



# Potential Indirect Impacts of Wind Power on Wildlife



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# Outline

- Definition of indirect impacts
- Description of potential indirect impacts
- What we know and don't know
- Current and planned research - when will we know more?



# Definition of Direct and Indirect Impacts

## Definitions in CEQ Regulations Sec. 1508.8

Direct effects “are caused by the action and occur at the same time and place”

Indirect effects “are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.”

# Characteristics of Indirect Impacts

- Caused by the action
- Later in time
- Further in distance
- Reasonably foreseeable
- Cause ecosystem changes that affect wildlife
- Can be short-term or long-term

# Characteristics of Indirect Impacts

- Later in time
  - May take 10 years (Walker et al. 2007 sage-grouse & coal bed methane in WY & MT)
- May occur along a spatial gradient from the disturbance until the impacts are no longer distinguishable from “background”
  - Gradual effect
  - Threshold effect



# Potential Indirect Impacts

- Behavior Changes
  - Avoidance (small and large scale)
  - Attraction
  - Change from “normal” behavior
- Habitat Changes
  - Food, cover, breeding sites, disturbance level
- Population Changes
  - Survival, reproductive success, predation



# Indirect Impacts Are Not Well Known

- Severity
- Mechanism for behavioral responses
- Distance range of effect
- Level of disturbance the local population will tolerate



# Indirect Impacts Are Difficult To Study

- High level of effort (multi-year BACI)
- Multiple components (roads, traffic, turbines, t-lines, buildings, substations, increased public access)
- Confounding influences (weather, habitat)
- Distance gradient could be large
- Subtle effects
- Long time frame for some species

# Potential Indirect Impacts

## ■ Grassland passerines

- Some species may avoid - distances vary from 0 to 200 m among studies to date (Shaffer and Johnson 2010, Erickson et al. 2007, Leddy et al. 1999)

## ■ Cranes

- Migrating cranes may avoid wind farms (Nagy et al. 2011)

# Potential Indirect Impacts

- Golden eagles
  - Don't appear to exhibit small-scale avoidance of turbines (i.e., fatalities occur during all seasons)
- Bald eagles
  - Show small-scale avoidance of turbines (no fatalities recorded), no change in use of wind farm vicinity (Sharp et al. 2010)



