

Ewiiaapaayp Band of Kumeyaay Indians

Meteorological Tower Deployment
and Data Measurement and
Analysis

Ewiiaapaayp Indian Reservation

- The Ewiiaapaayp Reservation is divided between the 4,542.5-acre land parcel near Mt. Laguna that is approximately 47 miles east of San Diego and 19 miles east of Alpine, and the 10-acre land parcel at 4054/4058 Willows Road in Alpine, CA, an unincorporated community of east San Diego County.

The Project

- The Tribe continues its assessment of its wind resource and development plan for a wind energy project that it partially completed in 2004-2005 with a previous wind resource study.
- The development plan consists of the installation and operation of a 37.5 megawatt (MW) wind energy facility (wind farm), featuring 25 wind turbines and transmission lines.

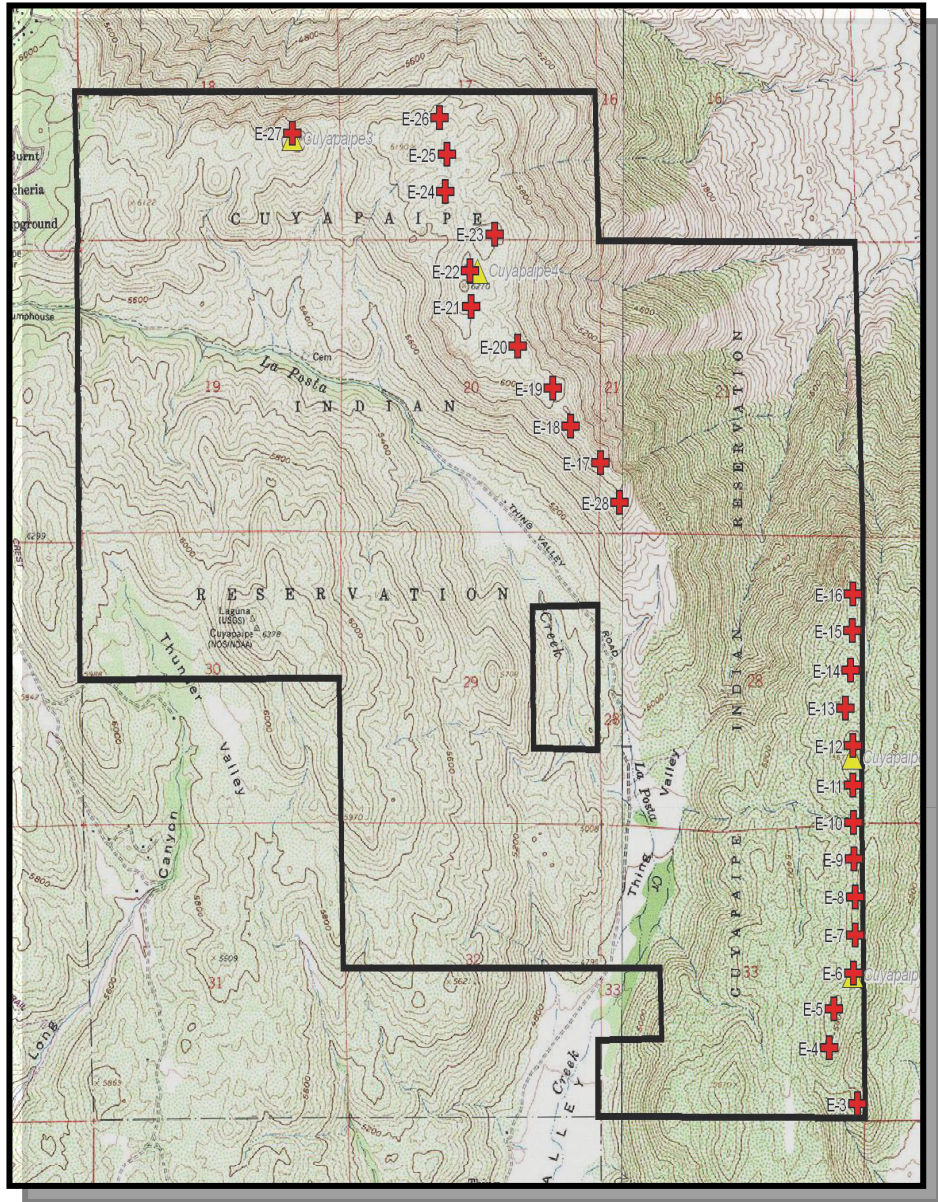


Figure 1
Regional Location Map

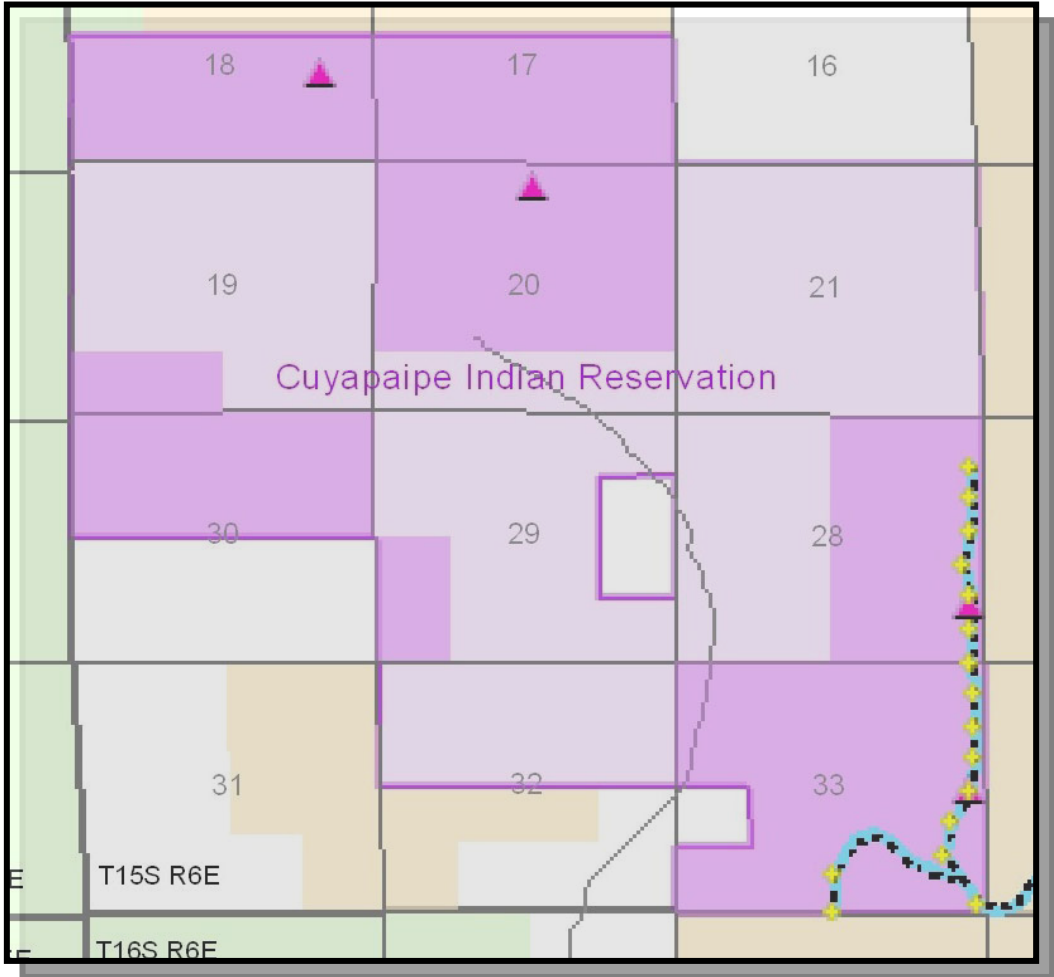


Proposed Development

- Each wind turbine would be constructed on an approximately 150' by 180' graded pad. Access to each graded pad would require the construction of access roads to two ridges. The transmission lines would connect the wind turbines to a future SDG&E transmission line, the Sunrise Powerlink to the north of the Reservation.
- The area of the proposed project would include access roads, service roads, wind turbines, an electric substation, and electric transmission lines.



