2.5 Noise

This section of the Environmental Impact Report (EIR) evaluates noise and vibration impacts resulting from development of the Jacumba Solar Energy Project (Proposed Project). Information contained in this section is based on review of existing documentation, including the following:

- *Acoustical Assessment Report, Jacumba Solar Energy Project* (prepared by Dudek in 2014 (updated 2015) and included as Appendix 2.5-1 to this EIR)

2.5.1 Existing Conditions

This section describes basic noise information, the existing setting in the Proposed Project area, and also identifies the resources that could be affected by the Proposed Project.

Noise Measurement

Noise is typically defined as unwanted sound. Sounds are perceived based on their loudness (i.e., volume or sound pressure level) or pitch (i.e., tonal or frequency content). The standard unit of measure for sound pressure levels is the decibel (dB). Sound pressures in the environment have a wide range of values and the sound pressure level was developed to describe this range as a logarithm of the sound pressure. The sound pressure level is the logarithm of the ratio of the unknown sound pressure to an agreed upon reference quantity. To account for the pitch of sounds and the corresponding sensitivity of human hearing to them, the raw sound pressure level is adjusted with an A-weighting scheme based on frequency that is stated in units of decibels (dBA). The A-weighting scale is appropriate because it is a close approximation of the human response to different frequencies of sound and is in broad use across many disciplines that address noise. The A-weighting scale attenuates low-frequency noises in a manner that simulates how human ears attenuate low-frequency noise at low levels (approximately 40 dB). The A-weighting scale is the most common weighting scale for environmental acoustics analysis and assessing compliance with applicable noise limits. State and federal agencies that regulate environmental noise throughout the United States rely on the A-weighted decibel, or dBA, as the appropriate metric for assessing human response to noise. San Diego County Code of Regulatory Ordinances Section 36.403, Sound Level Measurement, specifies that sound level measurements "shall be measured with a sound level meter using A-weighting."

While there are weighting scales other than the A-weighting scale, which simulates human response to frequencies of sound, use of other weighting scales produces results that do not reflect how human ears respond to different frequencies of sound. Therefore, they are not used in the context of an environmental acoustics analysis performed to assess compliance with applicable noise limits. C-weighting, for example, is nearly flat for audible frequencies, and

therefore narrowly accounts for the human ear's decreased sensitivity to high and low frequencies while approximating the human ear's sensitivity to higher intensity sounds.

Typical A-weighted noise levels are listed in Table 2.5-1, Typical Sound Levels Measured in the Environment and Industry.

A given level of noise can be more or less tolerable depending on the sound level, duration of exposure, character of the noise sources, time of day during which the noise is experienced, and activity affected by the noise. For example, noise that occurs at night tends to be more disturbing than that which occurs during the day because sleep has the potential to be disturbed. Additionally, rest at night is a critical requirement in the recovery from exposure to high noise levels during the day. In consideration of these factors, different measures of noise exposure have been developed to quantify the extent of the effects anticipated from these activities. For example, some indices consider the 24-hour noise environment of a location by using a weighted average to estimate its habitability on a long-term basis. Other measures consider portions of the day and evaluate the nearby activities affected by it as well as the noise sources. The most commonly used indices for measuring community noise levels are the equivalent energy level (L_{eq}), and the community noise equivalent level (CNEL).

- **L_{eq},** the equivalent energy level, is the average acoustical or sound energy content of noise, measured during a prescribed period, such as 1 minute, 15 minutes, 1 hour, or 8 hours. It is the decibel sound level that contains an equal amount of energy as a fluctuating sound level over a given period of time.
- **CNEL,** community noise equivalent level, is the average equivalent A-weighted sound level over a 24-hour period. This measurement applies weights to noise levels during evening and nighttime hours to compensate for the increased disturbance response of people at those times. CNEL is the equivalent sound level for a 24-hour period with a +5 dBA weighting applied to all sound occurring between 7:00 p.m. and 10:00 p.m., and a +10 dBA weighting applied to all sound occurring between 10:00 p.m. and 7:00 a.m.

The decibel level of a sound decreases (or attenuates) exponentially as the distance from the source of that sound increases. For a single point source such as a piece of mechanical equipment, the sound level normally decreases by about 6 dBA for each doubling of distance from the source. Sound that originates from a linear (or "line") source, such as a heavily traveled traffic corridor, attenuates by approximately 3 dBA per doubling of distance, provided that the surrounding site conditions lack ground effects or obstacles that either scatter or reflect noise.

Noise Effects

Noise can have a substantial effect on the quality of life. An individual's reaction to a particular noise depends on many factors, such as the source of the noise, its loudness relative to the background noise level, and the time of day. The reaction to noise can also be highly subjective; the perceived effect of a particular noise can vary widely among individuals in a community. Because of the nature of the human ear, a sound must be about 10 dBA greater than the reference sound to be judged as twice as loud. In general, a 3 dBA change in community noise levels is perceivable, while 1 to 2 dBA changes generally are not perceived. Although the reaction to noise can vary, it is clear that noise is a significant component of the environment, and excessively noisy conditions can affect an individual's health and well-being. The effects of noise are often only transitory, but adverse effects can be cumulative with prolonged or repeated exposure. The effects of noise can be organized into six broad categories: general annoyance, sleep disturbance, interruption of human performance and behavior, interruption of social interaction of communication, extra-auditory health effects, and permanent hearing loss.

Ground-Borne Vibration

Ground-borne vibration propagates from the source through the ground to adjacent buildings by surface waves. Vibration may be composed of a single pulse, a series of pulses, or a continuous oscillatory motion. The frequency of a vibrating object describes how rapidly it is oscillating, measured in hertz (Hz). The normal frequency range of most ground-borne vibration that can be felt generally starts from a low frequency of less than 1 Hz to a high of about 200 Hz. Vibration energy spreads out as it travels through the ground, causing the vibration amplitude to decrease with distance away from the source. Ambient and source vibration are often expressed in terms of the peak particle velocity (PPV) or root mean square (RMS) velocity in inches per second that correlates best with human perception. The Federal Transit Administration estimates that the threshold of perception is approximately 0.0001 inches/second RMS and the level at which continuous vibrations begins to annoy people is approximately 0.001 inches per second (in/sec) RMS.

Vibration-Sensitive Land Uses

Ground-borne vibration can disrupt vibration-sensitive land uses by causing movement of buildings, rattling of windows and items inside buildings, rumbling sounds, and even property damage. Vibration-sensitive land uses include buildings where vibration would interfere with operations within the building, such as vibration-sensitive research and manufacturing, hospitals with vibration-sensitive equipment, and university research operations. The degree of sensitivity to vibration depends on the specific equipment that would be affected by the vibration. Residential uses are also sensitive to excessive levels of vibration of either a regular or an intermittent nature. According to the Transit Noise and Vibration Impact Assessment (FTA

2006), background vibration level in residential areas is typically 0.00003 inches/second RMS, which is lower than 0.0001 in/sec RMS, the threshold of perception for humans. There are several sources of ground-borne vibration in the unincorporated areas of San Diego County (County), including construction, railroad operations, and extractive mining operations.

Regional and Local Setting

The Proposed Project is located approximately 3 miles to the east of the community of Jacumba Hot Springs and immediately north of the U.S./Mexico International Border.

The Proposed Project site is subject to the General Plan Rural Lands Regional Category and contains lands within the Rural Lands 80 (RL-80) Land Use Designation. The Proposed Project site is also subject to the policies of the Mountain Empire Subregional Plan and Jacumba Subregional Group Community Plan. The Proposed Project site is zoned as General Rural (S-92). The Proposed Project use could only be allowed with the approval of a major use permit on the Proposed Project site.

Existing Noise Conditions

The Proposed Project site is located approximately 1,200 feet south of Old Highway 80, a two-lane road. Existing noise sources in the area include distant traffic noise, distant construction noise, rustling leaves and distant electrical corona noise from adjacent energy facilities.

Noise measurements were conducted on June 25, 2014[1]. The noise measurements were conducted for 20 minutes at the locations depicted as Sites M1 through M5 on Figure 2.5-1, Noise Measurement Locations. The measured average, maximum, and minimum noise levels are shown in Table 2.5-2, Measured Noise Level. The measured average ambient noise levels ranged from approximately 53 dBA L_{eq} at Site M1, located near the southwest boundary of the Proposed Project site, to 65 dBA L_{eq} at Site M4, located adjacent to the nearest noise sensitive land use (NSLU) (a residence), located 3,500 feet north of the Proposed Project site. At Site M4 the dominant noise source was traffic from Interstate 8 (I-8).

Noise Sensitive Land Uses

NSLUs include residential, schools, hospitals, hotels, daycare facilities, and passive recreational parks. The Proposed Project would consist of a solar energy collection/generation facility with

[1] During this time, construction activity was ongoing at the East County (ECO) Substation project, to the northeast of the Proposed Project. The construction activity which was audible primarily consisted of worker trucks and a roller working on Old Highway 80, large materials delivery trucks to the substation site, and several helicopter flyovers along the transmission line alignment and near the site. Some of this noise was audible at the measurement locations, although the overall effect on average ambient noise levels was relatively minor. The noise environment was generally dominated by local vehicle traffic on nearby roadways, distant traffic on I-8, noise from rustling leaves, and corona discharge noise.

neither dedicated office space nor any related residential components; therefore, the Proposed Project would not create an NSLU. The nearest residence to the Proposed Project site is located approximately 3,500 feet to the north.