Kodiak Harbor



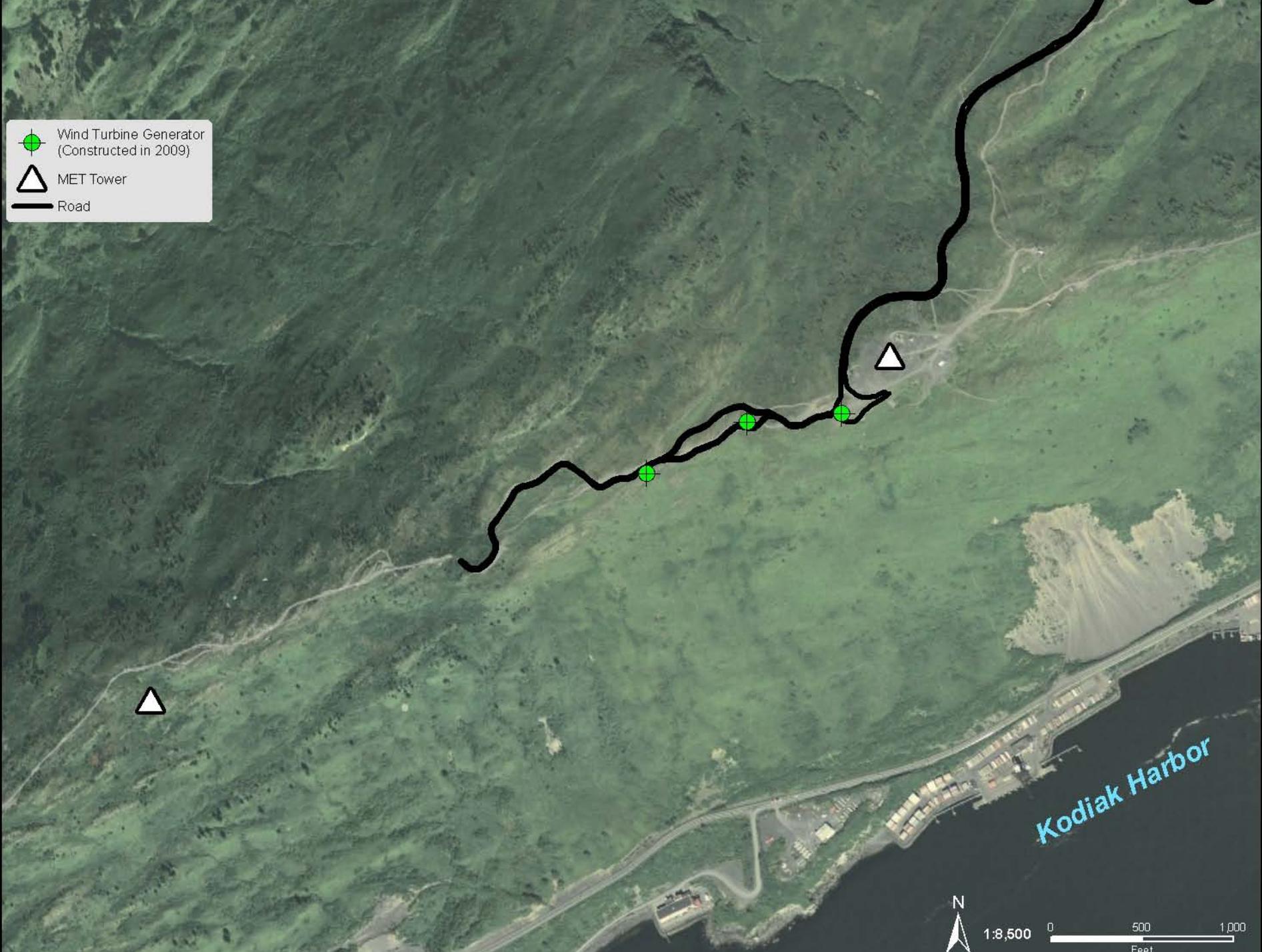
1:8,500



Wind Turbine Generator  
(Constructed in 2009)

