



# Renewable Energy Transmission Initiative Phase 1B Work Group Meeting

**Black & Veatch**

**Phase 1B Work Group**

**July 10, 2008**

## Phase 1B Work Group Issues

- Energy price forecast –reference and sensitivities
- Net short calculation
- Resource valuation model review
- Transmission assumptions
- Project characterization & identification
- Uncertainty assumptions - cost and CF data by resource type
- Advise on sensitivity analyses and data



TBD

TBD

# Agenda

- Actions taken last two meetings
  - Transmission Approach
  - Solar thermal and solar PV project ID
- Loose ends
  - Wet vs. Dry cooling
  - Common resource exclusions
- Project characterization & identification
  - Biomass
  - Wind
  - Geothermal
- Development Timeframe

## Wet vs. Dry Cooling

- Cooling type will be based on availability of recycled water (treated municipal waste water)
- If recycled water available, use wet cooling
- All other plants assumed to be dry cooled
- Black & Veatch investigating modeling implications / capabilities
- Consider wet / dry as uncertainty issue
- Potential for lower water use with alternative / future technology to be noted

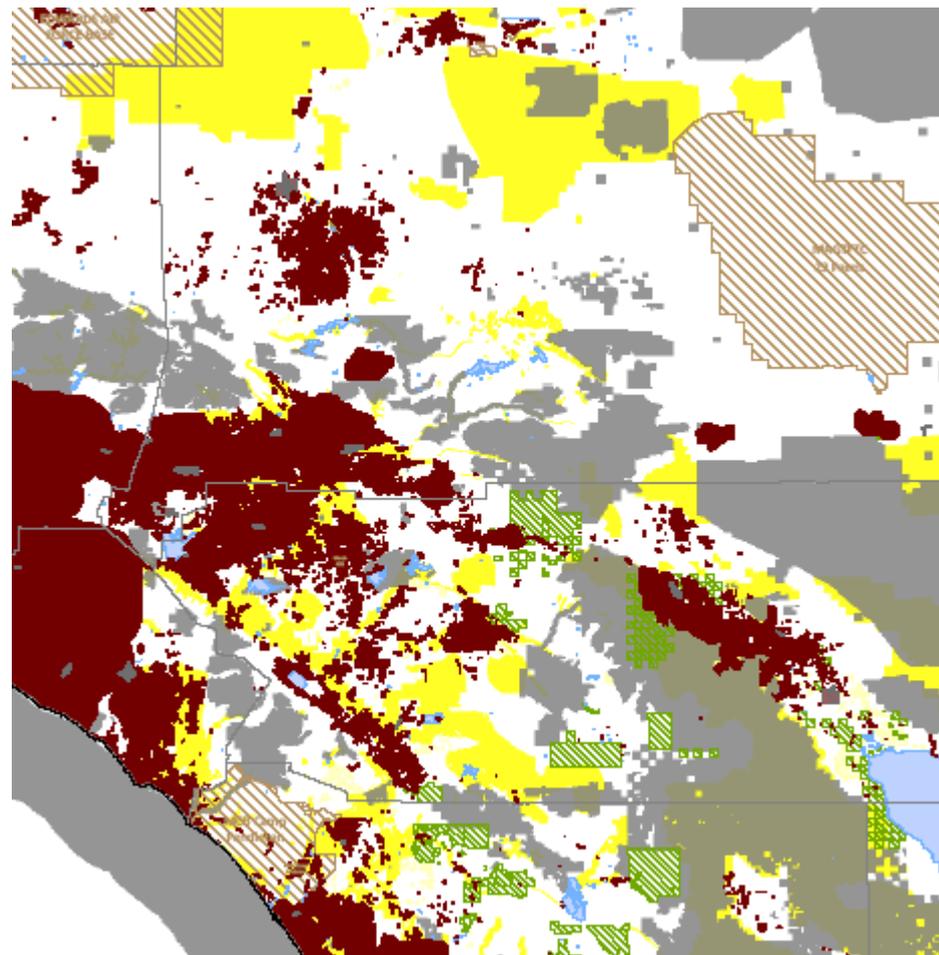
# Common Resource Exclusions

(Biomass projects separately considered)

	<b>Solar Thermal</b>	<b>Solar PV</b>	<b>Wind</b>	<b>Geo-thermal</b>	<b>Actions</b>
Environmental black-out areas	Yes	Yes	Yes	Yes	
Environmental yellow areas	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects allowed
Urban areas	Yes, +buffer	Yes, +buffer	Yes, +buffer	Yes, +buffer	buffer up to 3 miles depending on population
Airports	Yes	Yes	Yes, +5 mi	Yes	Major airports only
Wetlands and water bodies	Yes	Yes	Yes	Yes	Dry lakes not excluded
Min. contiguous acreage	640	160	none	none	640 acres = 1 section
Land slope	< 2%	< 5%	none	none	Geothermal and wind to be evaluated on case by case basis
Native American reservations	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects allowed
Military lands	Yes*	Yes*	Yes*	Yes*	*Pre-identified projects allowed
Mines (surface)	Yes	Yes	Yes	Yes	
Military flyways / radar	No	No	Yes* (Red)	No	*Pre-identified projects allowed in red zones. All other open.
Williamson Act Prime Agricultural land	Yes*	Yes*	No	No	*Pre-identified projects allowed

# Resource Exclusions

- Base map distributed >
- Supplemental maps for each resource
  - Military flyway / radar
  - Williamson Act



# List of Screened Resources

	CA	OR	WA	NV	AZ	Baja California	British Columbia
<b>Solid Biomass</b>							
<b>Solar Photovoltaic</b>							
<b>Solar Thermal</b>				 (south)	 (west)		
<b>Onshore Wind</b>				 (south)		 (north)	
<b>Geothermal</b>							

# Wind Projects - Siting

## Identified Projects

**RETI will model projects in California for which there is commercial interest. The list will be consolidated from:**

- Bureau of Land Management applications
  - Precise location where available, approximate location based on description where necessary
- CAISO and POU transmission queues
  - Approximate location based on nearest reasonable site to interconnection point.
- Other publicly available data sets (PPAs and permitting)
- Generator-provided data

# Wind Projects - Siting

## Proxy Projects

- Based on available land not identified or connected with other project data
- Meet requirements for wind resource, terrain, environmental sensitivity, military restrictions, etc.
- Best projects selected first

## Out of State Projects

- Out-of-state projects will be modeled by wind class, considering competing demand and a discount for “developability”
- Subject to import limitations

# Wind Projects - Characterization

## Capital Costs

- Reference balance of plant construction costs developed for several types of project sites
  - Flat terrain, several rows of turbines
  - Intermediate terrain types
  - Mountainous terrain, turbines on ridgeline
- Wind turbine price assumed to be uniform for all project types
- Cost adjustment for distance of site from major roads and highways

# Wind Projects - Characterization

## Plant Performance

Performance characteristics will be based on the California speed wind map

- Capacity factor calculated for number of MW at each wind speed, based on California wind map (adjusted to 80-m hub height)
- General wind turbine power curves used
  - Representative power curves for IEC design classes (I, II, and III)
  - Adjustment of power curves based on average temperature in area and project site elevation
- Losses applied, wake losses based on terrain type and project size
- Production profile by region from wind map

