ACOUSTICAL ASSESSMENT REPORT
Tierra del Sol Solar Farm Project
Environmental Review Project Number 3910-120005
Major Use Permit 3300-12-010
Rezone 3600-12-005
Boulevard, San Diego County, California

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EXECUTIVE SUMMARY

Dudek has prepared this noise analysis report for the Tierra del Sol Solar Farm Project, evaluating operational noise impacts associated with outdoor mechanical equipment and short-term construction noise to sensitive land uses located within the vicinity of the proposed project.

The proposed Tierra Del Sol Solar Farm project would produce up to 60 megawatts (MW) of solar energy on 420 acres in southeastern San Diego County near the unincorporated community of Boulevard, California. The project would also develop an approximately 5-mile gen-tie electrical transmission line from the Tierra Del Sol site to the Boulevard rebuilt substation.

Noise impacts associated with the proposed project include outdoor mechanical equipment noise and short-term construction activities. The proposed inverters would result in a significant noise impact at the adjacent property lines. The inverter noise could be mitigated by placing all the inverters within an enclosure, or placing them a minimum distance of 800 feet from the adjacent property lines. The project includes several design features to address noise from panel washing activity, including retrofit of the proposed IPC Eagle Wash Station to include an acoustic enclosure for the engine, panel washing operations in a north-south direction, and prohibition of the wash station itself within a specified distance from any adjacent north-south oriented property line with occupied residence. Helicopter use for annual inspection and repair of the gen-tie line has the potential to exceed the County Noise ordinance, resulting in a potentially significant operational noise impact. This impact could be mitigated through a Helicopter Noise Control Plan.

The proposed use of vibratory pile driver, with pre-drilling where bedrock occurs, to install support masts for panel arrays would generate noise levels which would comply with applicable portions of the County's noise ordinance. Noise abatement measures pertinent to construction nuisance noise avoidance have been incorporated for general project construction.

Heavy construction equipment use during construction of the gen-tie transmission line has the potential to exceed the County Noise ordinance, resulting in a potentially significant short-term noise impact. This impact could be mitigated through a Construction Management Noise Control Plan. Helicopter use during construction of the gen-tie transmission line has the potential to exceed the County Noise ordinance, resulting in a potentially significant short-term noise impact. This impact could be mitigated through a Helicopter Noise Control Plan, which includes schedule restrictions to achieve 8-hour average noise levels in compliance with the County Noise ordinance.

Potential blasting activities for installation of gen-tie transmission poles in areas of encountered bedrock has the potential to exceed the County Noise Ordinance limits for impulsive noise. This impact can be mitigated by prohibiting blasting within 430 feet of the boundary of any occupied parcels zoned for agricultural use, and through the requirement to prepare and adhere to a comprehensive Blasting Plan. Blasting also has the potential to produce significant vibration impacts upon existing structures. This impact can be mitigated by prohibiting blasting within 1,700 feet of any existing structure.

1.0 INTRODUCTION

1.1 Project Description

The proposed Tierra Del Sol Solar Farm project (project) would produce up to 60 megawatts (MW) of solar energy and would consist of approximately 2,657 Concentrator Photovoltaic (CPV) dual axis tracking systems ("trackers") on 420 acres in southeastern San Diego County near the unincorporated community of Boulevard, California. As proposed, the project will be developed in two phases. Phase I would include the construction and operation of 45 MWs (1,993 CPV trackers) on approximately 330 acres. Phase II would consist of the construction and operation of 15 MWs (664 CPV trackers) on approximately 90 acres. The project includes a Major Use Permit (MUP) to authorize a Major Impact Utility Pursuant to Sections 1350, 2705, and 2926 of the County of San Diego's Zoning Ordinance. The project will also require a Rezone to remove Special Area Designator "A" to ensure compliance with Section 5100 of the County's Zoning Ordinance. An Agricultural Preserve Cancellation will also be required to develop the project site as proposed.

Individual tracker dimensions are approximately 48 feet across by 25 feet tall. Each tracker would be mounted on a 28-inch steel mast (steel pole), which would be supported by one of the following (1) inserting the mast it into the ground up to 20 feet and encasing it in concrete, (2) vibrating the mast into the ground up to 20 feet, or (3) attaching the mast to a concrete foundation sized to adequately support the tracker based on wind loading and soil conditions at the site. The preferred method would be to set the mast by vibratory pile driving methods depending upon soil conditions.

In its most vertical position and depending on foundation design, the top of each tracker would not exceed 30 feet above grade, and the lower edge would not be less than 1 foot above ground level. In its horizontal "stow" mode (for high winds), each tracker would have a minimum ground clearance of 13 feet, 6 inches

Trackers would be installed and arranged into building blocks, or groups. Power from each building block would be delivered from each tracker to a conversion station through a 1,000 volt(V) direct current (DC) underground collection system. The underground 1,000 V DC collection system construction footprint would include a trench of 1–2 feet in width and a depth of up to approximately 4 feet. It is anticipated that power from the trackers on site would be separated into three 34.5 kV underground collection circuits, each delivering approximately 20 MW of power to the project substation.

Each 34.5 kV underground branch circuit associated with Phase I would connect to a 34.5 kV overhead trunk line on the project site for delivery to the project substation. These two collection circuits for Phase I would run overhead on an above ground trunk line adjacent to

the south side of the Southwest Powerlink right of way. The approximately 1.2 mile above ground trunk line would utilize steel poles and would be approximately 50–75 feet high and spaced about 300–500 feet apart. The minimum ground clearance of the 34.5 kV lines would be 30 feet. The maximum hole dimensions for steel pole foundations would be 24 inches in diameter and approximately 20 feet deep. Phase II will connect to the project substation entirely via one 34.5 kV underground branch circuit and the underground 34.5 kV collection system construction footprint would include a trench of 3–4 feet in width and a depth of up to approximately 4 feet. Base material would be installed in all trenches to (i) ensure adequate drainage, and (ii) to ensure sufficient thermal conductivity and electrical insulating characteristics below and above collection system cables.

The project will include construction of a 34.5/138 kV step-up substation site (located within the northeast corner of the project site and adjacent to the operations and maintenance (O&M) annex site) would increase the voltage received from the overhead and underground collector system from 34.5–138 kV. Switching and transformer equipment as well as a control house and a parking area for utility vehicles would be located within the 3-acre substation site and for security purposes and to allow for nighttime inspections lighting would be installed near substation equipment, the control shelter, and on the entrance gates.

A 4-acre O&M annex site would be located adjacent to the substation site and would be used for storage, employee operations, and maintenance equipment. The approximate 125-foot by 60 foot pre-manufactured single story building would include administrative and operational offices, warehouse storage for material and equipment, and lavatory facilities served by a private on-site septic system and groundwater well. It is anticipated that in-place tracker washing would occur every 6–8 weeks during nighttime and evening hours, using an IPC Eagle Wash Station which would be towed by a pick-up truck, ATV, or Cushman electric cart. On-site water storage tanks may be installed to facilitate washing.

In order to deliver the power generated from the proposed Tierra Del Sol Solar Farm, a gen-tie (i.e., transmission line) will need to be constructed. A dual circuit 138 kV gen-tie transmission line would be utilized to deliver power from the project site located adjacent to Tierra del Sol Road and the U.S./Mexico International border to the Rebuilt Boulevard Substation, located approximately 6 miles to the northeast of the project site.

The dual circuit 138 kV transmission line will consist of an approximately one mile underground alignment leading northward from the on-site substation along the County right-of-way within Tierra del Sol Road for approximately 0.6 miles. The underground alignment would then be routed to the east via a 90-degree turn that would consist of an approximately 0.3 mile segment. A transition pole would be constructed at this location where the gen-tie line would transition from an underground alignment to an overhead alignment that would extend northward for

approximately 3.5 miles and end just east of Jewel Valley Road, where the gen-tie line would transition back to an underground alignment for the remaining 1.5 miles and end at the interconnection point at the Rebuilt Boulevard Substation.

Maintenance and repair activities for the gen-tie transmission facilities would include both routine preventive maintenance and emergency procedures conducted to maintain system integrity, as well as vegetation clearing. The following maintenance activities are envisioned for the gen-tie transmission facilities:

- *Pole or Structure Brushing*. Certain poles or structures would require the removal of vegetation to increase aerial patrol effectiveness or to reduce fire danger. Vegetation would be removed using mechanical equipment, such as chainsaws, weed trimmers, rakes, shovels, and brush hooks. Poles are typically inspected on an annual basis to determine if vegetation removal around poles is required.
- *Application of Herbicides*. To prevent vegetation from reoccurring around structures, Soitec may use herbicides in accordance with SDG&E's Herbicides and Application Procedures. The application of herbicides generally requires one person, who would either walk from the nearest access road to apply the herbicide or drive a pick-up truck directly to each pole location as access permits.
- *Equipment Repair and Replacement*. Poles or structures support a variety of equipment, such as conductors, insulators, switches, transformers, lightning arrest devices, line junctions, and other electrical equipment. Equipment repair or replacement generally requires a crew to gain access to the location of the equipment to be repaired or replaced. The crew normally consists of four people with 2–3 trucks, a boom or line truck, an aerial-lift truck, and an assist truck. If no vehicle access exists, the crew and material are flown in by helicopter.
- *Insulator Washing*. The dual circuit 138 kV transmission line would use polymer insulators that do not require washing.
- *Use of Helicopters*. Each electric transmission line is inspected several times a year via a passenger-type helicopter. Helicopters may also be used to deliver equipment, position poles and structures, string lines, and position aerial markers, as required by Federal Aviation Administration (FAA) regulations. The type of helicopter used for delivery of materials would be a utility or "lift" helicopter (such as the Kman Kmax brand). Helicopters would only be used during daytime hours due to safety reasons, and would not be used in any one location for more than 3-5 minutes.

Project construction would consist of several phases including site preparation, development of staging areas and site access roads, tracker assembly and installation, and construction of

on-site electrical transmission facilities. The project would require a total of approximately 372 acres of site preparation activities prior to tracker installation, in addition to approximately 47 acres of fire buffer preparation involving non-motorized brush clearing techniques. After site preparation, initial project construction would include the development of the staging and assembly areas, and the grading of site access roads for initial tracker installation. The Project would be constructed over a period of up to approximately 14 months, which includes Phase I, Phase II, and the gen-tie line.

The overhead portion of the gen-tie alignment would require the setting of new steel transmission poles and conductors installed along the poles to deliver power from the project site to the Rebuilt Boulevard Substation. Since the span between poles would be dependent on the terrain, the cable span lengths range from 500-1,400 feet and would require between 20-25 steel poles, within a maximum height of 125-150 feet. Temporary work areas measuring 80 feet by 80 feet around each steel pole location would be cleared of vegetation in order to assist in pole installation.

Several of the pole site locations are accessible from existing dirt access roads; however, where pole site locations are not accessible from existing roads, materials would be transported to the pole site by helicopter, light duty off-road equipment, and/or foot.

1.2 Environmental Settings and Existing Conditions

1.2.1 Regional and Local Setting

The proposed solar farm site is located approximately 3.5 miles south of SR 94, and along the south of Tierra Del Sol Road, and immediately north of the U.S./Mexico International Border. Figure 1 depicts the regional location and Figure 2 depicts the project vicinity.

The proposed solar farm is undeveloped but has remnants of some small structures associated with previous grazing activities located near the western portion and middle of the study area. The U.S./Mexico border fence is located adjacent to the southern portion of the study area and the site is traversed by the 500 kV Southwest Power Link, which consists of lattice steel towers.

The proposed solar farm site is within the Boulevard Community Planning Area of San Diego County's General Plan; the land use category is Multiple Rural Use with a permitted density of 1 dwelling unit per 4, 8 and/or 20 acres. Existing zoning is General Rural (S92) and Agriculture (A70). The Project site is located at an elevation of approximately 3,700–3,566 feet above mean sea level.

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FIGURE 1

Regional Map

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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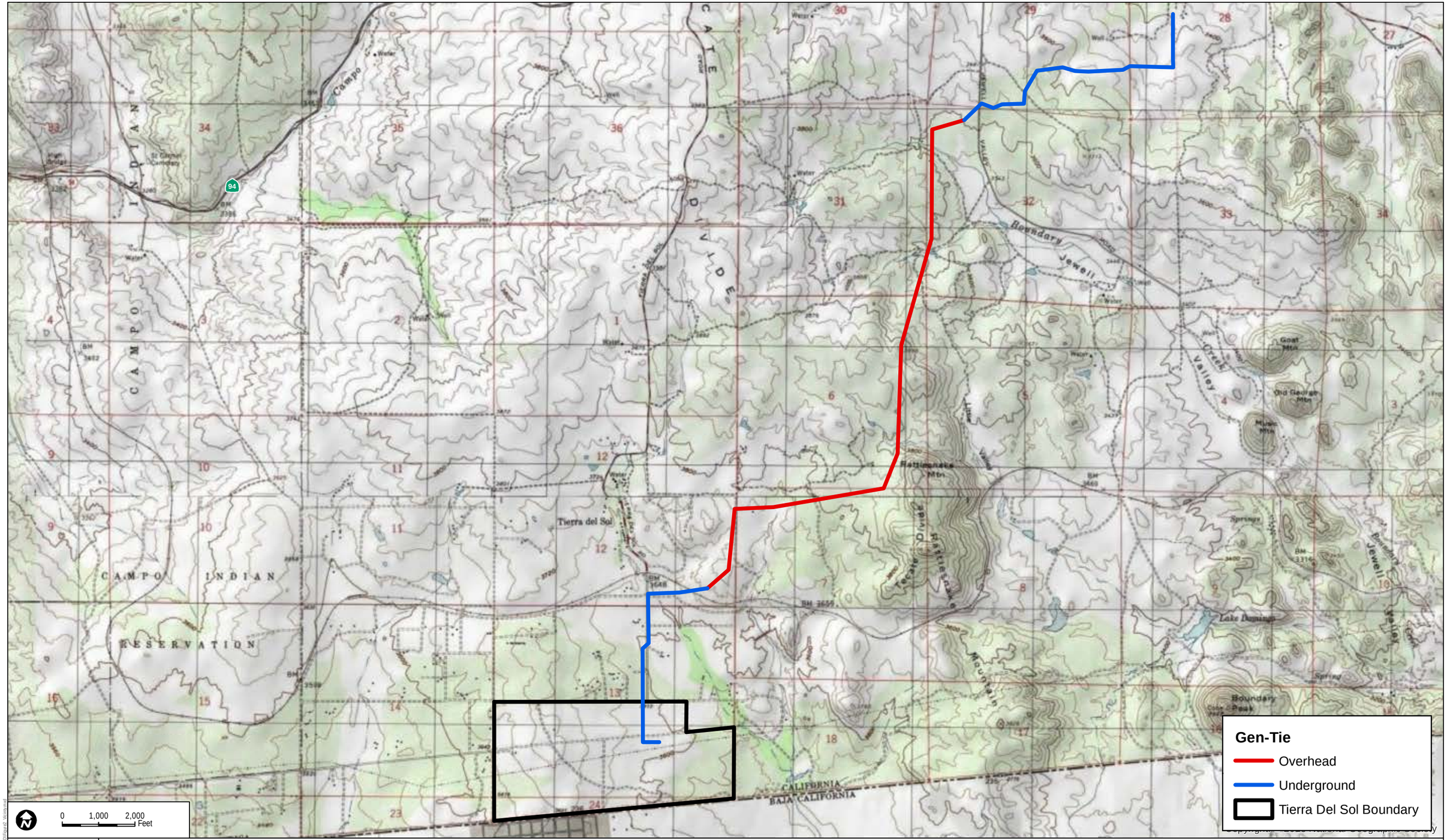

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MARCH 2012

SOURCE: USGS 7.5-Minute Series Tierra Del Sol and Live Oak Springs Quadrangle.

FIGURE 2

Vicinity Map

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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The proposed solar farm gen-tie alignment is surrounded by rural properties that are zoned S92, General Rural, and include residential uses as shown on Figures 3a and 3b, Gen-Tie Alignment Map. With rural residential land uses, it is often difficult to identify the limits of areas intended for exterior living use; this analysis assumes that exterior living areas on parcels with an occupied residence could extend to, or be in close proximity to, the property line which is adjacent to the project site. Therefore, the nearest noise-sensitive land uses (NSLUs) are considered to be the adjacent property boundaries (potential exterior living space) to the north, east, and west of the project site.

The proposed 5-mile gen-tie line alignment is located to the northeast of the solar farm site. The gen-tie line traverses County right-of-way and private property before connecting with the Rebuilt Boulevard Substation, as shown on Figure 3a and 3b.

