Noise Technical Report Rancho Viejo Solar Project

Santa Fe County, New Mexico

JULY 2024

PREPARED FOR

Rancho Viejo Solar, LLC

PREPARED BY

SWCA Environmental Consultants

NOISE TECHNICAL REPORT
RANCHO VIEJO SOLAR PROJECT
SANTA FE COUNTY, NEW MEXICO

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1 INTRODUCTION

SWCA Environmental Consultants (SWCA) prepared this noise technical report in support of the proposed Rancho Viejo Solar Project (project). The project would be developed by Rancho Viejo Solar, LLC. The project would be in unincorporated Santa Fe County, New Mexico (county), in the northern part of the state.

This report presents the analysis and noise impact estimates for the construction and operation of the project at the property boundaries and at noise sensitive areas (NSAs) to demonstrate that the proposed activities associated with this project will not result in a substantial permanent increase in ambient noise levels in the vicinity of the project.

1.1 Project and Study Description

Rancho Viejo Solar, LLC proposes to design, construct, operate, and maintain a solar energy generation and storage site in Santa Fe County, New Mexico. The project includes the development of a 96-megawatt solar facility, a 48-megawatt battery energy storage system (BESS), a substation, an operations building, a water storage tank, a generation tie-in line, and an access road on private land approximately 3 miles south of Santa Fe city limits and approximately 4.2 miles east of La Cienega (Figure 1). A general layout of the facility based on its current design is provided in Figure 2.

Potential noise impacts from the construction and operation of the project were evaluated by determining the projected noise increases over ambient conditions and potential exposure of sensitive receptors to excessive noise from the proposed noise-generating sources.

Construction of the project will consist of earthwork (e.g., site grading) and the construction of a solar facility. Predicted construction-generated noise levels at nearby NSAs were calculated using the Federal Highway Administration (FHWA) Roadway Construction Noise Model (RCNM). The RCNM is FHWA's national model for the prediction of construction noise

Among project operational components, the sources with potential to impact ambient noise levels are inverters, transformers, BESS equipment and solar trackers.

The noise impact evaluation for the operation of the project, provided herein, consists of computer noise modeling using SoundPLAN Essential Version 5.1 and assessment of the outputs as they pertain to the sound (noise) standards and nearest property boundaries and NSAs (i.e., residences).

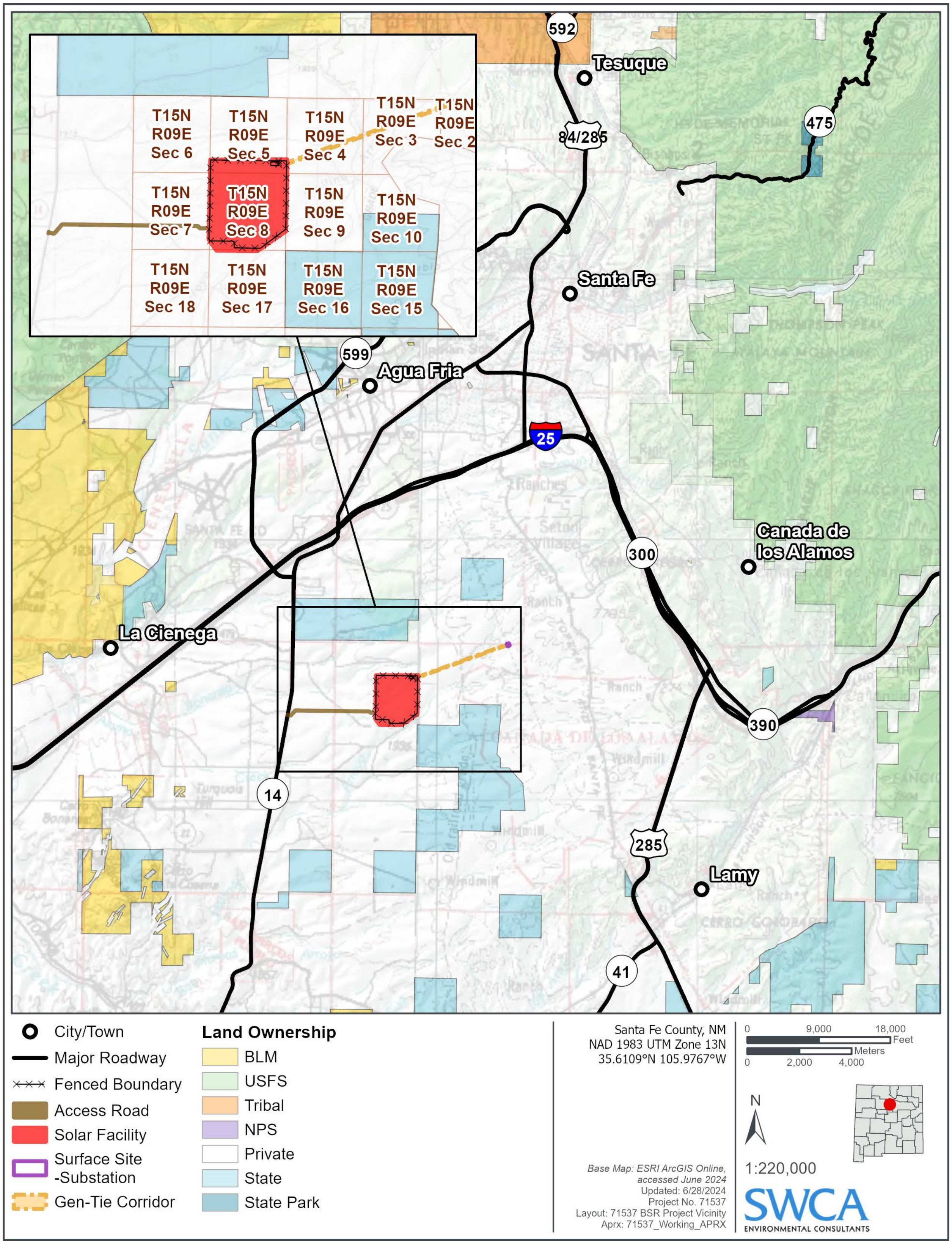

Figure 1. Project vicinity map.

