- In collaboration with ORPC

- **Goals:** Assess river conditions prior to - and after - installation of a hydrokinetic turbine

- The river power resource: summer & winter
 - The river environment
 - River debris conditions
 - Fish behavior and mortality
 - Turbine technology test site



Bathymetric, hydrodynamic, & sediment Surveys

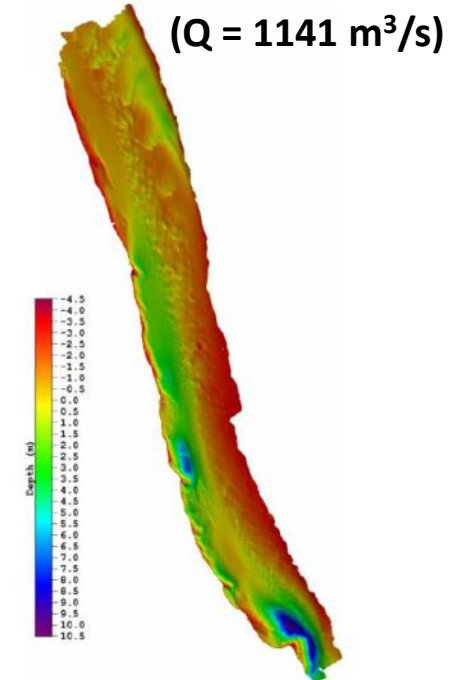


Conducted by Terrasond

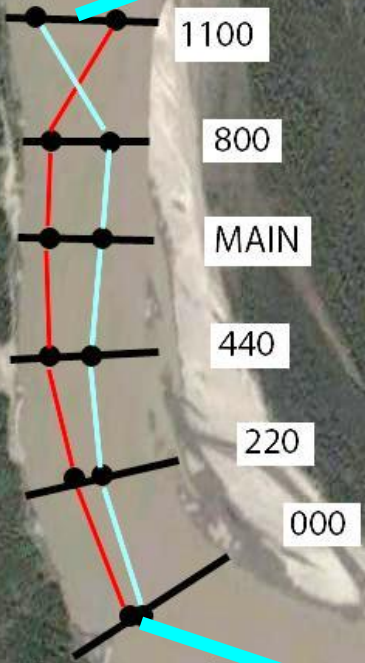
MV Irish Eyes



- Multibeam Echo sounder
- GPS – RTK
- ADCP

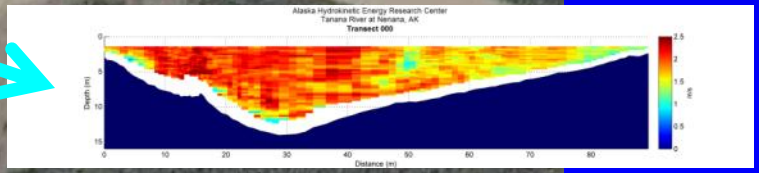
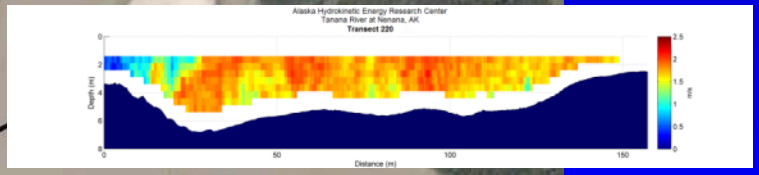
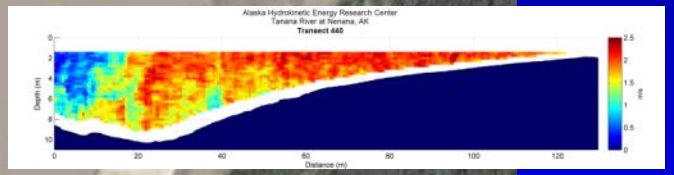
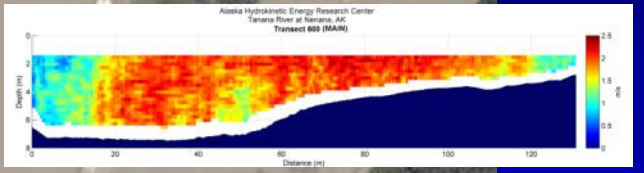
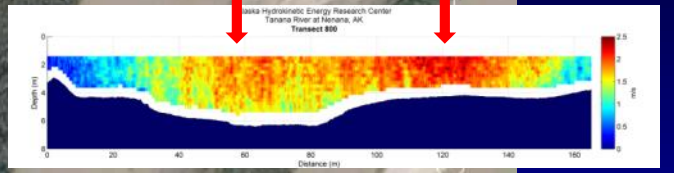
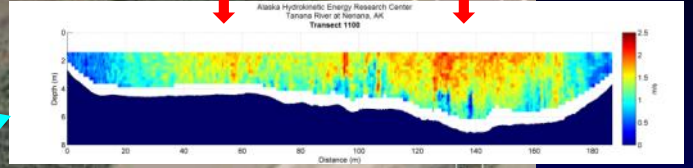