# Biomass Projects - Siting

## Proxy Projects

- California Biomass Collaborative 2010 technically feasible capacity by county as basis for supply
  - Breakdown by agricultural residues, forest residues, and urban wood waste; subdivisions in each
- Determined maximum potential MW from supply using 85% capacity factor and 13,650 BTU/kWh heat rate
  - Reduced by assuming 1/3<sup>rd</sup> of maximum supply available for power generation (remainder for other purposes or potentially too expensive)
  - Minimum project size set at 20 MW for economic feasibility

# Biomass Projects - Siting

## Proxy Projects

- Determined if specific subtypes of biomass could meet 20 MW threshold; if not, grouped together
  - Example: Vegetable crop subtype of agriculture
- If none of the three major types of biomass within a county can meet the 20 MW threshold, group together in a multi-fuel plant
  - Urban wood waste held separate due to properties
- Use remaining material to consider plants at county borders
- Assume siting near major county substations

# Biomass Project Examples (Single County)

Project	County	Generation Capacity (MW)	Biomass Fuel(s)
1	Butte	22	Composite Agricultural Residues
2	Colusa	23	Field/Seed Crop Residues
3	El Dorado	32	Composite Wood Residues
4	Fresno	24	Field/Seed Crop Residues
5	Fresno	22	Multifuel
6	Fresno	20	Orchard/Vineyard Residues
7	Glenn	22	Composite Agricultural Residues
8	Humboldt	61	Forest Thinnings/Slash
9	Kern	21	Field/Seed Crop Residues
10	Kern	30	Multifuel
11	Kings	21	Field/Seed Crop Residues
12	Lassen	39	Composite Wood Residues

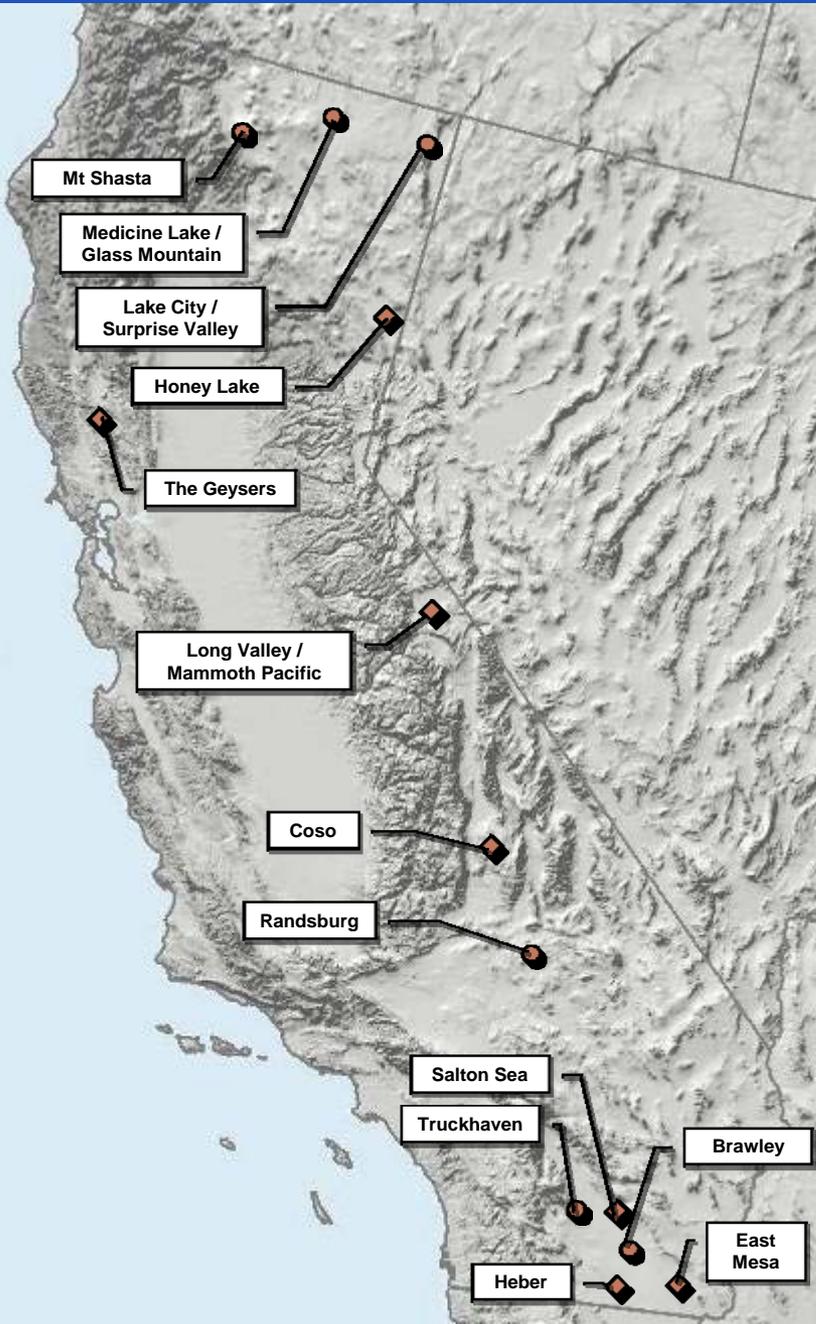
# Biomass Project Examples (Multiple County)

Project	Central County	Additional Counties	Generation Capacity (MW)	Biomass Fuel(s)
6		Amador, Calaveras	24	Multifuel
7		Yolo, Colusa	26	Multifuel
8		Butte, Yuba	32	Multifuel
9		Del Norte, Humboldt	25	Multifuel
10		San Diego, Imperial	33	Multifuel
11		San Bernadino, Riverside, LA	28	Multifuel
12		Inyo, Tulare	20	Multifuel
13		Lake, Napa, Solano	32	Multifuel
14		Mendocino, Sonoma, Marin	21	Multifuel
15		Mariposa, Stanislaus	24	Multifuel
16		SLO, Santa Barbara, Ventura	21	Multifuel
17		Nevada, Sierra	29	Multifuel
18		Placer, Sacramento	27	Multifuel
19		Monterey, San Benito, Santa Cruz, Santa Clara	24	Multifuel

# Biomass Projects - Characterization

## Plant Performance

- Capital cost to be based on a \$/kW basis for biomass
- Operating cost largely driven by feedstock. Will set a cost per feedstock type, sensitive to any counties with remote sources
  - Cost of environmental credits may also need to be evaluated per county. May also restrict siting (example: SCAQMD)
- Heat rate – function of fuel type (moisture content)