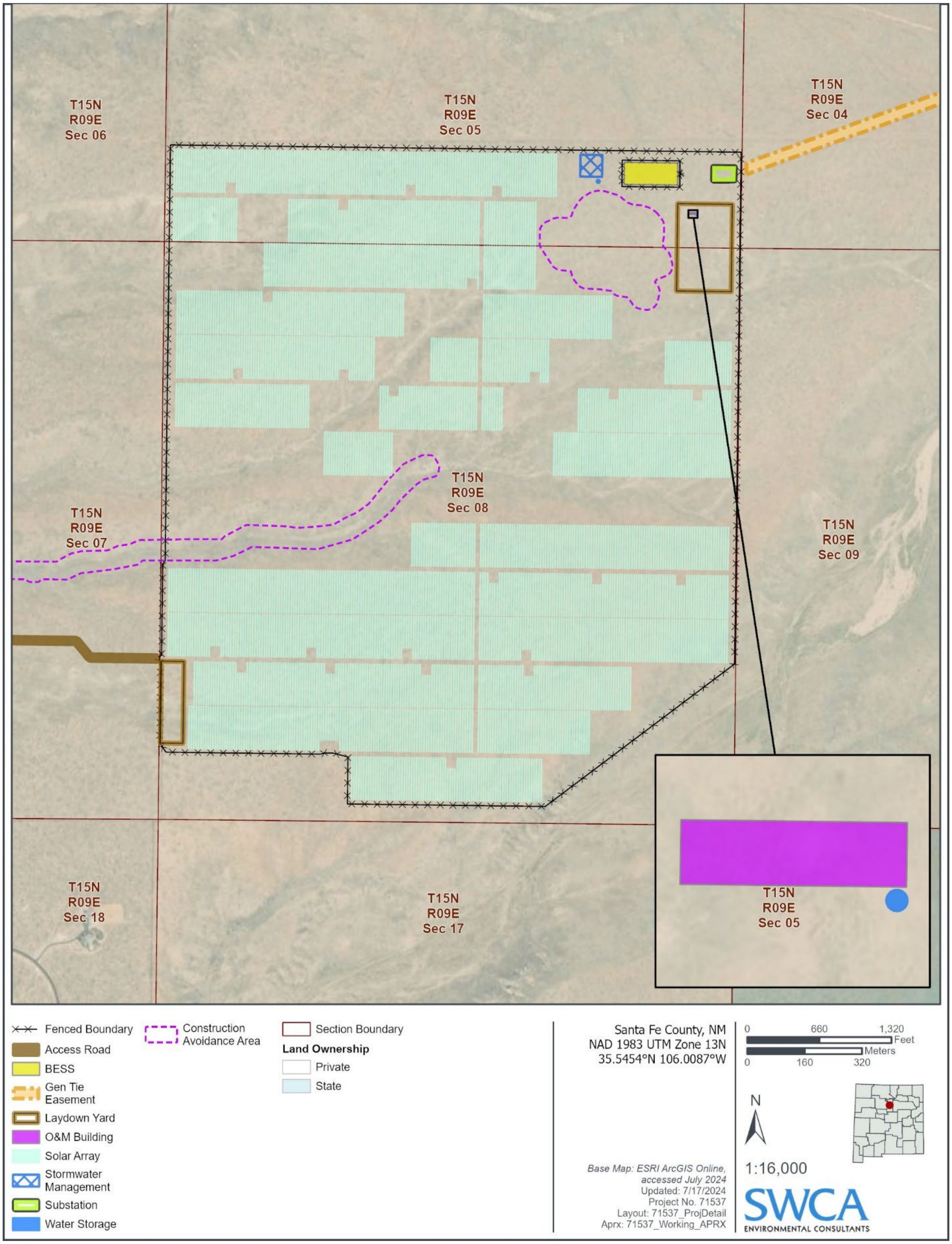

Figure 2. Project layout.

1.2 Sound Fundamentals – Background

Sound is defined as a form of energy that is transmitted by pressure variations, which the animal or human ear can detect. Noise can be defined as any unpleasant or unwanted sound that is unintentionally added to a desired sound or environment. The noise effects in humans include interference with communication, learning, rest, or sleep and physiological health effects. There are two main properties of sound: the amplitude and the frequency. Amplitude refers to the level of energy that reaches the ear (how loud we perceive the sound), while frequency is the number of cycles or oscillations per unit of time completed by the source. Frequency is normally expressed in hertz (Hz).

Sound power is defined as the measurement of the ability of a source to make sound. It is independent of the acoustic environment in which is located. The sound power level (L_{pw}) of a source is the amount of energy it produces relative to a reference value and is normally expressed in decibels. The decibel is a logarithmic scale to describe the sound pressure ratio.