With respect to the setting for the 6-mile gen-tie alignment, ownership or control of the properties along the proposed alignment is an important consideration with regard to the evaluation of project-related noise impacts. Figures 3a and 3b indicate the parcel boundaries for properties along the gen-tie alignment, including the identification of the assessor parcel number (APN) for each parcel. There are two sets of 'special consideration' parcels identified on the alignment figure with color coded boundaries: 1) Soitec Mitigation Parcel Site; and 2) Los Robles Parcels. These two special consideration parcels are discussed below.

Soitec Mitigation Parcel Site - The County requires that Soitec demonstrate mitigation lands are available and meet certain biological criteria as part of the CEQA process. Soitec has identified 2000+ acres of mitigation lands that are being included in a Resources Management Plan and evaluated under CEQA to demonstrate feasibility for meeting habitat loss requirements. Soitec has options in place to purchase the land and thus, the lands are not subject to any further development for other uses (including rural residential structures). No sensitive receptors currently exist on the mitigation parcels, nor would they exist in the reasonably foreseeable future on these lands. Consequently, the mitigation parcels do not fall within the County criteria of occupied parcel or noise sensitive land use, and are not analyzed further in this noise study.

Los Robles – Soitec has options to buy this land, and the land is being considered as an alternative site for development of a solar farm in the EIR. Soitec holds the full ability to develop these lands, and there are no other pending projects on these lands. The proposed use is solar and current use is predominantly vacant (one residence exists on one of the parcels). Because the land is controlled by the Applicant, who willingly accepts the noise effects of the proposed project, no sensitive receptors are deemed to exist now or in the foreseeable future. Consequently, the Los Robles parcels do not fall within the County criteria of noise sensitive land use, and are not analyzed further in this noise study.

For airborne noise effects, limits are typically evaluated and applied at the parcel boundary of a parcel with occupied residence, or at the boundary of an exterior use area dedicated for the residence.

For vibration impacts, the distance to the actual structure from activity such as blasting or pile driving is of interest. The value in the table below for "Residence / NSLU" is the distance from the gen-tie transmission line alignment to the closest side of a 1-acre rectangle containing the existing residence (the outdoor living area defined under the County Guidelines for Determination of Significance, 4.1 Noise Sensitive Land Uses Affected by Airborne Noise is a one acre portion of the parcel, for lots 10 acres or larger). Table 1a provides information for each of the parcels along the gen-tie alignment pertinent to the evaluation of project noise effects. Note that parcels along or adjacent to the alignment are each included in the table, but many of these are dismissed from project analysis, according to the preceding discussion. A column is provided in the table which indicates whether the parcel in analyzed in this noise report, or dismissed from noise evaluation.

Table 1a
Information Regarding Properties Along Gen-Tie Route

Parcel Number	Status	Analyzed/ Dismissed	Above Ground/ Under Ground	Distance to Property Line (Feet)	Distance To Residence / Nslu (Feet)
65809017	Vacant	Dismissed	Underground	N/A	N/A
65809036	Occupied	Analyzed	Underground	Within Parcel	300
65809034	Occupied	Analyzed	Underground	0	450
65805117	Occupied	Analyzed	Underground / Above ground	100 375	1,125 1,125
65805108	Vacant	Dismissed	Underground	N/A	N/A
65809040	Occupied	Analyzed	Underground / Above Ground	125 625	560 1,375
65806020	Occupied	Analyzed	Underground	625	1,250
65809053	Occupied	Analyzed	Underground / Above Ground	1,060 1,060	1,375 1,375
65805107	Vacant	Dismissed	Above Ground	N/A	N/A
65907011	Vacant	Dismissed	Above Ground	N/A	N/A
65907016	Las Robles	Dismissed	Above Ground	N/A	N/A
65907015	Las Robles	Dismissed	Above Ground	N/A	N/A
65901001	Soitec Mitigation	Dismissed	Above Ground	N/A	N/A
61210002	Soitec Mitigation	Dismissed	Above Ground	N/A	N/A
61210001	Soitec Mitigation	Dismissed	Above Ground	N/A	N/A
61211018	Occupied	Analyzed	Above Ground	Within Parcel	4,500
61211020	Vacant	Dismissed	Above Ground	N/A	N/A
61210002	Soitec Mitigation	Dismissed	Underground	N/A	N/A
61208212	Soitec Mitigation	Dismissed	Underground	N/A	N/A
61209057	Vacant	Dismissed	Underground	N/A	N/A
61209058	Vacant	Dismissed	Underground	N/A	N/A
61209211	Vacant	Dismissed	Underground	N/A	N/A
61209211	Sub-Station	Dismissed	Underground	N/A	N/A
61209202	Occupied	Analyzed	Underground	1,000	1,125

Table 1b
Properties Analyzed for Project Noise Effects Along Gen-Tie Route

Parcel Number	Status	Above Ground/ Under Ground	Distance to Property Line (Feet)	Distance To Residence/ Nslu (Feet)
65809036	Occupied	Underground	Within Parcel	300
65809034	Occupied	Underground	0	450
65805117	Occupied	Underground / Above ground	100 375	1,125 1,125
65809040	Occupied	Underground / Above Ground	125 625	560 1,375
65806020	Occupied	Underground	625	1,250
65809053	Occupied	Underground / Above Ground	1,060 1,060	1,375 1,375
61211018	Occupied	Above Ground	Within Parcel	4,500
61209202	Occupied	Underground	1,000	1,125

1.2.2 Existing Noise Conditions

The Tierra Del Sol electrical generation site is located adjacent to Tierra del Sol Road. The gen-tie line is also aligned along a portion of Tierra Del Sol Road, as well as unnamed private (unpaved) roads. Tierra del Sol Road is described as a local road in the County of San Diego's Circulation Element. Existing noise sources in the area include intermittent traffic along Tierra del Sol Road and occasional helicopters and general aviation aircraft.

Noise measurements were conducted on January 19, 2012. The noise measurements were conducted for 15 minutes at the locations depicted as Sites 1 and 2 on Figure 4. Site 1 was located near the northeastern boundary of the project site. Noise measurement Site 2 was located near the western portion of the project site near Tierra del Sol Road. The measured average noise level was 38 dB at Site 1 and 44 dB at Site 2. The measured average, maximum, and minimum noise levels are depicted in Table 2.

Table 2
Measured Noise Level

Site	Location	Start Time	Noise Level (dB)		
			Leq[1]	*Lmax*[2]	*Lmin*[3]
1	East side of project site	3:05 p.m.	38	49	32
2	West side of project site	3:30 p.m.	44	57	34

Notes:
1 Equivalent Continuous Sound Level (Time-Average Sound Level)
2 Maximum Sound Level
3 Minimum Sound Level

1.3 Methodology and Equipment

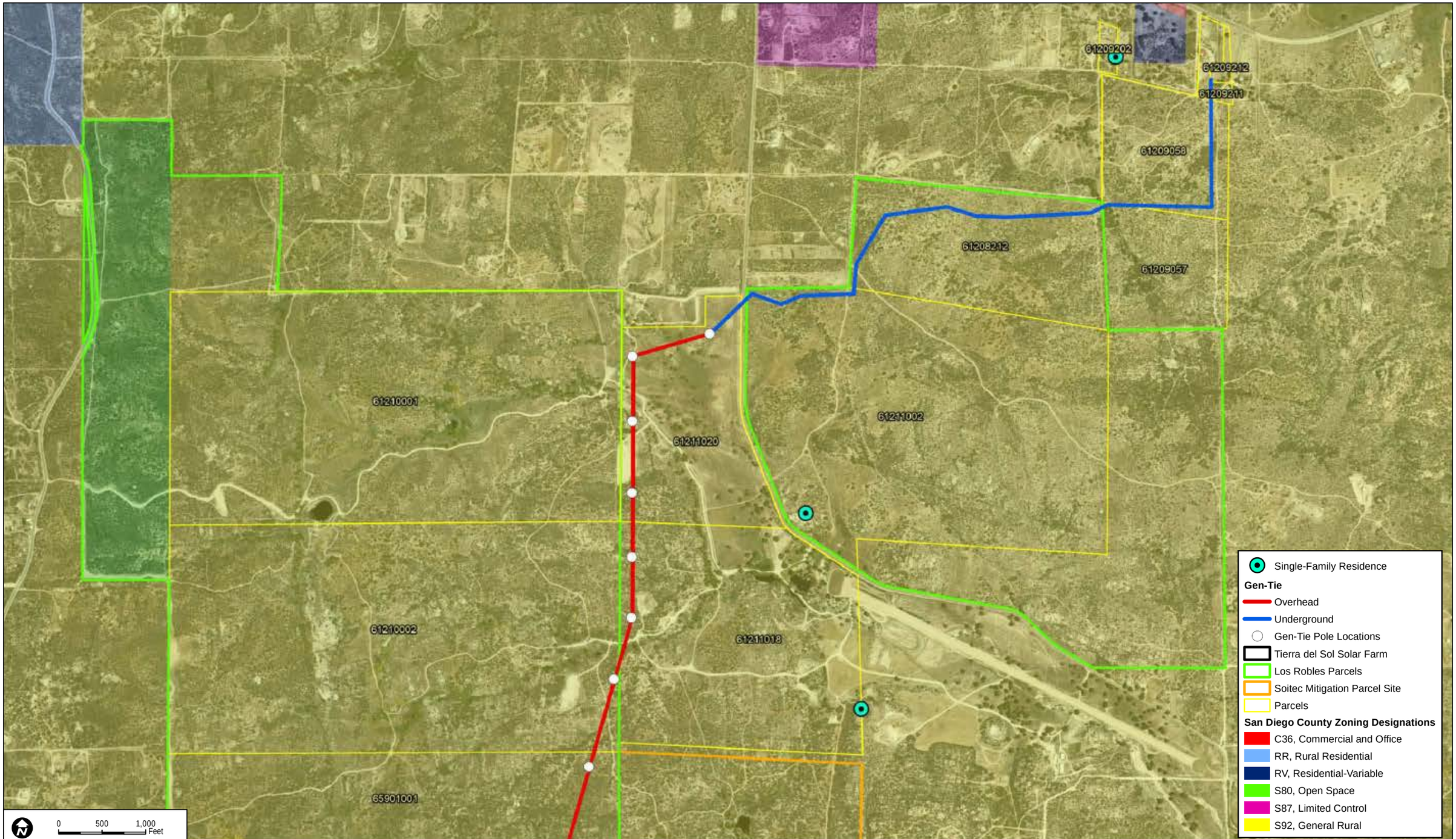
1.3.1 Noise Measuring Methodology and Procedures

Noise measurements were conducted at the site to determine the existing noise level. The measurements were made using a calibrated Rion Model NA 27 (SN 01030561) 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 1 precision sound level meter. The sound level meter was positioned at a height of approximately 5 feet above the ground.

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 (2006) and field data from files. The noise impact assessment utilized criteria established in the County of San Diego General Plan Noise Element (County of San Diego 2006) and Noise Ordinance (County of San Diego 2009).

1.3.2 Noise Calculations – Community Noise Equivalent Level

Community sound levels are measured in terms of the A-weighted sound level. The A-weighted scale measures sound levels corresponding to the human frequency response. All sound levels discussed in this report are A-weighted. In community noise, it is necessary to use a noise scale that averages varying noise exposure over time and quantifies the results using a single number descriptor. Units of measure to evaluate the long-term characteristics of sound that are applicable to this analysis are the equivalent continuous sound level (Leq) and the Community Noise Equivalent Level (CNEL). The Leq is a single-number representing the fluctuating sound level in decibels (dB) over a specified period of time. It is a sound energy average of the fluctuating level and is equal to a constant unchanging sound level of that dB level. CNEL is a 24-hour average A-weighted sound level with 10 dB added to noise during the nighttime hours from 10:00 p.m.–7:00 a.m., and 5 dB added to the noise during the evening hours from 7:00 p.m.–10:00 p.m. The 5 and 10 dB penalties are applied to account for increased noise sensitivity during the evening and nighttime hours. Appendix A contains definitions of acoustical terms used in this report.



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SOURCE: SanGIS 2012; Bing Maps

FIGURE 3a

Gen-Tie Alignment Map

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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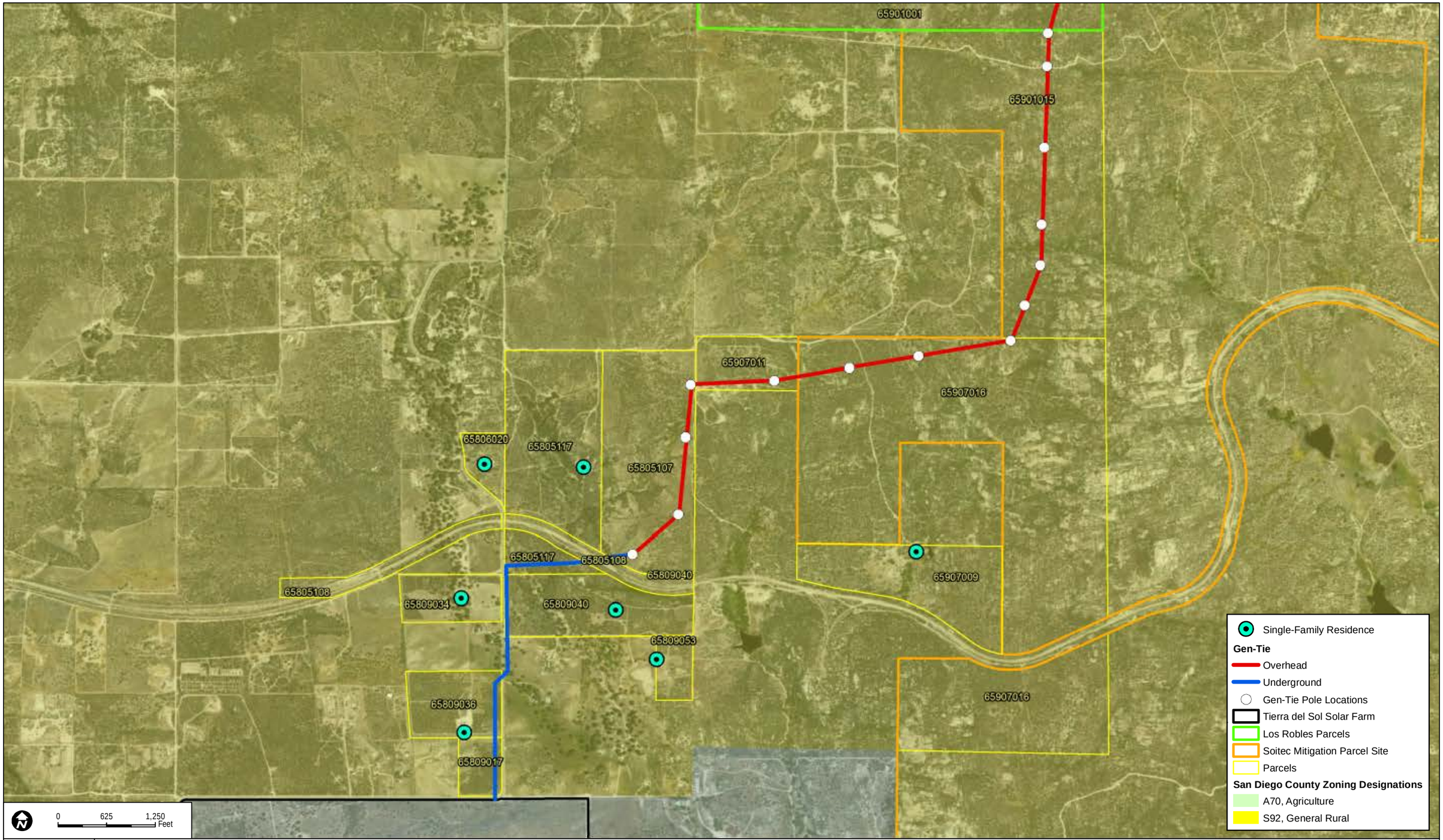

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SOURCE: SanGIS 2012; Bing Maps