2.5.2 Analysis of Proposed Project Effects and Determination as to Significance

Noise and vibration impacts are evaluated based on specified thresholds identified in Appendix G of the California Environmental Quality Act (CEQA) Guidelines (14 CCR 15000 et seq.) and in the County of San Diego's Guidelines for Determining Significance: Noise (County of San Diego 2009).

Methodology and Noise Calculations

Noise measurements were conducted at the Proposed Project site and at nearby noise-sensitive land uses to determine the existing noise levels. The measurements were made using a calibrated SoftdB Piccolo integrating sound level meter equipped with 0.5-inch pre-polarized condenser microphone with pre-amplifier. The sound level meter meets the current American National Standards Institute standard for a Type 2 (General Purpose) sound level meter. The sound level meter was positioned on a tripod at a height of approximately 5 feet above the ground, to replicate the approximate height of a standing person's audio experience, and fitted with a wind screen to limit the noise of wind friction on the instrument.

Noise levels resulting from the outdoor mechanical equipment is based on manufacturer's data or published noise levels. Noise levels associated with the proposed construction activities have been obtained from reports prepared by the Federal Transit Administration and field data from files (FTA 2006). The noise impact assessment utilized criteria established in the County of San Diego General Plan Noise Element (County of San Diego 2011) and Noise Ordinance (County of San Diego 2009).

2.5.2.1 Increase in Ambient Noise Levels from Construction Activities

Guidelines for the Determination of Significance

According to the County of San Diego Guidelines for Determining Significance, the Proposed Project would have a significant noise impact if it would result in excess of any of the following:

- Construction Noise: The standards listed in San Diego County Code Section 36.409, Sound Level Limitations on Construction Equipment. Section 36.409 states: Except for emergency work, it shall be unlawful for any person to operate construction equipment or cause construction equipment to be operated, that exceeds an average sound level of 75 dB for an eight-hour period, between 7:00 a.m. and 7:00 p.m., when measured at the

boundary line of the property where the noise source is located or on any occupied property where the noise is being received.

- Impulse Noise: The standards listed in San Diego County Code Section 36.410, Sound Level Limitations on Impulsive Noise. Section 36.410 states: Except for emergency work or work on a public road project, no person shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level, when measured at the boundary line of the property where the noise source is located or on any occupied property where the noise is received, for 25% of the minutes in the measurement period. The maximum sound level depends on the use being made of the occupied property and are as follows:
    - Residential, village zoning, or civic use – 82 dBA
    - Agricultural, commercial, or industrial use – 85 dBA
    - The minimum measurement period for any measurements conducted for impulse noise determination shall be one hour. During the measurement period, a measurement shall be conducted every minute from a fixed location on an occupied property. The measurements shall measure the maximum sound level during each minute of the measurement period. If the sound level caused by construction equipment or the producer of the impulsive noise, exceeds the maximum sound level for any portion of any minute it will be deemed that the maximum sound level was exceeded during that minute.

Analysis

Noise resulting from construction of the Proposed Project would be considered temporary due to its short-term nature. The construction of the Proposed Project would consist of several phases, including site preparation (clearing, grading, and collection system trenching), development of staging areas and site access roads, solar array assembly and installation (photovoltaic (PV) module construction), and construction of electrical transmission facilities.

The temporary increase in traffic related to construction of the Proposed Project would also result in a temporary increase in noise levels in and around the Proposed Project site. Existing traffic is very low on local roads surrounding the Proposed Project site because the surrounding area is rural. The number of workers expected on site during construction would vary over the construction period with an average of approximately 120 personnel each day, with a maximum number of daily workers of approximately 140, generating approximately 126 daily round trips (or 252 ADT) during the installation of racks and panels. It is assumed that all employees would arrive within the morning peak hour and depart within the evening peak hour, and delivery truck trips would be distributed evenly throughout a 12-hour-shift day, between the hours of 7:00 a.m. and 7:00 p.m. Deliveries of equipment and supplies to the site would also vary over the construction period but are expected to average approximately five to seven daily trips. The

grading activities result in the need for the most intense water use with 74 truck deliveries a day. During the grading phase, approximately 278 average daily trips (ADT) would be generated (139 round trips). The maximum number of workers would occur during the racks and panels installation, when water deliveries would be considerably reduced (requiring approximately 10 water truck deliveries a day); equipment deliveries would be ongoing throughout this phase. The trips generated during this phase would be approximately 298 ADT (149 round trips).

General Construction

Construction activities would occur during the County's allowable hours of operation (i.e., 7:00 a.m. to 7:00 p.m.). The noise levels generated by construction equipment would vary greatly depending upon factors such as the type and specific model of the equipment, the activity being performed, the condition of the equipment, the amount of time that the equipment operates, and the intensity of the construction during the time period.

Construction equipment would include standard equipment such as graders, scrapers, backhoes, loaders, cranes, dozers, water trucks, portable generators and air-compressors, and miscellaneous trucks. The maximum noise level ranges for various pieces of typical construction equipment associated with this type of project at a distance of 50 feet are depicted in Table 2.5-3, Construction Equipment Noise Emission Levels, with the maximum noise levels ranging up to 88 dBA. While the hourly average noise levels would vary, construction noise levels of up to approximately 75 to 80 dBA at 50 feet are typical for the anticipated construction activities. Construction noise in a well-defined area typically attenuates at approximately 6 dB per doubling of distance. When the sites have an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, an excess ground attenuation value of 1.5 dB per doubling distance can be assumed (Caltrans 2009).

The closest sensitive receptor (residence) is located approximately 3,500 feet north of the Proposed Project site. The construction equipment would be spread out over the entire site with some equipment operating along the perimeter of the site while the rest of the equipment could be located 2,000 to 3,500 feet from the same property perimeter. The most intense noise generation from construction is expected to be associated with earthmoving activity to produce level ground for the installation. A combination of dozer and loader working together would generate a maximum noise level of approximately 88 dBA at a distance of 50 feet. At a distance of 3,500 feet, which is the shortest distance between earthmoving activity and the property boundary of any occupied residence, the maximum noise level from earthmoving would be approximately 50 dBA.

Earthmoving along any single property boundary abutting the site would not occur for more than 50% of an hour, the average hourly noise level would be approximately 85 dBA at 50 feet from

the equipment or 47 dBA2 at 3,500 feet, the distance to the closest residential property boundary. Therefore, construction-related noise would be compliant with the County's construction noise criterion and impacts would be less than significant.

Impulse Noise

During construction, a pile/vibratory/rotary driving technique, similar to that used to install freeway guardrails, would be used to install 4- to 6-inch-diameter pipes or beams at a depth of 10 to 15 feet to which the panel rack(s) would be attached.

It is anticipated that an RTG Model RG21T vibratory pile driver or comparable driver would be used. Based on previous experience, the applicant requires only approximately 18 minutes to set up the pile driver, drive a pile, and move to the next pile driving location. This time would also allow for complications in a more rocky terrain. Based upon data provided by the equipment vendor for this product and prior project experience, this size and type of equipment is anticipated to generate a maximum noise level of approximately 85 to 92 dBA at a distance of 50 feet (RTG 2014; Dudek 2013). At a distance of 3,500 feet, which is the shortest distance between the pile driving activity and the property boundary of any occupied residence, the maximum noise level from pile driving would be approximately 47 to 54 dBA.[2]

Assuming pile driving occurs for approximately 20% of an hour at each panel rack(s) site, the average hourly noise level would be approximately 78 to 85 dBA at 50 feet from the pile driver or 41 to 48 dBA[3] at 3,500 feet, the distance to the closest residential property boundaries to the pile driving locations. Therefore, noise from pile driving would be less than the County's impulsive noise criterion of 82 dBA, resulting in a **less than significant impact**.

2.5.2.2 Noise Levels from Operational Activities

On-site operational noise sources associated with the Proposed Project would include pad-mounted inverters and transformers, substation transformers, the DC underground collection systems linking the panels to the on-site substation, the collector substation site, and the energy storage facility located within the collector substation boundaries. Each of these noise sources are discussed below.

Building Block Inverters and Transformers

The solar PV modules would be electrically connected to adjacent modules to form module "strings" using wiring attached to the support structures. PV module strings would be electrically connected to each other via underground wiring, which ultimately would be connected to the

[2] Neglecting additional noise reduction from atmospheric absorption, terrain shielding, etc.
[3] Ibid.

inverters and transformers. The inverters within the electrical enclosures would convert the DC power to AC power and the medium-voltage transformers would step up the voltage to collection-level voltage of 34.5 kilovolts (kV). The inverters, medium-voltage transformers, and other electrical equipment are proposed to be either outdoor rated or mounted within enclosures designed specifically for outdoor installation and would sit on site.

The proposed Sunny Central 750 watt (W) (24 units) and 500 W (four units) inverters have a noise level rating of 60 dBA at 10 meters (SMA Solar Technology 2014). The transformer has a sound rating of 60 dBA at 5 feet based on National Electric Manufacturers Association ratings for the size of transformer anticipated to be used with inverters (NEMA 2000).

Energy Storage Facility and Connector Line

An energy storage facility is proposed adjacent to the on-site substation in the northeast section of the Proposed Project site. It would consist of seven connex boxes equipped with batteries that would be capable of storing approximately 10 megawatts (MW) of energy, via associated step-up transformers and power inverters. Each connex box would include an air conditioning unit for cooling purposes and a self-extinguishing fire system. A 138 kV overhead power line would interconnect the Proposed Project to the ECO Substation.