Existing Met Tower Sites



Previous Study

- Calculations from the previously collected raw wind data and correlations among the towers show:
- Wind speeds at a hub height of 67m range between 7.7 m/s and 8.2 m/s across the development area.
- Using the Gamesa G87, an efficient 2.0 MW Class II wind turbine, gross capacity factors would range between 34% and 36% between Cuyapaibe #1 and #2.
- Gross capacity factors between Cuyapaibe #3 and #4 with the G87 would range between 39% and 36%.
- The aggregate gross capacity across the ridgelines may be on the order of 34% to 37%.

Long Term Wind Assessment

- Their long-term wind speeds along the ridgeline at 67m range from 7.4 – 7.7 m/s.
- Gross capacity factor values range between 31% - 33%.

Site Characteristics

- The extreme and frequent icing experienced at the site during the winter.
- Such icing may prove to be a significant productivity loss to any array.
- NRG 50m HD towers.

Data Capture and Analysis Project

- Installation and maintenance of two (2) NRG 50m HD meteorological (met) towers to record data for heavy icing events, electrical discharge caused by lightning strikes, and recording wind speeds at the 10m, 30m and 50m levels, particularly during 25 m/s wind speed events.
- New wind resource data will be applied to update the previous wind resource study.











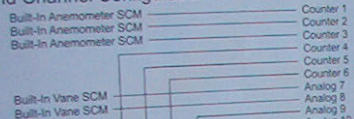
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Symphonie

INTERNET ENABLED

Logger
S/N: 30904471

Logger and Channel Configuration:



Clock Battery
use CR2032 Lithium Cell
+ to right
If Red LED lights,
battery is reversed!

Keypad and Display Quick Reference:

Press **[ON]** to turn on display or to return to home page at any time. Press number to select menu item.
In settings pages, **[SAVE]** saves your change, **[RETURN]** returns to the home page without saving.
To type numbers, use **[0-9]** for decimal point, and **[+/-]** for negative.
To type letters, use **[Red legends]**. Press key to select each letter in turn. **[NEXT]** moves to next letter. **[UP]** for upper case, **[DOWN]** for lower case. Press **[SYM]** for symbols.

Routine Site Check and Data Collection:

1. Check sensor readings. Press **[1]**, then **[UP]** and **[DOWN]** to scroll.
2. Check battery and clock. Press **[2]**.
3. Pull Data Card and label it.
4. If battery status is "Replace", replace both batteries now, one at a time.
Use only Alkaline "D" cells, IEC type LR20
5. Correct clock if needed. Press **[3]**.
6. Insert new Data Card.
7. Check Data Card status. Press **[4]**.