Study site



THALWEG PATH 
MAXIMUM PATH 

FLOW DIRECTION 



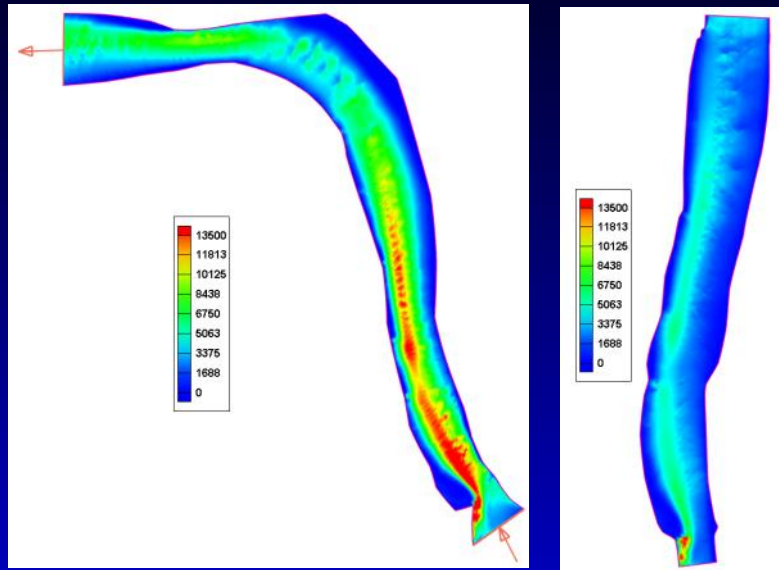
2001 ft
Imagery Date: Jun 20, 2008

© 2011 Google
Image © 2011 DigitalGlobe
64° 33.665' N 149° 3.237' W elev 356 ft

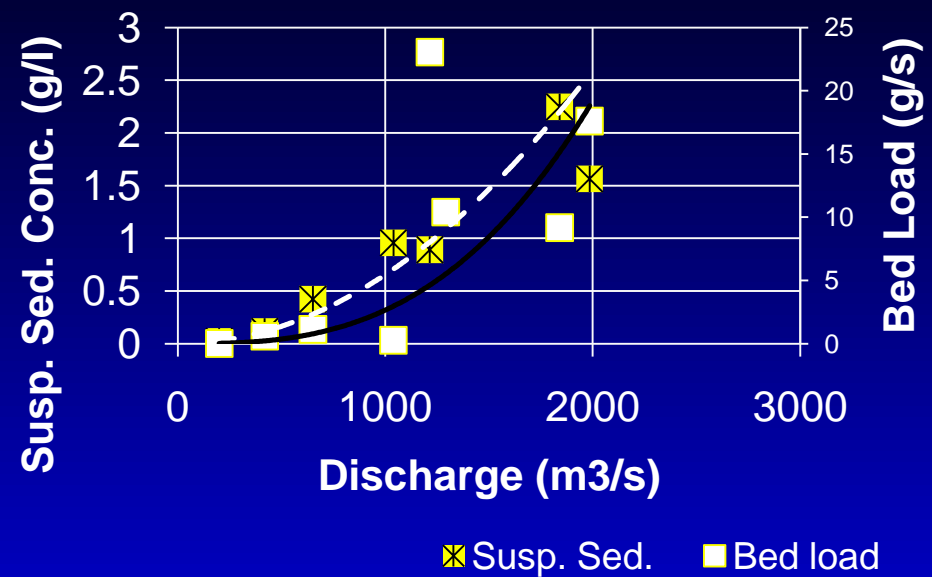
© 2010 Google

Eye alt 7267 ft

Power density (numerical modeling)