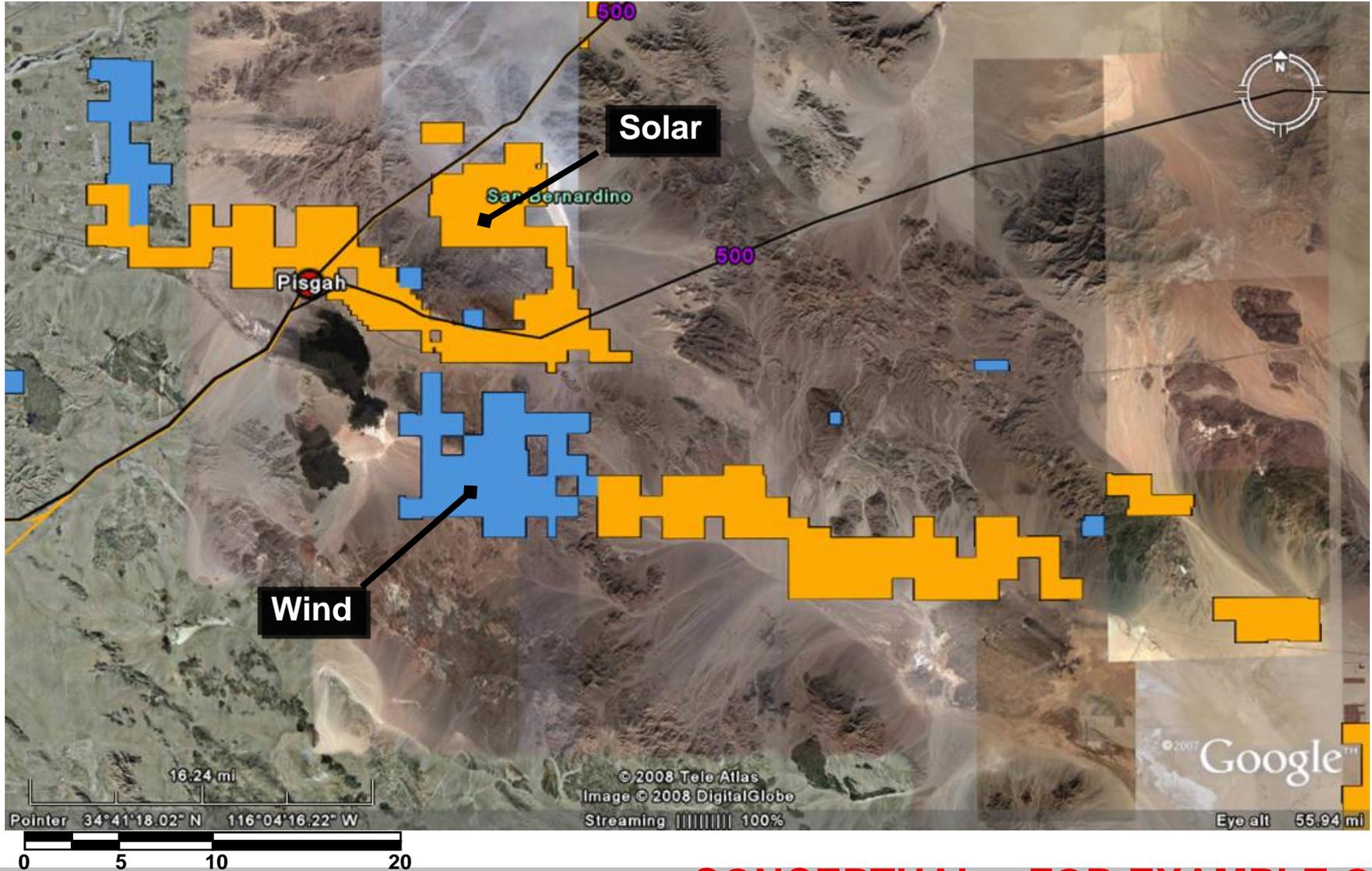
## Geothermal

- Geothermal assessment performed by GeothermEx
- California and Nevada estimates based on past GeothermEx work
- Estimates for other regions rely on multiple data sources

## Example Project Identification for Pisgah

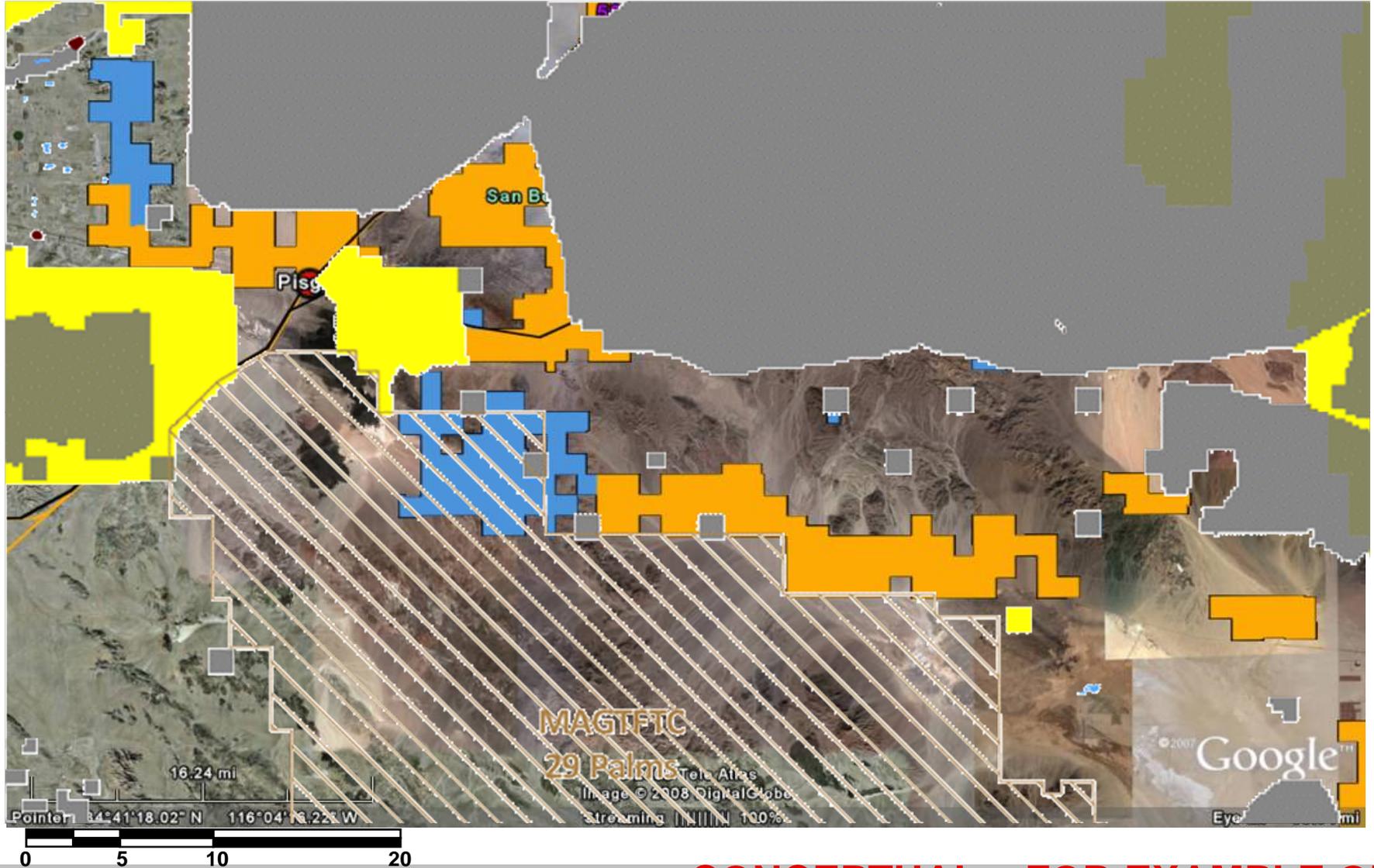
- Hypothetical Supra-CREZ around Pisgah
- Wind and solar resources