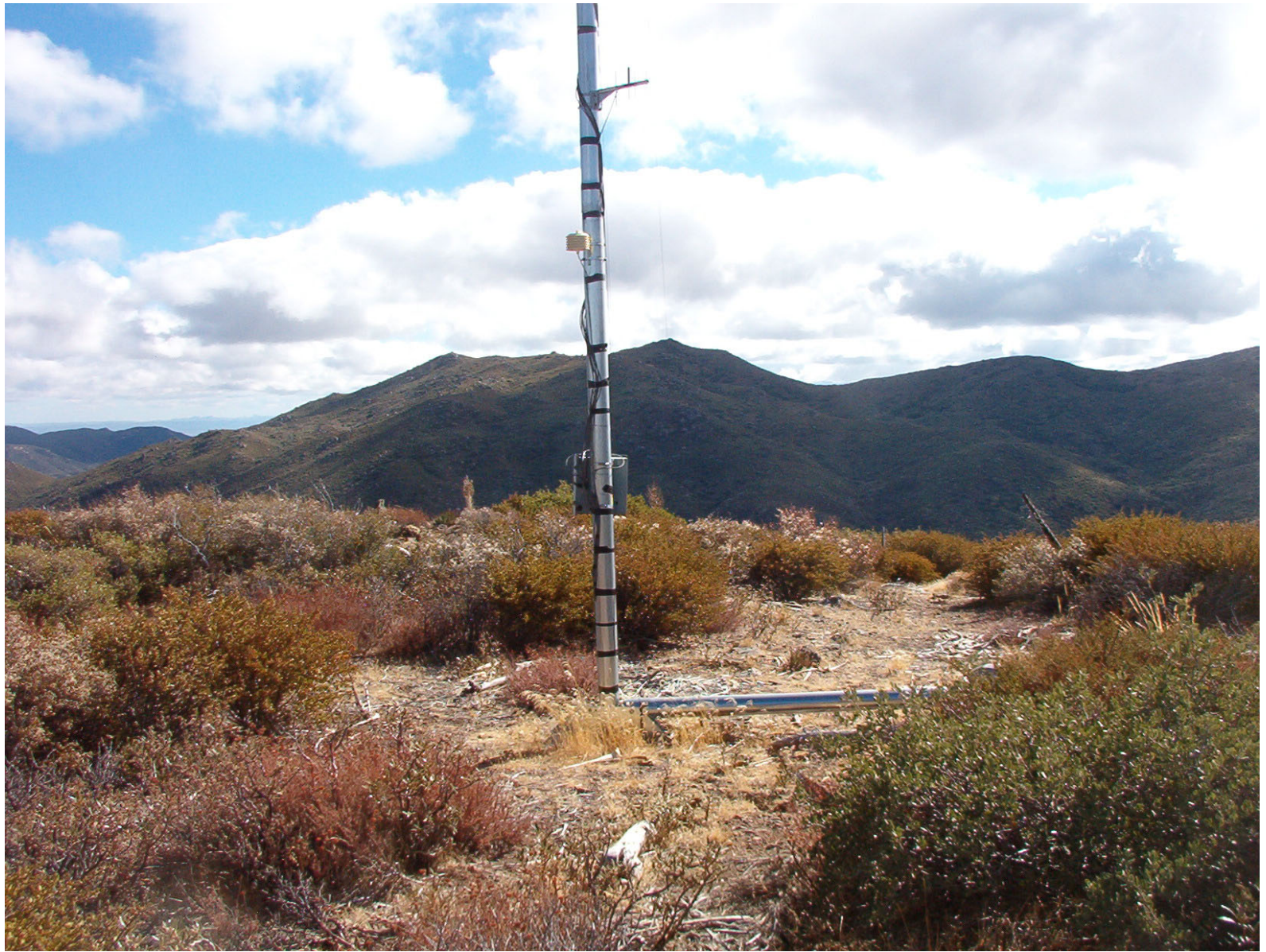
Symphonie
INTERNET ENABLED

Keypad with buttons: **[←]**, **[→]**, **[↑]**, **[↓]**, **[1]**, **[2]**, **[3]**, **[4]**, **[5]**, **[6]**, **[7]**, **[8]**, **[9]**, **[0]**, **[OK]**, **[HOME/ESC]**, **[SYM]**, **[NEXT]**, **[UP]**, **[DOWN]**