The heating, ventilation, and air conditioning (HVAC) unit for each storage trailer would be a primary source of noise generation associated with the energy storage component of the Proposed Project. Standard literature from one energy storage vendor indicates a typical installation of one step-up transformer for each pair of trailers. Therefore, a total of seven HVAC units, seven power inverters, and four transformers would be required.

While it is not known what HVAC would be purchased, information from the vendor for a similar energy storage project (Rugged LLC 2014) indicates the HVAC unit which is supplied as standard equipment for the storage containers produces 68 dBA at a distance of 50 feet during full operation (NACO Model 30RB120). An alternate HVAC unit with the same capacity is available from another vendor, which has a much lower sound rating of 60 dBA at a distance of 30 feet during full operation (Daikin McQuay 025D). The anticipated step-up transformer has a sound rating of 60 dBA at 5 feet based on National Electric Manufacturers Association ratings for the size of transformer anticipated to be used with storage battery systems (NEMA 2000). The anticipated power inverter is a Xantrex model, or equivalent, which has a noise level rating of 77 dBA at 6 feet (Schneider Electric 2011).

Guidelines for the Determination of Significance

Noise Ordinance

According to the County of San Diego's Guidelines for Determining Significance, the Proposed Project would have a significant noise impact if it would result in excess of any of the following:

- Non-Construction Noise: The limit specified in the San Diego County Code Section 36.404, General Sound Level Limits, at the property line of the property on which the noise is produced or at any location on a property that is receiving the noise. Based on the Proposed Project's zoning of S92, the noise level limits are as follows:
  - Between 7:00 a.m. and 10:00 p.m., the one-hour average sound level limit is 50 dBA
  - Between 10:00 p.m. and 7:00 a.m., the one-hour average sound level limit is 45 dBA

Noise Element

According to the County of San Diego's Guidelines for Determining Significance, the Proposed Project would have a significant noise impact if it would result in exposure of an on- or off-site, existing or reasonably foreseeable future NSLU to exterior or interior noise, including noise from roads, railroad, heliports, and all other noise sources (airports discussed specifically in Section 2.5.2.4) in excess of any of the following:

- Exterior Locations: 60 dB (CNEL) or an increase of 10 dB (CNEL) over preexisting noise. In the case of single-family residential detached NSLUs, exterior noise shall be measured at an outdoor living area which adjoins and is on the same lot as the dwelling, and which contains at least the following minimum area:
  - Net lot area up to 4,000 square feet: 400 square feet
  - Net lot area 4,000 square feet to 10 acres: 10% of net lot area
  - Net lot area over 10 acres: 1 acre
    - For all other projects, exterior noise shall be measured at all exterior areas provided for group or private usable open space.
- Interior Locations: 45 dB (CNEL) except for the following cases:
  - Rooms which are usually occupied only a part of the day (schools, libraries, or similar facilities), the interior one-hour average sound level due to noise outside should not exceed 50 dB.
  - Corridors, hallways, stairwell, closets, bathrooms, or any room with a volume less than 490 cubic feet.

Analysis

Noise Ordinance

The primary sources for potential operational excessive noise would be the HVAC systems for the energy storage facilities at the northeastern portion of the Proposed Project site, while the inverter and transformers would be located throughout. Figure 2.5-2, Noise Modeling Locations, shows the noise modeling locations that were selected to determine the worst-case cumulative noise levels at the eastern property and results associated with this eastern property line would be applicable to the southern and western property lines. The noise levels from all the noted equipment were combined and calculated for the eastern property line without any shielding. Table 2.5-4, Noise Level at Eastern Property Line near the Northeast Corner of the Proposed Project (E1), Table 2.5-5, Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2), and Table 2.5-6, Noise Level at Eastern Property Line near the South Side of the Project Site (E3), present the predicted noise levels at points E1, E2, and E3 (see Figure 2.5-2). As shown in Tables 2.5-4, 2.5-5, and 2.5-6, the 1-hour average sound levels would range up to approximately 64 dBA along the eastern property line near the northeast corner of the Proposed Project site, 56 dBA along the eastern property line nearer the east-central portion of the Project (E2), and 47 dBA along the eastern property line near the southern side of the Project site.. The primary noise source along the eastern property line would be the HVAC units and the power inverters associated with the energy storage facility. Additionally, the PV inverters nearest the project property lines (within 1,200 feet) would also contribute to a significant noise impact unless mitigated. The noise levels would exceed the County's Noise Ordinance criteria of 45 dBA L_{eq}. Operational noise would exceed the County's Noise Ordinance; therefore, the Proposed Project would result in a **significant noise impact** (**Impact N-1**).

Mitigation measures which would provide effective noise reduction sufficient to ensure that the Proposed Project would meet the County's noise ordinance criteria were developed. The photovoltaic inverters within 1,200 feet of the project property lines could be mitigated by specification of quieter inverters, or technology with equivalent or lower noise emission levels; A quieter HVAC system for the energy storage containers is specified; Additionally, storage containers will be oriented in a north–south configuration, and the HVAC modules, step-up transformers and power inverters will be located against the west-facing sides of the containers at ground level, so that the containers provide acoustical shielding to the east. These measures are summarized in Section 2.5.5, Mitigation. For additional details such as shielding calculations, see the Acoustical Assessment Report (Appendix 2.5-1). Table 2.5-10, Noise Level at Eastern Property Line near the Northeast Corner of the Proposed Project (E1) with Mitigation Measures, Table 2.5-11, Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2) with Mitigation Measures, and Table 2.5-12, Noise Level at Eastern Property Line near the South Side of the Project (E3) with Mitigation Measures,

contain the calculated noise levels at the same points along the eastern Project boundary (E1, E2 and E3 on Figure 2.5-2) with incorporation of measures identified in M-N-1 (see Section 2.5.5, Mitigation). Results indicate that the Proposed Project, with implementation of M-N-1, would not exceed the County's Noise Ordinance; therefore, impacts would be less than significant with mitigation incorporated.

Noise Element

The potential for a permanent increase in noise levels is associated with long-term operational noise.

Traffic generation is a key factor in determining permanent increases in ambient noise levels. The Proposed Project would not require a substantial amount of operational worker trips to and from the Proposed Project site. Operational trips would be limited to PV module washing every 2 months, occasional maintenance, as-needed site clearing of vegetation (fire safety), and annual reapplication of soil stabilizers. Operational traffic would generate an annual CNEL of less than 60 dBA along the roadways in the vicinity of the Proposed Project site. As such, the primary source for noise would be the HVAC units and inverter/transformers associated with the energy storage facility when regarding long-term ambient noise levels.

The nearest NSLU (a residence) is located approximately 3,500 feet to the north. Any increase in ambient noise at this residence resulting from the Proposed Project would be diminished due to distance from the noise generating source and intervening terrain. Using the same methodology shown above, the noise levels at the nearest NSLU would be approximately 47 dBA CNEL, below the 60 dBA CNEL threshold for exterior noise levels. While ambient CNEL levels were not recorded, the short-term noise level conducted at this location was 65 dBA L_{eq}. The Proposed Project would not be expected to result in an increase in 10 dB or more CNEL at the nearest NSLU because (a) the proximity of the nearest residence to I-8 already exposes that residence to CNEL noise levels in excess of that anticipated to be generated by the Proposed Project, and (b) the Proposed Project operations would be approximately 3,500 feet or more away from the residence. Therefore, **impacts would be less than significant**.

2.5.2.3 Excessive Ground-Borne Vibration

Guidelines for the Determination of Significance

According to the County of San Diego's Guidelines for Determining Significance, the Proposed Project would have a significant noise impact if it would expose NSLUs and other vibration sensitive uses to existing and future ground-borne vibration, including vibration sources caused by new development impacting existing or foreseeable future NSLUs. The ground-borne

vibration and noise standards identify the following three land use categories with increasing sensitivity to ground-borne vibration and noise impacts:

1. Category 1: Buildings where low ambient vibration is essential for interior operations (research and manufacturing facilities with special vibration constraints)
2. Category 2: Residences and buildings where people normally sleep (hotels, hospitals, residences, and other sleeping facilities)
3. Category 3: Institutional land uses with primarily daytime use (schools, churches, libraries, other institutions, and quiet offices)

As outlined in Table 2.5-13, Ground-Borne Vibration and Noise Standards, the Proposed Project would result in a significant impact if frequent events would exceed 0.0018 in/sec RMS for Category 1 land uses, 0.004 in/sec RMS for Category 2, and 0.0056 in/sec RMS for Category 3. Occasional or infrequent events (fewer than 70 vibration events per day) would be considered a significant impact if they would exceed 0.0018 in/sec RMS for Category 1 land uses, 0.010 in/sec RMS for Category 2, and 0.014 in/sec RMS for Category 3.

Analysis

Depending on the type and method of use of equipment, construction activity can result in varying degrees of ground vibration. Ground vibrations are caused by the operation of construction equipment and diminish in strength with distance from the vibration source. Buildings founded on the soil in the vicinity of the construction site can experience these vibrations in a manner ranging from no perceptible effects at the lowest levels, low rumbling sounds and perceptible vibrations at moderate levels, and slight damage at the highest levels. Ground vibrations from construction activities do not often reach the levels that can damage structures, but they can achieve the sensible range in buildings very close to the site.