MET Tower

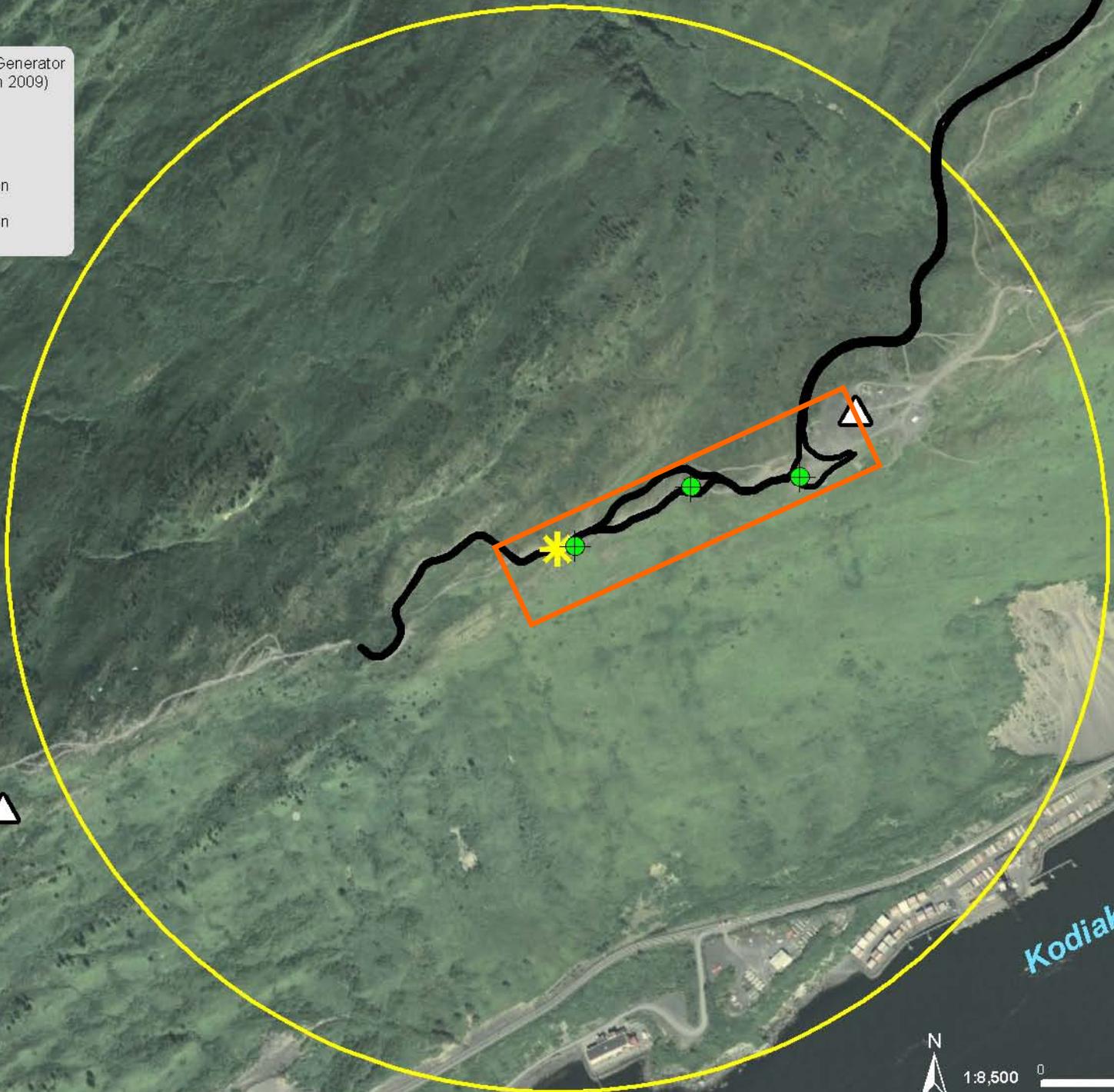
Road



Kodiak Harbor



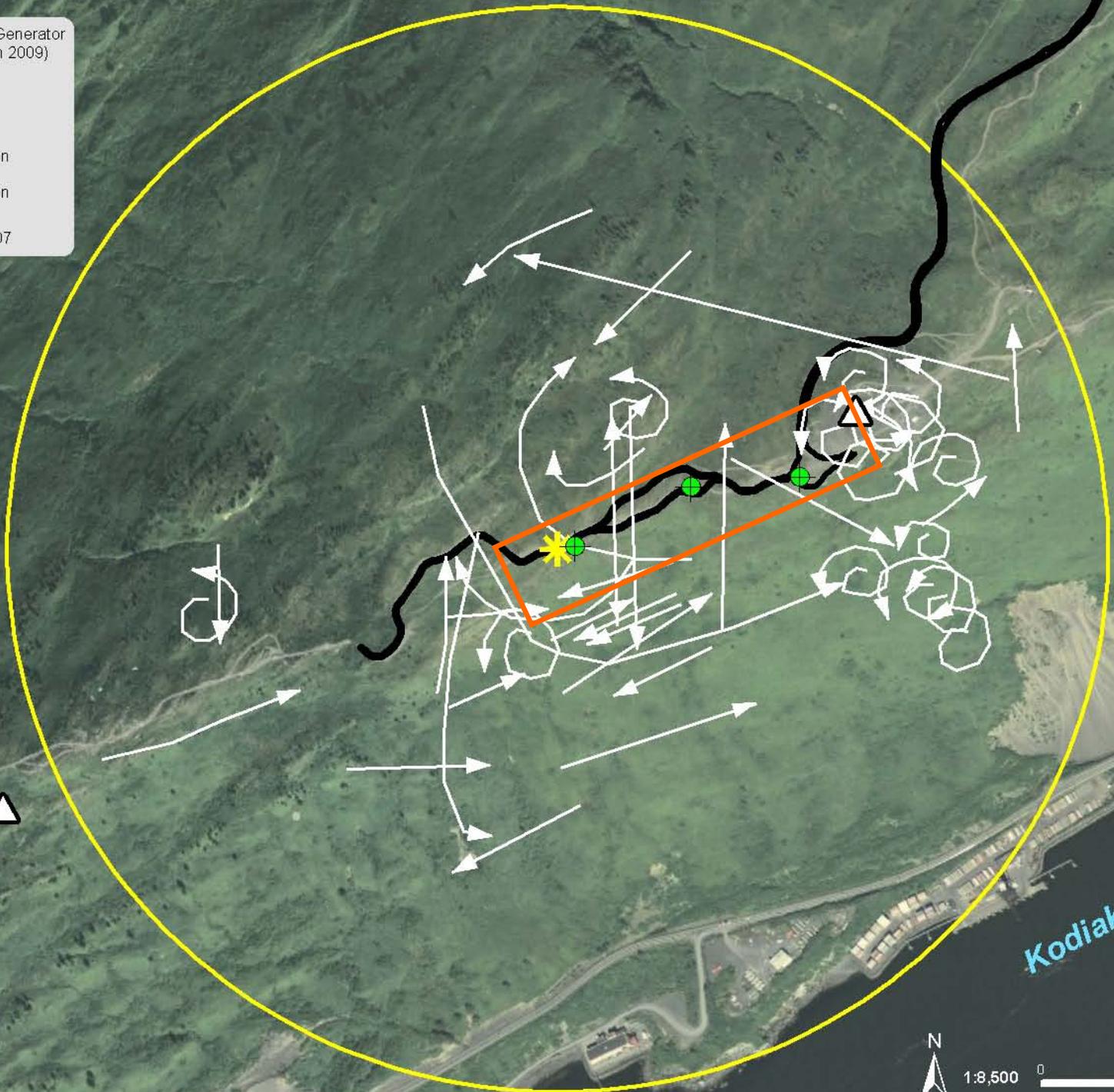
- Wind Turbine Generator (Constructed in 2009)
- MET Tower
- Road
- Survey Location
- Survey Location 800m Buffer