Humans perceive a frequency range of about 20 Hz to about 20,000 Hz. An internationally standardized frequency weighting, the A-weighting scale, was designed to approximate the audible range of frequencies of a healthy human ear. The A-weighting scale corresponds to the fact that the human ear is not as sensitive to sound at the lower frequencies as it is at the higher frequencies.

1.2.1 Definition of Acoustical Terms

Several different descriptors of time-averaged sound levels are used to account for fluctuations of sound intensity over time. The sound descriptors calculated by the sound meters and used in this report to describe environmental sound are defined below.

- Ambient sound level is defined as the composite of noise from all sources near and far, the normal or existing level of environmental noise at a given location.
- Decibel (dB) is the physical unit commonly used to measure sound levels. Technically, a dB is a unit of measurement that describes the amplitude of sound equal to 20 times the base 10 logarithm of the ratio of the reference pressure to the sound of pressure, which is 20 micropascals (μPa).
- Equivalent noise level (L_{eq}) is the energy average A-weighted noise level during the measurement period.
- Day-night sound level (L_{dn}) is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during night-time hours (10 p.m. [22:00] to 7 a.m. [07:00]).
- Daytime Sound Level (L_d) is defined as the equivalent sound level for a 15-hour period between 7 a.m. (07:00) and 10 p.m. (22:00).

1.2.2 Sound Levels of Representative Sounds and Noises

The U.S. Environmental Protection Agency (EPA) has developed an index to assess noise impacts from a variety of sources using residential receptors. If L_{dn} values exceed 65 dBA, residential development is not recommended (EPA 1979). Noise levels in a quiet rural area at night are typically between 32 and 35 dBA. Quiet urban night-time noise levels range from 40 to 50 dBA. Levels above 70 dBA tend to be associated with task interference. Levels between 50 and 55 dBA are associated with raised voices in a normal conversation. Noise levels during the day in a noisy urban area are frequently as high as 70 to 80 dBA. Noise levels above 110 dBA become intolerable. Table 1 presents sound levels for some common noise sources and the human response to those decibel levels.

Table 1. Sound Levels of Representative Sounds and Noises

Source and Distance	Sound Level (dBA)	Human Response
Jet takeoff (nearby)	150	
Jet takeoff (15 m/50 feet)	140	
50-hp siren (30 m/100 feet)	130	
Loud rock concert (near stage)	120	Pain threshold
Construction noise (3 m/10 feet)	110	Intolerable
Jet takeoff (610 m/2,000 feet)	100	
Heavy truck (8 m/25 feet)	90	
Garbage disposal (0.6 m/2 feet)	80	Constant exposure endangers hearing
Busy traffic	70	
Normal conversation	60	
Light traffic (30 m/100 feet)	50	Quiet
Library	40	
Soft whisper (4.5 m/15 feet)	30	Very quiet
Rustling leaves	20	
Normal breathing	10	Barely audible
Threshold of hearing	0	

Source: Beranek (1988).

Table 2 provides criteria that have been used to estimate an individual's perception of increases in sound. In general, an average person perceives an increase of 3 dBA or less as barely perceptible. An increase of 10 dBA is perceived as a doubling of the sound.

Table 2. Average Human Ability to Perceive Changes in Sound Levels

Increase in Sound Level (dBA)	Human Perception of Sound
2–3	Barely perceptible
5	Readily noticeable
10	Doubling of the sound
20	Dramatic change

Source: Bolt Beranek and Newman, Inc. (1973).

2 EXISTING CONDITIONS

2.1 Existing Land Use and Site Conditions

The site is located in Santa Fe County, New Mexico. The lands within the Project area are privately managed. State Land Office–managed lands are located north (0.8 mile) and southeast (0.2 mile) of the Project area. The project is located in a rural setting with predominantly undeveloped rangelands; however, regionally, there are several existing residential and commercial developments and industrial uses. The nearest noise sensitive receptor to a project boundary is a residence located approximately 1,400 feet to the southwest.

2.2 Existing Sound Conditions

2.2.1 Existing Sound Levels

Santa Fe County is a semi-rural, semi-urban county in central New Mexico. The acoustical setting in the Project area and its immediate vicinity generally has relatively low ambient noise levels due to the rural setting. Noise in the region typically ranges from very quiet with natural sounds such as birds and wind dominating, to noisy in localized areas near towns, cities, highway crossings, and oil and gas gathering activities. Small ranches and rural residences are spread throughout the area.

The American National Standards Institute (ANSI) has published a standard (Acoustical Society of America S12.9-1993/Part 3) (ANSI 1993) with estimates of general ambient noise levels based on detailed descriptions of land use categories. The ANSI document organizes land use based on six categories. Based on an analysis of the area surrounding the project, the noise at the property lines of most interest would be represented by ANSI's Category 5 – Quiet Suburban Residential Areas with an ambient daytime noise level of approximately 48 dBA and an ambient nighttime noise level of approximately 42 dBA. Existing noise typically ranges from very quiet with natural sounds to occasional vehicles passing through analysis area or on rural roads directly adjacent to the analysis area.

2.3 Regulatory Setting

Federal, state, and local agencies have set noise regulations and policies to protect the health and welfare of the public, as described below.

2.3.1 Applicable Noise Standards

2.3.1.1 FEDERAL

In 1974 the EPA published Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin on Safety. In this publication, the EPA evaluated the effects of environmental noise with respect to health and safety and determined an L_{dn} of 55 dBA (equivalent to a continuous noise level of 48.6 dBA) to be the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas.