NRG
SYSTEMS





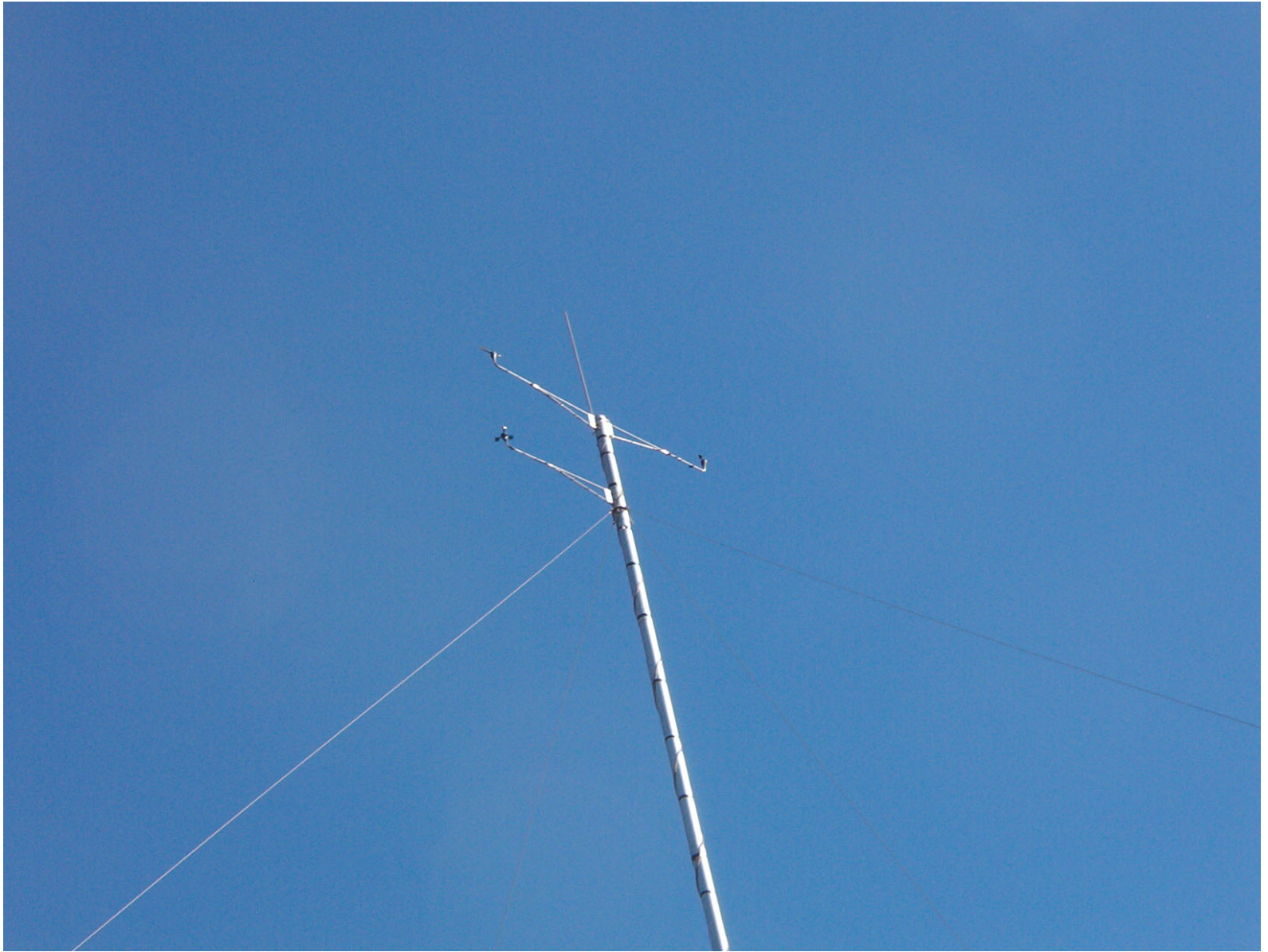






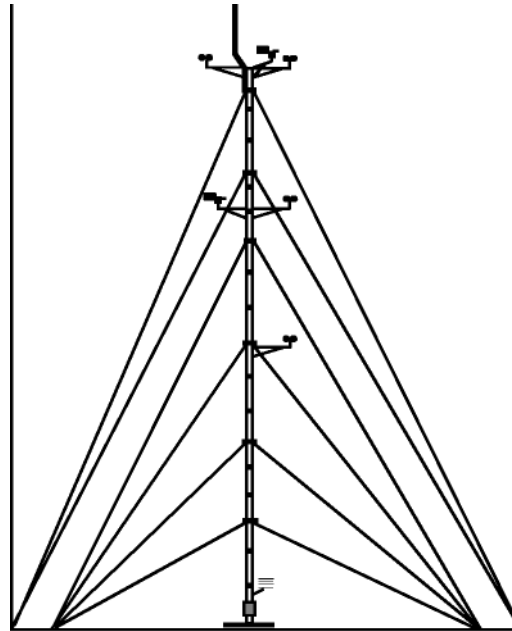








50 Meter HD Symphonie NRG-NOW System



50 Meter HD Symphonie NRG-NOW System

- **INCLUDES**
- 1 **50 Meter** (164 feet) **NRG TallTower™**, 203 mm (8.0 inches) diameter with galvanized steel baseplate, guy wires, screw-in anchors, and all necessary hardware for quick installation
- 1 **Symphonie** NRG Logger
- 2 16 MB Non-volatile MMC FLASH Memory Cards
- 1 Steel Shelter Box enclosure with mounting hardware for the Symphonie NRG Logger
- 4 NRG #40 Maximum Anemometers with protective terminal boots
- 2 NRG #200P Wind Direction Vanes with protective terminal boots 1 NRG 110S Temperature Sensor with Radiation Shield
- 6 Sensor Side Mount Booms with clamps for 50 m, 40 m and 30 m level sensors 4 #2C Shielded Sensor Cables for 50 m, 40 m and 30 m level anemometers 2 #3C Shielded Sensor Cables for 50 m and 40 m level wind direction vanes 1 Grounding Kit with lightning spike, ground rod, and 52.5 m solid copper
- grounding wire

50 Meter HD Symphonie NRG-NOW System

- **OPTIONS**
- **Symphonie iPack for AMPS Analog (North America) with PV Kit** Item No. 3273 **Symphonie iPack for GSM (International) with PV Kit** Item No. 3274 **Symphonie iPack for Dialup** Item No. 3161 **Symphonie iPack for PV only** Item No. 3166
- First time users will require the following equipment for operation of NRG-NOW Systems:
- **DataKit4 for Symphonie Logger & iPacks** Item No. 3279 For data analysis of Symphonie data from one or multiple sites
- **InstallKit for 50mHD** Item No. 3424 For installation of one or multiple 50 Meter HD NRG-NOW sites, includes
- Ginpole 12 m, 203 mm (8.0 inches) diameter for raising and lowering 50mHD TallTower
- 12 V Electric WinchKit (4082 kg / 9000 pounds)
- ToolKit with assorted nut drivers and spare wire rope clips

Meteorological Tower Data Study

- Wind resource study for the 2 sites.
- Wind data collected, and progress report. This report will include:
- Average and maximum wind speed, wind shear, and turbulence intensity data.
- Average, minimum, and maximum air temperature, pressure, and density information.
- Plots of 10-minute wind speed data