Kodiak Harbor



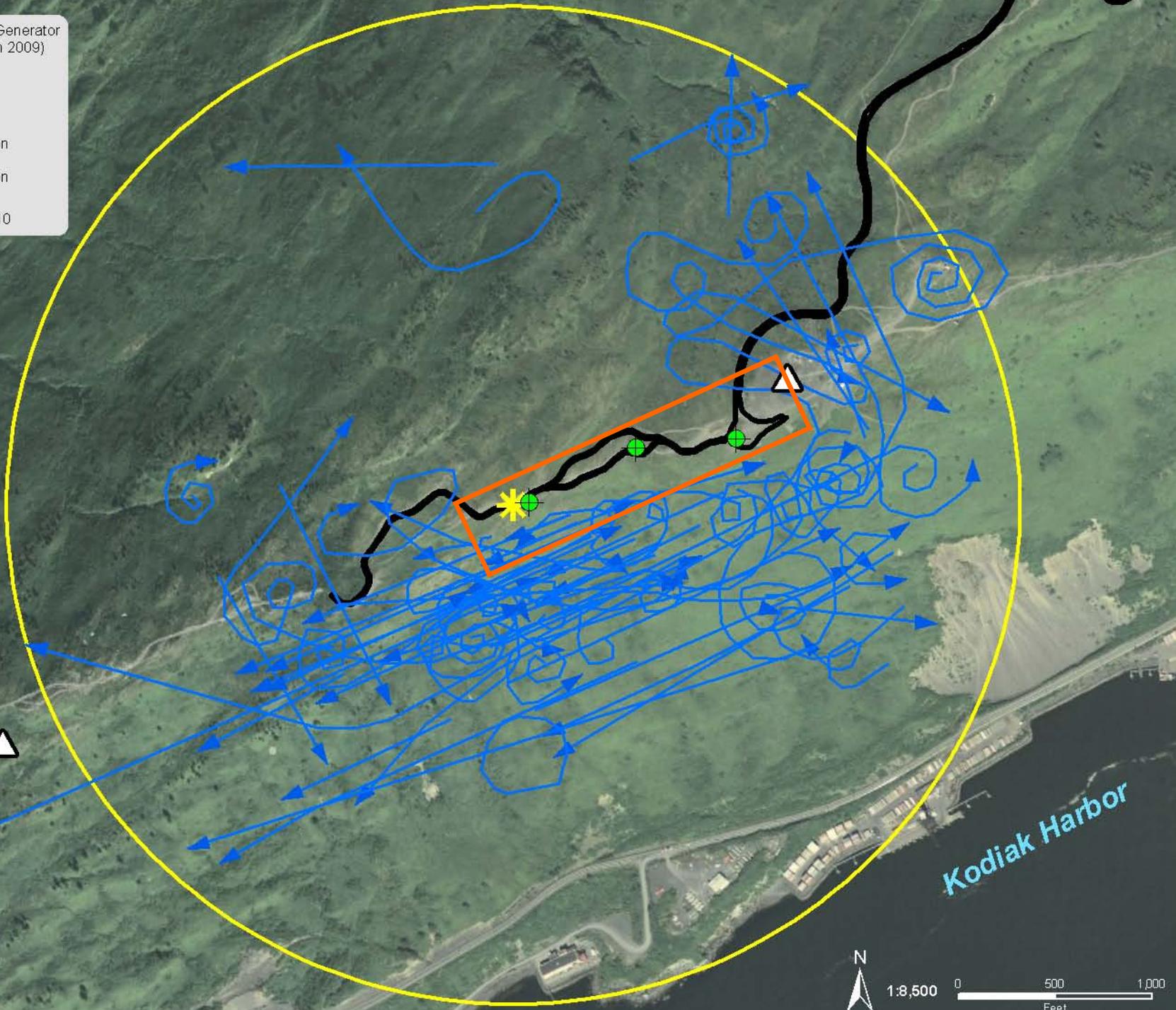
- Wind Turbine Generator (Constructed in 2009)
- MET Tower
- Road
- Survey Location
- Survey Location 800m Buffer
- Flight Path 2007



Kodiak Harbor



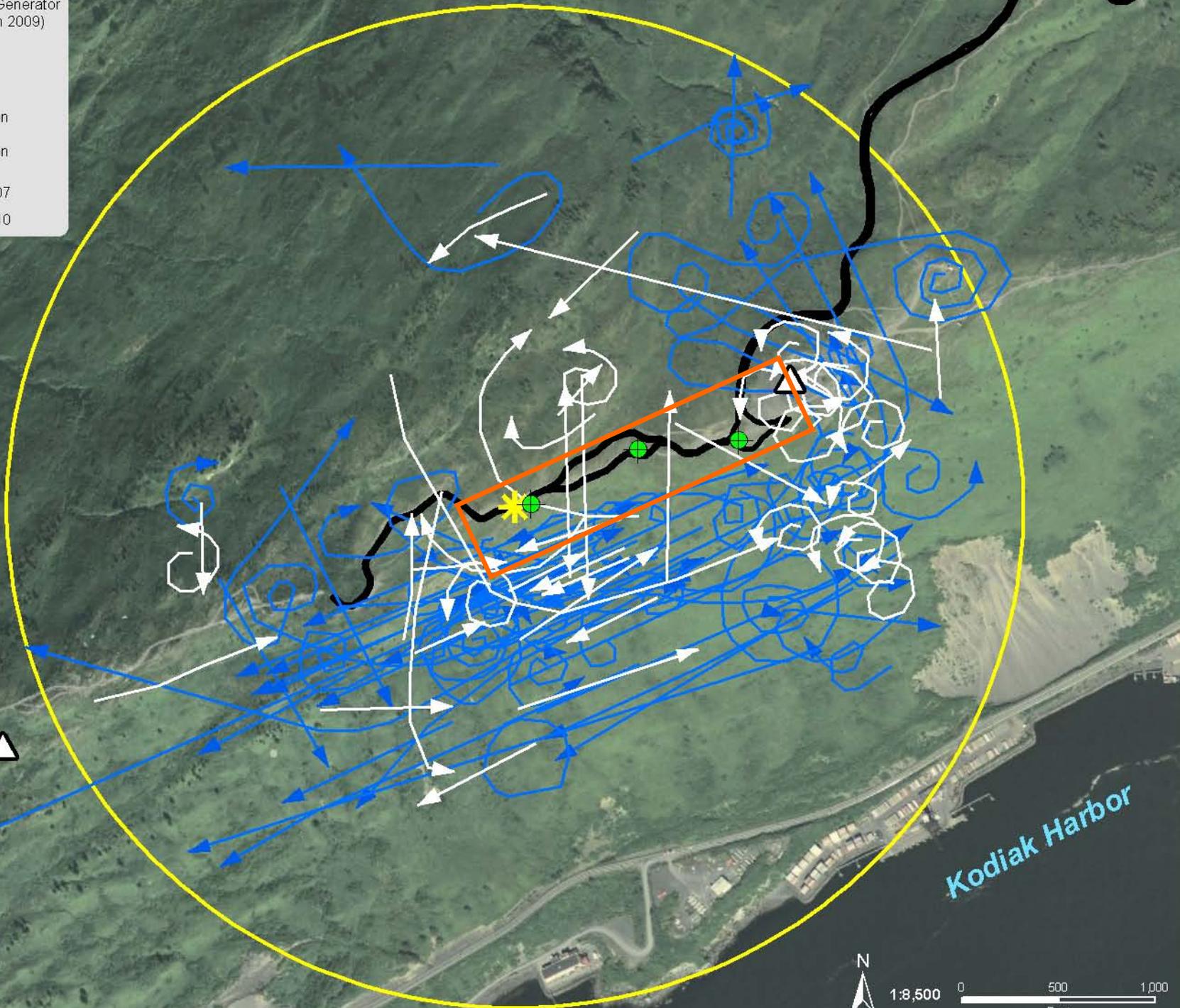
- Wind Turbine Generator (Constructed in 2009)
- MET Tower
- Road
- Survey Location
- Survey Location 800m Buffer
- Flight Path 2010