The nearest vibration sensitive receptor to the Proposed Project site is a residence located approximately 3,500 feet to the north (Category 2 land use type). The Proposed Project does not propose the development of any vibration sensitive land uses within the Proposed Project site. Typical vibration inducing construction equipment used during construction of the Proposed Project would likely include graders, scrapers, backhoes, loaders, cranes, dozers, water trucks, and miscellaneous trucks. These pieces of construction equipment would have peak particle velocities (PPVs) of approximately 0.089 in/sec or less at a distance of 25 feet (FTA 2006). The greatest potential for vibration impacts would result from pile driving activities. Pile drivers differ in PPV depending on the type of equipment. A sonic pile driver has a typical PPV of 0.170 in/sec at 25 feet, with an upper range of 0.734 in/sec at 25 feet, and an impact pile driver has a typical PPV of 0.644 in/sec at 25 feet, with an upper range of 1.518 in/sec at 25 feet (FTA 2006).

It is not anticipated that construction activates would result in continuous vibration levels because, as discussed in Section 2.5.2.1, pile driving is anticipated to occur for only approximately 20% of an hour at each PV module site. Depending on the day, pile driving could be considered a "Frequent Event" or an "Occasional Event," with the lowest threshold being the "Frequent Event" threshold of 0.004 in/sec. Ground-borne vibration is typically attenuated over short distances (i.e., 25 feet) from the source, whereas the closest sensitive receptor is a residence located approximately 3,500 feet to the north of the Proposed Project site. Even with the highest potential upper range PPV for a pile driver PPV of 1.518 in/sec at 25 feet, the induced vibration would substantially attenuate within the distance to this residence to a level below 0.004 in/sec ("Frequent Events"). Therefore, the Proposed Project would not result in ground-borne vibration that would exceed the County's Guidelines for Determining Significance and said impact would be less than significant.

2.5.2.4 Airport Related Noise

Guidelines for the Determination of Significance

According to the County of San Diego's Guidelines for Determining Significance, the Proposed Project would have a significant noise impact resulting from airport noise if it would result in exposure of an on- or off-site, existing or reasonably foreseeable future NSLU to exterior in excess of any of the following:

- Exterior Locations: 60 dB (CNEL) or an increase of 10 dB (CNEL) over preexisting noise.

Analysis

According to the Jacumba Airport Land Use Capability Plan, the Proposed Project site does not lie within any of the calculated noise contours (San Diego County Regional Airport Authority 2011). Further, the Proposed Project does not propose any land uses that would be considered a NSLU, and therefore would not expose a NSLU to airport noise. Therefore, no impact would occur in this regard.

2.5.3 Cumulative Impact Analysis

Noise levels tend to diminish quickly with distance from a source; therefore, the geographic scope for the analysis of cumulative impacts related to noise would be limited to projects within approximately 0.25 mile of Proposed Project components and access routes. This area is defined as the geographic extent of the cumulative impact area because noise impacts would generally be localized, mainly within approximately 500 feet from any noise source; however, it is possible that noise from different sources within 0.25 mile of each other could combine to create a significant impact to receptors at any point between the projects. At distances greater

than 0.25 mile, construction noise would be briefly audible and steady construction noise from the Proposed Project would generally dissipate into quiet background noise levels. The temporal scope for cumulative impacts associated with noise would include the construction and operation phases of the Proposed Project. The baseline for assessing cumulative noise impacts includes the noise sources associated with other projects within 0.25 mile of the Proposed Project that could be constructed and/or operated at the same time as the Proposed Project. Based on the foregoing criteria, the only cumulative projects included in this cumulative analysis are the ECO Substation project and the 230 kV interconnection line associated with the Energia Sierra Juarez (ESJ) Gen-Tie project.

2.5.3.1 Construction Noise

No cumulative impact regarding construction could occur because construction of the ECO Substation would be complete by Spring 2015, which is before construction of the Proposed Project anticipated to start in May 2016. Similarly, the construction of the ESJ project's 230 kV interconnection line is complete. Therefore, impacts could not combine to cause a cumulative impact.

As discussed above, construction of the Proposed Project would cause a temporary increase in traffic on area roadways that is not expected to result in a significant noise impact from the temporary increase in trips. None of the cumulative projects located in the vicinity of the Proposed Project that may have overlapping construction schedules are substantial in size such that they would contribute to a cumulatively considerable increase in area traffic trips that would result in a temporary noticeable increase in traffic noise. Therefore, the Proposed Project's contribution of noise from increased traffic along area roadways would not be cumulatively considerable.

2.5.3.2 Operational Noise

The primary source of operating noise at the ECO Substation would be the on-site transformers that result in a 1-hour average 45 dBA noise contour within the substation property line (Dudek 2010). Therefore, operational noise from the ECO Substation and Proposed Project would not combine to create a cumulative impact related to the County Noise Ordinance. The Proposed Project has only the direct impact **Impact N-1**, as described in Section 2.5.2.2.

The nearest sensitive receptor to the ECO Substation is a residence located approximately 2,600 feet (i.e., approximately 0.5 mile) northwest of the substation site adjacent to I-8. This is the same sensitive receptor located approximately 3,500 feet (approximately 0.7 mile) north of the Proposed Project. At the nearest sensitive receiver the noise level from the project is estimated to be approximately 41.5 dBA (1-hour average level). Adding the Proposed Project's noise levels to the ECO Substation project noise levels would not result in an adverse cumulative noise increase

as defined by the Noise Element, at the closest sensitive receptor location, because of the low project noise levels and distance (greater than 0.25 mile). Therefore, the Proposed Project's **contribution would not be cumulatively considerable**.

2.5.3.3 Vibration

No cumulative impact regarding ground-borne vibration, which is limited to the construction phase, could occur because construction of the ECO Substation would be complete by February 2015, which is before construction of the Proposed Project is anticipated to start in May 2016. Therefore, impacts would not combine to cause a cumulative impact.

2.5.4 Significance of Impacts Prior to Mitigation

Excessive Noise Levels

Operational noise, primarily due to the HVAC systems and power inverters associated with the energy storage facility as well as the PV inverters, would exceed the County's Noise Ordinance standards at the project property lines; therefore, the Proposed Project would result in a significant noise impact (Impact N-1).

Ground-Borne Vibration

Considering the distance of sensitive receptors from the Proposed Project site and the anticipated construction equipment fleet (including the highest PPV for an impact pile driver), the PPV would be well below the "Frequent Events" threshold of 0.004 in/sec at any residences in the vicinity of construction and impacts would be **less than significant**.

Permanent Ambient Noise

Operational noise, which would potentially affect the permanent ambient noise levels, would not exceed the County of San Diego's Guidelines for Determining Significance as it would not increase ambient levels by more than 10 dBA CNEL or exceed 60 dBA CNEL at any NSLU. Therefore, impacts would be **less than significant**.

Temporary Ambient Noise

The average hourly noise level would be approximately 85 dBA at 50 feet from the equipment or 47 dBA at 3,500 feet, the distance to the closest residential property boundaries. Therefore, since these noise levels would be compliant with the County's construction noise criterion, impacts would be less than significant.

Airport Noise

The Proposed Project site is located outside the 60 dBA noise level contours of Jacumba Airport; therefore, impacts would be **less than significant**.

2.5.5 Mitigation

M-N-1 To ensure that the Proposed Project-generated noise from the PV inverters, HVAC systems and power inverters associated with the energy storage facilities comply with the County's Noise Ordinance:

1. For the PV inverters within 1,200 feet of the property lines: Selection of PV inverters that do not exceed 45dBA L_{eq} emission level at the property boundary, such as the GE 4 MVA 1500V inverter, which according to the product engineers produces a noise level of 61.5 dB(A) at a distance of 1 meter, or equivalent device/technology producing this noise level or lower. The proposed inverters shall be located at a distance no closer than shown on the approved plot plan.
2. The Project applicant shall not install an HVAC system that exceeds 60 dBA at 30 feet.
3. The enclosures containing the storage batteries shall be configured in a north–south direction so as to provide acoustical barrier shielding to the boundary on the east side of the Proposed Project site. The HVAC units, step-up transformers, and power inverters shall be located on the west side of the enclosures at ground level so as to be completely shielded from a direct line of site to the eastern Project boundary.
4. If new information is provided to prove and certify that the equipment being used is different than what is proposed currently (because of updates in solar technology and the associated equipment choices), than a new analysis which addresses these proposed changes may be prepared and reviewed to the satisfaction of the [PDS, PCC]. The supplemental analysis shall be prepared by a County Approved Noise Consultant and the report shall comply with the Noise Report Format and Content Requirements of the County of San Diego. Any proposed alternative methods, and/or the addition, modification, reduction of the noise measures may be approved if the activities will not result in noise levels greater than 45 dB at the property line (N.O. 36.404). The applicant may be subject to obtaining deviation or modification contingent of the new information provided.

   Prior to the approval of any grading permit, the above-identified measures shall be included in the Proposed Project design plans and subject to the approval of the County of San Diego's Development and Development Services Director (or designee).

2.5.6 Conclusion

This section provides a synopsis of the conclusion reached in each of the above impact analyses, and the level of impact that would occur after mitigation measures are implemented.