2.3.1.2 STATE

No state laws regulating noise were identified during a review of potentially applicable regulations.

2.3.1.3 SANTA FE COUNTY

Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards

This ordinance provides restrictions on noise generating activities that occur within Santa Fe County. Under section 131.21 Prohibitions of this ordinance, it is stated that:

> The maximum permissible noise limit at the property line shall not exceed the following depending on the zoning district:

Industrial and Commercial Zoning Districts:

- Daytime (7:00 a.m. to 10:00 p.m.): 75 dB(A), or 10 dB(A) above ambient; whichever is less
- Nighttime (10:00 p.m. to 7:00 a.m.): 60 dB(A), or 5 dB(A) above ambient; whichever is less

All Other Districts:

- Daytime (7:00 a.m. to 10:00 p.m.): 55 dB(A), or 10 dB(A) above ambient; whichever is less
- Nighttime (10:00 p.m. to 7:00 a.m.): 45 dB(A), or 5 dB(A) above ambient; whichever is less

Based on Santa Fe County Zoning Maps, no Industrial or Commercial Zoning Districts are located immediately adjacent to the project. As a result, the All Other Districts noise limits were used in this analysis to assess noise impacts. The assumed daytime ambient noise level was 48 dBA. Based on the language of this ordinance, a 10 dBA increase above daytime ambient noise levels would be 58 dBA, which is more than 55 dBA, requiring that 55 dBA be used as the allowable noise limit during daytime hours. Similarly, the assumed nighttime noise level was 42 dBA. Based on the language of this ordinance, a 5 dBA increase above nighttime ambient noise levels would be 47 dBA, which is more than 45 dBA, requiring that 45 dBA be used as the allowable noise limit during nighttime hours.

Sante Fe County Ordinance No. 2009-11 An Ordinance to Prohibit Excessive, Unnecessary and Unreasonable Noise and Public Nuisances, Section 7 - Sound Exceptions, exempts sounds made by activities or on direction of Sante Fe County or any other public or private utility in maintenance, construction, or repair of public or utility improvements in public rights-of-way, easements, or property.

2.3.1.4 CITY OF SANTA FE

Santa Fe, New Mexico – Code of Ordinances, Chapter X – Environmental Regulations, Section 10-2 – Noise

This ordinance provides restrictions on noise generating activities in order to ensure residents of Santa Fe are provided with an environment free from such excessive sound that may jeopardize their health, welfare and safety, or degrade the quality of life.

Section 10-2.4 of this ordinance (Noises Prohibited) restricts the allowable hours for construction activities within the city of Santa Fe. This section specifically applies to construction activities occurring within the city limits. Because the project is located outside of the city limits, this section is not applicable and no limitations on the allowable hours for construction activities based on noise ordinances have been identified.

Section 10-2.5 of this ordinance (Zone district noise levels; maximum; correction) provides the maximum allowable noise levels that are permitted at different receiving zones. This regulation stipulates that:

A. It is a violation of this section for any person to operate or permit to be operated any stationary source of sound in such a manner as to create a ninetieth percentile sound pressure level (L90) for a measurement period of ten (10) minutes or more unless otherwise provided in this section, which exceeds the limits set forth for the following receiving zones. The location for measuring exterior sound levels shall be at least one foot (1') inside the property line of the affected property and three to six feet (3' to 6') above ground level and at least four feet (4') from walls and other reflective surfaces.

Table 3. Maximum Permissible Noise Levels at Noise Receiving Zones Provided in Santa Fe, New Mexico – Code of Ordinances, Chapter X – Environmental Regulations, Section 10-2 – Noise

Zone District	9:00 p.m. to 7:00 a.m.	7:00 a.m. to 9:00 p.m.
Residential	**50 dBA**	**55 dBA**
R-1, R-2, R-3, R-4, R-5, R-7, RC-5, RC-8, RM, RAC, AC, PRC, PRRC, HZ, Mobile Home Park		
Commercial	**55 dBA**	**60 dBA**
C-1, C-2, C-4, SC, BCD		
Industrial-Agricultural	**70 dBA**	**75 dBA**
I-1, I-2, IP		

When a noise source can be identified and its noise measured in more than one (1) land use category, the limits of the more restrictive use shall apply at the boundaries between different zones.

Though the project will be located outside of the City of Santa Fe, noise impacts within the city are possible. However, Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards presented above in Section 4.3.1.3 is a more restrictive ordinance enforced at the county level. Due to it being a more restrictive ordinance in terms of what levels of noise are allowable, it was used to assess noise impacts for this project. As a result, the noise limits provided by this ordinance were not used, as demonstrating compliance with Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards also demonstrates compliance with this ordinance.

3 NOISE IMPACTS

The following section provides results and interpretation of potential impacts from noise generated by the project during construction and operation phases.

3.1 Noise Assessment Components

A noise assessment is based on the following components: a sound-generating source, a medium through which the source transmits, the pathways taken by these sounds, and an evaluation of the proximity to impact locations. Soundscapes are affected by the following factors:

- Source. The sources of sound are any generators of small back-and-forth motions (i.e., motions that transfer their motional energy to the transmission path where it is propagated). The acoustic characteristics of the sources are very important. Sources must generate sound of sufficient strength, approximate pitch, and duration so that the sound may be perceived and can cause adverse effects, compared with the natural ambient sounds.
- Transmission path or medium. The transmission path or medium for sound or noise is most often the atmosphere (i.e., air). For the noise to be transmitted, the transmission path must support the free propagation of the small vibratory motions that make up the sound. Atmospheric conditions (e.g., wind speed and direction, temperature, humidity, precipitation) influence the attenuation of sound. Barriers and/or discontinuities (e.g., existing structures, topography, foliage, ground cover, etc.) that attenuate the flow of sound may compromise the path. For example, sound will travel

very well across reflective surfaces such as water and pavement but can attenuate across rough surfaces (e.g., grass, loose soil).