Kodiak Harbor



- Wind Turbine Generator (Constructed in 2009)
- MET Tower
- Road
- Survey Location
- Survey Location 800m Buffer
- Flight Path 2007
- Flight Path 2010



Kodiak Harbor



# Potential Indirect Impacts

## ■ Raptors

- New transmission lines can provide perches and/or new nest sites (Steenhof et al. 1993, Hagen in press)

## ■ Corvids

- Can be attracted to construction sites
- Can nest and perch on new transmission lines or other structures (Steenhof et al. 1993, Hagen in press)

# Potential Indirect Impacts

## ■ Big game

- Pronghorn may not avoid (WEST, Inc. 2010 OR, Johnson et al. 2000 WY)
- Deer and elk response variable (Walter et al. 2006 OK; WEST, Inc. 2010 OR)

## ■ Bats

- Some species don't appear to avoid turbines
- May be attracted to new forest clearings or the turbines themselves (Arnett et al. 2008)

# Potential Indirect Impacts

- Extrapolate from
  - Oil and gas development avoidance by greater sage-grouse and big game to wind
  - Wind avoidance by related species (prairie chickens → greater sage-grouse)
  - Transmission line, communication tower, road effects to wind
  - Note: There are differences between oil/gas and wind

# Wild Horse Wind Project near Ellensburg, Washington



Image U.S. Geological Survey

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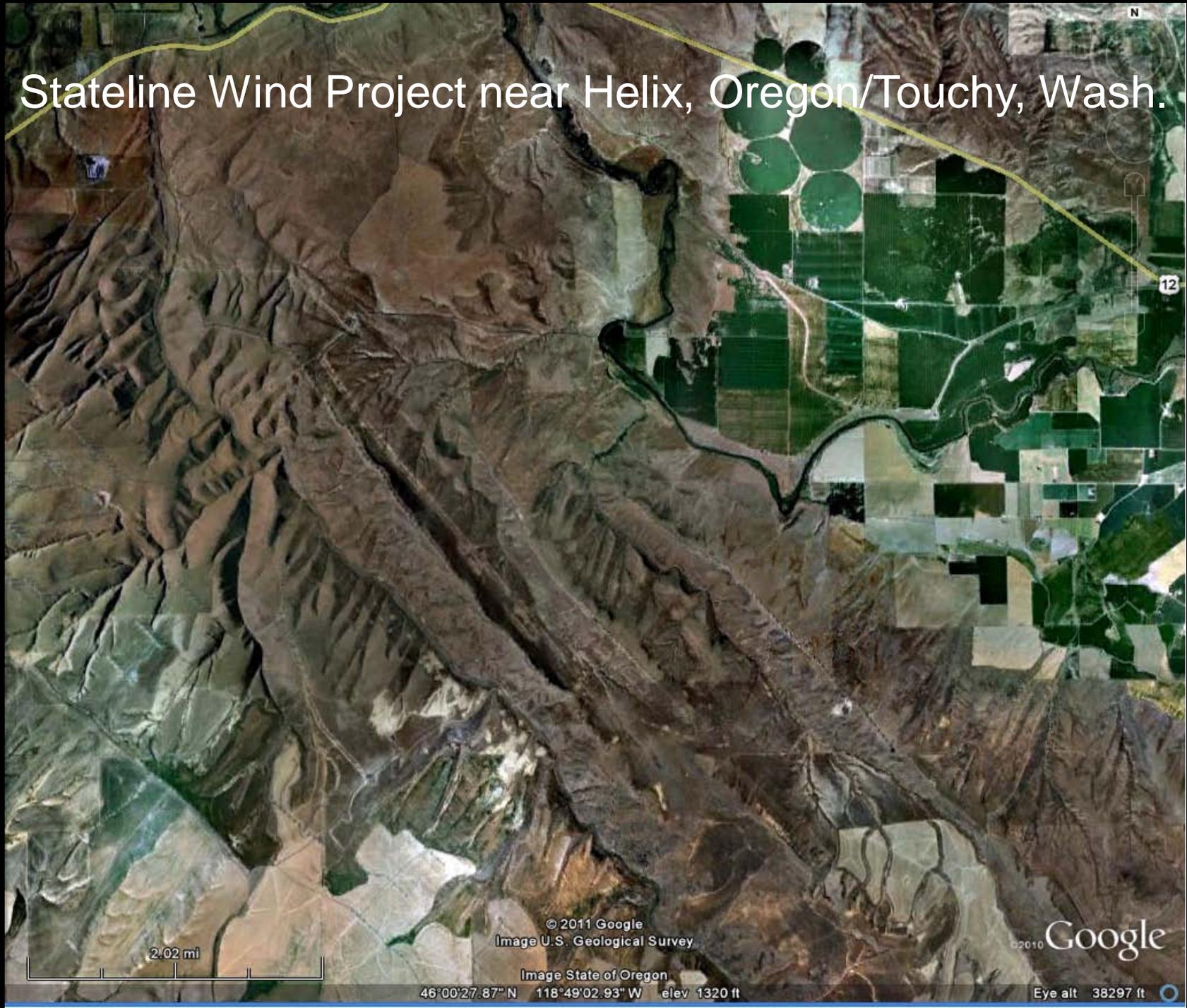