Operational Noise

As stated above, noise generated during operations of the Proposed Project would result in a potentially significant impact (Impact N-1) at the property boundary lines, as indicated in Tables 2.5-4, 2.5-5 and 2.5-6, because it would exceed limits specified in the San Diego County Code Section 36.404 (Noise Ordinance). Tables 2.5-7, 2.5-8 and 2.5-9 provide the anticipated noise levels at the eastern property boundaries from operation of the Proposed Project with implementation of **M-N-1**. Figure 2.5-3 illustrates a conceptual reorientation of the battery storage components to reduce noise levels at the property boundary. As shown in Tables 2.5-7, 2.5-8 and 2.5-9, with implementation of **M-N-1**, which would require quieter PV inverters, quieter HVAC systems and modified siting of certain energy storage facility components or equivalent or lower noise levels using different equipment / technologies, operational impacts associated with the Proposed Project would be reduced to below the County standard as defined by the Noise Ordinance and therefore would be **less than significant with mitigation incorporated**.

Regarding the Noise Element, operation of the Proposed Project would cause an increase in long term noise that would be less than the threshold noise level for exterior and interior noise at the closest sensitive receptor. Therefore, impacts would be **less than significant**.

Construction Noise

During construction of the Proposed Project, construction activities, such as earthmoving activities, would result in increased noise levels; however, these noise levels would not exceed the County's construction noise standards listed in San Diego County Code Section 36.409, Sound Level Limitations on Construction Equipment at a nearby residence; therefore, impacts would be would be **less than significant**.

Regarding impulse noise, use of a pile/vibratory/rotary driving technique to install pipes/beams for installation of the panel rack(s) would result in an increase in hourly noise levels at the closest residential property. However, the increase would be less than the standards listed in San Diego County Code Section 36.410, Sound Level Limitations on Impulsive Noise, resulting in a **less than significant** impact.

Ground-Borne Vibration

Operational activities associated with the Proposed Project would not produce ground-borne vibrations; therefore, no impact would occur. During construction, vibration from pile driving

activities at the Proposed Project site would be less than significant because ground-borne vibration would not exceed the County's Guidelines for Determining Significance at the nearest sensitive receptor.

Jacumba Airport Land Use Capability Plan

The Proposed Project site does not lie within any of the calculated noise contours and does not propose any land uses that would be considered an NSLU; therefore, no impact would occur in this regard.

Table 2.5-1
Typical Sound Levels Measured in the Environment and Industry

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet flyover at 1,000 feet		
	— 100 —	
Gas lawnmower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawnmower, 100 feet	— 70 —	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher in next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: Caltrans 2009, pp. 2–21.
Note: dBA = A-weighted decibels.

Table 2.5-2
Measured Noise Level

Site	Location	Start Time	Noise Level (dBA)		
			L_{eq}	L_{max}	L_{min}
M1	Southwest side of Proposed Project site	2:50 p.m.	53	68	40
M2	Northwest side of Proposed Project site	1:45 p.m.	56	67	39
M3	East side of Proposed Project site	2:20 p.m.	61	73	43
M4	Adjacent to nearest residence, approx. 3,500 feet north of Proposed Project site	12:34 p.m.	65	76	45
M5	Adjacent to next-nearest residence, approx. 7,300 feet west of Proposed Project site.	1:07 p.m.	63	74	42

Source: Appendix 2.5-1.
Notes: dBA = A-weighted decibels; L_{eq} = equivalent continuous sound level (time-averaged sound level); L_{max} = maximum sound level; L_{min} = minimum sound level.

Table 2.5-3
Construction Equipment Noise Emission Levels

Equipment Type	Typical Equipment dBA at 50 feet	Quiet Equipment dBA at 50 feet
Air Compressor	81	71
Backhoe	85	80
Concrete Pump	82	80
Concrete Vibrator	76	70
Crane	88	80
Dozer	87	83
Generator	78	71
Loader	84	80
Paver	88	80
Pneumatic Tools	85	75
Water Pump	76	71
Power Hand Saw	78	70
Shovel	82	80
Trucks	88	83

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-4
Noise Level at Eastern Property Line near the Northeast Corner of the Project Site (E1)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2510	37.7	25.3
Transformer	60	5	1	2510	54.0	6.0
Inverter	60	32.8	2	3060	39.4	23.6
Transformer	60	5	1	3060	55.7	4.3
Inverter	60	32.8	2	2820	38.7	24.3
Transformer	60	5	1	2820	55.0	5.0
Inverter	60	32.8	2	3405	40.3	22.7
Transformer	60	5	1	3405	56.7	3.3
Inverter	60	32.8	2	3070	39.4	23.6
Transformer	60	5	1	3070	55.8	4.2
Inverter	60	32.8	2	2310	37.0	26.1
Transformer	60	5	1	2310	53.3	6.7
Inverter	60	32.8	2	2610	38.0	25.0
Transformer	60	5	1	2610	54.4	5.6
Inverter	60	32.8	2	3175	39.7	23.3
Transformer	60	5	1	3175	56.1	3.9
Inverter	60	32.8	2	690	26.5	36.6
Transformer	60	5	1	690	42.8	17.2
Inverter	60	32.8	2	915	28.9	34.1
Transformer	60	5	1	915	45.2	14.8
Inverter	60	32.8	2	1150	30.9	32.1
Transformer	60	5	1	1150	47.2	12.8
Inverter	60	32.8	2	1460	33.0	30.0
Transformer	60	5	1	1460	49.3	10.7
Inverter	60	32.8	2	1770	34.6	28.4
Transformer	60	5	1	1770	51.0	9.0
Inverter	60	32.8	2	2330	37.0	26.0
Transformer	60	5	1	2330	53.4	6.6
Inverter	60	32.8	2	600	25.2	37.8
Transformer	60	5	1	600	41.6	18.4
Storage battery HVAC Module	68	50	1	245	13.8	54.2
Step-up Transformer	60	5	1	245	33.8	26.2
Power Inverter	77	6	1	245	32.2	44.8
Storage battery HVAC Module	68	50	1	240	13.6	54.4
Step-up Transformer	60	5	1	240	33.6	26.4
Power Inverter	77	6	1	240	32.0	45.0

Table 2.5-4
Noise Level at Eastern Property Line near the Northeast Corner of the Project Site (E1)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Storage battery HVAC Module	68	50	1	240	13.6	54.4
Step-up Transformer	60	5	1	240	33.6	26.4
Power Inverter	77	6	1	240	32.0	45.0
Storage battery HVAC Module	68	50	1	215	12.7	55.3
Step-up Transformer	60	5	1	215	32.7	27.3
Power Inverter	77	6	1	215	31.1	45.9
Storage battery HVAC Module	68	50	1	205	12.3	55.7
Step-up Transformer	60	5	1	205	32.3	27.7
Storage battery HVAC Module	68	50	1	200	12.0	56.0
Step-up Transformer	60	5	1	200	32.0	28.0
Storage battery HVAC Module	68	50	1	200	12.0	56.0
Step-up Transformer	60	5	1	200	32.0	28.0
					Combined Noise Level	**64**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-5
Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2220	36.6	26.4
Transformer	60	5	1	2220	52.9	7.1
Inverter	60	32.8	2	2780	38.6	24.4
Transformer	60	5	1	2780	54.9	5.1
Inverter	60	32.8	2	2475	37.6	25.5
Transformer	60	5	1	2475	53.9	6.1
Inverter	60	32.8	2	3055	39.4	23.6
Transformer	60	5	1	3055	55.7	4.3
Inverter	60	32.8	2	2675	38.2	24.8
Transformer	60	5	1	2675	54.6	5.4
Inverter	60	32.8	2	1870	35.1	27.9
Transformer	60	5	1	1870	51.5	8.5
Inverter	60	32.8	2	2130	36.3	26.8
Transformer	60	5	1	2130	52.6	7.4