- Wind rose by month
- Wake and turbulence estimates
- Diurnal patterns by month
- Frequency distributions (by month and cumulative)
- Correlation parameters to long-term data sources (if possible)
- Long-term hub height wind speeds
- Hysteresis effect estimates
- Generation potential estimates
- Uncertainty analysis
- Analysis of the data, including any concerns regarding quality control or potential instrumentation issues.

Updated Resource Assessment

- At the conclusion of the eight months of data, update previous wind resource assessment.
- Evaluations of the wind data will be performed based on both the new data collected, and the data from the previous MET tower installations.
- Estimates for gross and net annual energy production will be calculated for the specified turbine (Gamesa G87) and other candidate turbines.
- Additional analysis such as radar interferences, zones of visual influence, noise and optimizations for turbine layouts, roads and collection systems.
- Independent wind energy meteorologist to further review the data, and provide a separate analysis report.

Sensors and Configurations

- Frequent, long term icing events at MET locations require the use of heated sensors
- A standard non-heated anemometer should be installed at the same level as a heated anemometer.
- A non-heated wind vane should also be installed with a heated vane at the same monitoring level.
- For each of the two NRG 50m HD towers, the following sensor configuration:
 - 50m Monitoring Level –NRG IceFree3 Heated Anemometer (Primary Sensor) NRG IceFree3 Heated Wind Vane NRG #40 Anemometer (Redundant Sensor)
 - 30m Monitoring Level –NRG #40 Anemometer NRG #200P Wind Vane
 - 10m Monitoring Level –NRG #40 Anemometer
- Power consumption during extreme icing events lasting longer than 2 two weeks require a “stand-alone” power supply be installed with each tower consisting of a 10 watt PV panel accompanied by a PV controller and two 12 volt 125 ampere-hour sealed lead-acid marine batteries (connected in series).

On Site Equipment Delivery

- Picked up by the installer via a rented truck and taken to staging area.
- Transported via helicopter to the installation sites.