Imagery Date: Jul 1, 2006

47°01'50.39" N 120°13'41.02" W elev 3455 ft

Eye alt 38734 ft

# Stateline Wind Project near Helix, Oregon/Touchy, Wash.



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Image U.S. Geological Survey

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Image State of Oregon

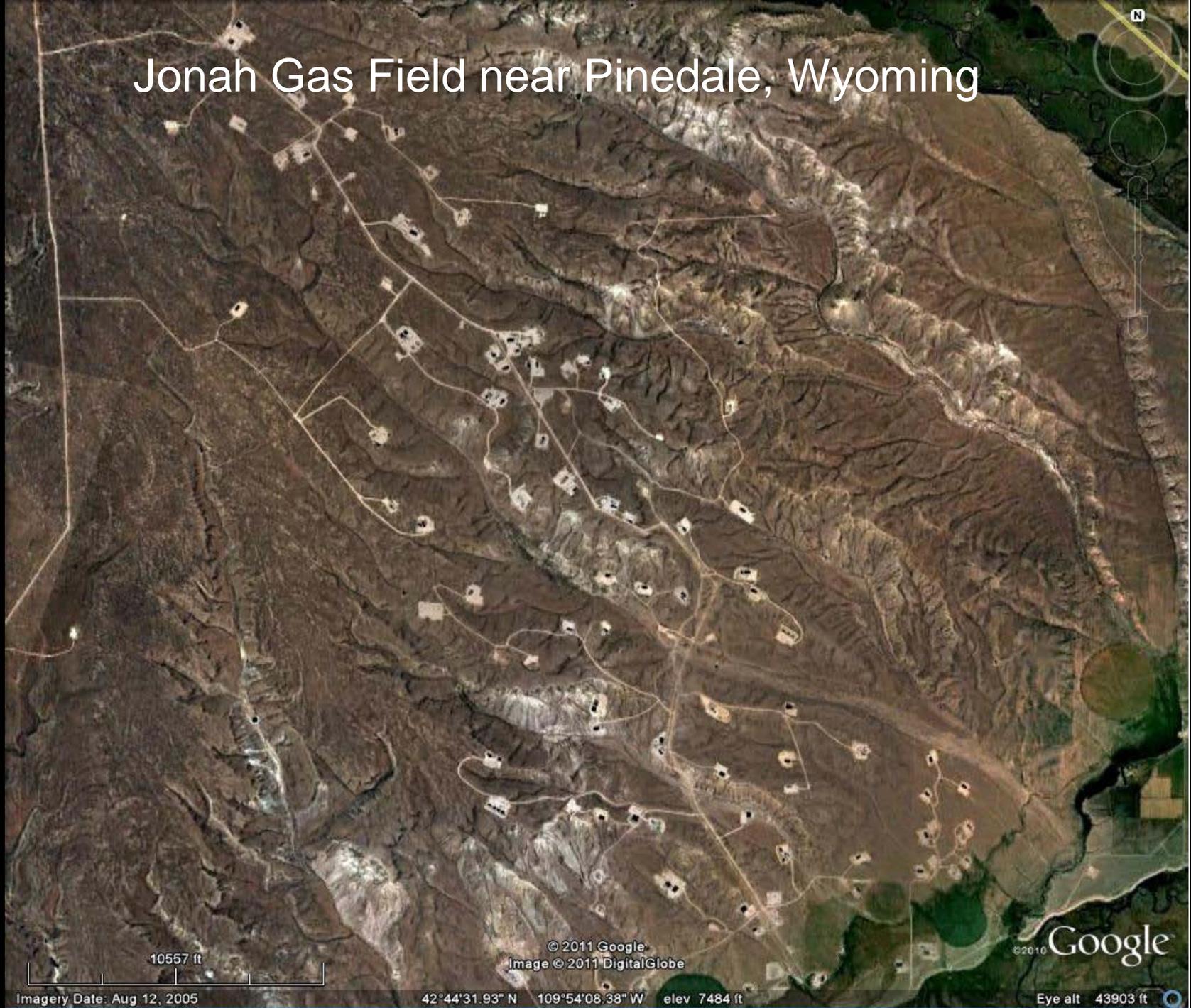
46°00'27.87" N 118°49'02.93" W elev 1320 ft