Table 2.5-5
Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2735	38.4	24.6
Transformer	60	5	1	2735	54.8	5.2
Inverter	60	32.8	2	760	27.3	35.7
Transformer	60	5	1	760	43.6	16.4
Inverter	60	32.8	2	705	26.6	36.4
Transformer	60	5	1	705	43.0	17.0
Inverter	60	32.8	2	775	27.5	35.5
Transformer	60	5	1	775	43.8	16.2
Inverter	60	32.8	2	980	29.5	33.5
Transformer	60	5	1	980	45.8	14.2
Inverter	60	32.8	2	1245	31.6	31.4
Transformer	60	5	1	1245	47.9	12.1
Inverter	60	32.8	2	1770	34.6	28.4
Transformer	60	5	1	1770	51.0	9.0
Inverter	60	32.8	2	205	15.9	47.1
Transformer	60	5	1	205	32.3	27.7
Storage battery HVAC Module	68	50	1	665	22.5	45.5
Step-up Transformer	60	5	1	665	42.5	17.5
Power Inverter	77	6	1	665	40.9	36.1
Storage battery HVAC Module	68	50	1	630	22.0	46.0
Step-up Transformer	60	5	1	630	42.0	18.0
Power Inverter	77	6	1	630	40.4	36.6
Storage battery HVAC Module	68	50	1	600	21.6	46.4
Step-up Transformer	60	5	1	600	41.6	18.4
Power Inverter	77	6	1	600	40.0	37.0
Storage battery HVAC Module	68	50	1	680	22.7	45.3
Step-up Transformer	60	5	1	680	42.7	17.3
Power Inverter	77	6	1	680	41.1	35.9
Storage battery HVAC Module	68	50	1	650	22.3	45.7
Step-up Transformer	60	5	1	650	42.3	17.7
Storage battery HVAC Module	68	50	1	615	21.8	46.2
Step-up Transformer	60	5	1	615	41.8	18.2
Storage battery HVAC Module	68	50	1	585	21.4	46.6
Step-up Transformer	60	5	1	585	41.4	18.6
					Combined Noise Level	**56**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-6
Noise Level at Eastern Property Line near the South Side of the Project Site (E3)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2000	35.7	27.3
Transformer	60	5	1	2000	52.0	8.0
Inverter	60	32.8	2	2445	37.4	25.6
Transformer	60	5	1	2445	53.8	6.2
Inverter	60	32.8	2	1990	35.7	27.4
Transformer	60	5	1	1990	52.0	8.0
Inverter	60	32.8	2	2405	37.3	25.7
Transformer	60	5	1	2405	53.6	6.4
Inverter	60	32.8	2	1955	35.5	27.5
Transformer	60	5	1	1955	51.8	8.2
Inverter	60	32.8	2	1875	35.1	27.9
Transformer	60	5	1	1875	51.5	8.5
Inverter	60	32.8	2	2130	36.3	26.8
Transformer	60	5	1	2130	52.6	7.4
Inverter	60	32.8	2	2735	38.4	24.6
Transformer	60	5	1	2735	54.8	5.2
Inverter	60	32.8	2	2015	35.8	27.2
Transformer	60	5	1	2015	52.1	7.9
Inverter	60	32.8	2	1655	34.1	29.0
Transformer	60	5	1	1655	50.4	9.6
Inverter	60	32.8	2	1345	32.3	30.8
Transformer	60	5	1	1345	48.6	11.4
Inverter	60	32.8	2	1010	29.8	33.2
Transformer	60	5	1	1010	46.1	13.9
Inverter	60	32.8	2	735	27.0	36.0
Transformer	60	5	1	735	43.3	16.7
Inverter	60	32.8	2	505	23.7	39.3
Transformer	60	5	1	505	40.1	19.9
Inverter	60	32.8	2	1565	33.6	29.4
Transformer	60	5	1	1565	49.9	10.1
Storage battery HVAC Module	68	50	1	2205	32.9	35.1
Step-up Transformer	60	5	1	2205	52.9	7.1
Power Inverter	77	6	1	2205	51.3	25.7
Storage battery HVAC Module	68	50	1	2170	32.7	35.3
Step-up Transformer	60	5	1	2170	52.7	7.3
Power Inverter	77	6	1	2170	51.2	25.8
Storage battery HVAC Module	68	50	1	2135	32.6	35.4
Step-up Transformer	60	5	1	2135	52.6	7.4
Power Inverter	77	6	1	2135	51.0	26.0
Storage battery HVAC Module	68	50	1	2240	33.0	35.0
Step-up Transformer	60	5	1	2240	53.0	7.0
Power Inverter	77	6	1	2240	51.4	25.6

Table 2.5-6
Noise Level at Eastern Property Line near the South Side of the Project Site (E3)

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Storage battery HVAC Module	68	50	1	2205	32.9	35.1
Step-up Transformer	60	5	1	2205	52.9	7.1
Storage battery HVAC Module	68	50	1	2170	32.7	35.3
Step-up Transformer	60	5	1	2170	52.7	7.3
Storage battery HVAC Module	68	50	1	2135	32.6	35.4
Step-up Transformer	60	5	1	2135	52.6	7.4
					Combined Noise Level	**47**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-7
Noise Level at Eastern Property Line near the Northeast Corner of the Project Site (E1) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2510	37.7	n/a	25.3
Transformer	60	5	1	2510	54.0	n/a	6.0
Inverter	60	32.8	2	3060	39.4	n/a	23.6
Transformer	60	5	1	3060	55.7	n/a	4.3
Inverter	60	32.8	2	2820	38.7	n/a	24.3
Transformer	60	5	1	2820	55.0	n/a	5.0
Inverter	60	32.8	2	3405	40.3	n/a	22.7
Transformer	60	5	1	3405	56.7	n/a	3.3
Inverter	60	32.8	2	3070	39.4	n/a	23.6
Transformer	60	5	1	3070	55.8	n/a	4.2
Inverter	60	32.8	2	2310	37.0	n/a	26.1
Transformer	60	5	1	2310	53.3	n/a	6.7
Inverter	60	32.8	2	2610	38.0	n/a	25.0
Transformer	60	5	1	2610	54.4	n/a	5.6
Inverter	60	32.8	2	3175	39.7	n/a	23.3
Transformer	60	5	1	3175	56.1	n/a	3.9
Inverter	61.5	3.28	2	690	46.5	n/a	18.1
Transformer	60	5	1	690	42.8	n/a	17.2
Inverter	61.5	3.28	2	915	48.9	n/a	15.6

Table 2.5-7
Noise Level at Eastern Property Line near the Northeast Corner of the Project Site (E1) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Transformer	60	5	1	915	45.2	n/a	14.8
Inverter	61.5	3.28	2	1150	50.9	n/a	13.6
Transformer	60	5	1	1150	47.2	n/a	12.8
Inverter	60	32.8	2	1460	33.0	n/a	30.0
Transformer	60	5	1	1460	49.3	n/a	10.7
Inverter	60	32.8	2	1770	34.6	n/a	28.4
Transformer	60	5	1	1770	51.0	n/a	9.0
Inverter	60	32.8	2	2330	37.0	n/a	26.0
Transformer	60	5	1	2330	53.4	n/a	6.6
Inverter	61.5	3.28	2	600	45.2	n/a	19.3
Transformer	60	5	1	600	41.6	n/a	18.4
Storage battery HVAC Module	60	30	1	245	18.2	12.0	29.8
Step-up Transformer	60	5	1	245	33.8	12.0	14.2
Power Inverter	77	6	1	245	32.2	12.0	32.8
Storage battery HVAC Module	60	30	1	240	18.1	12.0	30.0
Step-up Transformer	60	5	1	240	33.6	12.0	14.4
Power Inverter	77	6	1	240	32.0	12.0	33.0
Storage battery HVAC Module	60	30	1	240	18.1	12.0	30.0
Step-up Transformer	60	5	1	240	33.6	12.0	14.4
Power Inverter	77	6	1	240	32.0	12.0	33.0
Storage battery HVAC Module	60	30	1	215	17.1	12.0	30.9
Step-up Transformer	60	5	1	215	32.7	12.0	15.4
Power Inverter	77	6	1	215	31.1	12.0	33.9
Storage battery HVAC Module	60	30	1	205	16.7	12.0	31.3
Step-up Transformer	60	5	1	205	32.3	12.0	15.8
Storage battery HVAC Module	60	30	1	200	16.5	12.0	31.5
Step-up Transformer	60	5	1	200	32.0	12.0	16.0
Storage battery HVAC Module	60	30	1	200	16.5	12.0	31.5
Step-up Transformer	60	5	1	200	32.0	12.0	16.0
						Combined Noise Level	**43**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-8
Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2220	36.6	n/a	26.4
Transformer	60	5	1	2220	52.9	n/a	7.1
Inverter	60	32.8	2	2780	38.6	n/a	24.4
Transformer	60	5	1	2780	54.9	n/a	5.1
Inverter	60	32.8	2	2475	37.6	n/a	25.5
Transformer	60	5	1	2475	53.9	n/a	6.1
Inverter	60	32.8	2	3055	39.4	n/a	23.6
Transformer	60	5	1	3055	55.7	n/a	4.3
Inverter	60	32.8	2	2675	38.2	n/a	24.8
Transformer	60	5	1	2675	54.6	n/a	5.4
Inverter	60	32.8	2	1870	35.1	n/a	27.9
Transformer	60	5	1	1870	51.5	n/a	8.5
Inverter	60	32.8	2	2130	36.3	n/a	26.8
Transformer	60	5	1	2130	52.6	n/a	7.4
Inverter	60	32.8	2	2735	38.4	n/a	24.6
Transformer	60	5	1	2735	54.8	n/a	5.2
Inverter	61.5	3.28	2	760	47.3	n/a	17.2
Transformer	60	5	1	760	43.6	n/a	16.4
Inverter	61.5	3.28	2	705	46.6	n/a	17.9
Transformer	60	5	1	705	43.0	n/a	17.0
Inverter	61.5	3.28	2	775	47.5	n/a	17.0
Transformer	60	5	1	775	43.8	n/a	16.2
Inverter	61.5	3.28	2	980	49.5	n/a	15.0
Transformer	60	5	1	980	45.8	n/a	14.2
Inverter	60	32.8	2	1245	31.6	n/a	31.4
Transformer	60	5	1	1245	47.9	n/a	12.1
Inverter	60	32.8	2	1770	34.6	n/a	28.4
Transformer	60	5	1	1770	51.0	n/a	9.0
Inverter	61.5	3.28	2	205	35.9	n/a	28.6
Transformer	60	5	1	205	32.3	n/a	27.7
Storage battery HVAC Module	60	30	1	665	26.9	11.9	21.2
Step-up Transformer	60	5	1	665	42.5	11.9	5.6
Power Inverter	77	6	1	665	40.9	11.9	24.2
Storage battery HVAC Module	60	30	1	630	26.4	11.9	21.6
Step-up Transformer	60	5	1	630	42.0	11.9	6.1
Power Inverter	77	6	1	630	40.4	11.9	24.7