# Pre-Identified Projects (Partial)



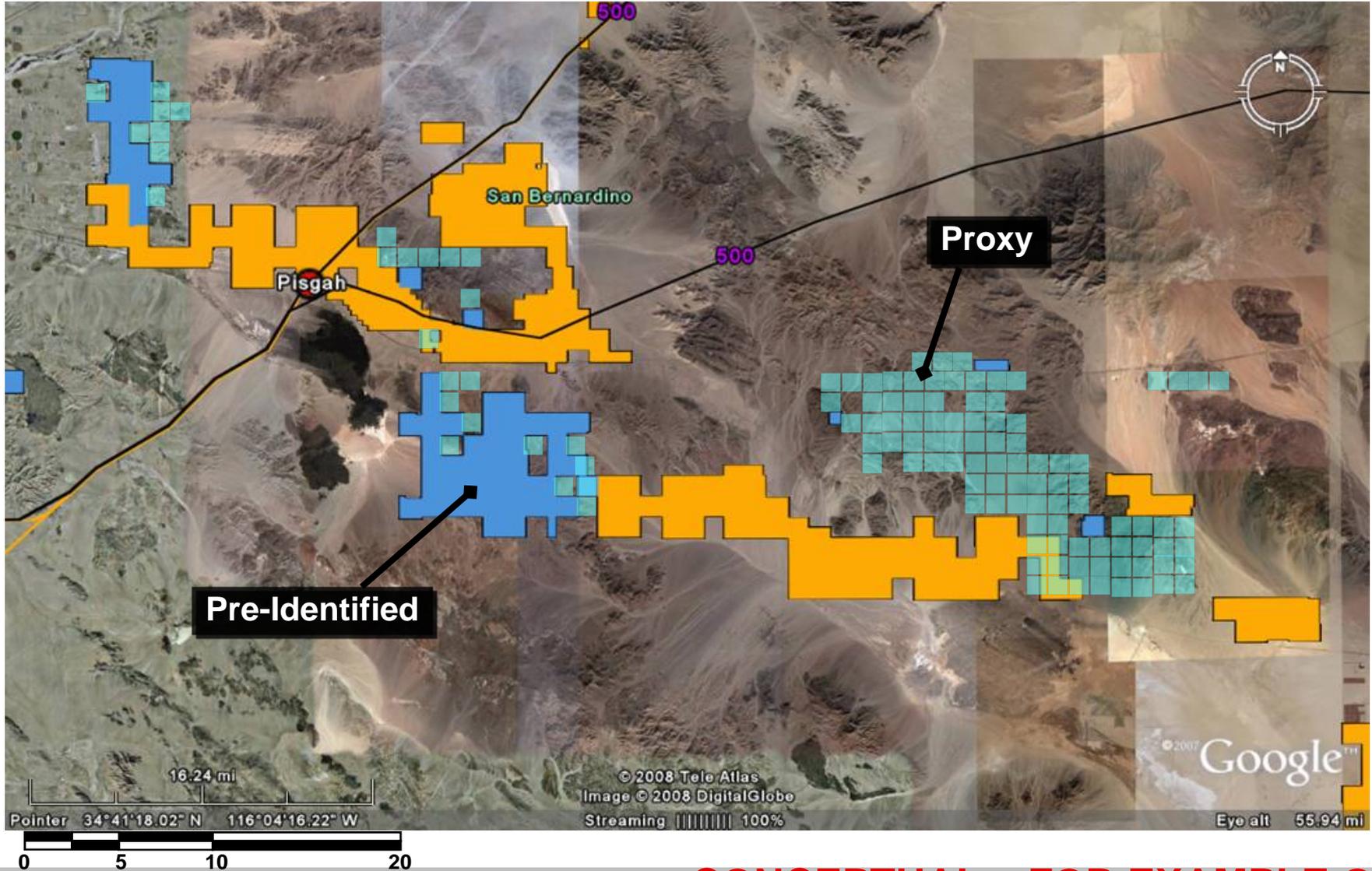
**CONCEPTUAL – FOR EXAMPLE ONLY**

# Land Restrictions



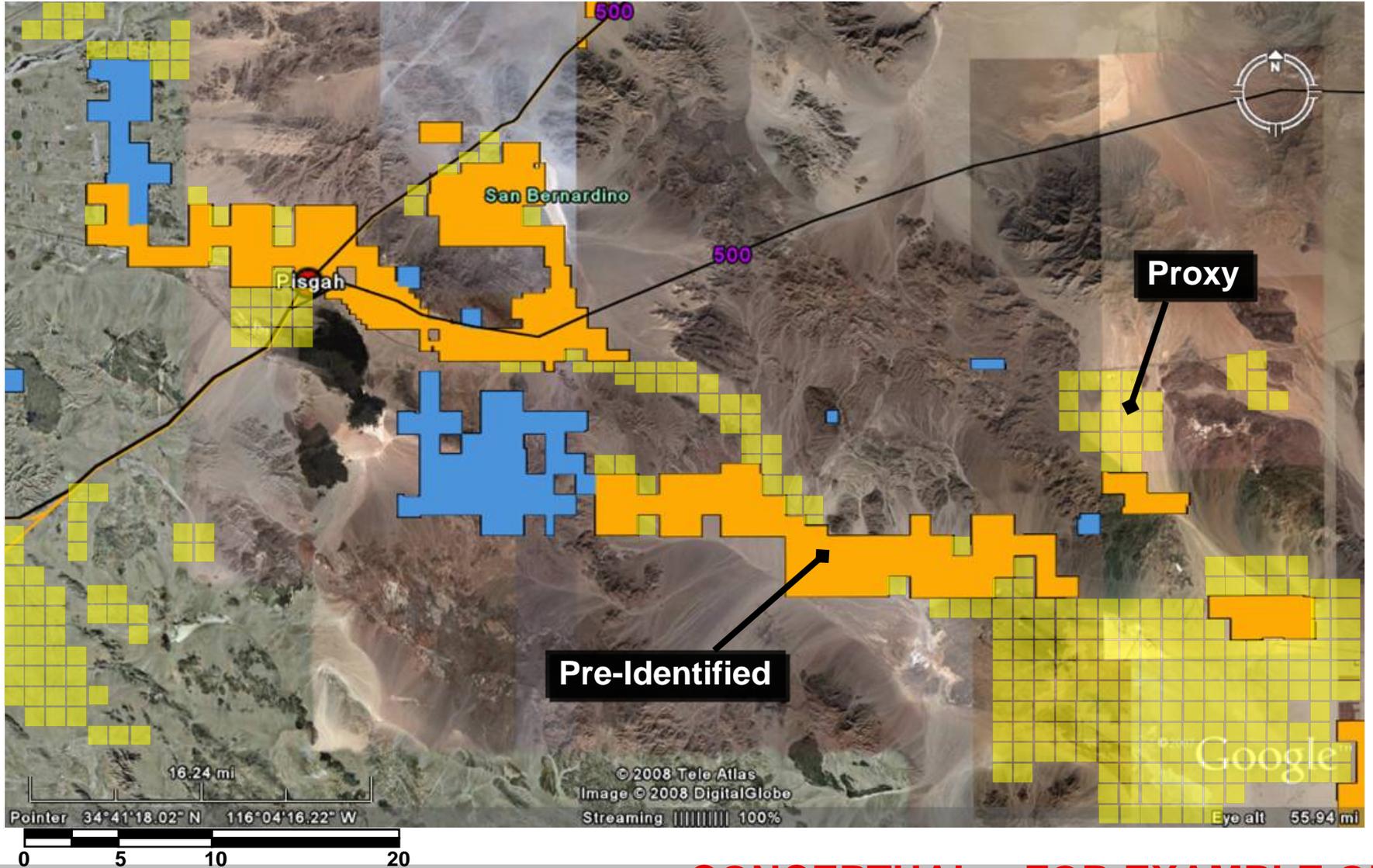
**CONCEPTUAL – FOR EXAMPLE ONLY**

# Candidate Land – Wind



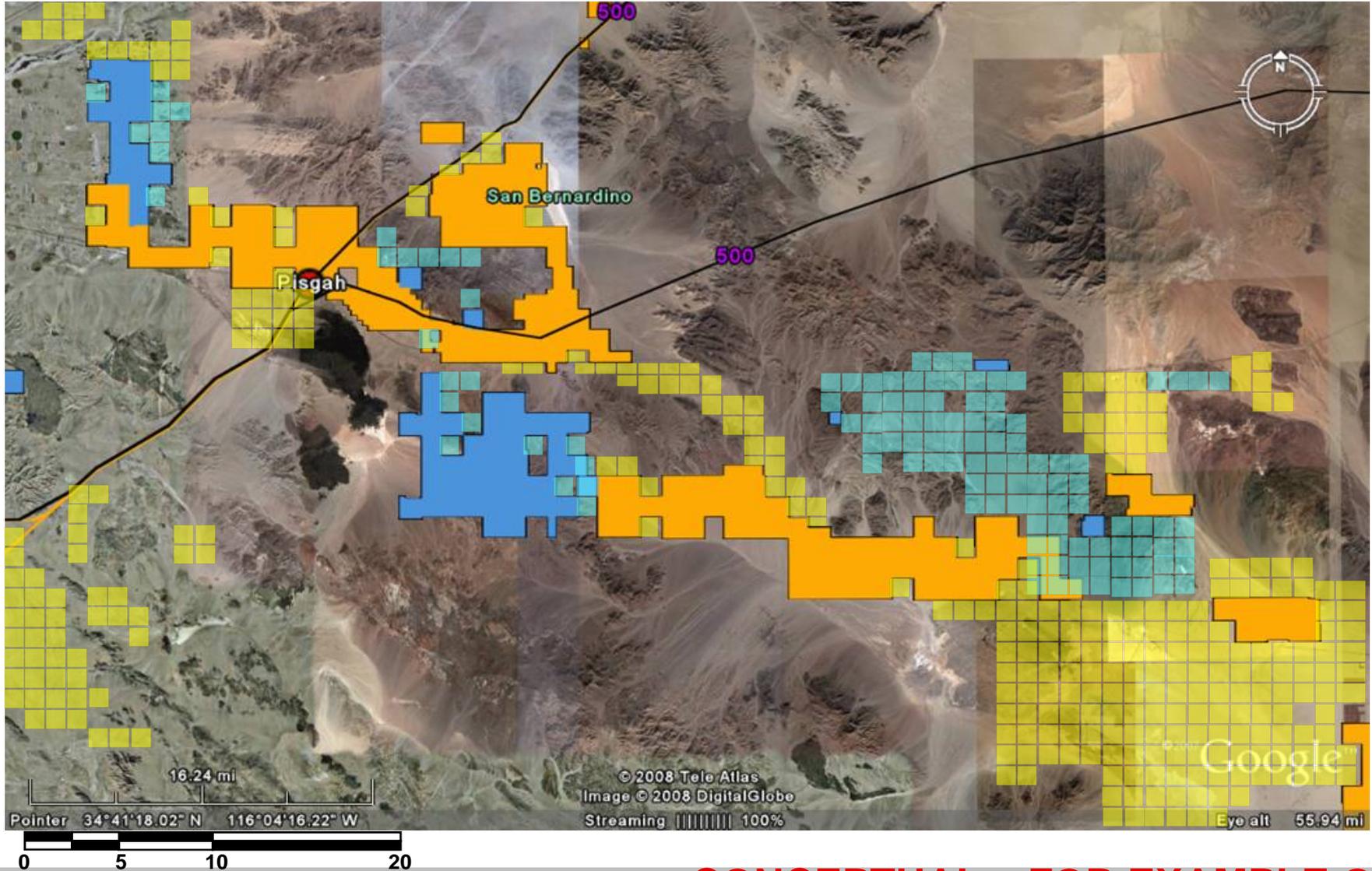