FIGURE 3b

Gen-Tie Alignment Map

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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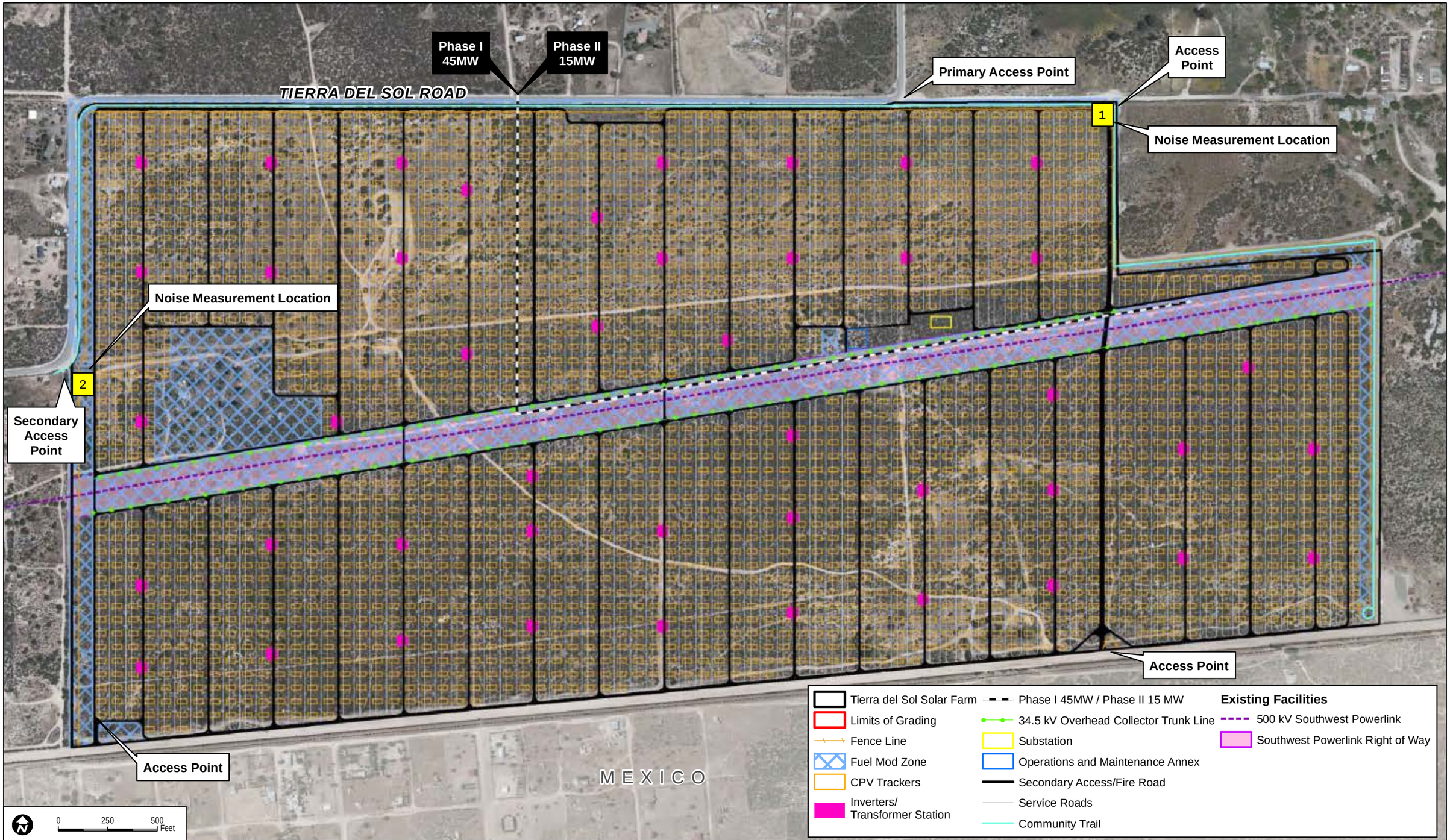

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SOURCE: SanGIS 2011; AECOM 2012; Soitec 2012; Bing Maps

FIGURE 4

Noise Measurement Locations

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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2.0 NOISE SENSITIVE LAND USES AFFECTED BY AIRBORNE NOISE

2.1 Guidelines for the Determination of Significance

The County of San Diego has adopted various noise policies and standards contained within the County's General Plan Noise Element and Guidelines for Determining Significance (Noise).

County of San Diego – General Plan Noise Element

The County has established exterior noise guidelines in the Noise Element of its adopted General Plan (County of San Diego). These guidelines identify compatible exterior noise levels for various land use types. "Exterior noise" means noise measured at an outdoor living area that meets specified minimum area requirements for single-family detached dwelling projects, and for other projects it means noise measured at all exterior areas that are provided for group or private usable open space.

The Noise Element states that an acoustical study is required if it appears that an NSLU would be subject to noise levels of CNEL equal to 60 dB or greater. An "NSLU" is defined as any residence, hospital, school, hotel, resort, library, or any other facility where quiet is an important attribute of the environment.

County of San Diego – Guidelines for Determining Significance (Noise)

The following threshold has been developed to apply to long-term operational noise generated by a proposed new development.

> *An affirmative response to the following guideline will generally be considered a significant impact related to noise as a result of project implementation, in the absence of scientific evidence to the contrary:*
>
> *4.1 Noise Sensitive Land Uses Affected by Airborne Noise*
>
> *Project implementation will result in the exposure of any on- or off-site, existing or reasonably foreseeable future NSLU to exterior or interior noise (including noise generated from the project, together with noise from roads [existing and planned Circulation Element roadways], railroads, airports, heliports and all other noise sources) in excess of any of the following:*
>
> *A. Exterior Locations:*
>
> *i. 60 dB (CNEL); or*

ii. An increase of 10 dB (CNEL) over pre-existing 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 sq. ft. 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.

2.2 Potential Noise Impacts

The proposed project consists of a solar energy collection/generation facility and gen-tie transmission line with neither dedicated office space nor any related residential components. As such, no portion of the proposed Tierra Del Sol Solar Farm project would involve proposed noise sensitive land uses on-site.

2.2.1 Solar Farm Operation Noise Sources

On-site noise sources associated with the project would include pad-mounted inverters and transformers, substation transformers, tracker array motors and dryers/blowers. Maintenance of the solar panels, involving periodic washing by specialized equipment, would be an additional on-site operational noise source. Off-site operational noise sources would include corona discharge noise from the transmission lines, and noise from periodic maintenance activities for the gen-tie facilities. Each of these noise sources is discussed below.

2.2.1.1 Building Block Inverters and Transformers

The Project includes a total installation of 2,538 CPV Trackers. The CPV Trackers would be arranged into a building block that consists of Soitec Concentrix CX-S530 dual-axis trackers that would feed into an inverter station.

The proposed Xantrex Inverter, or equivalent has a noise level rating of 77 dB at 6 feet (Schneider Electric 2011). The transformer has a sound rating of 60 dB at 5 feet based on National Electric Manufactures Association (NEMA) ratings for the size of transformer anticipated to be used with inverters (NEMA 2000).

2.2.1.2 Substation Transformers

The Project requires the use of a private on-site collector substation 75 feet by 100 feet that would be located on a 3.0-acre site within the central portion of the Project site, adjacent to the northern limits of the SWPL right-of-way. The purpose of the substation is to collect the energy received from the overhead and underground collector system and increase the voltage from 34.5–138 kV. Once the voltage is stepped up to 138kV, the power would be conveyed through a 35-foot-high deadened structure that terminates the gen-tie within the on-site collector substation. The power would then be conveyed through the gen-tie line to the Boulevard Substation.

The transformers at the on-site substation would be as follows:

- One 50 MVA rated step up transformer for phase one
- One 16.5 MVA rated step up transformer for phase two

The proposed larger 50 MVA transformer has a noise level rating of 72 dB at 5 feet (Delta Star 2012). The smaller 16.5 MVA transformer has a sound rating of 69 dB at 5 feet (NEMA 2000).

2.2.1.3 Tracker Motors and Dryers/Blowers

Individual tracker dimensions are approximately 48 feet across by 25 feet tall. Each CPV Tracker unit would be mounted on a steel pole. Noise associated with the trackers would be from the motors and dryers/blowers. Field noise measurements of the tracker indicates the tracker motor generates a noise level of 37 dB at 50 feet and the dryers/blowers generate a noise level of 43 dB at 50 feet (AECOM 2012).

2.2.2 Solar Farm Equipment Noise Levels at Property Lines

With respect to the County Noise Element, the exterior noise exposure criterion is to be applied at the boundary of any dedicated outdoor living space. With rural residential land uses, it is often difficult to identify the limits of areas intended for exterior living use; this analysis assumes that exterior living areas on parcels with an occupied residence could extend to, or in close proximity to, the property line which is adjacent to the project site. To calculate CNEL, the hourly average equipment levels at each of the project's property boundaries with noise sensitive land uses was assumed to exist during each hour of a 24-hour period; using this method, noise sensitive land uses (residential properties) to the east, north, and west were found to be exposed to exterior noise levels of 54 dB CNEL, 55 dB CNEL, and 56 dB CNEL at the property boundary closest to the solar farm property, which would be within the County exterior living area criterion limit of

60 dB CNEL (see Table 3). However, existing ambient noise exposure at the closest noise sensitive land uses to the project is approximately 40 dB CNEL. Therefore, the County's development-related land use compatibility limit for these uses would be 50 dB CNEL (10 dB above ambient). For exterior use areas on the residential properties to the east, north, and west, which are relatively close to the property boundary, these exterior use areas could be subjected to a project-resultant CNEL greater than 50 dB CNEL; consequently, noise exposure in exterior use areas of noise sensitive land uses along the east, north, and west property boundary would be a significant noise impact unless mitigation is provided.

Table 3
Project Operational Noise Levels (CNEL)
at Property Boundary of Noise-Sensitive Land Uses

NSLU	Type	Project Operational Noise Level (CNEL)
NSLUs East	Single-Family Residence	54
NSLUs North	Single-Family Residence	55
NSLUs West	Single-Family Residence	56

2.2.3 Solar Panel Washing Activity

Periodic washing of the solar panels would be achieved using the IPC Eagle Wash Station or equivalent technology. Washing of the photovoltaic panels/tracker assemblies using the IPC Eagle Wash Station would generally occur during evening and nighttime hours, or between sunset and sunrise, when all panels/tracker assemblies are aligned in a westerly direction (i.e., overnight storage position). It is expected that panel/tracker assembly washing for the entire project site would take several consecutive days to complete, but would only occur once every 6–8 weeks. Additionally, during panel/tracker assembly washing times, project panel/tracker assembly tracking systems would not be operational (i.e., panels in stored position), and power inverters would have limited operations due to limited or no sunlight. Therefore, it is expected that neither tracker nor inverter noise would occur while the panel washing operation is in progress; this means the panel washing may be assessed by itself as an overnight noise source, and that it would not add to project-related noise exposure during the day (i.e., normal operating period). Therefore, the panel washing activity is addressed separately from other operational noise sources.

Ambient noise exposure at the closest noise sensitive receptors to the project is approximately 40 dB CNEL. Therefore, the County's land use compatibility limit for these uses would be either 50 dB CNEL (10 dB above ambient), or the County's Municipal Code limits of 50 dB Hourly Leq

(daytime) and 45 dB Hourly Leq (nighttime) at the project property lines. Because the panel washing activity is proposed to occur from sunset to sunrise, the nighttime Municipal Code limit of 45 dB Hourly Leq would be applicable. Consequently, the County's Municipal Code criteria are the most restrictive for application to project on-site sources of noise, and are the only criteria applied to the solar panel washing activity, see Section 3.2.6.1

2.2.4 Gen-tie Line Maintenance Activities

The gen-tie transmission line would consist of approximately 3 miles of buried cable and 3 miles of above-ground cable strung between towers. The buried cable portion of the gen-tie line will not require routine maintenance once installed, due to protection provided by placing the cable underground; infrequent activity along the buried portion of the gen-tie could occur in response to emergency situations. For the above ground portion of the gen-tie line, maintenance and repair activities for the gen-tie transmission facilities would include both routine preventive maintenance and emergency procedures conducted to maintain system integrity, as well as vegetation clearing. Certain poles or structures would require the removal of vegetation to increase aerial patrol effectiveness or to reduce fire danger. Vegetation would be removed during the day (i.e., 7 a.m.–7 p.m.) using mechanical equipment, such as chainsaws, weed trimmers, rakes, shovels, and brush hooks. To prevent vegetation from reoccurring around structures, herbicides may also be used. These vegetation clearing activities may involve a crew up to 3 employees, who would either walk from the nearest access road or drive a pick-up truck directly to each pole location as access permits. Chainsaws at full throttle can produce up to 104 dB at 10 feet; gas-powered weed trimmers would produce similar noise levels. Maximum noise levels from a chainsaw would be reduced to 62 dB at 1,125 feet, which is the distance from the above ground gen-tie alignment to the closest NSLU. Brush maintenance activities, carried out during the day, would not have the potential to increase existing CNEL by 10 dB, or to contribute to a CNEL that exceeds 60 dB since brush maintenance activities would occur for short bursts in one location before quickly moving on to another location, and CNEL is the average equivalent A-weighted sound level over a 24-hour period.

Poles or structures support a variety of equipment, such as conductors, insulators, switches, transformers, lightning arrest devices, line junctions, and other electrical equipment. Periodic equipment repair or replacement generally requires a crew to gain access to the location of the equipment to be repaired or replaced. The crew normally consists of four people with 2–3 trucks, a boom or line truck, an aerial-lift truck, and an assist truck. The necessary assembly of trucks, if they were all running during a maintenance operation, could produce a combined maximum noise level of approximately 85 dB measured at 50 feet. Maximum noise levels from the truck operations would be reduced to 57 dB at 1,125 feet, which is the distance from the above ground gen-tie alignment to the closest NSLU. Equipment maintenance activities would not have the

potential to increase existing CNEL by 10 dB, or to contribute to a CNEL that exceeds 60 dB because such maintenance activities would occur for short durations in one location, and CNEL is the average equivalent A-weighted sound level over a 24-hour period. Therefore, equipment maintenance or replacement associated with the gen-tie transmission lines would produce noise levels below the County significance threshold for operations associated with new development, and would be a less than significant operational noise impact.

If no vehicle access exists, the crew and material are flown in by helicopter. Each electric transmission line is inspected once per year via helicopter. Helicopters may also be used to deliver replacement equipment, and service aerial markers, as required by Federal Aviation Administration (FAA) regulations. It is anticipated that a passenger type helicopter would be used for the line inspection. The most common helicopter of this type is the Bell 407. At a hovering height of 100 feet above the ground, the Bell 407 produces a noise level of 82 dB (Leq) at 400 feet horizontal feet from the ground location below the hover point (NPS 2007). With the closest NSLU to the above ground gen-tie alignment at a distance of 1,125 feet, helicopter operations within 100 feet of the ground would generate maximum noise levels of 72 dBA at the closest NSLU. Helicopters would only be used during daytime hours due to safety reasons. Also, for inspection and limited use for equipment replacement, the helicopter would not be in any one location for more than 3–5 minutes. Use of helicopters in this fashion, for only a portion of an hour at any location, would not have the potential to increase existing CNEL by 10 dB or to contribute to a CNEL that exceeds 60 dB.

2.2.5 Design Considerations and Mitigation Measures

Significant noise impacts would result from the inverters. Implementation of the following mitigation measures would reduce the noise impact to a level below significance, including compliance with the County's daytime and nighttime hourly Leq standards as well as the CNEL based exterior noise exposure criterion (i.e., project resultant noise levels less than 60 dB CNEL and less than 10 dB CNEL over ambient).

Final engineering/design/building plans shall conform to the County Noise Element and Noise Guidelines for project resultant noise levels less than 10 dB CNEL over the ambient. Prior to approval of the Building Plans, a noise analysis shall be prepared that demonstrates that the inverters comply with the ordinance. The inverter noise could be mitigated by placing all the inverters situated within approximately 800 feet of the adjacent property lines within enclosures. Depending on the design, the enclosures would reduce the noise level by approximately 10–40 dB.

Table 4 demonstrates the CNEL noise levels with mitigation applied (i.e., inverters setback 800 feet or more to adjacent residential property lines, or the inverters shall be placed in an enclosure). Unless otherwise noted, inverter enclosure must be capable of achieving a 10 dB attenuation. This level of attenuation performance for the inverter enclosures should be feasible employing standard construction materials and techniques.

Table 4
Project Operational Noise Levels (CNEL)
at Property Boundary of Noise-Sensitive Land Uses with Mitigation

NSLU	Type	Project Operational Noise Level with Mitigation (CNEL)
NSLUs East	Single-Family Residence	49
NSLUs North	Single-Family Residence	47
NSLUs West	Single-Family Residence	48

Therefore, permanent noise sources associated with the project would incorporate the following measures to ensure impacts to existing noise sensitive receptors are exposed to levels of less than significant:

PDF-N All proposed inverter/(transformer) stations shall be set back at a minimum of 800 feet. These stations within 800 feet from the project property line shall be enclosed (providing a minimum of a 10 decibel reduction), primarily to screen the project property lines from the proposed noise generating equipment.

