San Luis West Solar Project

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SOUND ANALYSIS REPORT

Fresno County, California
July 2025

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ACRONYMS AND ABBREVIATIONS

µPa	microPascal
ANSI	American National Standards Institute
Applicant	San Luis West Solar, LLC
CEQA	California Environmental Quality Act
dB	decibel
dBA	A-weighted decibel
FTA	Federal Transit Authority
HVAC	heating, ventilation, and air conditioning
Hz	hertz
ISO	International Organization for Standardization
L_{dn}	Day-night average sound level
L_{eq}	equivalent sound level
L_P	sound pressure level
L	sound power level
MVA	megavolt ampere
MW-AC	megawatt-alternate current
MWh	megawatt hour
NSA	Noise Sensitive Area
PG&E	Pacific Gas and Electric Company
PPV	Peak-Particle-Velocity
Project	San Luis West Solar Project
Tetra Tech	Tetra Tech, Inc.
USEPA	U.S. Environmental Protection Agency
VdB	vibration decibel

1.0 INTRODUCTION

San Luis West Solar, LLC (Applicant) proposes to construct and operate the San Luis West Solar Project (Facility, Project). The Project consists of a photovoltaic (PV) solar generating facility with a nameplate production capacity of 125 megawatts (MW) of alternating current (AC) renewable energy as well as a Battery Energy Storage System (BESS) capable of storing approximately 30 MW of energy with a 4-hour/120 MW-hour (MWh) storage duration. The Project is a utility-scale solar farm on seven parcels totaling approximately 1,400 acres, including solar panels, security fencing, and BESS storage modules. The Project site, which encompasses all areas of temporary and permanent impacts, is approximately 1,100 acres.

Tetra Tech prepared this Sound Analysis Report to support project permitting. The report provides background information on concepts related to environmental sound including descriptions of the noise metrics used throughout the report; applicable noise standards and regulations; review of existing conditions; predicted noise levels from construction and operation of the Project equipment; and an assessment of the potential offsite noise impacts from construction and operation of the Project. Potential offsite noise impacts will be evaluated relative to the noise requirements prescribed by the California Environmental Quality Act (CEQA) and Fresno County.

1.1 Project Setting

The Project site is located in unincorporated Fresno County bounded by W. Gale Avenue to the north, the California Aqueduct to the east, W. Jayne Avenue to the south, and agricultural land to the west. The Project site is located just over 3 miles due east of Pacific Gas and Electric Company's (PG&E's) Gates Substation, which is located at the intersection of S. Trinity Avenue and W. Jayne Avenue. The nearest noise sensitive area (NSA) is located approximately 275 feet west of the Project site. Figure 1 provides an overview of the Project site as well as the surrounding area including the nearest NSAs, which are labeled as NSA-1 through NSA-8 within the figure. The Project is not located near an airstrip or airport, with the closest airport being the New Coalinga Municipal Airport, located approximately 5 miles to the west.

1.2 Acoustic Metrics and Terminology

All sounds originate with a source, whether it is a human voice, motor vehicles on a roadway, or a combustion turbine. Energy is required to produce sound and this sound energy is transmitted through the air in the form of sound waves—tiny, quick oscillations of pressure just above and just below atmospheric pressure. These oscillations, or sound pressures, impinge on the ear, creating the sound we hear. A sound source is defined by a sound power level (L_W), which is independent of any external factors. By definition, sound power is the rate at which acoustical energy is radiated outward and is expressed in units of watts.