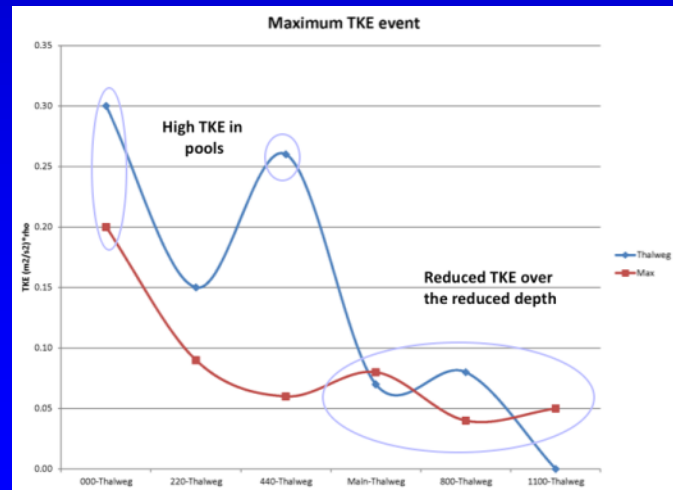
Sediment transport



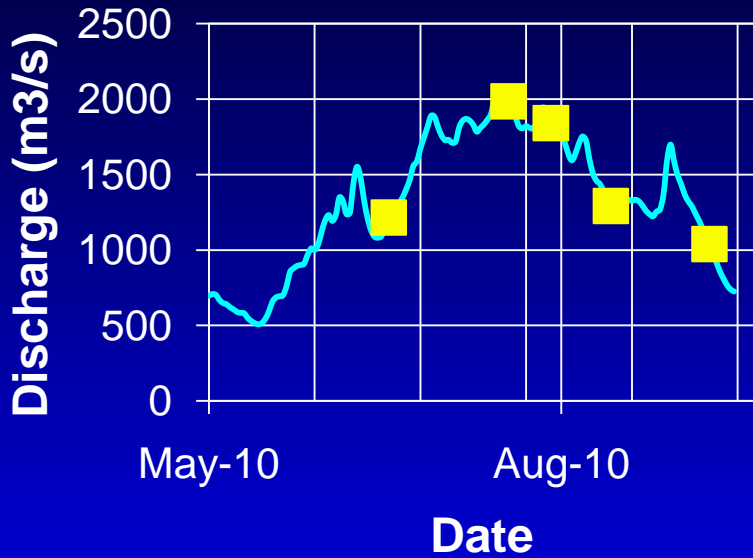
Frazil ice accumulation



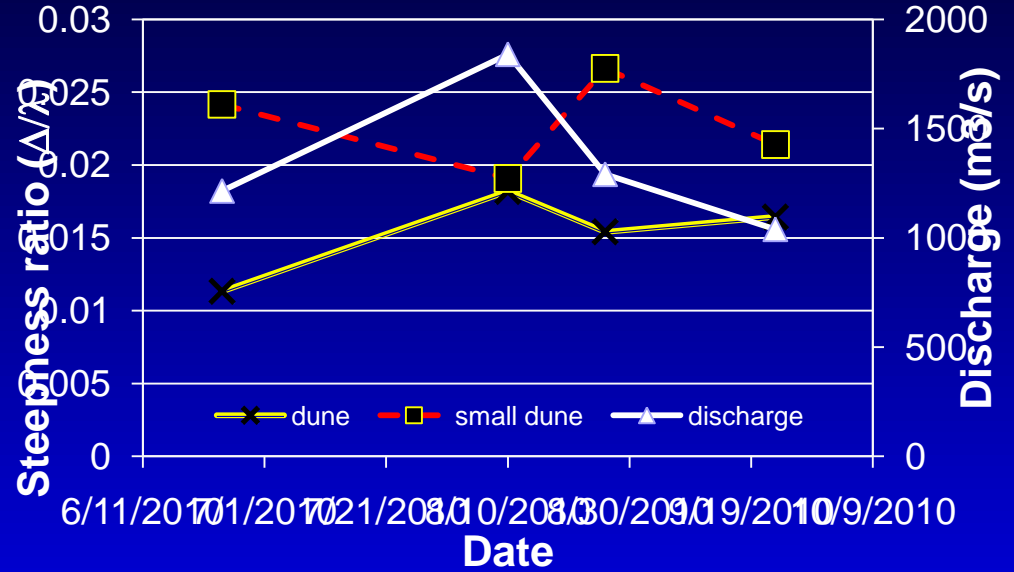
Turbulence



Seasonal discharge variation



Bed form stability



Fish Populations

Factors Affecting the Hydrokinetic Resource

- **Current velocity [site location; economic viability]**
 - Power density
 - Seasonal & temporal variation
 - Bathymetric and channel effects
- **Turbulence [engineering design & power recovery efficiency]**
 - Recoverable power
 - Infrastructure stress
 - Variation with current and bathymetry
- **Suspended & bed load sediment transport [operation & maintenance (O&M)]**
 - deposition and erosion
 - Infrastructure abrasion and clogging
 - Channel stability
 - Infrastructure integrity – bed scour, foundation stability

Factors Affecting the Hydrokinetic Resource

- **Debris [Site location; O&M]**
 - Type, size and frequency of occurrence, spatial location (lateral and depth)
- **Ice [O&M]**
 - Frazil ice accumulation
 - Depth & frequency of occurrence
 - Solid ice conditions
- **Fish [permit approval; site location; O&M]**
 - Seasonal populations and behavior
 - Spatial distribution