2.3 Off-Site Direct and Cumulative Noise Impacts

The proposed Tierra del Sol Solar Farm Project would have a short-term construction-related potential to generate noise impacts to off-site locations.

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3.0 PROJECT-GENERATED AIRBORNE NOISE

3.1 Guidelines for the Determination of Significance

The County of San Diego has adopted various noise policies and standards contained within the Guidelines for Determining Significance (Noise) and the County Noise Ordinance.

County of San Diego – Noise Ordinance

Noise thresholds for stationary sources and construction noise are regulated through the County's Noise Ordinance, Chapter 4, "Noise Abatement and Control." Section 36.404 includes sound level limits for non-construction-related stationary noise sources, and Section 36.409 includes time and noise limitations for construction equipment. Section 36.410 includes noise restrictions for impulsive construction equipment. All of these sections are summarized in the following paragraphs.

Section 36.404 Sound Level Limits – Non-Construction Activities

This section in the County's Noise Ordinance includes 1-hour average sound level limits applicable to the project's operation-related (non-construction) noise sources, such as mechanical equipment (inverters, transformers, etc.), operation-related traffic (vehicle movement, engine noise), and outdoor human activity in defined limited areas.

The allowable noise limits depend upon the zoning district and time of day. The project site and surrounding area are zoned General Rural (S-92) and Agriculture (A-72). The County's noise standards that apply to S-92 and A-72 zones are depicted in *Table 36.404*. Thus, as established in Section 36.404 of the County's noise ordinance, the 1-hour average sound level limit is 50 dB between the hours of 7:00 a.m.–10:00 p.m. and 45 dB between the hours of 10:00 p.m.–7:00 a.m. Most of the project components would only operate during the daytime hours, but a few may operate during the nighttime or early morning hours. Therefore, the most restrictive limit is to apply the one-hour average 45 dB nighttime standard at the property lines.

Table 36.404
County of San Diego Exterior Noise Standards

Zone	Time	One-Hour Sound Level Limits (dB)
General Rural (S-92)	7:00 a.m.–10:00 p.m.	50
Agriculture (A-72)	10:00 p.m.–7:00 a.m.	45

Source: County of San Diego Noise Ordinance, Section 36.404

Section 36.409 – Construction Equipment

Section 36.409 in this ordinance sets limits on the time of day and days of the week that construction can occur as well as setting noise limits for construction activities. In summary, the ordinance prohibits operating construction equipment as follows:

- Mondays through Saturdays except between the hours of 7:00 a.m.–7:00 p.m.
- Sundays, and days appointed by the president, governor, or board of supervisors for a public fast, Thanksgiving, or holiday.

In addition, the code requires that no equipment shall be operated so as to cause an 8-hour average construction noise level in excess of 75 dB between the hours of 7:00 a.m.–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.

Section 36.410 – Sound Limitations on Impulsive Noise

In addition to the general limitations on sound levels in Section 36.404 and the limitations on construction equipment in Section 36.409, the following additional sound-level limitations shall apply:

a. 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 shown in *Table 36.410A*, 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, as described in subsection (c), below. The maximum sound level depends on the use being made of the occupied property. The uses in *Table 36.410A* are as described in the County Zoning Ordinance.

Table 36.410A
County of San Diego Code Section 36.410, Maximum Sound Level (Impulsive) Measured at Occupied Property in Decibels (dBA)

Occupied Property Use	Decibels (dBA)
Residential, village zoning or civic use	82
Agricultural, commercial or industrial use	85

b. Except for emergency work, no person working on a public road project shall produce or cause to be produced an impulsive noise that exceeds the maximum sound level shown in

Table 36.410B, 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, as described in subsection (c) below. The maximum sound level depends on the use being made of the occupied property. The uses in Table 36.410B are as described in the County Zoning Ordinance.

c. The minimum measurement period for any measurements conducted under this section shall be 1 hour. During the measurement period, a measurement shall be conducted every 1 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 would be deemed that the maximum sound level was exceeded during that minute.

Table 36.410B
County of San Diego Code Section 36.410, Maximum Sound Level (Impulsive) Measured at Occupied Property in Decibels (dBA) for Public Road Projects

Occupied Property Use	Decibels (dBA)
Residential, village zoning or civic use	85
Agricultural, commercial or industrial use	90

3.2 Potential Operational Noise Impacts (Non-Construction Noise)

On-site noise sources associated with the project would include pad-mounted inverters and transformers, substation transformers, tracker array motors and dryers/blowers. Maintenance of the solar panels, involving periodic washing by specialized equipment, would be an additional on-site operational noise source. Off-site operational noise sources would include corona discharge noise from the transmission lines, and noise from periodic maintenance activities for the gen-tie facilities. Each of these noise sources is discussed above in Section 2.1.1, Solar Farm Operations Noise Sources.

3.2.1 Equipment Noise Levels at Property Lines

The inverter stations would be located throughout the site as shown in Figure 5. Also depicted in Figure 5 are the noise modeling locations selected to determine the worst-case cumulative noise levels at the property lines, resulting from the building block inverters and transformers, substation transformers, tracker motors and dryers/blowers. The noise levels from all the noted equipment were combined and calculated for the nearest property line without any shielding

from proposed buildings. The one-hour average sound levels would range up to approximately 50 dB along the northern property line, 49 dB along the western property line, 48 dB along the eastern property line and 55 dB along the southern property line. The results of the cumulative noise levels are included in Tables 5a–5d. Tables 5a–5d include the contribution of the closest 3 building block inverters/transformers that have the potential to be close enough to the other equipment to contribute to the overall noise level. The primary noise source at the property lines would be the inverters. The noise level would exceed the County's noise ordinance criteria during the nighttime hours (i.e., 7 p.m.–7 a.m.) at the northern, western and eastern property lines, and at all times of day at the southern property line, resulting in a significant noise impact. The approximate locations of the future 45, 50 and 55 dB one-hour average noise level contours are depicted in Figure 6.

Table 5a
Noise Level at Northern Property Line (N1)

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	77	6	3	305	34.1	47.6
Transformer	60	5	1	305	35.7	24.3
Inverter	77	6	3	645	40.6	41.1
Transformer	60	5	1	645	42.2	17.8
Inverter	77	6	3	715	41.5	40.2
Transformer	60	5	1	715	43.1	16.9
Substation Transformer	72	5	1	1230	47.8	24.2
Transformer	69	5	1	1230	47.8	21.2
Tracker Motor	37	50	1	85	4.6	32.4
Dryer/Blower	43	50	1	85	4.6	38.4
					Combined Noise Level	**50**

Table 5b
Noise Level at Western Property Line (W1)

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	77	6	3	355	35.4	46.3
Transformer	60	5	1	355	37.0	23.0
Inverter	77	6	3	540	39.1	42.7
Transformer	60	5	1	540	40.7	19.3

Table 5b
Noise Level at Western Property Line (W1)

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	77	6	3	580	39.7	42.1
Transformer	60	5	1	580	41.3	18.7
Substation Transformer	72	5	1	3975	58.0	14.0
Transformer	69	5	1	3975	58.0	11.0
Tracker Motor	37	50	1	160	10.1	26.9
Dryer/Blower	43	50	1	160	10.1	32.9
					Combined Noise Level	**49**

Table 5c
Noise Level at Eastern Property Line (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	77	6	3	400	36.5	45.3
Transformer	60	5	1	400	38.1	21.9
Inverter	77	6	3	590	39.9	41.9
Transformer	60	5	1	590	41.4	18.6
Inverter	77	6	3	660	40.8	40.9
Transformer	60	5	1	660	42.4	17.6
Substation Transformer	72	5	1	1380	48.8	23.2
Transformer	69	5	1	1380	48.8	20.2
Tracker Motor	37	50	1	105	6.4	30.6
Dryer/Blower	43	50	1	105	6.4	36.6
					Combined Noise Level	**48**

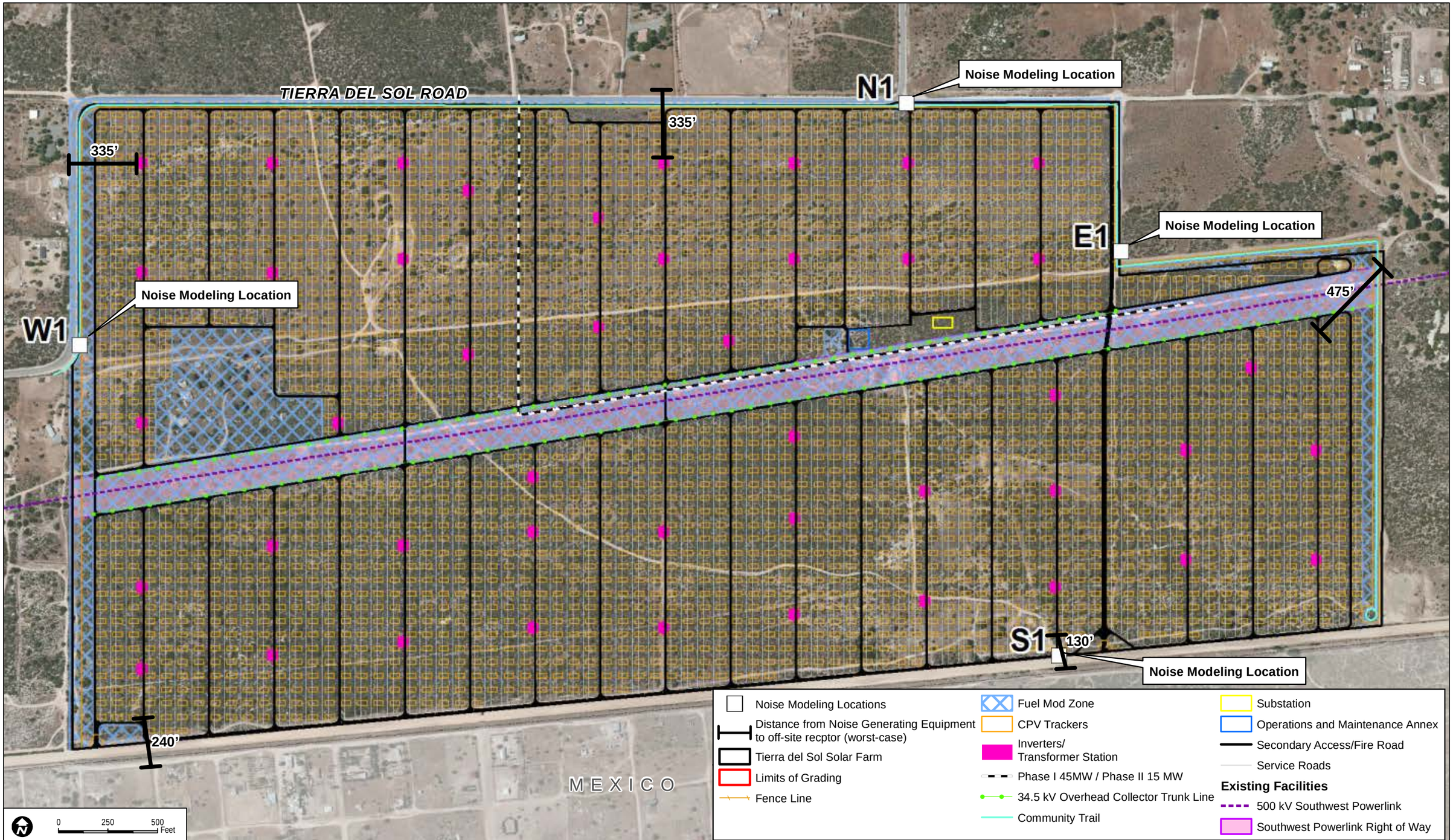
Table 5d
Noise Level at Southern Property Line (S1)

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	77	6	3	130	26.7	55.1
Transformer	60	5	1	130	28.3	31.7
Inverter	77	6	3	890	43.4	38.3
Transformer	60	5	1	890	45.0	15.0
Inverter	77	6	3	1100	45.3	36.5
Transformer	60	5	1	1100	46.8	13.2
Substation Transformer	72	5	1	1880	51.5	20.5
Transformer	69	5	1	1880	51.5	17.5
Tracker Motor	37	50	1	115	7.2	29.8
Dryer/Blower	43	50	1	115	7.2	35.8
					Combined Noise Level	**55**

3.2.2 Design Considerations and Mitigation Measures

Significant noise impacts would result from the inverters. Implementation of the following mitigation measures would reduce the noise impact to a level below significance, including compliance with the County's daytime and nighttime hourly Leq standards.

Final engineering/design/building plans shall conform to the County Noise Ordinance standards for operational noise (Section 36.404 Sound Level Limits). Prior to approval of the Building Plans, a noise analysis shall be prepared that demonstrates that the inverters comply with the ordinance. The inverter noise could be mitigated by placing all the inverters situated within approximately 800 feet of the adjacent property lines within enclosures. Depending on the design, the enclosures would reduce the noise level by approximately 10–40 dB.



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SOURCE: SanGIS 2011; AECOM 2012; Soitec 2012; Bing Maps

FIGURE 5

Noise Modeling Locations

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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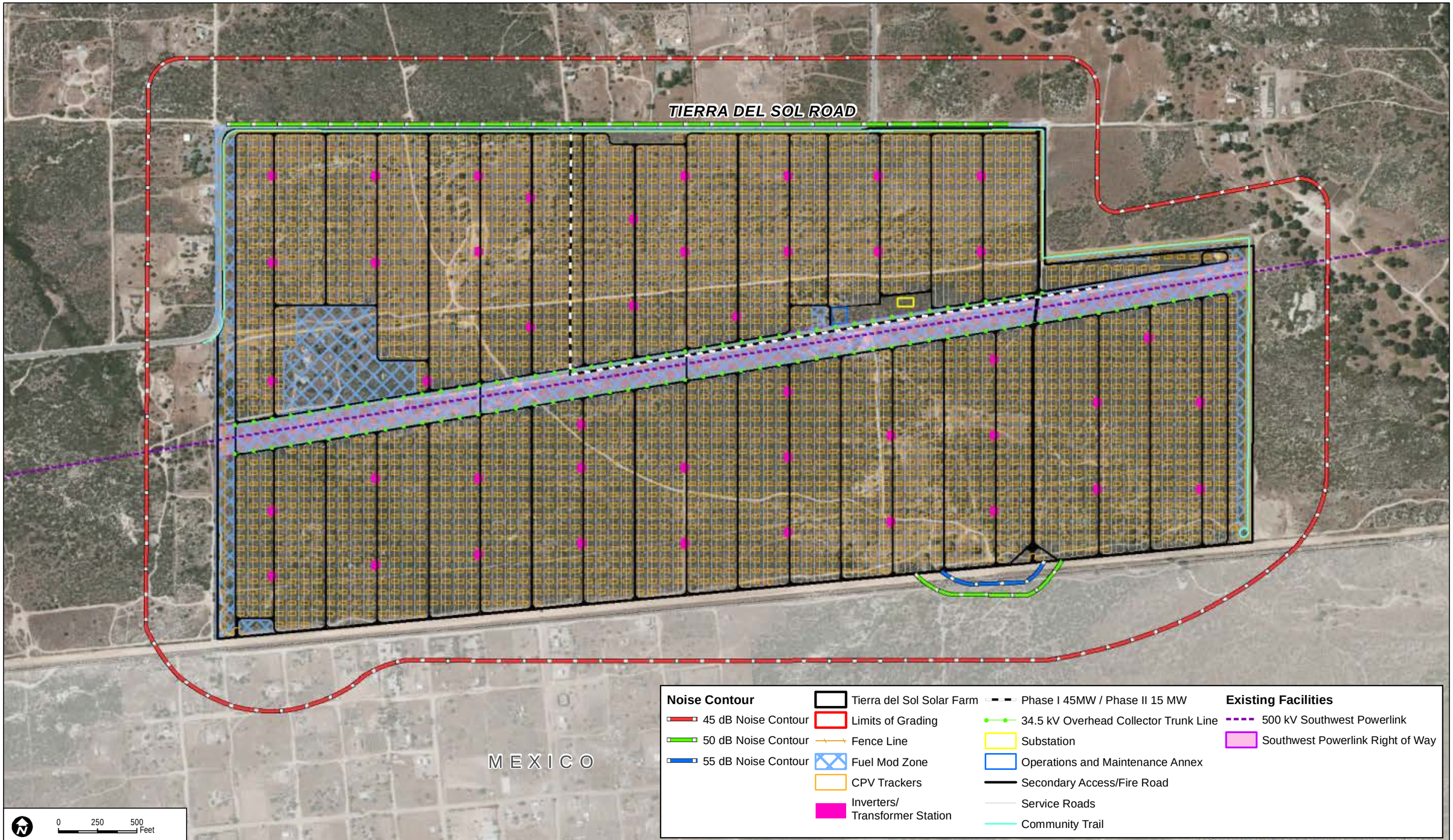

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SOURCE: SanGIS 2011; AECOM 2012; Soitec 2012; Bing Maps

FIGURE 6

Future One-Hour Average Noise Level Contours

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Tables 6a–6d demonstrate the noise levels with mitigation applied (i.e., inverters setback 800 feet or more to adjacent residential property lines, or the inverters shall be placed in an enclosure). Unless otherwise noted, inverter enclosure must be capable of achieving a 10 dB attenuation. The inverters located within 130 feet of a residential property line, along the southern project boundary, will require an enclosure capable of achieving a minimum of 15 dB attenuation. This level of attenuation performance for the inverter enclosures should be feasible employing standard construction materials and techniques.