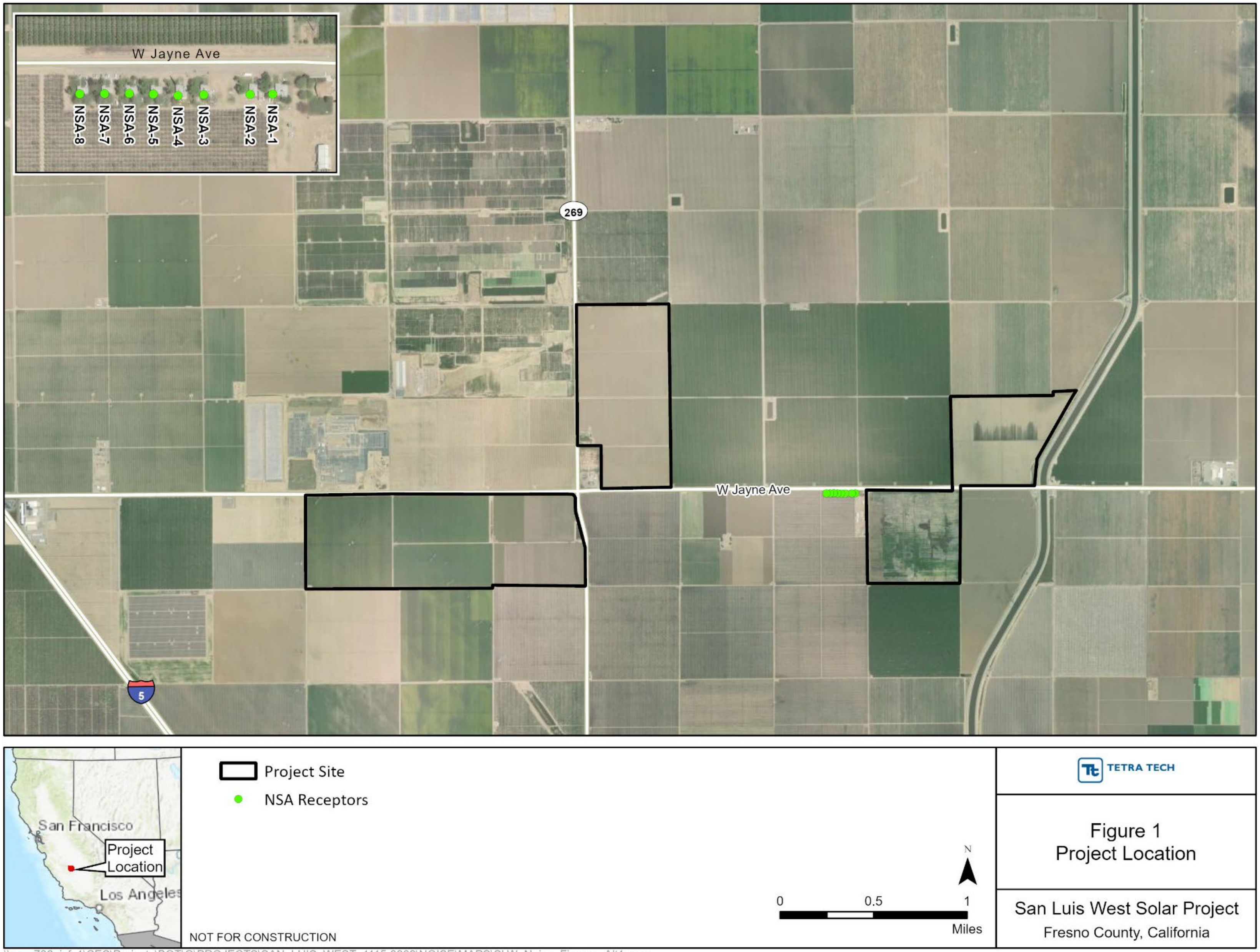

Figure 1
Project Location

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A source sound power level cannot be measured directly. It is calculated from measurements of sound intensity or sound pressure at a given distance from the source outside the acoustic and geometric near- field. A sound pressure level (L_P) is a measure of the sound wave fluctuation at a given receiver location and can be obtained through the use of a microphone or calculated from information about the source sound power level and the surrounding environment. The sound pressure level in decibels (dB) is the logarithm of the ratio of the sound pressure of the source to the reference sound pressure of 20 microPascals (µPa), multiplied by 20. The range of sound pressures that can be detected by a person with normal hearing is very wide, ranging from about 20 µPa for very faint sounds at the threshold of hearing, to nearly 10 million µPa for extremely loud sounds such as a jet during take-off at a distance of 300 feet.