Eye alt 38297 ft

# Gas Field (Left) and Wind Facility (right) Near Evanston, WY



# Jonah Gas Field near Pinedale, Wyoming



10557 ft

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Image © 2011 DigitalGlobe

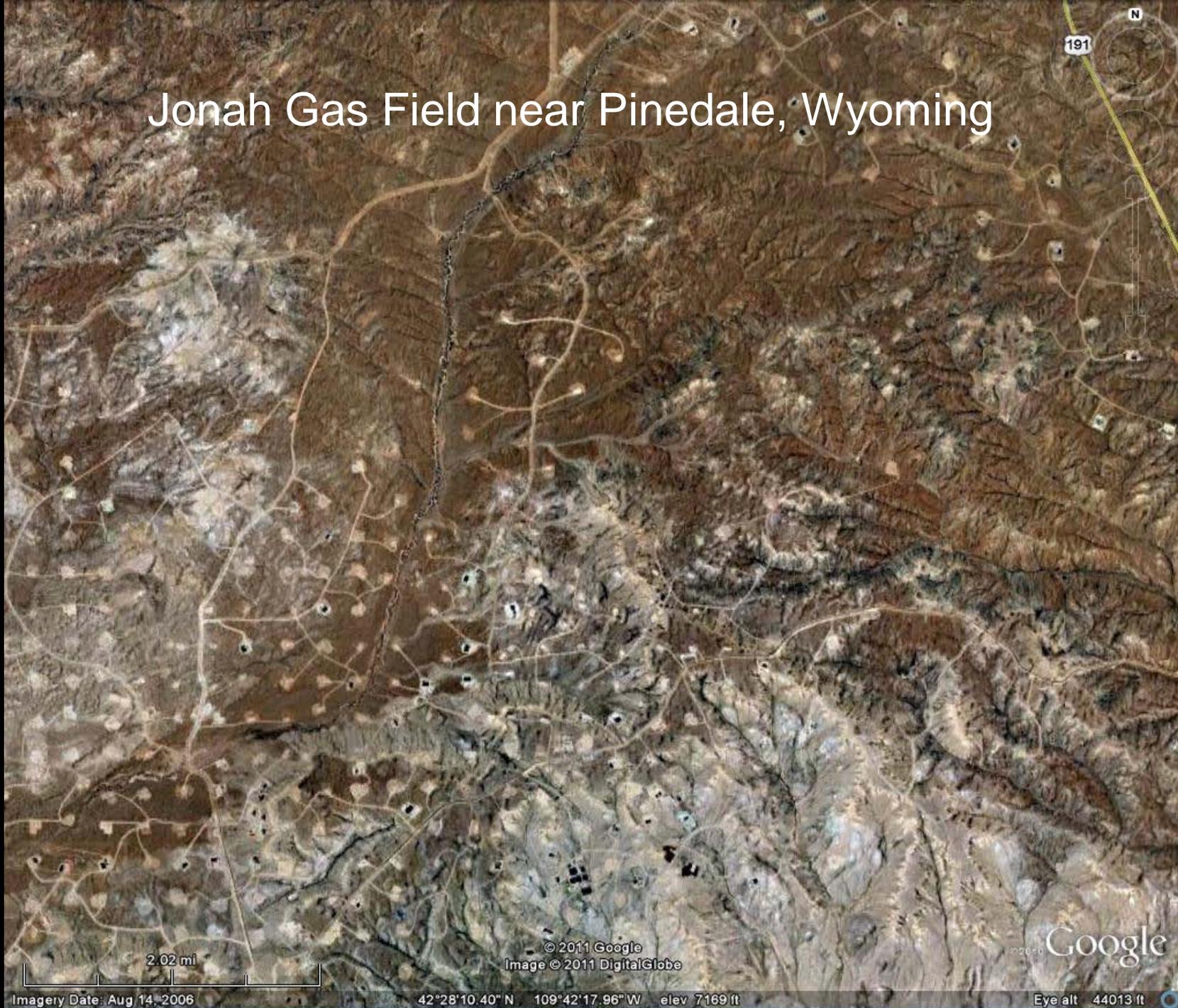
© 2010 Google

Imagery Date: Aug 12, 2005

42°44'31.93" N 109°54'08.38" W elev 7484 ft

Eye alt 43903 ft

# Jonah Gas Field near Pinedale, Wyoming



191

N

2.02 mi

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Image © 2011 DigitalGlobe

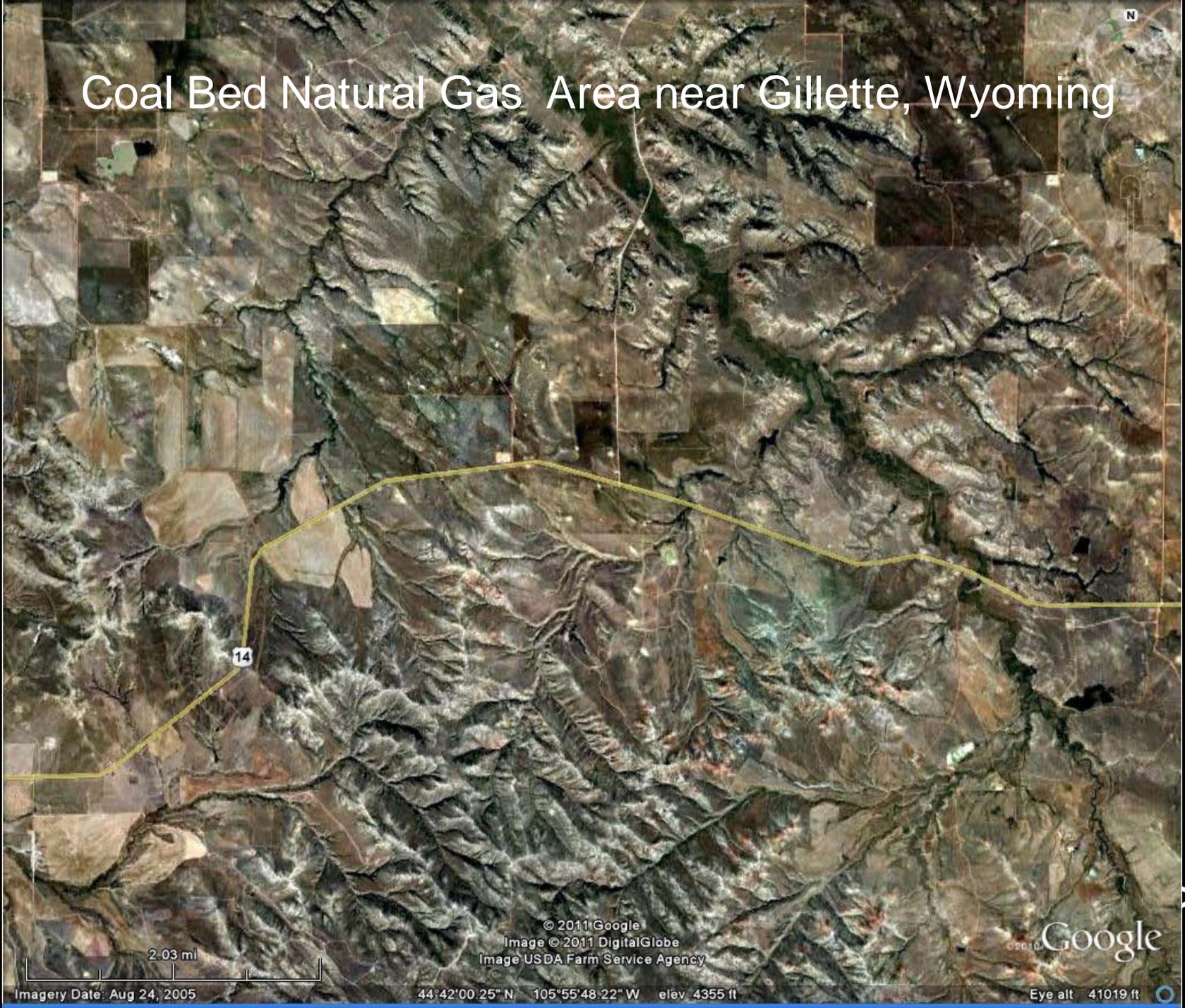
Google

Imagery Date: Aug 14, 2006

42°28'10.40" N 109°42'17.96" W elev 7169 ft

Eye alt 44013 ft

# Coal Bed Natural Gas Area near Gillette, Wyoming



14

2.03 mi

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Image © 2011 DigitalGlobe  
Image USDA Farm Service Agency

Google

Imagery Date: Aug 24, 2005

44°42'00.25" N 105°55'48.22" W elev 4355 ft

Eye alt 41019 ft

H

# Wind and Gas Disturbance Parameters

from Christian Hagen, ODFW

\*Calculated by WEST for Wild Horse

Variable	Gas	Wind
Structure height	<b>4-60 m</b>	<b>66-122 m</b>
Noise @ 0.25 miles	<b>52 db(A)</b>	<b>35 db(A)</b>
Compressor	<b>37 db(A)</b>	<b>NA</b>
Haul roads	<b>40 db(A)</b>	<b>?</b>
Maintenance visits	<b>1 per day-well</b>	<b>1 per 6 months per turbine</b>
Road density	<b>3.13 km / km<sup>2</sup></b>	<b>1.6 km/km<sup>2</sup>*</b>
% permanent disturbance	<b>5-10%</b>	<b>1%-5%</b>



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# Indirect Impact Research and The Future

When will we have data on indirect impacts of wind?

- Greater prairie-chicken
  - NWCC GS3C study by Kansas State
  - BACI study
  - 1-2 years
- Greater sage-grouse
  - NWCC GS3C chose 3 projects for BACI studies
  - 5 years ?

# Indirect Impact Research and The Future

When will we have data on indirect impacts of wind?  
(Not a comprehensive list, some not full BACI)

- Big game
  - Elkhorn, OR study 2010 report available now
  - Other studies going on now, don't know when done
- Cranes
  - Titan I SD study 2010-2011, ongoing
- Golden eagles – Various pre-construction radiotelemetry, nest monitoring started in 2010 – 5 years?



# Questions About Indirect Impacts

- Are indirect impact zones still useful for some activities by some species?
- Can habitat improvement offset some avoidance?
- Does habituation occur over time?