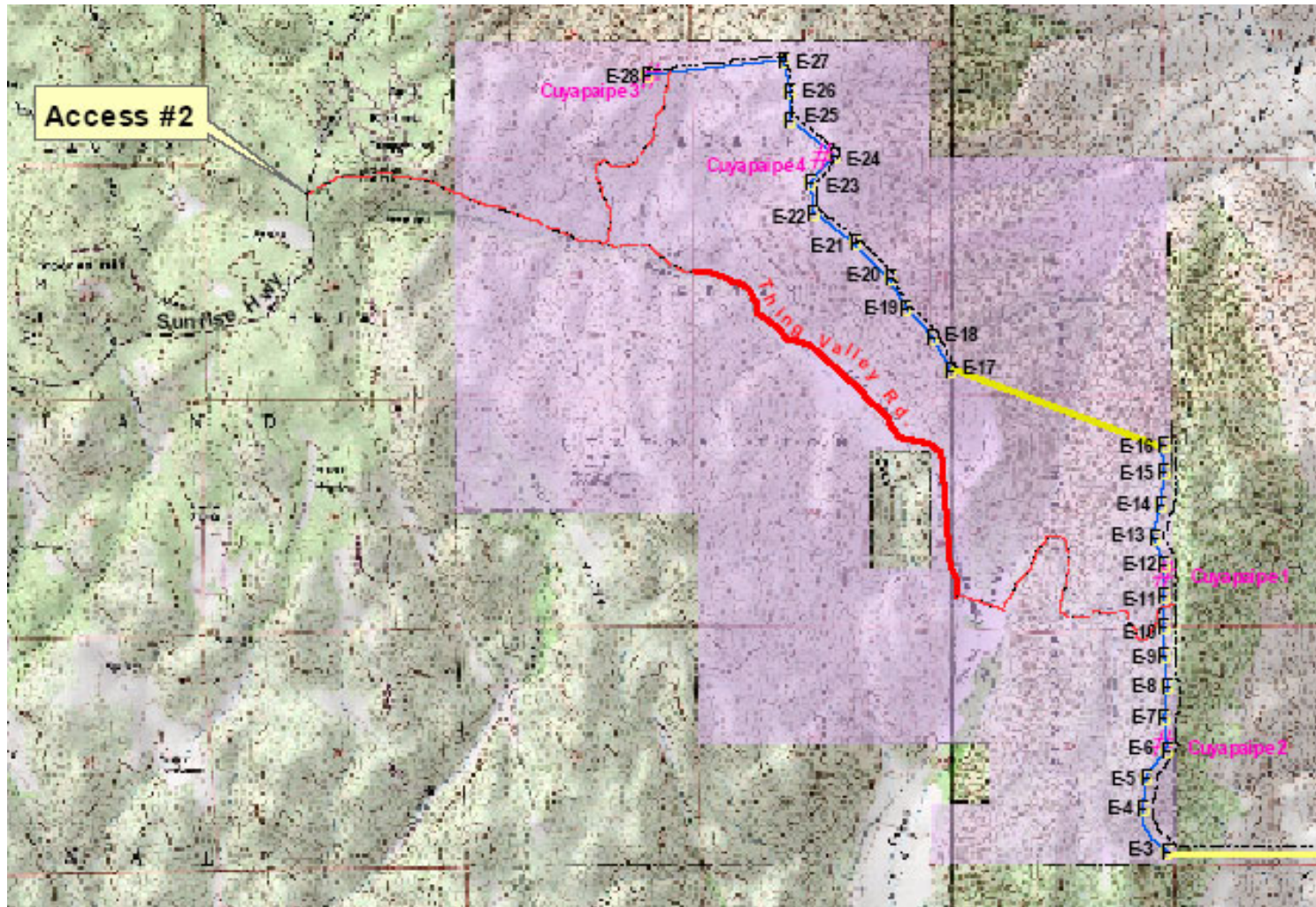
Meteorological Tower Maintenance and Data Monitoring

- Maintenance & inspections of the MET towers for the duration of data collection period.
Parameters to check will include:
- Condition of the instruments, especially the anemometers and wind vanes
- Condition of the guy anchors and wires
- Condition of the tower
- Condition of the power supply
- Any signs of weather damage or excessive icing
- Any signs of vandalism