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# Candidate Land – Solar



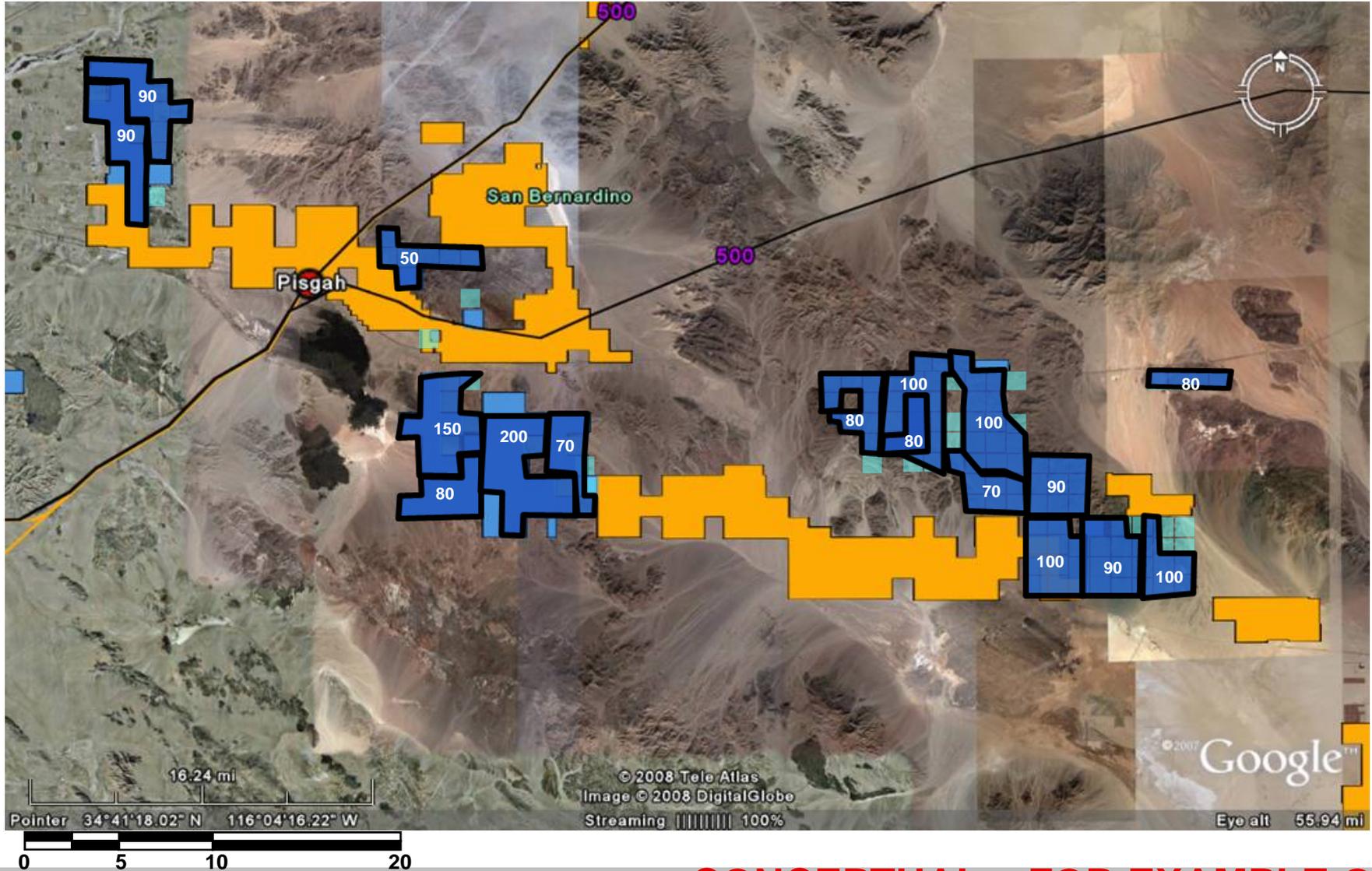
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# Candidate Land – Solar & Wind