Broadband sound includes sound energy summed across the entire audible frequency spectrum. In addition to broadband sound pressure levels, analysis of the various frequency components of the sound spectrum can be completed to determine tonal characteristics. The unit of frequency is hertz (Hz), measuring the cycles per second of the sound pressure waves. Typically, the frequency analysis examines 11 octave bands ranging from 16 Hz (low) to 16,000 Hz (high). Since the human ear does not perceive every frequency with equal loudness, spectrally varying sounds are often adjusted with a weighting filter. The A-weighted filter is applied to compensate for the frequency response of the human auditory system and is represented in A-weighted decibel (dBA).

Sound can be measured, modeled, and presented in various formats, with the most common metric being the equivalent sound level (L_{eq}). The L_{eq} has been shown to provide both an effective and uniform method for comparing time-varying sound levels and is widely used in acoustic assessments in the state of California. Estimates of noise sources and outdoor acoustic environments, and the comparison of relative loudness, are presented in Table 1. Additional reference information on terminology used in the report is provided in Table 2.

Table 1. Sound Pressure Levels (L_P) and Relative Loudness of Typical Noise Sources and Acoustic Environments

Noise Source or Activity	Sound Level (dBA)	Subjective Impression
Vacuum cleaner (10 feet)	70	Moderate
Passenger car at 65 miles per hour (25 feet)	65	
Large store air-conditioning unit (20 feet)	60	
Light auto traffic (100 feet)	50	Quiet
Quiet rural residential area with no activity	45	
Bedroom or quiet living room; Bird calls	40	Faint
Typical wilderness area	35	
Quiet library, soft whisper (15 feet)	30	Very quiet
Wilderness with no wind or animal activity	25	Extremely quiet
High-quality recording studio	20	
Acoustic test chamber	10	Just audible
	0	Threshold of hearing

Adapted from: Kurze and Beranek (1988) and USEPA (1971)

Table 2. Acoustic Terms and Definitions

Term	Definition
Noise	Typically defined as unwanted sound. This word adds the subjective response of humans to the physical phenomenon of sound. It is commonly used when negative effects on people are known to occur.
Sound Pressure Level (L_P)	Pressure fluctuations in a medium. Sound pressure is measured in dB referenced to 20 μPa, the approximate threshold of human perception to sound at 1,000 Hz.
Sound Power Level (L_W)	The total acoustic power of a noise source measured in dB referenced to picowatts (one trillionth of a watt). Noise specifications are provided by equipment manufacturers as sound power as it is independent of the environment in which it is located. A sound level meter does not directly measure sound power.
Equivalent Sound Level (L_{eq})	The L_{eq} is the continuous equivalent sound level, defined as the single sound pressure level that, if constant over the stated measurement period, would contain the same sound energy as the actual monitored sound that is fluctuating in level over the measurement period.
A-Weighted Decibel (dBA)	Environmental sound is typically composed of acoustic energy across all frequencies. To compensate for the auditory frequency response of the human ear, an A-weighting filter is commonly used for describing environmental sound levels. Sound levels that are A-weighted are presented as dBA in this report.
Unweighted Decibels (dBL)	Unweighted sound levels are referred to as linear. Linear decibels are used to determine a sound's tonality and to engineer solutions to reduce or control noise as techniques are different for low and high frequency noise. Sound levels that are linear are presented as dBL in this report.
Propagation and Attenuation	Propagation is the decrease in amplitude of an acoustic signal due to geometric spreading losses with increased distance from the source. Additional sound attenuation factors include air absorption, terrain effects, sound interaction with the ground, diffraction of sound around objects and topographical features, foliage, and meteorological conditions including wind velocity, temperature, humidity, and atmospheric conditions.

1.3 Vibration Metrics and Terminology

Vibration is an oscillatory motion that is described in terms of displacement, velocity, or acceleration. Velocity is the most common descriptor used when evaluating human perception or structural damage. Velocity represents the instantaneous speed of movement and more accurately describes the response of humans, buildings, and equipment to vibrations.