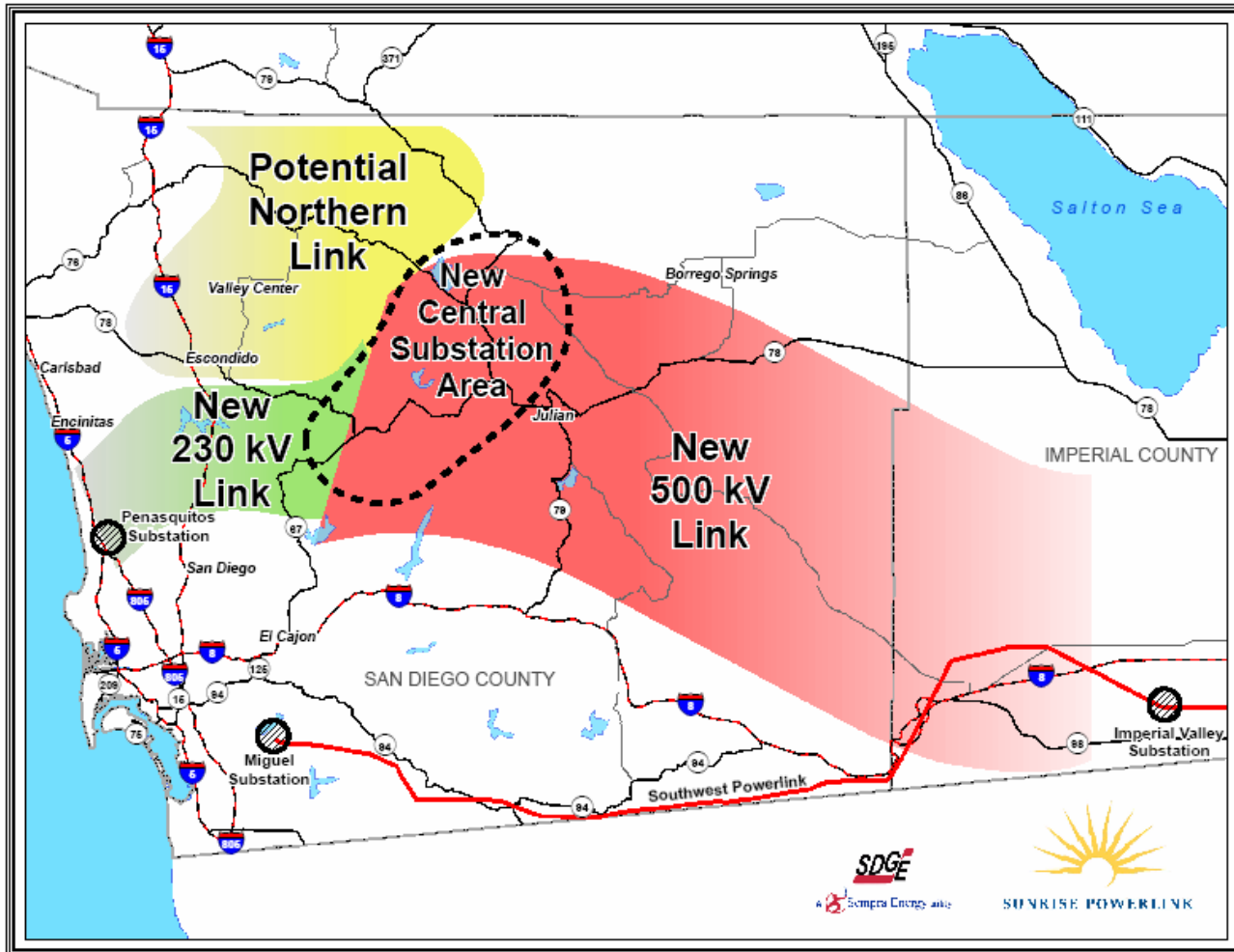
Data Monitoring

- Quality control checks on a weekly basis.
- Visual inspection of the time series data (to spot periods of icing or sensor failure.
- Comparison of wind speed measurements at different heights on the same tower and between towers.

Project Goal



Proposed Transmission Line



Corridor Map