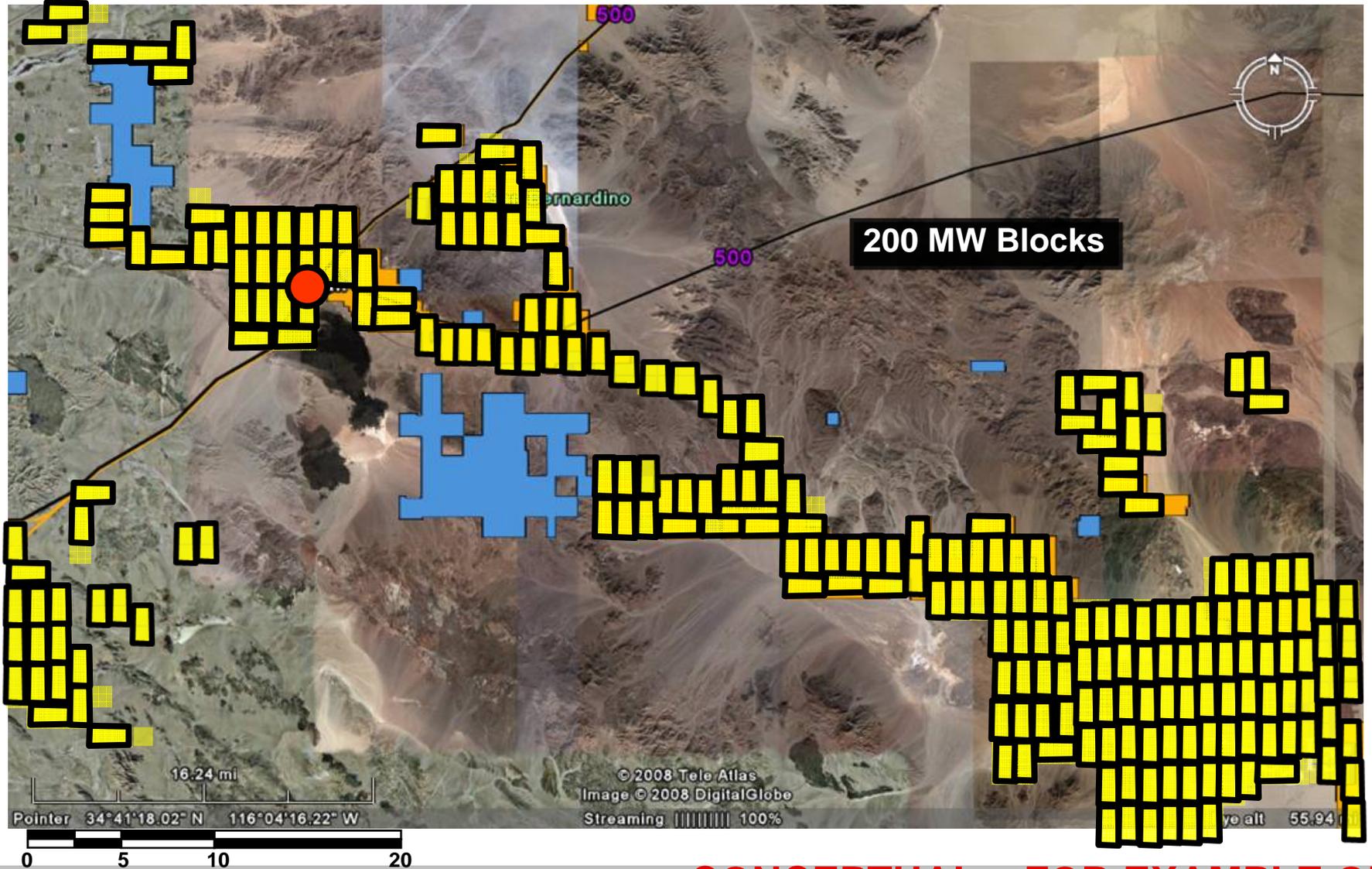
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# Project ID – Wind (1620 MW)



**CONCEPTUAL – FOR EXAMPLE ONLY**

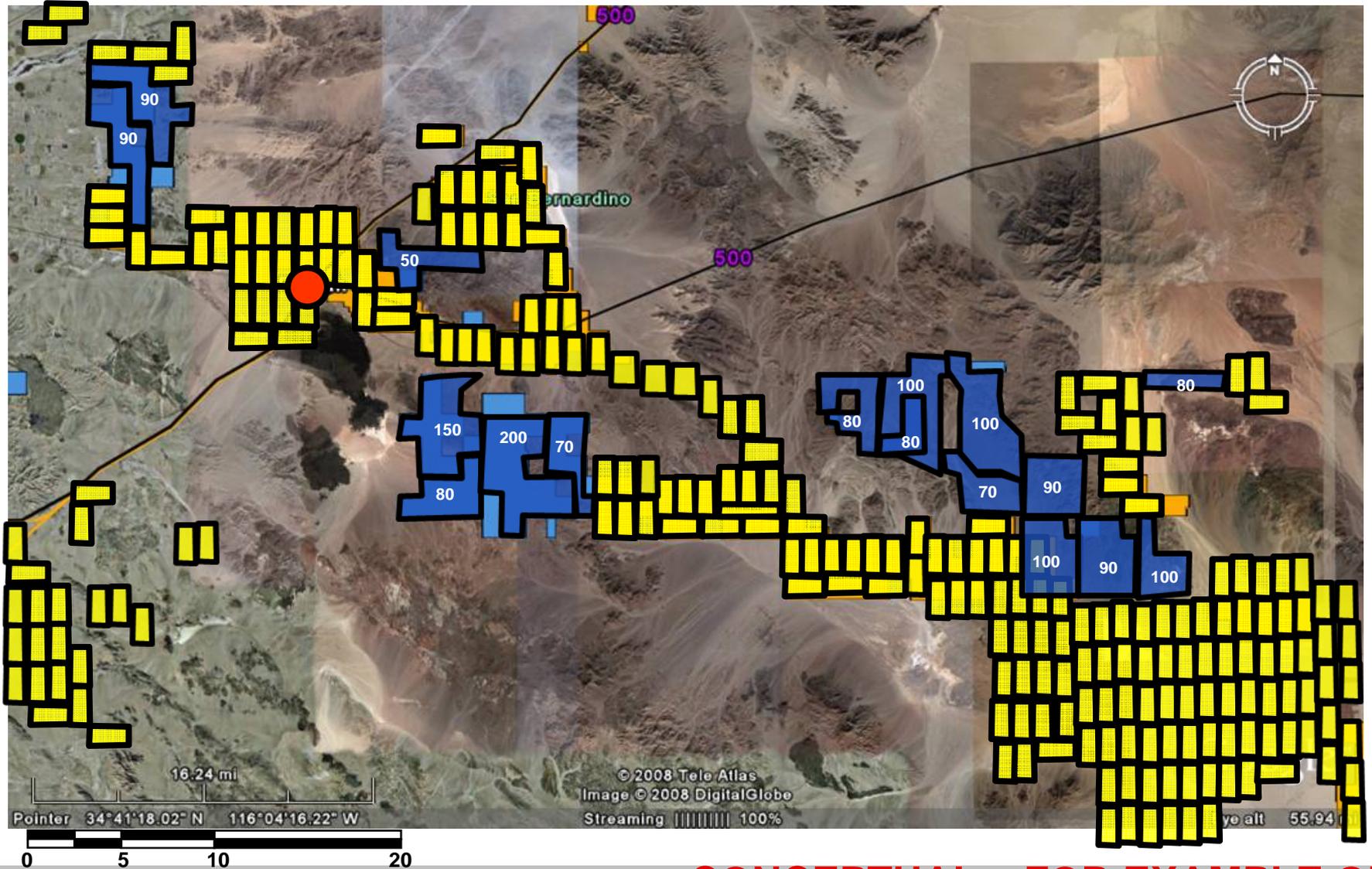
# Project ID – Solar (48,600 MW)