Table 6a
Mitigated Noise Level at Northern Property Line (N1)

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)
Enclosed Inverter *	67	6	3	305	34.1	37.6
Transformer	60	5	1	305	35.7	24.3
Enclosed Inverter *	67	6	3	645	40.6	31.1
Transformer	60	5	1	645	42.2	17.8
Enclosed Inverter *	67	6	3	715	41.5	30.2
Transformer	60	5	1	715	43.1	16.9
Substation Transformer	72	5	1	1230	47.8	24.2
Transformer	69	5	1	1230	47.8	21.2
Tracker Motor	37	50	1	85	4.6	32.4
Dryer/Blower	43	50	1	85	4.6	38.4
					Combined Noise Level	**42**

Note: *Enclosure for inverter to achieve minimum of 10 dB attenuation.

Table 6b
Mitigated Noise Level at Western Property Line (W1)

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)
Enclosed Inverter *	67	6	3	355	35.4	36.3
Transformer	60	5	1	355	37.0	23.0
Enclosed Inverter *	67	6	3	540	39.1	32.7
Transformer	60	5	1	540	40.7	19.3
Enclosed Inverter *	67	6	3	580	39.7	32.1
Transformer	60	5	1	580	41.3	18.7
Substation Transformer	72	5	1	3975	58.0	14.0
Transformer	69	5	1	3975	58.0	11.0
Tracker Motor	37	50	1	160	10.1	26.9
Dryer/Blower	43	50	1	160	10.1	32.9
					Combined Noise Level	**40**

Note: *Enclosure for inverter to achieve minimum of 10 dB attenuation.

Table 6c
Mitigated Noise Level at Eastern Property Line (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)
Enclosed Inverter *	67	6	3	400	36.5	35.3
Transformer	60	5	1	400	38.1	21.9
Enclosed Inverter *	67	6	3	590	39.9	31.9
Transformer	60	5	1	590	41.4	18.6
Enclosed Inverter *	67	6	3	660	40.8	30.9
Transformer	60	5	1	660	42.4	17.6
Substation Transformer	72	5	1	1380	48.8	23.2
Transformer	69	5	1	1380	48.8	20.2
Tracker Motor	37	50	1	105	6.4	30.6
Dryer/Blower	43	50	1	105	6.4	36.6
					Combined Noise Level	**41**

Note: *Enclosure for inverter to achieve minimum of 10 dB attenuation.

Table 6d
Mitigated Noise Level at Southern Property Line (S1)

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)
Enclosed Inverter **	62	6	3	130	26.7	40.0
Transformer	60	5	1	130	28.3	31.7
Enclosed Inverter *	67	6	3	890	43.4	28.3
Transformer	60	5	1	890	45.0	15.0
Enclosed Inverter *	67	6	3	1100	45.3	26.5
Transformer	60	5	1	1100	46.8	13.2
Substation Transformer	72	5	1	1880	51.5	20.5
Transformer	69	5	1	1880	51.5	17.5
Tracker Motor	37	50	1	115	7.2	29.8
Dryer/Blower	43	50	1	115	7.2	35.8
					Combined Noise Level	**42**

Notes: *Enclosure for inverter to achieve minimum of 10 dB attenuation.
** Enclosure for inverter to achieve minimum of 15 dB attenuation.

3.2.3 Solar Panel Washing Activity

Periodic washing of the solar panels would be achieved using the IPC Eagle Wash Station or equivalent technology. Washing of the photovoltaic panels/tracker assemblies using the IPC Eagle Wash Station would generally occur during evening and nighttime hours, or between sunset and sunrise, when all panels/tracker assemblies are aligned in a westerly direction (i.e., overnight storage position). It is expected that panel/tracker assembly washing for the entire project site would take several consecutive days to complete, but would only occur once every 6–8 weeks. Additionally, during panel/tracker assembly washing times, project panel/tracker assembly tracking systems would not be operational (i.e., panels in stored position), and power inverters would have limited operations due to limited or no sunlight. Therefore, it is expected that neither tracker nor inverter noise would occur while the panel washing operation is in progress; this means the panel washing may be assessed by itself as an overnight noise source, and that it would not add to project-related noise exposure during the day (i.e., normal operating period). Therefore, the panel washing activity alone is addressed in the following analysis.

3.2.3.1 Project Design Features

Wash Station Gasoline Engine Enclosure

The proposed IPC Eagle wash station has a reference noise level of 99 dBA, at 9 feet from the engine. The wash station incorporates a new generation Honda GX-160 gasoline powered engine. In the factory configuration, this engine is mounted to an open frame on the wash station. A number of manufacturers produce acoustic panels suitable for exterior use, fabricated with steel casing and foam insulation, which have a sound transmission class rating up to 40. Acoustic-rated louvers are also available to permit air circulation while dampening sound propagation; such louvers can achieve an STC rating up to approximately 25. A cubic enclosure constructed with solid panels on 5 sides, and an acoustic louver on the remaining face, would achieve a composite STC of 32. Such an enclosure would reduce the operational sound level of the wash station to 67 dBA at 9 feet. As a design feature, the applicant is proposing to employ a sound enclosure for the wash station engine to achieve a sound level of not greater than 67 dBA at 9 feet; as along as this maximum noise level is respected, other equipment may be substituted.

North/South Panel Washing Operations

Because of the orientation of the panels (long axis north-south), panel washing would take place in a north-south direction, using the service roads oriented in this direction. Along the northern and southern property lines, washing of the closest panel to the property line would require ten minutes, after which the adjacent panel (at the end of the next row over) would be washed for

another 10 minutes, and then then equipment would be moved down the row, away from the property line. The maximum amount of time within a critical 130 foot distance from the property line would therefore be 20 minutes in an hour.

Wash Station Operations Setback Distance

Using simple distance attenuation formulas, it was determined that continuous operation of the wash station within 130 feet of a property line with adjacent residential use would exceed the applicable portion of the San Diego County Noise ordinance (Section 36.404 Sound Level Limits). For eastern and western property lines, the distance from panel washing activity would remain constant, as the equipment moves parallel to the property line; therefore a design feature is to place the IPC Eagle Wash Station a minimum of 130 feet from the eastern and western property lines. This would equate to following the center-line of the service road on the interior side of the solar panel row closest to the east and west property lines.

3.2.3.2 Solar Panel Washing Activity Noise Levels

Noise exposure from the proposed operation of the solar panel wash station was calculated at the identified project property lines based on reference noise level with engine sound enclosure, approximate solar panel/tracker assembly placement/spacing provided by Figure 6, a north/south washing pattern, solar panel/tracker assembly distances from neighboring property lines, the proposed wash station setback restriction of 130 feet from east and west property lines, and a noise attenuation rate of 6 dB per doubling of distance (i.e., standard spherical divergence). The noise produced by the water spray nozzle itself was not calculated because the noise level is anticipated to be at least 10 dBA less than the enclosed engine (and would therefore not contribute to the composite noise level of the wash station). Property boundaries along the west of the solar farm are approximately 130 feet from the closest panels; on the north and east, the property lines are approximately 100 feet from the closest panels; along the south, the property lines are approximately 200 feet from the closest panels. Noise attenuation due to excess ground absorption, air absorption, and shielding from intervening solar panels/tracker assemblies and other structures was not included in the calculations in order to provide a conservative assessment of project-related noise exposure. Basic noise calculation data applicable to the photovoltaic panel/tracker assembly washing is as follows:

- IPC Eagle wash station with engine enclosure reference noise level at 9 feet is 67 dBA (Please refer to the detailed discussion under 3.2.6.1 Project Design Features, Wash Station Gasoline Engine Enclosure, and IPC Eagle Wash Station Specifications included in Appendix B and xyz).

- Approximate solar panel spacing: 75 feet (82 feet east/west, 69 feet north/south).
- Approximate solar panel washing rate: 6 solar tracker assemblies/hour.

Calculated noise exposure from project solar panel/tracker assembly tracker assembly washing is summarized in Table 7. For the calculations, with respect to east and west facing property lines the wash station was assumed to clean the column(s) of panels/tracker assemblies closest to the applicable property line over a continuous 8-hour period. For the north and south facing property lines, the wash station was assumed to clean the panel at the end of a row (closest to the property line) for 10 minutes, then wash the next panel at the end of the next row for 10 minutes, then proceed down the row away from the panel. The wash station would therefore be within 130 feet of any given north or south facing property line only 20 minutes of any given hour. Therefore, the calculations account for the worst case scenario for noise impacts along all property boundaries.

Table 7
Panel Washing Noise Level at Adjacent Property Lines Based on All Design Features

Adjacent Property Line Direction	Panel Distance to Property Line	Noise Level, dB Hourly Leq			Impact (Day/Night)
		Ambient (Assumed)	*Solar Panel Washing (Near Prop. Line)*	*Combined*	
West	130	40	44	45	No/No
North [1]	140	40	43	45	No/No
East	100	40	44	45	No/No
South [2]	200	40	40	43	No/No

1 Average noise from panel washing is based upon 20 minutes at 46 dBA, and 40 minutes at the existing ambient noise level.
2 Average noise from panel washing is based upon 20 minutes at 40 dBA, and 40 minutes at the existing ambient noise level. As shown in Table 7, solar panel washing activity incorporating all of the project design features would comply with the applicable portion of the San Diego County Noise ordinance (Section 36.404 Sound Level Limits).

As shown in Table 7, solar panel washing activity incorporating all of the project design features would comply with the applicable portion of the San Diego County Noise ordinance (Section 36.404 Sound Level Limits).

3.2.4 Corona Discharge Noise

Corona discharge results from the partial breakdown of the electrical insulating properties of the air surrounding electricity conductors. When the intensity of the electric field at the surface of the conductor exceeds the insulating strength of the surrounding air, a corona discharge occurs at the conductor surface, representing a small dissipation of heat and energy. Some of the energy may dissipate in the form of small local pressure changes that result in audible noise, or in radio

or television interference. Audible noise generated by corona discharge is characterized as a hissing or crackling sound that may be accompanied by a hum.

Slight irregularities or water droplets on the conductor and/or insulator surface accentuate the electric field strength near the conductor surface, making corona discharge and the associated audible noise more likely. Therefore, audible noise from transmission lines is generally a foul weather (wet conductor) phenomenon. Based on precipitation data from the Western Regional Climate Center, eastern San Diego County receives approximately 17.5 inches of precipitation a year, with daily highs of less than 0.10 inch per day (WRCC 2011). Because the number of days and amount of precipitation per year would be minimal, corona events would be rare and intermittent.

Nonetheless, in order to dismiss the potential significance of corona noise, research was conducted to determine the sound level associated with this phenomenon. Veneklasen Associates conducted noise measurements of a 500 kV double-circuit transmission line. Since corona noise is relative to the capacity of the transmission line, the noise levels from a 500 kV line would be greater than for the project's 138 kV transmission line. Veneklasen conducted noise measurements on a 15-minute average for a 500 kV double-circuit transmission line near Serrano Substation in Anaheim Hills, when humidity was greater than 80 percent and temperatures were in the range of 60 degrees F (conditions contributing to high corona noise). Directly under the transmission line tower, the measured level of corona noise, when ideal conditions existed for this phenomenon to occur, were 46 dBA (Veneklasen Associates, Inc. 2004). Beyond 100 feet of the T/L, the corona noise level drops at a rate of approximately 4 dB for each doubling of the distance. So at 100 feet from the transmission line, the average corona noise would be 42 dBA, roughly equivalent to the existing ambient noise levels in the project area. Consequently, corona noise would not have the potential to create an operational noise level of 60 dBA CNEL, or to increase ambient noise levels greater than 10 dBA above ambient.

The proposed transmission means for the Project would involve a new aerial gen-tie line connecting the project site with the Boulevard Substation. The Project would install polymer (silicon rubber) insulators on any new transmission line connections. This material is hydrophobic (repels water) and minimizes the accumulation of surface contaminants such as soot and dirt, which in turn reduces the potential for corona noise to be generated at the insulators. With consideration of these standard practices, noise from coronal discharge would not represent a substantial increase in noise levels in the project vicinity.

3.2.5 Gen-tie Transmission Line Maintenance

The gen-tie transmission line would consist of approximately 3 miles of buried cable and 3 miles of above-ground cable strung between towers. The buried cable portion of the gen-tie line will not require routine maintenance once installed, due to protection provided by placing the cable underground; infrequent activity along the buried portion of the gen-tie could occur in response to emergency situations. For the above ground portion of the gen-tie line, maintenance and repair activities for the gen-tie transmission facilities would include both routine preventive maintenance and emergency procedures conducted to maintain system integrity, as well as vegetation clearing. Certain poles or structures would require the removal of vegetation to increase aerial patrol effectiveness or to reduce fire danger. Vegetation would be removed during the day (i.e., 7 a.m.–7 p.m.) using mechanical equipment, such as chainsaws, weed trimmers, rakes, shovels, and brush hooks. To prevent vegetation from reoccurring around structures, herbicides may also be used. These vegetation clearing activities may involve a crew up to 3 employees, who would either walk from the nearest access road or drive a pick-up truck directly to each pole location as access permits. Chainsaws at full throttle can produce up to 104 dB at 10 feet; gas-powered weed trimmers would produce similar noise levels. Maximum noise levels from a chainsaw would be reduced to 62 dB at 1,125 feet, which is the distance from the above ground gen-tie alignment to the closest NSLU.. This activity could produce an hourly Leq at the closest NSLU that exceeds 50 dB (at 1,125 feet a gas-powered weed trimmer would produce an Lmax of 62 dB; 20 minutes at full-power and 40 minutes idling would generate an hourly Leq of 52 dB). Because brush clearing activity using gas-powered equipment could exceed the County noise ordinance limits, brush clearing should be accomplished with non-motorized equipment and hand tools when being completed within 4,500feet of an NSLU.

Poles or structures support a variety of equipment, such as conductors, insulators, switches, transformers, lightning arrest devices, line junctions, and other electrical equipment. Equipment repair or replacement generally requires a crew to gain access to the location of the equipment to be repaired or replaced. The crew normally consists of four people with 2–3 trucks, a boom or line truck, an aerial-lift truck, and an assist truck. The necessary assembly of trucks, if they were all running during a maintenance operation, could produce a combined maximum noise level of approximately 85 dB measured at 50 feet. Maximum noise levels from the truck operations would be reduced to 57 dB at 1,125 feet, which is the distance from the above ground gen-tie alignment to the closest NSLU. . . The Federal Highway Administration Roadway Construction Noise Model assigns a usage cycle of 16% for cranes and 20% for boom trucks (man-lift). Based on these use cycles, the three typical trucks would produce an average noise level at 1,125 feet of 46 dB (Leq). This noise level would comply with the Noise Ordinance daytime hourly non-construction noise limit affecting residential uses.