Table 2.5-8
Noise Level at Eastern Property Line near the East-Central Portion of the Project Site (E2) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Storage battery HVAC Module	60	30	1	600	26.0	11.9	22.1
Step-up Transformer	60	5	1	600	41.6	11.9	6.5
Power Inverter	77	6	1	600	40.0	11.9	25.1
Storage battery HVAC Module	60	30	1	680	27.1	11.9	21.0
Step-up Transformer	60	5	1	680	42.7	11.9	5.4
Power Inverter	77	6	1	680	41.1	11.9	24.0
Storage battery HVAC Module	60	30	1	650	26.7	11.9	21.4
Step-up Transformer	60	5	1	650	42.3	11.9	5.8
Storage battery HVAC Module	60	30	1	615	26.2	11.9	21.8
Step-up Transformer	60	5	1	615	41.8	11.9	6.3
Storage battery HVAC Module	60	30	1	585	25.8	11.9	22.3
Step-up Transformer	60	5	1	585	41.4	11.9	6.7
						Combined Noise Level	**40**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-9
Noise Level at Eastern Property Line near the South Side of the Project Site (E3) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	2000	35.7	n/a	27.3
Transformer	60	5	1	2000	52.0	n/a	8.0
Inverter	60	32.8	2	2445	37.4	n/a	25.6
Transformer	60	5	1	2445	53.8	n/a	6.2
Inverter	60	32.8	2	1990	35.7	n/a	27.4
Transformer	60	5	1	1990	52.0	n/a	8.0
Inverter	60	32.8	2	2405	37.3	n/a	25.7
Transformer	60	5	1	2405	53.6	n/a	6.4
Inverter	60	32.8	2	1955	35.5	n/a	27.5
Transformer	60	5	1	1955	51.8	n/a	8.2

Table 2.5-9
Noise Level at Eastern Property Line near the South Side of the Project Site (E3) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Inverter	60	32.8	2	1875	35.1	n/a	27.9
Transformer	60	5	1	1875	51.5	n/a	8.5
Inverter	60	32.8	2	2130	36.3	n/a	26.8
Transformer	60	5	1	2130	52.6	n/a	7.4
Inverter	60	32.8	2	2735	38.4	n/a	24.6
Transformer	60	5	1	2735	54.8	n/a	5.2
Inverter	60	32.8	2	2015	35.8	n/a	27.2
Transformer	60	5	1	2015	52.1	n/a	7.9
Inverter	60	32.8	2	1655	34.1	n/a	29.0
Transformer	60	5	1	1655	50.4	n/a	9.6
Inverter	60	32.8	2	1345	32.3	n/a	30.8
Transformer	60	5	1	1345	48.6	n/a	11.4
Inverter	61.5	3.28	2	1010	49.8	n/a	14.7
Transformer	60	5	1	1010	46.1	n/a	13.9
Inverter	61.5	3.28	2	735	47.0	n/a	17.5
Transformer	60	5	1	735	43.3	n/a	16.7
Inverter	61.5	3.28	2	505	43.7	n/a	20.8
Transformer	60	5	1	505	40.1	n/a	19.9
Inverter	60	32.8	2	1565	33.6	n/a	29.4
Transformer	60	5	1	1565	49.9	n/a	10.1
Storage battery HVAC Module	60	30	1	2205	37.3	n/a	22.7
Step-up Transformer	60	5	1	2205	52.9	n/a	7.1
Power Inverter	77	6	1	2205	51.3	n/a	25.7
Storage battery HVAC Module	60	30	1	2170	37.2	n/a	22.8
Step-up Transformer	60	5	1	2170	52.7	n/a	7.3
Power Inverter	77	6	1	2170	51.2	n/a	25.8
Storage battery HVAC Module	60	30	1	2135	37.0	n/a	23.0
Step-up Transformer	60	5	1	2135	52.6	n/a	7.4
Power Inverter	77	6	1	2135	51.0	n/a	26.0
Storage battery HVAC Module	60	30	1	2240	37.5	n/a	22.5
Step-up Transformer	60	5	1	2240	53.0	n/a	7.0
Power Inverter	77	6	1	2240	51.4	n/a	25.6
Storage battery HVAC Module	60	30	1	2205	37.3	n/a	22.7
Step-up Transformer	60	5	1	2205	52.9	n/a	7.1

Table 2.5-9
Noise Level at Eastern Property Line near the South Side of the Project Site (E3) with Mitigation Measures

Source	Source Noise Level (dB)	Source Reference Distance (ft.)	Number of Units	Distance to Nearest Property Line (ft.)	Distance Attenuation (dB)	Shielding Attenuation (dB)	One-Hour Average Noise Level at Property Line (dB)
Storage battery HVAC Module	60	30	1	2170	37.2	n/a	22.8
Step-up Transformer	60	5	1	2170	52.7	n/a	7.3
Storage battery HVAC Module	60	30	1	2135	37.0	n/a	23.0
Step-up Transformer	60	5	1	2135	52.6	n/a	7.4
						Combined Noise Level	**40**

Source: Appendix 2.5-1.
Note: dBA = A-weighted decibels.

Table 2.5-10
Ground-Borne Vibration and Noise Standards

Land Use Category	Definition	Ground-Borne Vibration Impact Levels (inches per second RMS)		Ground-Borne Noise Impact Levels (dB re 20 micropascals)	
		Frequent Events[a]	*Occasional or Infrequent Events*[b]	*Frequent Events*[a]	*Occasional or Infrequent Events*[b,e]
Category 1	Buildings where low ambient vibration is essential for interior operations (research and manufacturing facilities with special vibration constraints).	0.0018[c]	0.0018[c]	Not Applicable[d]	Not Applicable[d]
Category 2	Residences and buildings where people normally sleep (hotels, hospitals, residences, and other sleeping facilities).	0.0040	0.010	35 dBA	43 dBA
Category 3	Institutional land uses with primarily daytime use (schools, churches, libraries, other institutions, and quiet offices).	0.0056	0.014	40 dBA	48 dBA

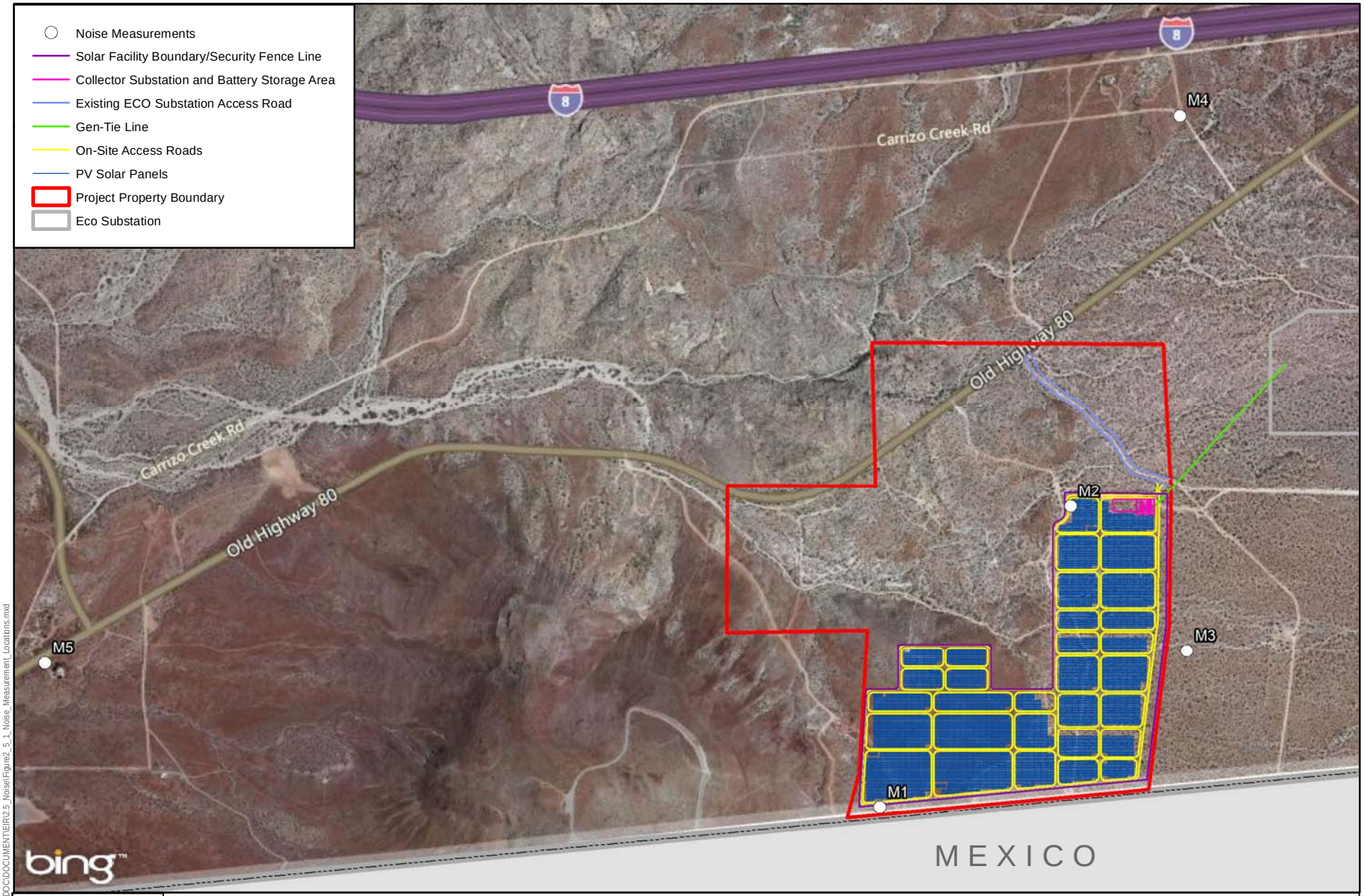
Source: County of San Diego 2009.
Notes: RMS = root mean square; dB = decibels; dBA = A-weighted decibels.