200 MW Blocks

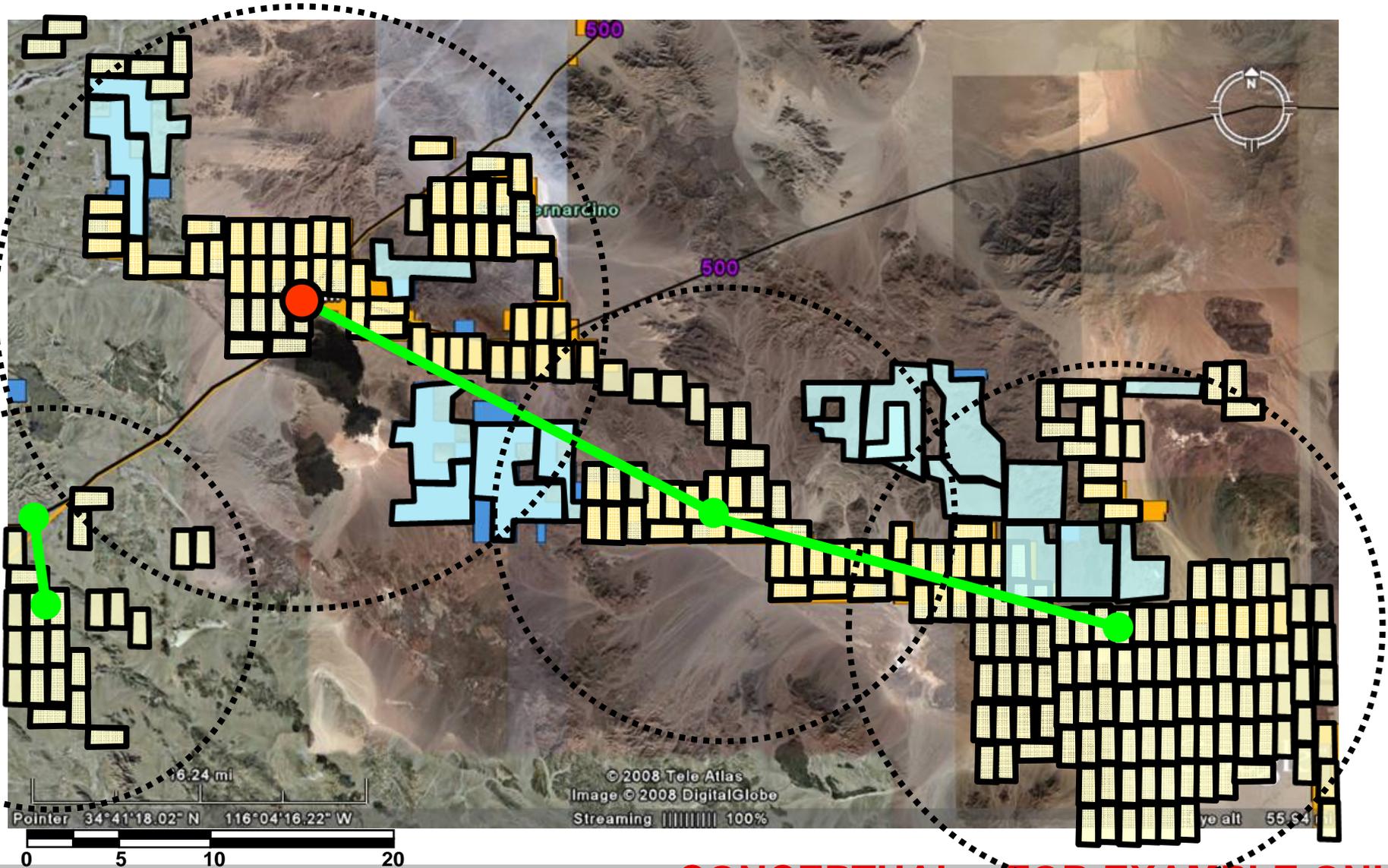
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# Project ID – Wind & Solar (50,220 MW)