If no vehicle access exists, the crew and material are flown in by helicopter. Each electric transmission line is inspected once per year via helicopter. Helicopters may also be used to deliver replacement equipment, and service aerial markers, as required by Federal Aviation Administration (FAA) regulations. It is anticipated that a passenger type helicopter would be used for the line inspection. The most common helicopter of this type is the Bell 407. At a hovering height of 100 feet above the ground, the Bell 407 produces a noise level of 82 dB (Leq) at 400 feet horizontal feet from the ground location below the hover point (NPS 2007). With the closest NSLU to the above ground gen-tie alignment at a distance of 1,125 feet, helicopter operations within 100 feet of the ground would generate maximum noise levels of 72 dBA at the closest NSLU, and could therefore result in an hourly Leq greater than 50 dBA at the closest NSLU. However, restricting line inspection helicopter use to an altitude not less than 400 feet, with static hovering above any point on the line not more than two minutes of any hour, would maintain the average Leq at the closest NSLU equal to or below 50 dBA. A quieter helicopter could also be employed for line inspection. A mitigation to address this line inspection helicopter noise has been included below. For areas of the gen-tie line with limited ground access, repair materials may also be delivered by helicopter. The type of helicopter used for delivery of materials would be a utility or "lift" helicopter such as the Kman Kmax. While suspending a load and hovering 200 feet above the ground, this helicopter produces a noise level of 92 dBA at 100 feet horizontal feet from the ground location below the hover point (USFS 2008). Helicopters would only be used during daytime hours due to safety reasons. Also, for inspection and limited use for equipment replacement, the helicopter would not be in any one location for more than 3–5 minutes. With the closest NSLU approximately 1,125 feet from the above-ground portion of the gen-tie alignment, helicopter operations within 200 feet of the ground for maintenance materials delivery would generate maximum noise levels of 70 dBA at the closest NSLU, and could therefore result in an hourly Leq greater than 50 dBA at the closest NSLU. However, restricting materials delivery helicopter use to an altitude not less than 400 feet, with static hovering above any point on the line not more than ten minutes of any hour, would maintain the average Leq at the closest NSLU at or below 50 dBA. A mitigation to address this maintenance materials delivery helicopter noise has been included below. Materials staging for helicopter-assisted routine repairs or maintenance would make sense to have delivered to the Tierra Del Sol operations and maintenance yard, where they could be retrieved and ferried to the work area by helicopter. The identified location of the O&M yard not closer than 1,000 feet from a property line with occupied residence would avoid raising the average noise level above 50 dBA at the closest residential property lines, when using the site for staging helicopter-lift materials.

Noise Abatement Measures (PDF-N)

- Brush clearance along the gen-tie route shall be accomplished using non-motorized equipment and hand tools when performing work within 1,125 feet of a NSLU.
- As part of an operations and maintenance program, the project applicant will prepare a Helicopter Noise Control Plan that addresses the use of helicopters for annual line inspection, and for delivery of repair parts or materials to limited access portions of the gen-tie line. The Plan shall demonstrate compliance with the County Noise ordinance for the impacts caused by helicopter noise on properties with an occupied residence, and with property lines within 3,000 feet of proposed helicopter use locations. Components of the plan may include the following.
    - Affected property owners shall be notified prior to the use of helicopters for repair/maintenance activity within 3,000 feet of their property boundaries.
    - Helicopter operations for line inspection and repair materials delivery shall be restricted to an altitude not less than 400 feet above ground level within 1,125 feet of an NSLU, unless a helicopter quieter than a Bell 407 or Kman Kmax is proposed to be used.
    - The area for take-off and landing of helicopters associated with line inspection or repair operations shall not be located within 3,000 feet of a property line with an occupied residence.

3.3 Construction Noise and Impacts

3.3.1 On-Site Construction

Construction of the Project would involve clearing and grubbing of the existing vegetation; grading necessary for construction of access roads and CPV foundations; trenching for the electrical collection system and communication lines; installation of a small concrete footing at each pair of inverters; construction of an overhead 34.5 kV “trunk line” for the collection system leading to the Project substation; and construction of the 34.5/138 kV substation, and an operations and maintenance building. Construction of the Tierra Del Sol Solar Farm Project would employ up to 146 workers per day. During the peak of construction, a typical day would include the transportation of trackers, movement of heavy equipment, and transportation of materials.

Construction activities would occur during the County’s allowable hours of operation. The noise levels generated by construction equipment would vary greatly depending upon factors such as the type and specific model of the equipment, the operation being performed and the

condition of the equipment. The average sound level of the construction activity also depends upon 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 construction equipment at a distance of 50 feet are depicted in Table 8. The maximum noise levels at 50 feet for typical equipment would range up to 88 dB for the type of equipment normally used for this type of project. The hourly average noise levels would vary, but construction noise levels of up to approximately 75–80 dB 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 2004).

Table 8
Construction Equipment Noise Emission Levels

Equipment	Noise Level at 50 Feet (dBA)	Typical Duty Cycle
Auger Drill Rig	85	20%
Backhoe	80	40%
Blasting	94	1%
Chain Saw	85	20%
Clam Shovel	93	20%
Compactor (ground)	80	20%
Compressor (air)	80	40%
Concrete Mixer Truck	85	40%
Concrete Pump	82	20%
Concrete Saw	90	20%
Crane (mobile or stationary)	85	20%
Dozer	85	40%
Dump Truck	84	40%
Excavator	85	40%
Front End Loader	80	40%
Generator (25 KVA or less)	70	50%
Generator (more than 25 KVA)	82	50%
Grader	85	40%
Hydra Break Ram	90	10%
Impact Pile Driver (diesel or drop)	95	20%
In Situ Soil Sampling Rig	84	20%
Jackhammer	85	20%

Table 8
Construction Equipment Noise Emission Levels

Equipment	Noise Level at 50 Feet (dBA)	Typical Duty Cycle
Mounted Impact Hammer (hoe ram)	90	20%
Paver	85	50%
Pneumatic Tools	85	50%
Pumps	77	50%
Rock Drill	85	20%
Rock Crusher	95	50%
Scraper	85	40%
Tractor	84	40%
Vacuum Excavator (vac-truck)	85	40%
Vibratory Concrete Mixer	80	20%
Vibratory Pile Driver	95	20%

Source: FHWA 2008

The property boundaries of closest residences are located approximately 75 feet north and 150 feet west of the closest construction areas at project site and the location of occupied residences on properties adjacent to the project site are depicted on Figure 7. 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 may be located from 3,000–6,000 feet from the same property perimeter.

As previously noted, the simultaneous operation of on-site construction equipment could result in hourly average noise levels of approximately 80 dBA at 50 feet. Eight-hour average noise levels would be less as the mobile equipment would move around the site increasing the distance to the acoustic center of the site, there would be work breaks and idle time. The construction noise level during grading and other typical construction activities would be approximately 73 dBA Leq or less at the nearest property line. General construction activities would comply with the County's 75 dB standard at the property lines; refer to the detailed discussion below regarding pile driving noise.

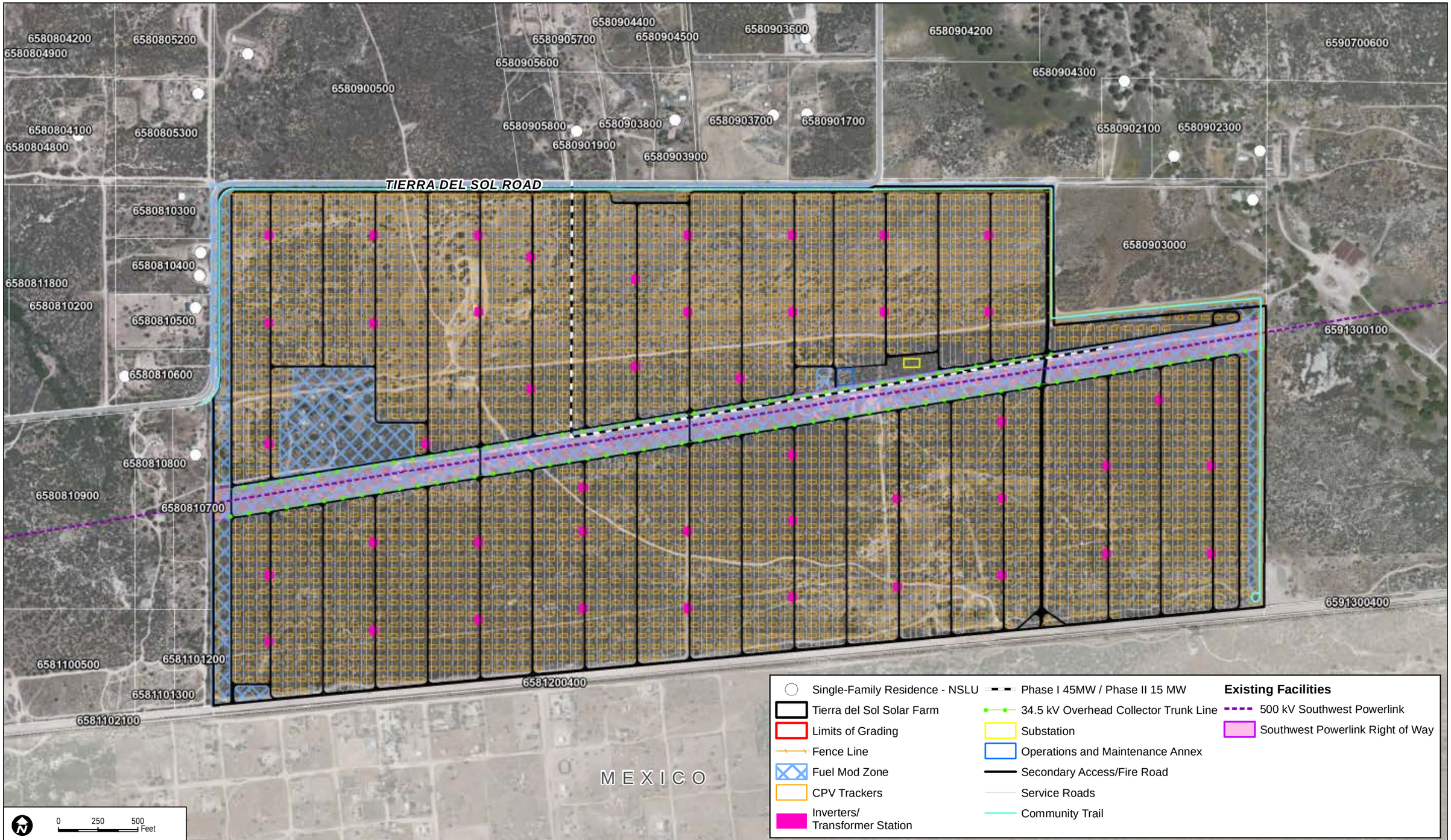
3.3.1.1 Vibratory Pile Driving

Each tracker would be installed on a 28-inch-diameter steel mast. The masts would be emplaced using a vibratory driver.

It is anticipated that a RG Model RG21T vibratory pile driver would be used. Based on previous experience, the project applicant anticipates it would take approximately 18 minutes to set-up the pile driver, drive a pile and move to the next the pile driving location. This time estimation is

broken down into the following sub-activities: 3 minutes for pile driver setup; 12 minutes of pile driving; 3 minutes to move to the next pile location. Thus, for a given pile location, there would be 12 minutes of pile driving activity (or full-power operation of the driver), which equates to 20% of an hour. This time also allows for complications in a more rocky terrain. Equipment noise levels are not available for the RGT RG21T vibratory pile driver. However, this size and type of equipment is anticipated to generate a maximum noise level of approximately 85–90 dB at a distance of 50 feet. At a distance of 75 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 82–87 dB.

Assuming pile driving occurs for approximately 20% of an hour at each tracker site, the average hourly noise level would be approximately 83 dB at 50 feet from the pile driver or 80 dB at 75 feet, the distance to the closest residential property boundaries to the pile driving locations. Given an 8-hour workday (or 480 minutes), and 18 minutes required for pile driving and movement between each pile location, a pile driver could complete approximately 27 piles per day. The 27 closest tracker masts would be located between 75–335 feet from the nearest property line with an occupied residence (the northern property line exhibits the minimum distance to neighboring occupied residential property at 75 feet). The worst-case noise exposure for adjacent residences assumes that pile driving at the 27 closest tracker masts to the nearest property line are completed in one day.



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SOURCE: SanGIS 2011; AECOM 2012; Soitec 2012; Bing Maps

FIGURE 7

Occupied Proximate Residences - With Property Boundary

NOISE ANALYSIS - TIERRA DEL SOL SOLAR FARM

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The total distance along the northern property boundary represented by 27 tracker masts is 2200 feet, which would be covered in a single day under the worst-case pile driver noise scenario; dividing this distance by 8 hours per day, the average distance the pile driver would move along the property boundary per hour is 275 feet. This means the distance from active pile driving to a given adjacent residential property line would increase or decrease by 275 feet per hour, resulting in an increase or decrease each hour of the average pile driver noise level at that property line. For a property line immediately adjacent to the pile driving operation (and at the closest distance of 75 feet from the operations), the hourly average noise levels from pile driving during the 8-hour day (due to increasing and decreasing distance from pile driving to a given property line as the pile driving activity would move around the site) would be: 80 dBA (Hour 1); 65 dBA (Hour 2); 58 dBA (Hour 3); 53 dBA (Hour 4); 50 dBA (Hour 5); 47 dBA (Hour 6); 45 dBA (Hour 7); and 43 dBA (Hour 8). Consequently, under this scenario, pile driving would generate an eight-hour average noise level of 71 dB at the nearest property line with an occupied residence (i.e., the northern property boundary, where adjacent occupied residential property boundaries are situated 75 feet away). If we look at the scenario where the pile driving is performed in a direction perpendicular to the property boundary, and using the same 2,200 feet covered during one construction day, the worst-case would be for the pile driving to commence 1,100 feet from the property line (1,175 feet to the closest adjacent residential property boundary), moving toward the property line for the first half day, moving over one row space at the project property boundary, and reversing direction away from the property line. The hourly average for pile driving would then be: 53 dBA (Hour 1); 58 dBA (Hour 2); 65 dBA (Hour 3); 80 dBA (Hour 4); 80 dBA (Hour 5); 65 dBA (Hour 6); 58 dBA (Hour 7); and 53 dBA (Hour 8). Under this scenario as well, pile driving would generate an 8-hour average noise level of 71 dB at the nearest property line with an occupied residence. Consequently, whether pile driving occurs parallel or perpendicular to the property boundary, worst-case noise levels at the closest occupied residential property boundary would comply with the County's noise criterion.

Thus, noise from vibratory pile driving would comply with the County's noise criterion, thereby maintaining pile driving noise levels at a less than significant level.

3.3.1.2 Pre-Drilling for Mast Emplacement

In areas of the site with intact bedrock within 20 feet of the ground surface, vibratory driving methods alone would not be capable of emplacing the mast to the design depth of up to 20 feet. A geotechnical survey will be performed of the entire site prior to the commencement of construction, to determine in which areas bedrock exists. In these areas, the construction process would include pre-drilling of a pilot hole with slightly smaller diameter than the mast, followed by insertion of the mast using the vibratory driver. Pilot hole drilling and

emplacement of the mast with vibratory driver would not occur on the same day; pilot holes would be drilled by one crew using the rock drill, the vibratory driver crew would be directed to an area once the pilot hole drilling within that area was completed (drilling takes about twice the time as the vibratory emplacement, so it is not efficient to have the vibratory rig following along behind the rock drilling).

However, to ensure that the rock drilling and use of a vibratory pile would not occur on the site on the same day the project will implement the following:

PDF-N In the event that pilot hole drilling would be necessary prior to installing the tracker masts due to bedrock conditions, any pilot hole drilling would not occur on the site on the same day as pile driver use.

Based upon bedrock drilling information from a construction industry handbook (McGraw, 2002), drilling up to 20 feet through granitic rock would require approximately 16 minutes. Allowing 7 minutes to set up the rig, and 7 minutes to move to the next site, two holes could be drilled per hour. Thus, for a given pile location, there would be 16 minutes of drilling activity (or full-power operation of the drill), which equates to 26% of an hour. From Table 11, a rock drill produces 85 dBA at a distance of 50 feet. At a distance of 75 feet, which is the shortest distance between the pile driving activity and the property boundary of any occupied residence, the maximum noise level from rock drilling would be approximately 81 dBA.

Assuming rock drilling occurs for approximately 16 minutes of an hour at each tracker site, the average hourly noise level would be approximately 79 dB at 50 feet from the drill or 75 dB at 75 feet, the distance to the closest residential property boundaries to the rock drilling locations. Given an 8-hour workday (or 480 minutes), and 30 minutes required for rock drilling and movement between each pile location, a rock drill could complete approximately 16 pilot holes per day. The 16 closest tracker masts would be located between 75-200 feet from the nearest property line with an occupied residence. The worst-case noise exposure for adjacent residences assumes that rock drilling at the 16 closest tracker masts to the nearest property line are completed in one day. In this scenario, rock drilling would generate an 8-hour average noise level of 75 dB at the nearest property line with an occupied residence. Thus, noise from bedrock drilling in preparation for emplacement of masts would comply with the County's 75 dBA 8-hour average noise criterion, thereby maintaining rock drilling noise levels at less than significant. As with vibratory pile driving operations, drilling performed in a row perpendicular to a property boundary would also comply with the County's noise criterion.