[a] "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.

[b] Occasional or Infrequent Events" are defined as fewer than 70 vibration events per day. This combined category includes most commuter rail systems.

[c] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration sensitive manufacturing or research will require detailed evaluation to define acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.[d] There are some buildings, such as concert halls, TV and recording studios, and theaters that can be very sensitive to vibration and noise but do not fit into any of the three categories. Table 5 (of the County's Guidelines for Determining Significance) gives criteria for acceptable levels of ground-borne vibration and noise for these various types of special uses.

[e] For Categories 2 and 3 with occupied facilities, isolated events such as blasting are significant when the peak particle velocity (PPV) exceeds one inch per second. Non-transportation vibration sources such as impact pile drivers or hydraulic breakers are significant when their PPV exceeds 0.1 inch per second. More specific criteria for structures and potential annoyance were developed by Caltrans (2004) and will be used to evaluate these continuous or transient sources in San Diego County.



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SOURCE: Bing 2014

FIGURE 2.5-1

Noise Measurement Locations

Jacumba Solar Energy Project

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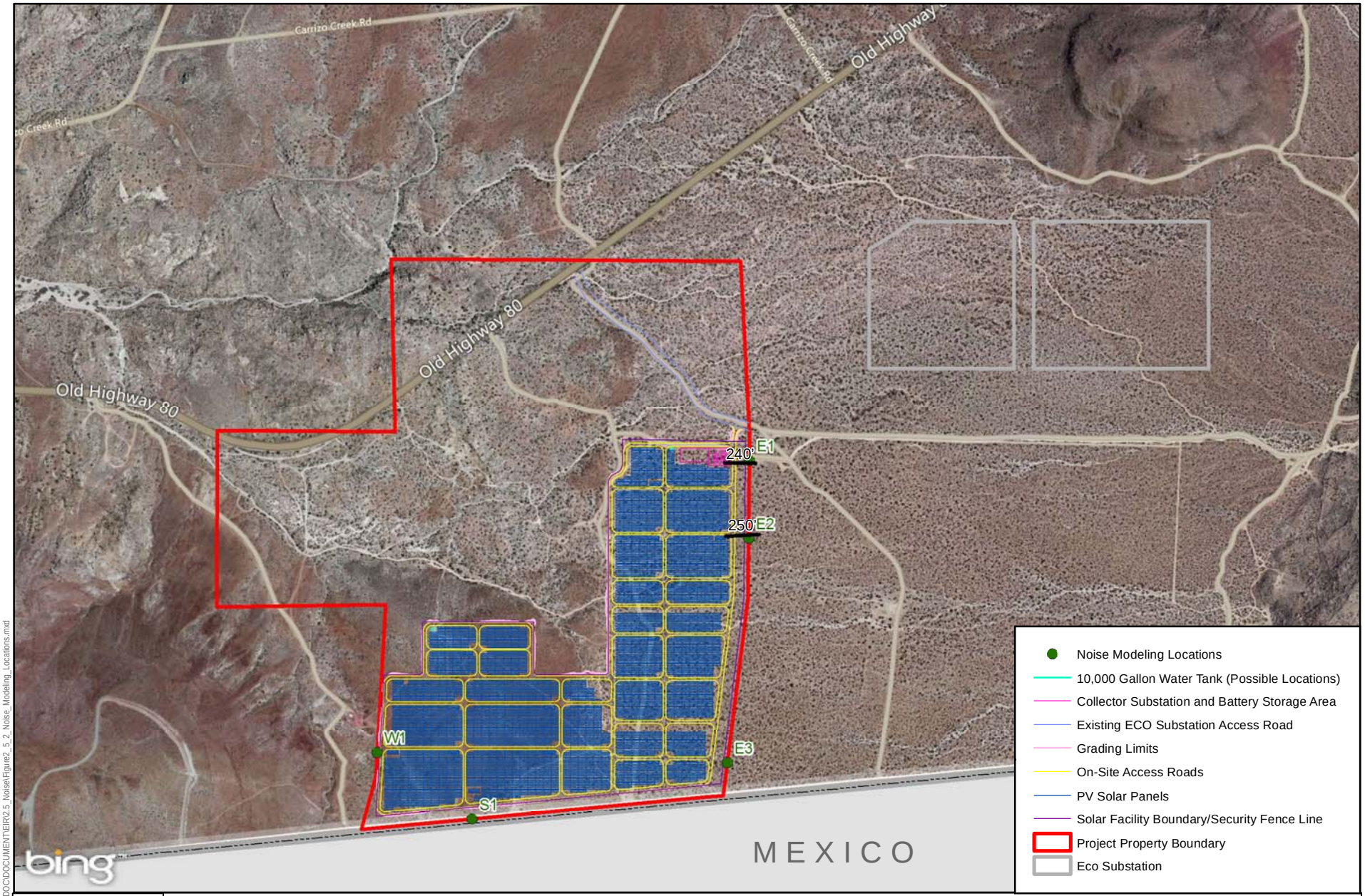

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FIGURE 2.5-2

Noise Modeling Locations

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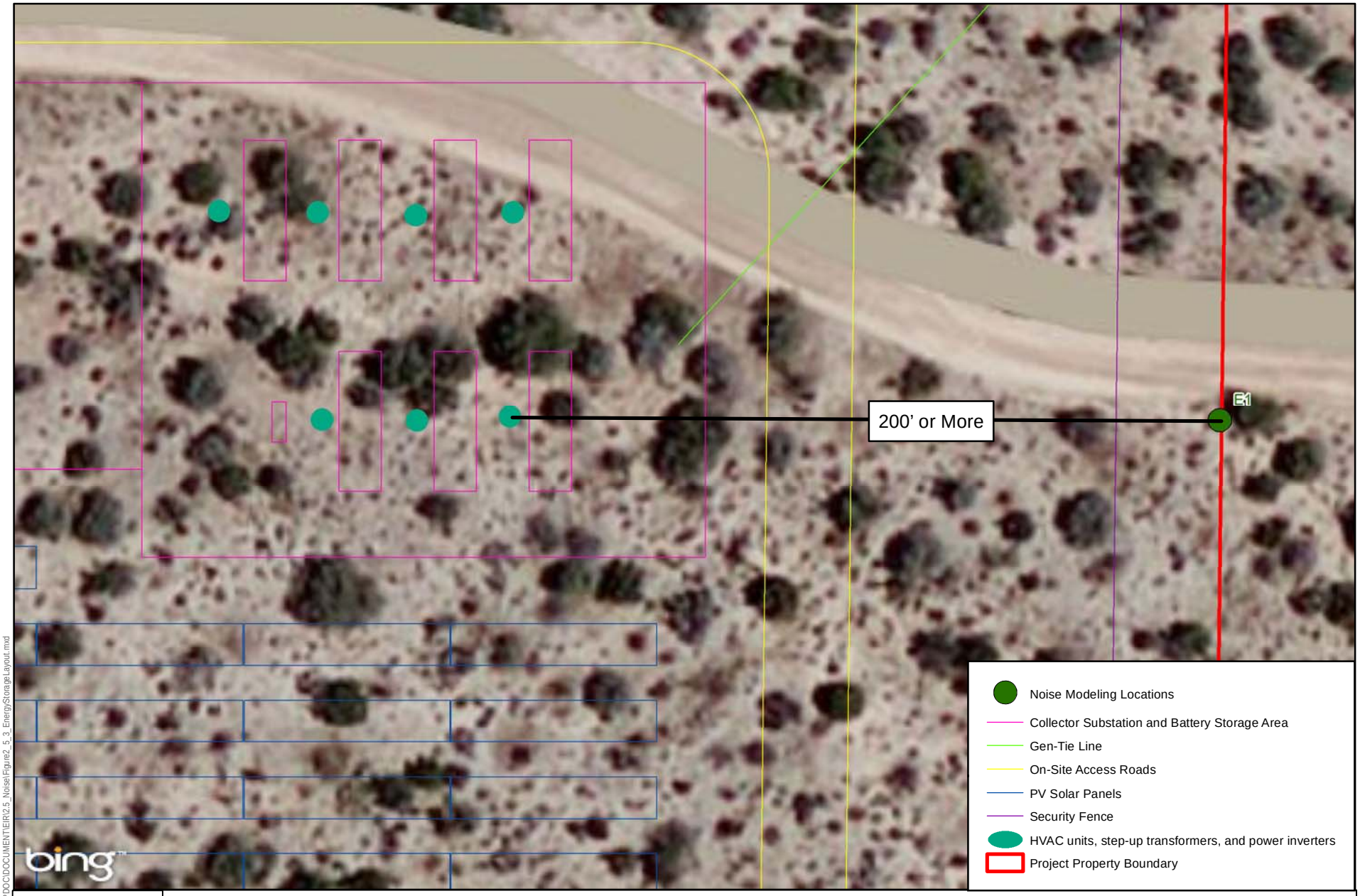

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FIGURE 2.5-3

Conceptual Energy Storage Layout

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