- Proximity to NSAs. An NSA is defined as a location where a state of quietness is a basis for use or where excessive noise interferes with the normal use of the location. Typical NSAs include residential areas, parks, and wilderness areas, but also include passive parks and monuments, schools, hospitals, churches, and libraries.

3.2 Construction Noise

The noise levels generated by construction equipment vary significantly and depend on several different parameters, such as the type, model, size, and condition of the equipment; the operation schedule; and the condition of the area being worked. Additionally, construction projects are accomplished in several different stages. Each stage has a specific equipment mix, depending on the work to be completed.

3.2.1 Equipment and Machinery

The use of heavy equipment such as hoist cranes, excavators, dozers, and backhoes during construction will elevate ambient noise levels. The type of standard construction equipment proposed typically operates in range of 68 to 90 dBA above ambient noise levels at the source. In outdoor settings, the rate at which noise decreases is influenced by the distance separating noise sources and noise receptors, as well as local conditions such as traffic, topography, and weather. Generally, when noise is emitted from a point source, the noise is decreased an average of 6 dBA each time the separating distance is doubled (Berger et al. 2003; Radtke 2016). Noise impact calculations are determined by using the rate of noise attenuation and rule for reducing sound levels by dBA subtraction for heavy equipment operations based on maximum noise levels using a reference distance beginning 50 feet from the proposed conveyor’s sound generation source (Thalheimer 2000).

Based on noise attenuation and these assumptions and estimated equipment noise levels (Federal Highway Administration 2011), noise generation from equipment operating in the ranges of 68 dBA (light trucks), 85 dBA (backhoe, excavator), and 90 dBA (heavy truck, concrete saw) at increasing distances is captured in Table 4. The majority of equipment will operate in the range of 80 dBA. Worker commutes and material delivery vehicles will cause noise that will be short term and have little effect on the hourly average noise level.

Table 4. Summary of Predicted Noise Generation from the Proposed Construction Equipment by Distance

Equipment Operating at 68 dBA		Equipment Operating at 85 dBA		Equipment Operating at 90 dBA	
Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)	Distance in Feet from the Source (miles [approximate])	Noise Level (dBA)
0	68	0	85	0	90
50 (0.01)	62	50 (0.01)	79	50 (0.01)	84
100 (0.02)	56	100 (0.02)	73	100 (0.02)	78
200 (0.04)	50	200 (0.04)	67	200 (0.04)	72
400 (0.08)	44	400 (0.08)	61	400 (0.08)	66
800 (0.15)	38	800 (0.15)	55	800 (0.15)	60
-	-	1,600 (0.30)	49	1,600 (0.30)	54
-	-	3,200 (0.60)	43	3,200 (0.60)	48
-	-	6,400 (1.20)	37	6,400 (1.20)	42

Based on noise attenuation, construction equipment noise levels will be expected to dissipate to below background levels (assumed to be 48 dBA) within approximately 0.15 mile to 1.2 miles of the Project area. The closest sensitive noise receptor, a residence located approximately 1,400 feet (0.15 mile) away, will experience a temporary increase in ambient outdoor noise levels during the 12-month construction period. Given the distance from the construction equipment, the increase in ambient noise levels at this sensitive noise receptors will attenuate to approximately 55 dBA, or the noise level of an air conditioning unit at 20 feet or noise that is quieter than normal human speech at 3 feet of distance. Sensitive noise receptors between 1,600 feet (0.3 mile) and 3,200 feet (0.6 mile) away consist of 114 residences and the Turquoise Trail Charter School and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to approximately 48 dBA, or the noise level of light automotive traffic or a quiet office environment. Sensitive noise receptors between 3,200 feet (0.6 mile) and 6,400 feet (1.2 miles) away consist of 262 residences and will experience a temporary increase in ambient outdoor noise levels, which will attenuate to low levels comparable to existing background noise levels.

It is expected that construction would occur primarily during daytime hours, though it is potential that some nighttime construction activities may be required. As discussed in Section 4.3.1.3, Sante Fe County Ordinance No. 2009-11 An Ordinance to Prohibit Excessive, Unnecessary and Unreasonable Noise and Public Nuisances, Section 7 - Sound Exceptions, exempts sounds made by activities or on direction of Sante Fe County or any other public or private utility in maintenance, construction, or repair of public or utility improvements in public rights-of-way, easements, or property. It is expected that the project will qualify for this exemption.

3.3 Operational Noise

To determine the potential noise impact from these sources, detailed noise modeling was conducted. The noise levels at the property boundaries and at identified NSAs in the vicinity of the project from the operation of the project have been predicted and compared with the relevant noise criteria, including the Sante Fe County Ordinance No. 2016-9 Chapter 7 – Sustainable Design Standards at property boundaries and the EPA's L_{dn} of 55 dBA at residential NSAs.

3.3.1 Operational Activities

The primary noise sources anticipated during operation of the proposed project are the solar trackers, inverters, BESS equipment, and transformers.