Peak-Particle-Velocity (PPV) and root mean square velocity are typical metrics used to describe vibration levels in units of inches per second in the United States. However, to evaluate annoyance to humans, the vibration dB (VdB) notation is commonly used. The decibel notation acts to compress the range of numbers required to describe vibration. In the United States, the accepted velocity reference for converting to dB is 1x10-6 inches per second. The abbreviation "VdB" is used for vibration dB to reduce the potential for confusion with sound decibels.

In contrast to airborne noise, ground-borne vibration is not an everyday occurrence for humans. The background vibration velocity levels within residential areas are usually 50 VdB or lower, which is well below the human perception threshold of approximately 65 VdB. However, human response to vibration is not usually significant unless the vibration exceeds 70 VdB. Outdoor sources that generate perceptible ground-borne vibrations are typically construction equipment, steel-wheeled trains, and traffic on rough roadways. Table 3 lists common vibration sources as well as human and structural response to ground-borne vibrations.

Table 3. Typical Levels of Ground-Borne Vibration

Human/Structural Response	PPV (inches/second)	Velocity Level (VdB)*	Typical sources (50 feet from source)
Threshold, Minor Cosmetic Damage, Fragile Buildings	0.4	100	Blasting from Construction Projects
	0.17–0.2	92–94	Heavy Tracked Construction Equipment
Difficulty with Tasks, Such as Reading a Computer Screen	0.125	90	
	0.074	85	Commuter Rail, Upper Range
Residential Annoyance, Infrequent Events	0.04	80	Rapid Transit, Upper Range
	0.013	75	Commuter Rail, Typical
	0.023	72	Bus or Truck Bump Over
Residential Annoyance, Frequent Events	0.013	70	Rapid Transit, Typical
Approximate Threshold of Human Perception	0.007	65	
	0.005	62	Bus or Truck, Typical
	0.0013	50	Typical Background Vibration Levels

*RMS Vibration Velocity in VdB reference to 10^{-6} inches/second.
Source: FTA (2006)

The degree of annoyance cannot always be explained by the magnitude of the vibrations alone. Phenomena such as ground-borne noise and rattling, visual effects (e.g., movement of hanging objects), and time of day all influence the response of individuals. The American National Standards Institute (ANSI) and the International Organization for Standardization (ISO) have developed criteria for evaluation of human exposure to vibrations. The recommendations of these standards and other studies evaluating human response to vibrations have been incorporated into the Federal Transit Administration's (FTA) Transit Noise and Vibration Impact Assessment Manual (2006). The criteria within this manual are used to assess noise and vibration impacts from transit operations.

2.0 NOISE AND VIBRATION LEVEL REQUIREMENTS AND GUIDELINES

Potential noise impacts associated with the Project were evaluated with respect to the applicable noise requirements prescribed by California Environmental Quality Act (CEQA), the Fresno County General Plan Health and Safety Element (Fresno County 2000), and the Fresno County Noise Control Ordinance. Details regarding each set of requirements are provided below.

2.1 California Environmental Quality Act

CEQA requires that significant environmental impacts be identified and that such impacts be eliminated or mitigated to the extent feasible. Appendix G of the CEQA Statutes and Guidelines (State Clearing House, Office of Planning and Research and the Natural Resources Agency [2016]) sets forth a series of suggested thresholds for determining a potentially significant impact. Under the thresholds suggested in Appendix G, the proposed project could be considered to have significant noise and vibration impacts if it results in one or more of the following:

a) Generation of substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or in other applicable local, state, or federal standards?

b) Generation of excessive groundborne vibration or groundborne noise level?

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan had not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

The CEQA Statutes and Guidelines Appendix G thresholds for items (c) and (d) do not define the term "substantial"; however, the California Energy Commission provides guidelines for operational noise or permanent increases which indicate that an increase of 5 dBA over ambient conditions may be significant and an increase of 10 dBA is significant (CEC 2010).

2.2 Fresno County General Plan Health and Safety Element

The Fresno County General Plan includes a Health and Safety Element with noise policies to manage sources of noise and protect noise sensitive land uses. Implementation of the General Plan anticipates growth of population, employment, and developed land uses as shown in the Project Description. Expansion of County-wide population, employment, and developed land uses each lead to the expansion of activities that have the potential to generate adverse noise effects.