3.3.1.3 Construction Trips

The grading for the project is designed to be balanced; thus, there would be no import or export of dirt. However, there would be worker vehicles and truck material deliveries to the site. It is anticipated that on average approximately 58 trips per day would be generated during construction. The project's worker vehicles and delivery trucks would generate a peak hour Leq of approximately 45 dBA at the edge of the Terra Del Sol Road right-of-way. Two peak hours (one arriving, one leaving) combined with 6 hours of the 40 dBA background level, would result in a construction traffic related 8-hour average of 41 dBA. Thus construction traffic noise would comply with the 8-hour construction noise criterion of 75 dBA at all adjacent residential property boundaries.

3.3.2 Off-Site Construction (Gen-tie Transmission Line)

The proposed 138 kV transmission line traverses both undeveloped open space and rural residential land uses. Refer to Figures 3a and 3b for the distribution of residences along the gen-tie alignment. Table 9 identifies the parcels with occupied residences along the gen-time alignment which are discussed in this construction noise analysis.

Table 9
Properties Analyzed for Construction Noise Effects Along Gen-Tie Route

Parcel Number	Status	Above Ground / Under Ground	Distance To Property Line (Feet)	Distance To Residence/ Nslu (Feet)
65809036	Occupied	Underground	Within Parcel	300
65809034	Occupied	Underground	0	450
65805117	Occupied	Underground / Above ground	100 375	1,125 1,125
65809040	Occupied	Underground / Above Ground	125 625	560 1,375
65806020	Occupied	Underground	625	1,250
65809053	Occupied	Underground / Above Ground	1,060 1,060	1,375 1,375
61211018	Occupied	Above Ground	Within Parcel	4,500
61209202	Occupied	Underground	1,000	1,125

Construction of the gen-tie transmission line would involve clearing and grubbing of the existing vegetation; grading necessary for construction of access roads and transmission pole foundations; trenching for the two 1.5 mile buried segments of the transmission line at the beginning and end of the alignment; and stringing of the transmission cable.

Construction activities would occur during the County's allowable hours of operation. The noise levels generated by construction equipment would vary greatly depending upon factors such as the type and specific model of the equipment, the operation being performed and the condition of the equipment. The average sound level of the construction activity also depends upon 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 construction equipment at a distance of 50 feet are depicted in Table 9. The maximum noise levels at 50 feet for typical equipment would range up to 88 dB for the type of equipment normally used for this type of project. The hourly average noise levels would vary, but construction noise levels of up to approximately 75–80 dB at 50 feet are typical for the anticipated construction activities (the analysis below assume 78 dB, a value in the middle of the range). 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 gen-tie alignment passes thru two parcels not excluded from the noise analysis requirements, and is aligned coincident with the parcel boundary of a third. On these properties, exclusionary fencing would be erected to keep residents a minimum of 50 feet away from the construction zone (the closest residence is 300 feet from the alignment); since a construction easement must be obtained from the property owner, the edge of the easement will serve as the "property boundary" during construction, and will be located not closer than 50 feet from the construction zone. The construction noise level during grading and other typical construction activities would be approximately 78 dBA Leq (hourly) at 50 feet from the construction activity, or the shortest distance to an "occupied residential property boundary". With these average noise levels sustained across an 8-hour workday, the project could exceed the County's 75 dBA 8-hour average for the properties where a construction easement must be obtained to accommodate the gen-tie line (establishing a 'property boundary' for temporary construction 50 feet from the construction). A construction management plan will be prepared which establishes construction restrictions in order to achieve compliance with the County's 8-hour average 75 dB standard at the property lines along the gen-tie route. For instance, work creating 78 dBA hourly Leq would be limited to no more than 4 hours within any 8-hour period.

In areas where there is limited access, helicopters may be used intermittently to assist with the installation of transmission line poles and conductors. The noise level generated by a utility or lift helicopter can be represented by the Kman Kmax, which produces a sound level of 92 dBA at

100 feet, measured horizontally from the point on the ground beneath the hovering helicopter. There are four residences with property boundaries located within approximately 1,600 feet of potential helicopter use (refer to Table 9, above ground gen-tie segments) that may experience temporary noise levels due to helicopter use in excess of an 8-hour 75 dBA average between, 7 a.m.–7 p.m. Use of helicopters only during daytime hours (for safety reasons) will partially mitigate these impacts by limiting construction activities to the hours permitted by the San Diego County Noise Ordinance. However, the 8-hour average noise level from use of a helicopter could occasionally exceed that allowed under County Ordinance. Therefore, absent mitigation, short-term helicopter noise levels could exceed the County's noise ordinance criteria and would result in a potentially significant noise impact.

Based upon one study (USFS 2008), a material staging area should be within approximately 5 miles of the sites where construction work assisted by a helicopter would be performed. Since the gen-tie line is a total distance of 6 miles in length, a staging area within the Tierra Del Sol project site could support helicopter-assisted construction at any point along the gen-tie line. The identified location of the Tierra Del Sol operations and maintenance compound is proposed as the staging area during gen-tie construction as it is located not closer than 1,000 feet from a property line with occupied residence, and use of this area of the site during gen-tie construction would not conflict with the location for the solar panel installation. The use of the operations and maintenance yard for staging of materials to be delivered/installed by helicopter during the gen-tie construction would not cause the 8-hour average 75 dBA construction noise criterion to be exceeded at the property line for a parcel with occupied residence.

Noise Abatement Measures (PDF-N)

- Prior to construction, the applicant shall prepare a construction management plan which establishes construction restrictions in order to achieve compliance with the County's 8-hour average 75 dB standard at the property lines, or edge of construction easement, for occupied residences along the gen-tie route. The Plan shall demonstrate compliance with the County Noise ordinance for the impacts caused by gen-tie construction activities within 100 feet of the affected property boundary. Components of the plan may include the following.
    - Affected property owners shall be notified prior to construction activity within 100 feet of their property boundaries.
    - In order to comply with the County Noise Ordinance (Section 36.409 – Construction Equipment), the duration of heavy equipment for construction shall comply with the following limitations, for the specified distance between heavy equipment operations and property line of (or edge of construction easement within the) occupied parcel:

    - Within 50 feet – no more than 4 hours per 8-hour period
    - Within 75 feet – no more than 6 hours per 8-hour period
    - 100 feet or greater - no use restriction

- Prior to construction, the applicant will prepare a Helicopter Noise Control Plan that indicates where helicopters would be used and the frequency and duration for such use during construction. The Plan shall demonstrate compliance with the County Noise ordinance for the impacts caused by helicopter noise on properties with an occupied residence, and with property lines within 1,600 feet of proposed helicopter use locations. Components of the plan may include the following.
    - Affected property owners shall be notified prior to the use of helicopters for construction activity within 1,600 feet of their property boundaries.
    - In order to comply with the County Noise Ordinance (Section 36.409 – Construction Equipment), the duration of helicopter use for construction shall comply with the following limitations, for the specified distance between helicopter operations and property line of occupied parcel:
        - Within 400 feet – no more than 1 hour per 8-hour period
        - Within 600 feet – no more than 5 hours per 8-hour period
        - 800 feet or greater - no use restriction

3.4 Potential Impulsive Noise Impacts

3.4.1 On-Site Impulsive Noise

According to the Federal Highway Administration (FHWA 2011a), neither a vibratory pile driver nor a rock drill are considered to be sources of impulsive noise. Therefore, construction of the solar farm site would not involve impulsive noise.

3.4.2 Gen-tie Transmission Line Impulsive Noise

Blasting activities may be required to facilitate excavation in areas where competent bedrock occurs at depths that interfere with transmission pole installation. Blasting activities would typically involve drilling multiple 2-inch-diameter holes into the rock to a depth between 40 inches and 15 feet, so that the pole holes can ultimately be excavated to a depth of approximately 15 feet. According to the Federal Highway Administration Construction Noise Handbook (2011), a rock drill does not produce impulse noise; the noise level for a rock drill is identified as 81 dB at 50 feet, and a loading factor of 20% is applicable (FHWA 2011b). Charges, typically

weighing between 2.5–5 pounds each, would then be inserted into each drilled hole. The charges would then be detonated sequentially, limiting the blasting-related noises to one individual charge at a time. Smaller charges and/or multiple blasting operations may be used to further limit blasting-related noise levels at individual pole holes. Based upon these assumptions, blasting occurring without mitigation would exceed the County's impulsive noise limit in any 1 minute at the boundary of any parcel used for agricultural purposes at a distance of approximately 1,100 feet, and for residential purposes at a distance of approximately 1,550 feet. Assuming that 5-pound charges will be used and soil, rubberized blankets, and/or steel plates will be placed over the area to be blasted to reduce the noise, the resulting noise level would be 85 dBA at a distance of 430 feet. Though the nearest residence to the gen-tie line is approximately 1,125 feet away, since a construction easement must be obtained from the property owner, the edge of the easement will serve as the "property boundary" during construction, and would be located not closer than 50 feet from the construction zone. Therefore, if blasting were to occur within 430 feet of the boundary of any occupied parcels zoned for agricultural use (all parcels along the gen-tie route are zoned General Rural (S92)), blasting noise could exceed the County's impulsive noise standard. Drilling associated with the placement of charges for blasting would not exceed the construction noise limit (i.e., 75 dB 8-hour average) where rock drilling sites are at least 100 feet from noise sensitive land uses. Abatement measures are provided to avoid this potential short-term impulsive noise impact.

PDF-N Blasting and drilling associated with gen-tie transmission line construction shall be prohibited within 430 feet of the boundary of any occupied parcels zoned for agricultural use. Alternate non-impulsive methods (i.e., chemical fracturing of the rock) shall be used, as necessary, to facilitate pole installation when bedrock is encountered within this blast prohibition radius.

PDF-N **Blasting Plan.** The applicant will prepare a blasting plan that will reduce impacts associated with construction-related noise, drilling operations and vibrations related to blasting. The blasting plan will be site specific, based on general and exact locations of required blasting and the results of a project-specific geotechnical investigation. The blasting plan will include a description of the planned blasting methods, an inventory of receptors potentially affected by the planned blasting, and calculations to determine the area affected by the planned blasting. Noise calculations in the blasting plan will account for blasting activities and all supplemental construction equipment. The final blasting plan and pre-blast survey shall meet the requirements provided below.

- The blasting plan will include a schedule to demonstrate, where feasible, construction blasting to occur infrequently enough that it will not exceed the

County's impulsive noise standard because blasting would not occur for more than 25% (15 minutes) during a 1-hour period due to the short time duration of a blast. Where this is not possible, other construction blasting would be coordinated with impacted building occupants to occur in their absence, or at other acceptable times, to avoid nuisance or annoyance complaints.

- To ensure that potentially impacted residents are informed, the applicant will provide notice by mail to all property owners within 430 feet of the project at least 1 week prior to the start of construction activities.
- Blasting would be completed between 7 a.m.–7 p.m. to be compliant with County noise ordinances.
- Drilling operations associated with blasting shall comply with the County Code Noise Ordinance, Section 36.408, .409, and .410.

3.5 Vibration (Groundborne Noise) Effects

3.5.1 Vibration – Long Term Operation

No operational components of the Proposed Project include significant groundborne noise or vibration sources, and no significant vibrations sources currently exist, or are planned, in the Project area. Thus, no significant groundborne noise or vibration impacts would occur with operation of the Proposed Project.

3.5.2 Vibration – Project Construction

Construction activities produce varying degrees of ground vibration, depending on the equipment and methods employed. While ground vibrations from typical construction activities rarely reach levels high enough to cause damage to structures, special consideration must be made when sensitive or historic land uses are near the construction site. The construction activities that typically generate the highest levels of vibration are blasting and impact pile driving.

On-site construction equipment that would cause the most noise and vibration would be associated with site grading and driving of pylons for tracking machinery. According to the Federal Transit Administration (FTA), vibration levels associated with the use of bulldozers (from the smallest to the largest available models, representing differing weight measured in the tons) range from approximately 0.003–0.089 inch/second PPV and 58–87 vibration decibels (VdB referenced to 1 micro-inch per second [µin/sec] and based on the root mean square [RMS] velocity amplitude) at 25 feet, as shown in Table 10.

Table 10
Typical Construction Equipment Vibration Levels

Equipment	PPV at 25 feet (inch/second)[1]	Approximate Lv at 25 feet[2]
Large Bulldozer	0.089	87
Trucks	0.076	86
Vibratory Pile Driver	0.170	93
Small Bulldozer	0.003	58

1 PPV = peak particle velocity
2 L_v is the velocity level in decibels (VdB) referenced to 1 microinch/second and based on the root mean square (RMS) velocity amplitude.

Sources: Caltrans 2004; FTA 2006

Table 11 provides a reference to the FTA thresholds for construction-related vibration significance determination, which the County has adopted.

Table 11
Guidelines for Determining the Significance of Groundborne Vibration and Impacts

	Frequent Events[1]	Infrequent Events[2]
Category 2: Residences and buildings where people normally sleep (hotels, hospitals, residences, and other sleeping facilities)	0.0040 inch/sec. RMS[3]	0.010 inch/sec. RMS [3]

1. "Frequent Events" is defined as more than 70 vibration events per day, applicable to bull dozer and truck operations.
2. "Infrequent Events" is defined as fewer than 70 vibration events per day, applicable to vibratory pile driving.
3. RMS = root mean squared velocity, expressed in inch/second.

Sources: Caltrans 2004; FTA 2006

Using FTA's recommended procedure for applying a propagation adjustment to these reference levels, vibration levels would exceed County-recommended thresholds (0.004 inch/second RMS) within 80 feet of bulldozers and 75 feet of trucks. For vibratory pile driving, vibration levels would exceed County-recommended thresholds (0.010 inch/second RMS) within 100 feet of pile driving. The nearest residence to these activities would be a minimum of 250 feet across property lines from potential construction activities. Therefore, vibration levels would not exceed 0.040 inch/second RMS or 0.010 inch/second RMS from general and pile-driving construction activities at the nearest residences. This impact would be less than significant. No mitigation is necessary.

3.5.3 Vibration – Off-Site Construction (Blasting)

According to Caltrans (2001) blasting of rock to support roadway and structural foundation construction produces peak particle velocity ground-borne vibration of 2 inch/second (0.12 inch/sec rms) up to 35 meters (100 feet) from the blast activity. Blasting would therefore have

vibration levels which exceed County-recommended thresholds (0.010 inch/sec rms) within 1,700 feet of the blast activity. If there are existing structures which are located within 1,700 feet of blast sites for the gen-tie construction activities, a significant vibration impact could occur. An abatement measure is provided to avoid this potential short-term vibration impact.

PDF-N Blasting associated with gen-tie transmission line construction shall be prohibited within 1,700 feet of existing structures. Alternate non-explosive methods (i.e., chemical fracturing of the rock) shall be used, as necessary, to facilitate pole installation when bedrock is encountered within this blast prohibition radius.

4.0 SUMMARY OF PROJECT IMPACTS, DESIGN CONSIDERATIONS, NOISE MITIGATION, AND CONCLUSIONS

Noise impacts associated with the project proposed include outdoor mechanical equipment noise and short-term construction activities. The proposed inverters would result in a significant noise impact at the adjacent property lines. The inverter noise could be mitigated by placing all the inverters no closer than approximately 800 feet of the adjacent property lines, or for inverters less than this setback distance, placing them within enclosures. The project includes design features to address noise associated with panel washing activity. The proposed IPC Eagle Wash Station or equivalent would be retrofitted with an acoustic enclosure for the gasoline engine, solar panel washing would occur using a north/south washing pattern, and operation of the wash station itself is prohibited within a specified distance from any adjacent east and west facing property lines with an occupied residence.

The proposed use of vibratory pile driver, with pre-drilling where bedrock occurs, to install support masts for panel arrays would generate noise levels which would comply with applicable portions of the County's noise ordinance. Noise abatement measures pertinent to construction nuisance noise avoidance have been incorporated for general project construction.

The construction of the gen-tie transmission line for the project may involve limited blasting to accomplish the installation of support poles for the transmission line. Blasting shall not occur within 600 feet of a property line zoned for residential use, within 430 feet of a parcel with agriculture zoning, or within 700 feet of an existing structure. A blasting plan would be required in order to limit the frequency of blasting to comply with the County to occur infrequently enough that it will not exceed the County's impulsive noise standard because blasting would not occur for more than 25% (15 minutes) during a 1-hour period due to the short time duration of a blast. Where this is not possible, other construction blasting would be coordinated with impacted building occupants to occur in their absence, or at other acceptable times, to avoid nuisance or annoyance complaints.