3.3.2 Noise Profile

The sound power level (Lpw) and quantities for each equipment noise source is listed in Table 5. All equipment sound levels were estimated based on available data from the equipment manufacturers or obtained from other sources or calculations where manufacturer's data were not available.

Table 5. Equipment Sound Power Levels

Equipment	1/1 Octave Spectrum									dBA	Qty.
	31Hz	63Hz	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz	8kHz		
Aux Transformer	84	90	92	87	87	81	76	71	64	87.4	1
Substation Transformer	84	90	92	87	87	81	76	71	64	87.4	1
BESS HVAC	94	94	94	94	92	87	87	86	80	72 [1]	38
BESS Chiller	94	94	94	94	92	87	87	86	80	61 [1]	19
PCS Inverter	86	87	91	86	92	83	83	73	74	95.8	19
SG4400UD-MV-US	84	90	92	87	87	81	76	71	64	96	25
Solar Tracker Motor	94	94	94	94	92	87	87	86	80	72 [1]	72

[1] Representative spectra were used for equipment for which only dBA levels were used. dBA values noted here are the dBA values resulting from converting the spectra to a dBA value, then applying a correction factor. As a result, frequency values presented here do not directly correspond to the noted dBA values.

In addition to the equipment listed in Table 5, a 115 kV transmission line is proposed. However, based on previous analyses, it is generally accepted that 115 kV transmission lines are not responsible for audible noise that can be perceived by humans during fair weather (CH2M 2012). Additionally, any corona discharges resulting in increased noise levels during foul (wet) weather would typically be quieter than the rain that would cause the increase in noise levels from the transmission line and would similarly not be perceptible to a human observer. It is expected that any noise generated during foul weather would attenuate to less than background noise levels at the edge of the right of way for the transmission line. For this reason, the 115 kV transmission line was not included in the SoundPLAN model.

3.3.2.1 INTERMITTENT NOISE SOURCES

An intermittent noise source represents any stationary noise source which is periodically or intermittently active during the day or night. Solar trackers were modeled in SoundPLAN assuming that they would only be operational during daytime hours, and that they would be intermittent sources of noise. Other noise-emitting sources with intermittent daily operation of 4 hours or less, or emergency operation only units, were not considered in the model.

3.3.3 Assessment Methodology

Based on the sound power levels for each of the sources, SoundPLAN estimates noise contours of the overall project in accordance with a variety of standards, primarily International Standards Organization (ISO) 9613-2:1996, Acoustics, standards for noise propagation calculations. All sound propagation losses, such as geometric spreading, air absorption, ground absorption, and barrier shielding, are calculated in accordance with these recognized standards.

The model accounts for reflection, from adjacent structures and the ground. The model uses industry-accepted propagation algorithms and accepts sound power levels (in dB) provided by the manufacturer and other sources. The calculations account for classical sound wave divergence, plus attenuation factors resulting from air absorption, basic ground effects, and barrier/shielding. SoundPLAN does not account for noise modulation or refraction.

The sound propagation model considers the following influences:

- sound power levels and locations of noise sources
- distance between noise sources and receivers
- topography of the area
- influence of the absorption provided by the ground
- shielding from structures or vegetation
- air absorption
- meteorological conditions

The ISO 9613-2 methodology provides tables and equations for estimating the atmospheric absorption coefficient corresponding to various temperatures and humidity levels. Topographic inputs were also included in the model.

The ISO 9613-2 standard estimates sound pressure levels at a specified distance by subtracting the attenuation factors from the source sound power level for each source in octave frequency bands. Attenuation factors include geometrical divergence, atmospheric attenuation, ground effect, and barrier attenuation. These terms are defined as follows.

- Geometrical divergence occurs as the source sound power is spread out over an increasing surface area (i.e., as the distance from the source increases). The estimated loss rate is the same for all frequencies. This is considered the most significant loss associated with propagation. Attenuation due to geometrical divergence is highly dependent on the distance between the source and the receiver. Direction also affects the noise level; 0° direct line of sight noise level will be higher than 90° direction line of sight to a stack emission point. Therefore, the differences in ground elevation and receiver height and hub height (source height) are important parameters.

- Losses due to atmospheric attenuation occur as the energy in the sound wave is transformed to heat. As this attenuation is frequency dependent and high frequencies are more readily attenuated than low frequencies, these losses are highly influenced by humidity and temperature.

- Ground effect is described according to the parameter Ground Factor, which varies between 0 for surfaces with low porosity (“hard” ground) and 1 for “soft” ground (surfaces including loose dirt, grass, crops, and other vegetation). This factor describes the effect of sound waves reflected off the ground. Parameters influencing the ground effect are the source height, receiver height, and propagation distance between the source and receiver and the ground conditions. Barrier attenuation describes the effect of sound waves refracted around an imperforate element or barrier.

- A barrier could include human-made objects such as structures, buildings, and fences, as well as topographical features. Therefore, the differences in ground elevation, source height, receiver height, dimensions, and location absorption and reflection coefficients of human-made structures and topographic features are important parameters when estimating barrier attenuation in SoundPLAN.