The Draft General Plan contains the following policies to address noise:

Policy HS-G.1 The County shall require that all proposed development incorporate design elements necessary to minimize adverse noise impacts on surrounding land uses.

Policy HS-G.2 The County shall require new roadway improvement projects to achieve and maintain the normally acceptable noise levels shown in Chart HS-1: "Land Use Compatibility for Community Noise Environments."

Policy HS-G.3 The County shall allow the development of new noise-sensitive land uses (which include, but are not limited to, residential neighborhoods, schools, and hospitals) only in areas where existing or projected noise levels are "acceptable" according to the Chart HS-1: "Land Use Compatibility for Community Noise Environments." Noise mitigation measures may be required to reduce noise in outdoor activity areas and interior spaces to these levels.

Policy HS-G.4 So that noise mitigation may be considered in the design of new projects, the County shall require an acoustical analysis as part of the environmental review process where:

a. Noise sensitive land uses are proposed in areas exposed to existing or projected noise levels that are "generally unacceptable" or higher according to the Chart HS-1: "Land Use Compatibility for Community Noise Environments;"

b. Proposed projects are likely to produce noise levels exceeding the levels shown in the County's Noise Control Ordinance at existing or planned noise-sensitive uses.

Policy HS-G.5 Where noise mitigation measures are required to achieve acceptable levels according to land use compatibility or the Noise Control Ordinance, the County shall place emphasis of such measures upon site planning and project design. These measures may include, but are not limited to, building orientation, setbacks, earthen berms, and building construction practices. The County shall consider the use of noise barriers, such as soundwalls, as a means of achieving the noise standards after other design-related noise mitigation measures have been evaluated or integrated into the project.

Policy HS-G.6 The County shall regulate construction-related noise to reduce impacts on adjacent uses in accordance with the County's Noise Control Ordinance.

Policy HS-G.7 Where existing noise-sensitive uses may be exposed to increased noise levels due to roadway improvement projects; the County shall apply the following criteria to determine the significance of the impact:

a. Where existing noise levels are less than 60 dB L_{dn} at outdoor activity areas of noise-sensitive uses, a 5 dB L_{dn} increase in noise levels will be considered significant;

b. Where existing noise levels are between 60 and 65 dB L_{dn} at outdoor activity areas of noise-sensitive uses, a 3 dB L_{dn} increase in noise levels will be considered significant; and

c. Where existing noise levels are greater than 65 dB L_{dn} at outdoor activity areas of noise-sensitive uses, a 1.5 dB L_{dn} increase in noise levels will be considered significant.

Policy HS-G.8 The County shall evaluate the compatibility of Proposed Projects with existing and future noise levels through a comparison to Chart HS-1, "Land Use Compatibility for Community Noise Environments."

Policy HS-G.9 The County shall not allow the development of new residential land uses in areas exposed to existing or projected levels of noise from aircraft operations at any airport or air base which exceed 60 dB L_{dn} or Community Noise Equivalent Level.

2.3 Fresno County Noise Control Ordinance

Section 8.40 of the Fresno County Code of Ordinances provides the Fresno County Noise Control Ordinance (Ordinance) which establishes standards concerning acceptable noise levels for both noise-sensitive land uses and for noise-generating land uses. This section presents standards and requirements for noise measurements, exterior noise standards, interior noise standards, increases in allowable noise levels, reductions in allowable noise levels, and exempt noise. Table 4 describes the allowable exterior noise levels as measured at any affected single- or multiple-family residence, school, hospital, church, or public library situation in either the incorporated or unincorporated area. The table demonstrates that a continuous source may emit up to 50 dBA during the day (7:00 a.m. to 10:00 p.m.) and 45 dBA during the night (10:00 p.m. to 7:00 a.m.) to residential land uses.