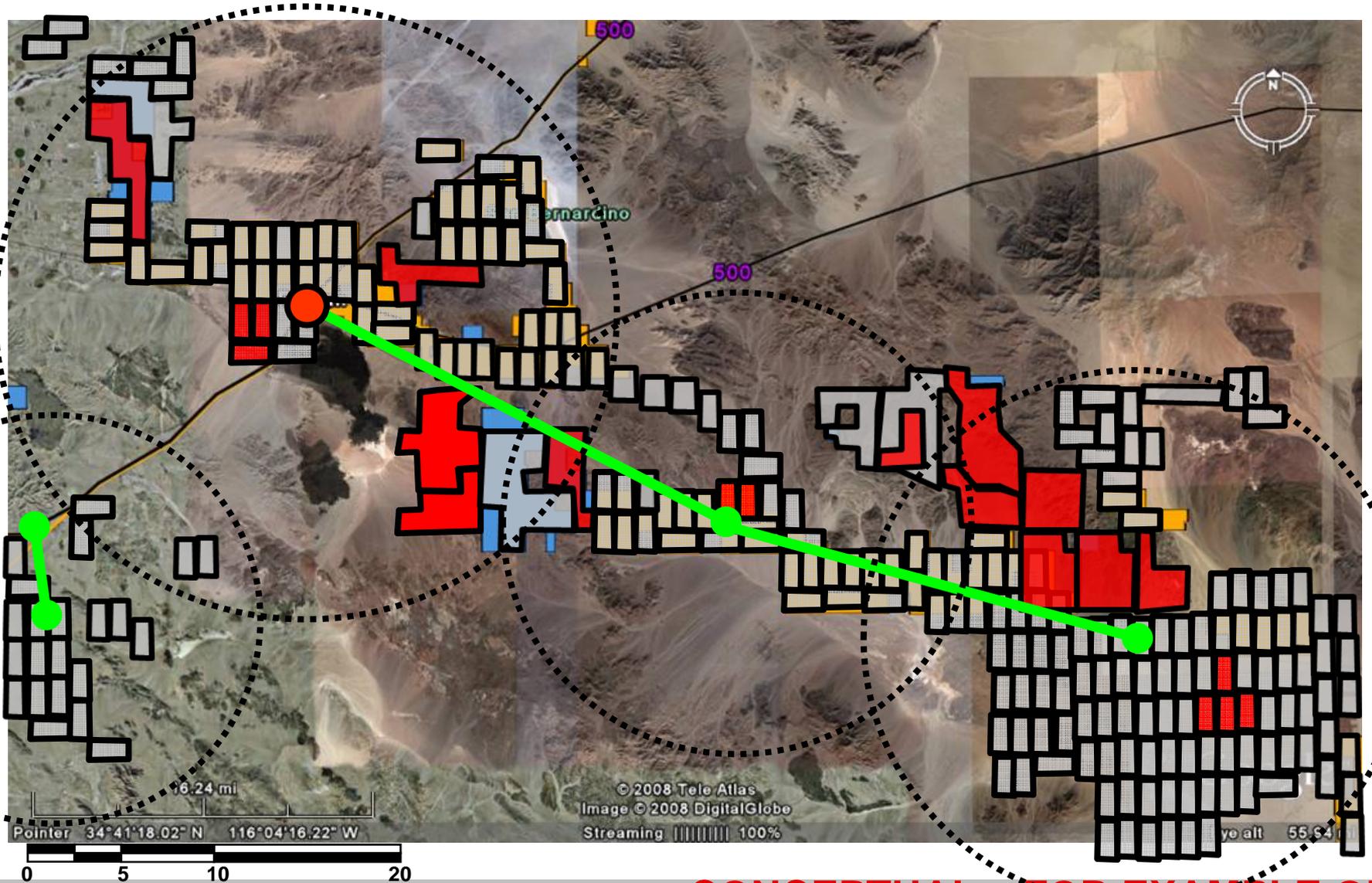
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# Trunklines to Create Four CREZs



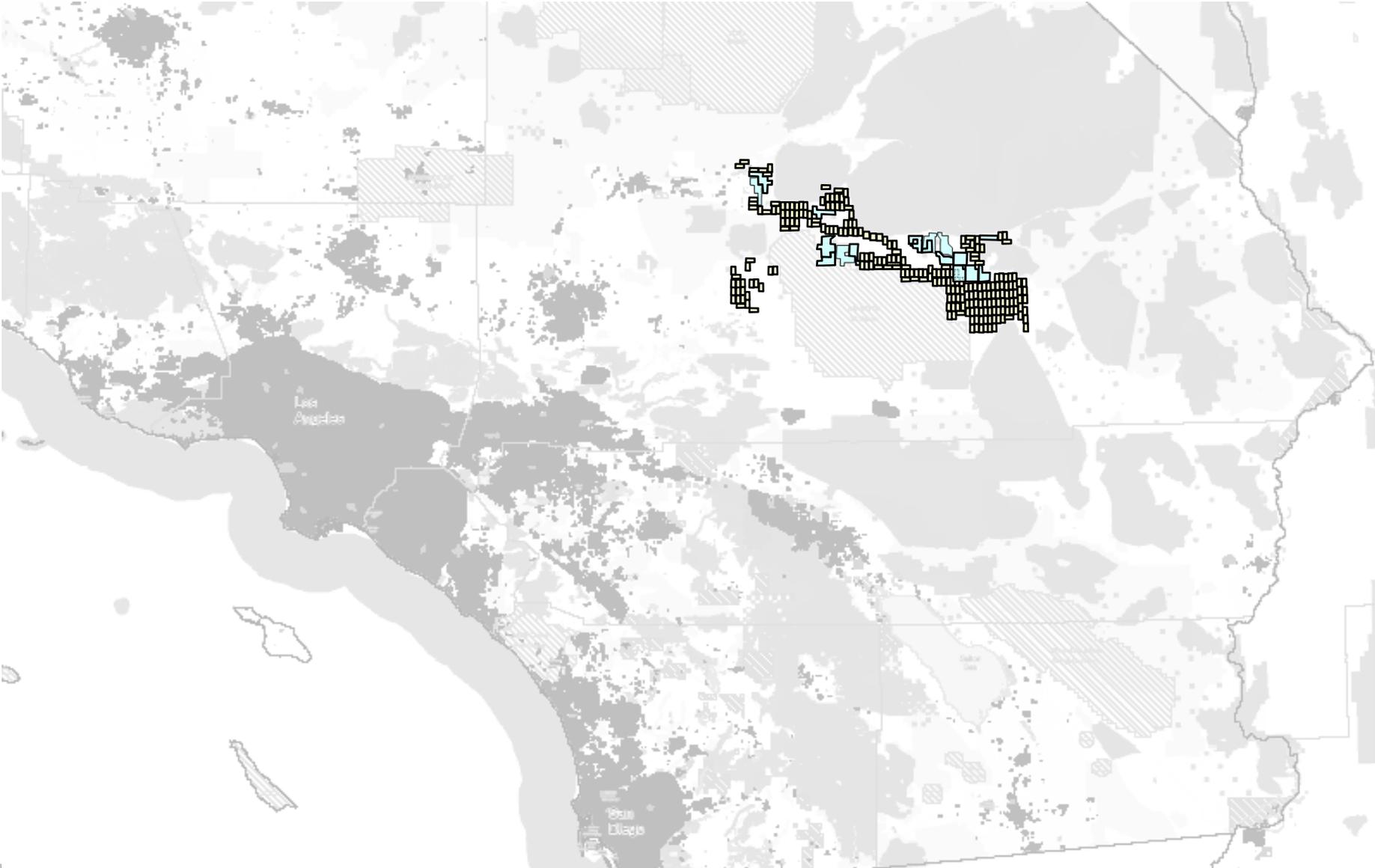
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# Hypothetical Best Projects



**CONCEPTUAL – FOR EXAMPLE ONLY**

# Sense of Scale



# Development Timeframe

- Near term: before 2013
- Mid term: 2013-2016
- Long term: 2017-2020

# Development Timeframe Linked to Transmission

Transmission Timing	Timeframe	Project Type	
		Pre-Identified	Proxy Projects
Existing Transmission	N/A	near	near
Approved Transmission	2009-2012*	near	mid
Proposed Transmission	2013-2016*	mid	mid
New Transmission	2017-2020	long	long

\* Timeframe assignment is typical. Will vary depending on specific transmission project timing

# Approved Transmission

- Tehachapi 1-3
- Tehachapi 4-11
- Sunrise Powerlink
- Devers – Palo Verde 2
- IID - Dixieland
- IID - Midway-Bannister

# Proposed Transmission

- TANC Projects
  - Alpha
  - Zeta
- PG&E
  - Central California Clean Energy Transmission
  - BC Link
- IID - PV-Yuma
- IID - CV – Devers
- Etc.

## New Transmission

- All other not-identified
- Other regional transmission links



# Thank You!

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