The following assumptions were made when running SoundPLAN:

- The model assumed all proposed noise-generating sources operated concurrently.
- Noise impacts at the selected impact locations and depicted in the isopleths were estimated assuming a receiver height of 5 feet above ground level.
- Elevations of the sources and of the receptors examined in the modeling were determined from U.S. Geological Survey Digital Elevation Map (DEM) and are based on North American Datum of 1927. The DEM files each had a 100-foot resolution (7.5-minute DEM providing coverage of 7.5 × 7.5-minute blocks).
- To better represent the actual conditions of the proposed project and to ensure that both hard and soft ground absorption were considered, acoustically hard sites including surfaces such as pavement and bare hard ground were assumed to have high reflectivity properties and a ground absorption coefficient of 0.0 was used. Ground cover in the vicinity of the project was analyzed using satellite imagery from Google Earth. A higher ground factor of 1.0 was defined for more absorptive ground, such as vegetation and loose soil. Semi-hard materials such as gravel and sand were assumed to have a ground absorption coefficient of 0.6.

3.3.4 Operational Noise Impacts

Summaries of the sound propagation model results are presented in the following section.

3.3.4.1 SOUND LEVELS AT THE NEAREST RECEPTORS

The calculated noise levels emitted by the project would be below EPA's 55 dBA L_{dn} (48.6 L_{eq}) recommended noise standard at the NSAs. The maximum noise levels due to the operation of the project at the property line at which the maximum noise impacts are expected to occur was estimated to be 36.5 dBA during both daytime and nighttime hours. Including assumed ambient noise levels, this equates to a noise level at the closest property boundary of 48.3 dBA during daytime hours and 43.5 dBA during nighttime hours, with ambient noise being in greater than the project's contribution to the total noise. These noise levels were based on estimates made by SoundPLAN software at a the nearest property boundary located to the southwest of the project area. All other project boundaries were estimated to experience lower noise impacts due to the operation of the project. As a result, the project noise would remain below the specified noise standard. Table 6 lists the overall noise levels (background, contributions, total noise levels) at the property line in where the maximum impact is expected to occur in A-weighted sound levels.

Table 6. Summary of Estimated Noise Levels from Project Operation

Description	Project Contribution (dBA)	Representative Background Noise Levels (dBA)	Total Calculated Noise Levels (dBA)	Estimated Noise Increase (dBA)
Loudest Property Line Modeled Noise Level	36.5	48.0	48.3	0.3
Santa Fe County Noise Limit (daytime)	-	-	55	-
Loudest Property Line Modeled Noise Level	36.5	42.0	43.5	1.5
Santa Fe County Noise Limit (nighttime)	-	-	45.0	-

Regarding the human perception for change in sound level (i.e., potential increase above ambient), is estimated as 0.3 dBA during daytime hours and 1.5 dBA during nighttime hours. These noise increases would not be able to be perceived by a human observer. Therefore, the proposed operation would not result in a substantial permanent increase in ambient noise levels in the vicinity of the project, as it is not expected for the Project to produce noise that is audible to residents at these locations.

Noise contour grid maps were generated by SoundPLAN software and are presented in Appendix A. The maps depict the extent of noise propagation from the SoundPLAN models that were developed for the noise impact assessment. The noise contour map illustrates the extent of noise associated with the proposed development. It is important to note that the extent of the impacts depicted in these figures does not include the contribution of the existing background noise.