Heavy construction equipment use within 100 feet of the property boundary with occupied residence along the gen-tie line could exceed a 75 dBA hourly average between 7 a.m.–7 p.m. at the property lines of some occupied parcels. As such, the hourly noise level from use of heavy construction equipment could occasionally exceed that allowed under County Ordinance. A Construction Management Noise Control Plan will be required that addresses the use of heavy equipment within 100 feet of an occupied residential parcel along the gen-tie alignment. The Plan shall demonstrate compliance with the County Noise ordinance for the impacts caused by heavy equipment use on properties with an occupied residence. In areas where there is limited access, helicopters may be used intermittently to assist with the installation of transmission line

poles and conductors. Temporary noise levels due to helicopter use could exceed a 75 dBA hourly average between 7 a.m.–7 p.m. at the property lines of some occupied parcels. As such, the hourly noise level from use of a helicopter could occasionally exceed that allowed under County Ordinance. A Helicopter Noise Control Plan will be required that indicates where helicopters would be used and the frequency and duration for such use during construction. The Plan shall demonstrate compliance with the County Noise ordinance for the impacts caused by helicopter noise on properties with an occupied residence, and with property lines within 2,200 feet of proposed helicopter use locations.

5.0 CERTIFICATION

This report has been prepared by Mr. Jonathan V. Leech and Mr. Mike Greene. Mike Greene is a County of San Diego approved CEQA Consultant for Acoustics.

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Senior Environmental Planner/Acoustician

Mike Greene, INCE Bd. Cert.
Environmental Specialist / Acoustician

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APPENDIX A

Definitions

APPENDIX A
Definitions

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location.
A-Weighted Sound Level (dBA)	The sound pressure level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise.
Community Noise Equivalent Level (CNEL)	CNEL is the A-weighted equivalent continuous sound exposure level for a 24-hour period with a 10 dB adjustment added to sound levels occurring during the nighttime hours (10 p.m.–7 a.m.) and 5 dB added to the sound during the evening hours (7 p.m.–10 p.m.).
Decibel (dB)	A unit for measuring sound pressure level and is equal to 10 times the logarithm to the base 10 of the ratio of the measured sound pressure squared to a reference pressure, which is 20 micropascals.
Equivalent Continuous Sound Level (Leq)	The sound level corresponding to a steady state sound level containing the same total energy as a varying signal over a given sample period. Leq is designed to average all of the loud and quiet sound levels occurring over a time period.
Maximum A-weighted Sound Level, (Lmax)	The greatest sound level measured on a sound level (Lmax) meter during a designated time interval or event using fast time-averaging and A-weighting.
Sound Transmission Class, STC	A single number rating of the noise reduction of a building element.

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APPENDIX B

IPC Eagle Wash Station Specifications

Hydro Station

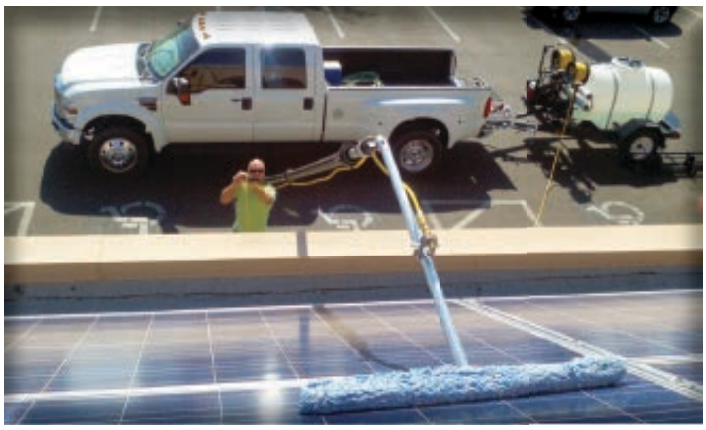
IPC Eagle

Pure Water Cleaning System NEW!

The Hydro Station is a compact and portable Pure Water Cleaning System. The Hydro Station has the unique ability to produce a high volume of pure water for multiple remote applications. The possibilities are endless and the system can be upgraded at any time to fit the application. This includes a 4 stage filtration system which includes reverse osmosis, and deionization process to produce mineral free water providing for incredible cleaning action and spot free windows.

Product applications for this system include the following:

- Window Cleaning
- Solar Panels
- House & Wall Washing
- Mobile Car Washing
- Pressure Washing
- Soft Wash Roof Cleaning
- More!



Great for the following industries:

- School Districts
- Universities
- Municipalities
- Contractors
- Landscapers
- Window Cleaners
- Facility Maintenance
- Car/RV/ATV/Motorcycle/Boat Dealerships
- Police Stations
- Property Management

Technical Data

Dimensions	51"W x 23" D x 26.5 H
Weight	250 Lbs.
Engine	Honda GX160, 5.5 hp pump

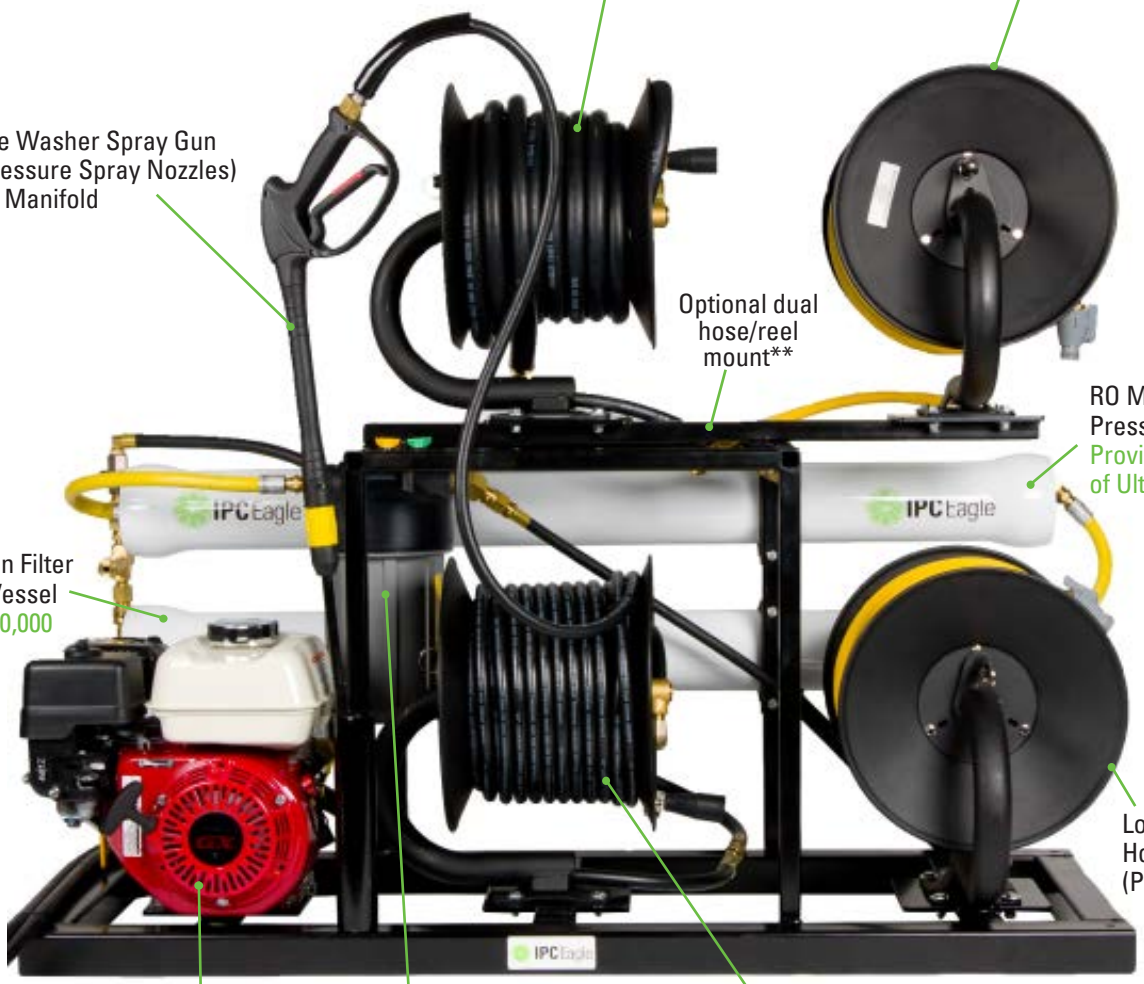
Pressure Washer

Flow	4 gpm
Pressure	1500 psi
Max temp	160 degrees F
Feed	Pressure or Suction

RO System Specs

Pure Water Prod. Rate	1.25 - 3 gpm (depending on supply water temp)
Pure Water Pressure	60 psi (average working pressure at hose reel inlet)
Rejection Rate	99%
Recovery Rate	50-70%
Operating Pressure	200 psi
Pre-Filter Service	@ 20,000 gallons

Single Unit Assembly for Ease of Use*



Hydro Station can be mounted in
an open or enclosed trailer.
(Tank and trailer not included)

* Comes standard with 1 High Pressure Hose/Reel and 1 Low Pressure Hose/Reel
** Shown with optional dual hose reel mount on top of unit

IPC Eagle

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For Immediate Release

Honda Launches All-New Mid GX Engine Lineup
New Models for Commercial Power Equipment Market Designed with Technologically Advanced Features for Lower Emissions, Lower Noise, Lower Vibration

ALPHARETTA, Ga., January 18, 2011 – At the 2011 World of Concrete trade venue, an international event dedicated to the commercial concrete and masonry construction industries, Honda today announced the launch of its all-new mid GX engines line. Completely redesigned for 2011, the new GX120, the GX160 and the GX200 are single-cylinder, horizontal-shaft engines that replace the existing GX120, GX160 and GX200 models. The lineup is an ideal fit for an array of commercial turf applications and equipment including generators; construction/industrial equipment; agricultural equipment; water pumps; and pressure washers.

The new Honda mid GX engines, while being dimensionally equivalent and having the same power output of the models they replace, boast increased performance resulting, in part, from the incorporation of these innovative features:

- improved fuel economy through changes in valve timing, compression ratio, carburetor settings, and cooling system modifications;
- new, more stringent emissions standards met through changes in valve timing; carburetor settings; and other proprietary components;
- low noise levels achieved via a change in muffler structure design, breather valve, push rod materials, and crank/case cover rigidity; reduced vibration accomplished through use of a lighter engine piston.

The new mid GX engines also are equipped with a number of design enhancements, including a new carburetor chamber coating; a recoil rope design change; the addition of a

-more-

carburetor filter; and an improved fuel tank guard – all of which improve their fuel economy, reliability and durability.

"As a global environmental leader, Honda developed our new mid GX engines with technologically advanced features that contribute to lower emissions, lower noise, lower vibration and nearly 100 percent installation capability for OEMs in the commercial power equipment market," said Mike Rudolph, senior manager, Honda Engines. "Because the new engines essentially match the dimensions of the existing GX models they replace, original equipment manufacturers will not have to modify the designs of their commercial equipment."

A Closer Look at Emissions Standards in 2011 and Beyond

The new Honda GX120, GX160 and GX200 mid GX engines meet EPA Phase 3 exhaust and evaporative emissions standards – the most stringent emission regulations in the world. As background, the EPA has finalized a new emission control program to reduce hydrocarbon emissions from small spark-ignition engines by approximately 35 percent. These new exhaust emissions standards will take effect in 2011 or 2012, depending on the size of the engine. The final rule also includes new standards to reduce evaporative emissions from these fuel systems. Ultimately, these standards will serve to reduce the ozone and carbon monoxide levels produced by these engines.

The design configuration of the new Honda mid GX models reduces pollutants such as hydrocarbons (HCs) and nitrous oxide (NOx) while maintaining the same level of output power as the previous Honda GX models they replace. "The engines reduce HCs by reducing oil consumption via a redesigned piston shape and piston ring along with a modified carburetor setting. In addition, the engine designs reduce NOx emissions through an adjustment in ignition timing which reduces combustion temperature and pressure," explained Rudolph.

Reduction of Noise and Vibration and in the New Honda Mid GX Models

In the new mid range GX160 engines, the composition of the push rods has been changed from steel to aluminum. Because the cylinder heads also are constructed from aluminum, this design change equalizes the linear expansion coefficient (the ratio at which the length of the push rod changes from reaction to engine heat) of the push rods. This improvement reduces the valve clearance (caused by the thermal expansion of the push rods and the cylinders) which reduces the tappet noise. The new engines also exhibit three primary design enhancements that contribute to class-leading low noise operations. Enhancements to the muffler, the breather valve and the case cover (GX160/200 models only) result in lower noise levels:

Current Honda GX120: 101 dBA	**New Honda GX120:** 99 dBA – dual silent spec
Current Honda GX160: 102 dbA	**New Honda GX160:** 99 dBA – dual silent spec
Current Honda GX200: 103 dbA	**New Honda GX200:** 101 dBA – dual silent spec

* Noise levels at rated load to reflect maximum noise level possible, measured at 9 Feet (3 Meters)

Turning to the issue of vibration, any engine generates vibration through the reciprocal movement of the pistons. In the new mid GX models, the piston weight has been reduced and the crank weight has been adjusted according to the piston weight and connecting rod weight. As a result, the crankshaft rotates to counterbalance the reciprocal movement force of the pistons – reducing primary engine vibration.

All three new mid GX models – the GX120, the GX160 and the GX200 – carry the Honda industry-competitive, three-year warranty. Comprehensive details about this warranty offering and other consumer information can be found at www.honda.com.

Honda is the world's largest manufacturer of engines, producing and marketing more than 23 million units globally in 2009 for a diverse array of automotive, motorcycle, marine, and power equipment products. Honda Engines offers a complete line of small, general purpose engines for commercial, rental industry, and consumer applications. Honda engines

supply smooth and dependable power for more than 3,000 different product applications including pressure washers, lawnmowers, and rescue and construction equipment.

Specifications for Honda Mid GX Engines			
	GX120	***GX160***	***GX200***
Engine Type	Air-cooled, 4-stroke, OHV, single cylinder		
Bore X Stroke (inches/mm)	2.4” X 1.7” (60 mm X 42 mm)	2.7” X 1.8” (68 mm X 45 mm)	2.7” X 2.1” (68 mm x 54 mm)
Displacement	7.2 cubic in. (118 cm^3)	9.9 cubic in. (163 cm^3)	12 cubic in. (196 cm^3)
Compression Ratio	8.5 : 1	9.0 : 1	8.5 : 1
Net Power (kW/rpm)*	3.5 hp (2.6 kW)	4.8 hp (3.6 kW)	5.5 hp (4.1 kW)
Net Torque*	5.4 lbs. ft. (7.3 Nm)	7.6 lbs. ft. (10.3 Nm)	9.1 lbs. ft. (12.4 Nm)
PTO Shaft Rotation	Counterclockwise (from PTO shaft side)		
Ignition System	Transistor Magneto		
Starting System	Recoil Starter		
Carburetor	Butterfly		
Lubrication System	Splash		
Governor System	Mechanical		
Air Cleaner	Dual Element		
Oil Capacity	0.59 US qt. (0.56 L)	0.61 US qt. (0.58 L)	0.63 US qt. (0.60 L)
Fuel Tank Capacity	2.1 US qt. (2.0 L)	3.3 US qt. (3.1 L)	3.3 US qt. (3.1 L)
Evaporative Emissions	Low permeation hose and purge joint provided		
Exhaust Emissions	Certified for use in all 50 states		
Dimensions (L X W X H)	12.0” (305 mm) X 13.4” (341 mm) X 13.0” (329 mm)	12.3” (312 mm) X 13.6” (346 mm) X 13.6” (346 mm)	12.6” (321 mm) X 14.8” (376 mm) X 13.6” (346 mm)
Dry Weight	29 lbs. (13.0 kg)	33 lbs. (15.1 kg)	35 lbs. (16.1 kg)

* The power rating of the engines indicated in this document measures the net power output at 3600 rpm (7000 rpm for model GXH50, GXV50, GX25 and GX35) and net torque at 2500 rpm, as tested on a production engine. Mass production engines may vary from this value. Actual power output for the engine installed in the final machine will vary depending on numerous factors, including the operating speed of the engine in application, environmental conditions, maintenance and other variables.

Editor’s Note:

Honda Power Equipment, a division of American Honda Motor Co., Inc., markets a complete range of outdoor power equipment, including outboard marine engines, general purpose engines, generators, lawnmowers, pumps, snowblowers, tillers and trimmers for commercial, rental and residential applications. Its comprehensive product line is powered exclusively by environmentally advanced 4-stroke engines.

Information for media regarding Honda products is available at www.hondanews.com.
Consumer information regarding Honda products is available at www.honda.com.