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APPENDIX A

Project Operation Noise Maps

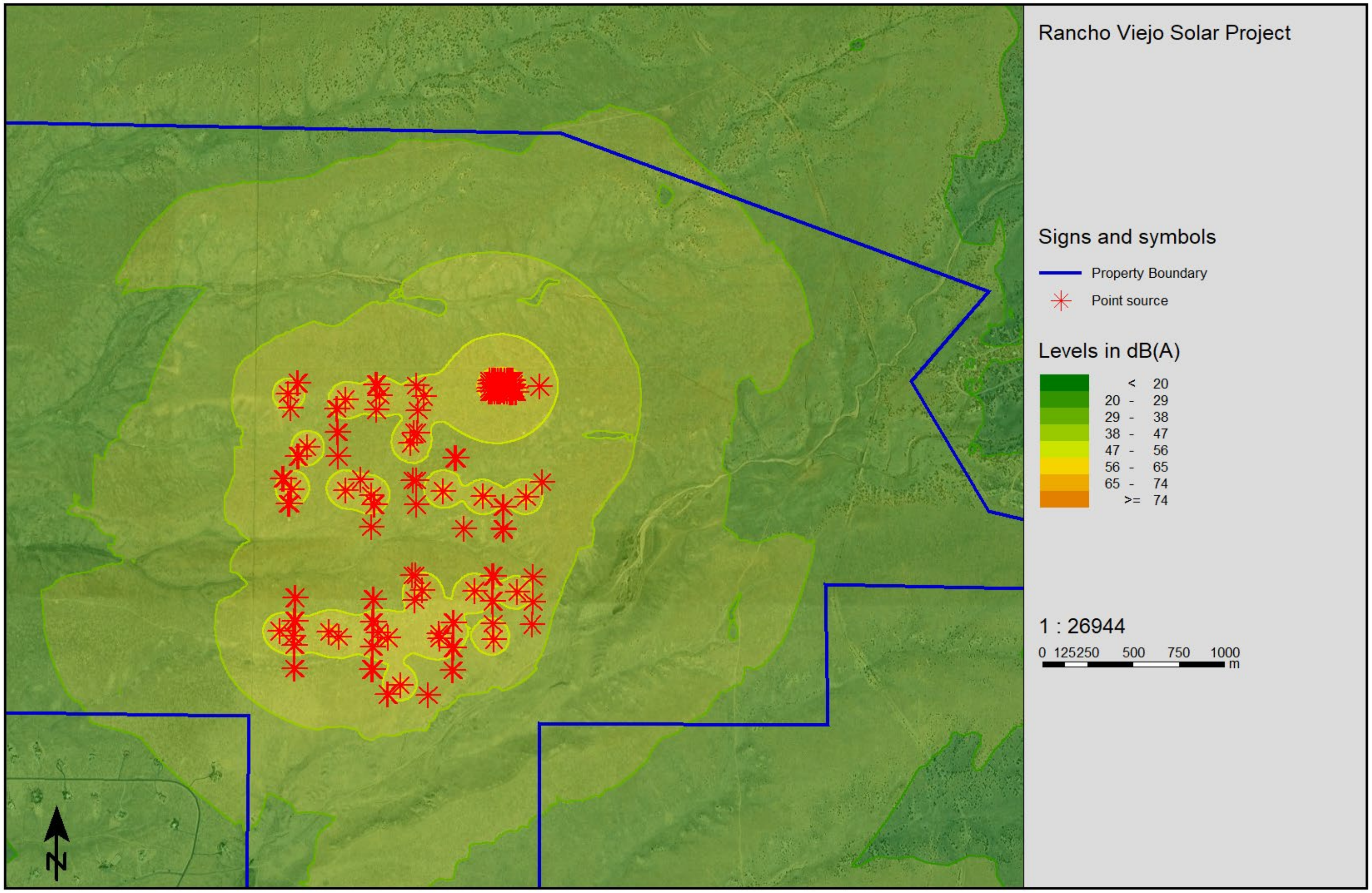

Figure A-1. Project operation noise isopleth

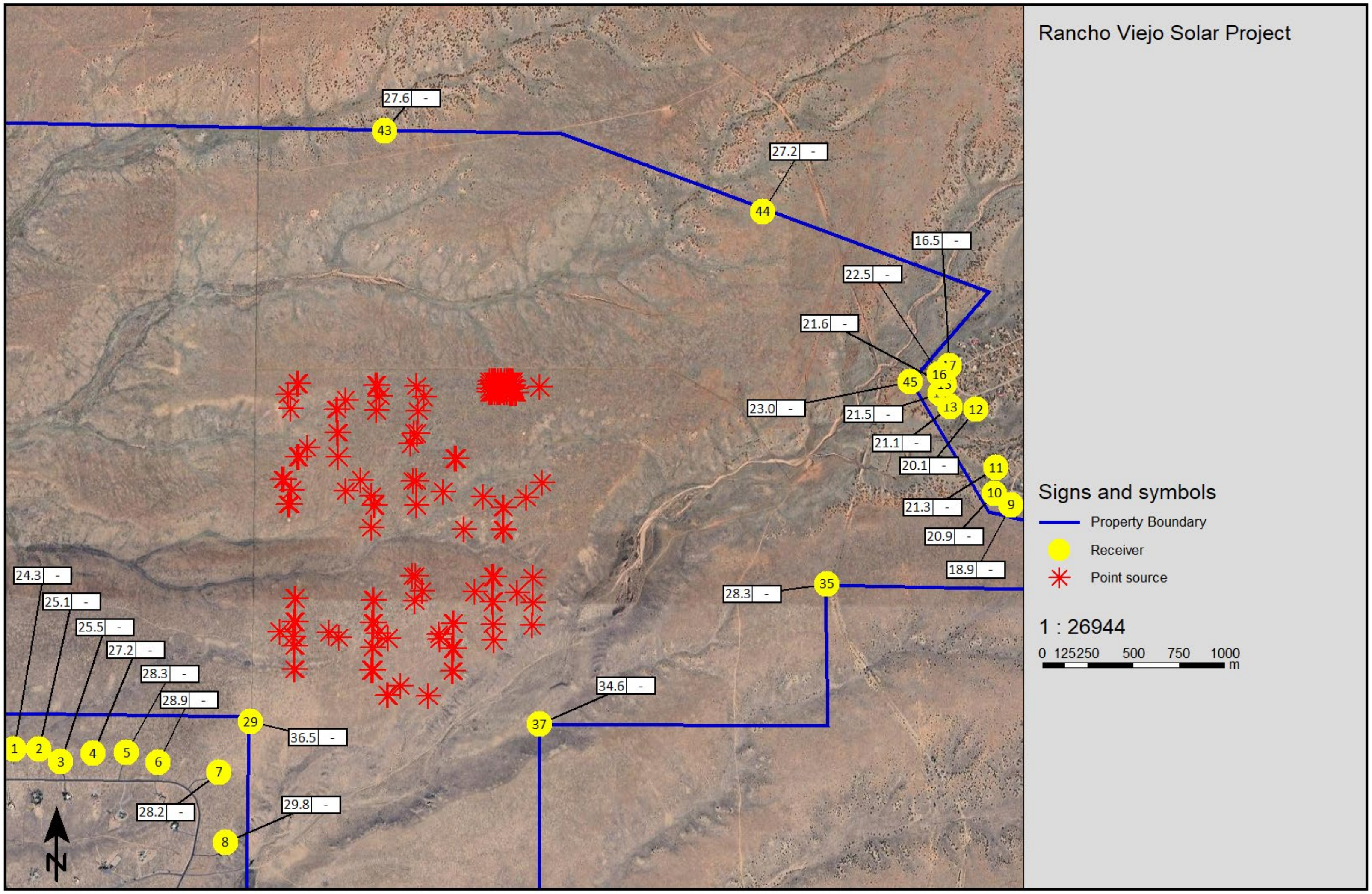

Figure A-2. Project operation noise single point map