Table 4. Exterior Noise Standards

Category	Cumulative number of minutes in any 1-hour time period	Noise Level Standards, dBA	
		Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
1	30	50	45
2	15	55	50

Category	Cumulative number of minutes in any 1-hour time period	Noise Level Standards, dBA	
		Daytime 7 a.m. to 10 p.m.	Nighttime 10 p.m. to 7 a.m.
3	5	60	55
4	1	65	60
5	0	70	65

In the event the measured ambient noise level exceeds the applicable noise level standard in any category above, the applicable standard shall be adjusted so as to equal the ambient noise level. Each of the noise level standards specified above shall be reduced by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. If the intruding noise source is continuous and cannot reasonably be discontinued or stopped for a time period whereby the ambient noise level can be measured, the noise level measured while the source is in operation shall be compared directly to the noise level standards.

In Section 8.40.060, the Ordinance exempts noise sources associated with construction, provided such activities do no take place before 6 a.m. or after 9 p.m. on any day except Saturday or Sunday, or before 7 a.m. or after 5 p.m. on Saturday or Sunday.

Section 8.40.090 of the Ordinance states noise sources associated with the operation of electrical substations shall not exceed 50 dBA when measured at NSAs.

2.4 Federal Transit Authority Construction Noise Guidelines

There is no standardized state or federal regulatory standards developed for assessing construction noise impacts. However, the FTA has developed and published a guideline criterion that is considered to be reasonable to assess noise impacts from construction operations. The FTA criteria is summarized in Table 5 below.

Table 5. Federal Transit Authority Construction Noise Criteria

Land Use	8-hour (dBA L_{eq})		30-Day Average L_{dn} (dBA) or L_{eq} (dBA)
	Day	Night	
Residential	80	70	75[a]
Commercial	85	85	80[b]
Industrial	90	90	85[b]

[a] In urban areas with very high ambient noise levels (Ldn > 65 dB), Ldn from construction operations should not exceed existing ambient + 10 dB.
[b] Twenty-four-hour L_{eq}, not L_{dn}.

3.0 EXISTING SOUND ENVIRONMENT

There are multiple sound sources that surround the Project, including a large substation, multiple solar facilities, and interstate 5. Other sources of sound relative to the Project location can be attributed to agriculture operations. The Project and closest NSAs are located in Huron, California, which has a population density of 4,655 people per square mile (U.S. Census Bureau 2020). Using the Federal Transit Administration (FTA) noise guidelines (FTA 2018) the ambient noise at the nearest NSA is 59 dBA L_{dn}, which is approximately a daytime level of 59 dBA L_{eq} and nighttime level of 50 dBA L_{eq}.

4.0 PROJECT CONSTRUCTION

Construction of the Project is expected to be typical of other solar power generating facilities in terms of schedule, equipment, and activities. Construction is anticipated to occur over approximately 9 months and would require a variety of equipment and vehicles. The Project would comply with regulatory requirements and applicable conditions related to noise.

4.1 Noise Calculation Methodology

Acoustic emission levels for activities associated with Project construction were based upon typical ranges of energy equivalent noise levels at construction sites, as documented by the U.S. Environmental Protection Agency (USEPA 1971) and the USEPA's "Construction Noise Control Technology Initiatives" (USEPA 1980). The USEPA methodology distinguishes between type of construction and construction stage. Using those energy-equivalent noise levels as input to a basic propagation model, construction noise levels were calculated at the nearest NSAs.

The basic model assumed spherical wave divergence from a point source located at the closest point of the Project site to NSA-1. Furthermore, the model conservatively assumed that all pieces of construction equipment associated with an activity would operate simultaneously for the duration of that activity. An additional level of conservatism was built into the construction noise model by excluding potential shielding effects due to intervening structures and buildings along the propagation path from the site to receiver locations.

4.2 Predicted Noise Levels During Construction

The Applicant predicted construction noise levels using a semi-qualitative approach based on equipment sound levels provided in the Federal Highway Administration Roadway Construction Noise Model (Federal Highway Administration [FHWA] 2018). This equipment is also used on solar projects, so the FHWA's sound levels are applicable to incorporate into the Project. Construction activities associated with the Project have the potential for localized sound on a temporary basis because construction activities progress through certain locations within the Project area. Construction activities at the Project can be generally divided into five phases:

- Site Preparation and Grading (2 months expected duration);
- Solar Arrays and Inverters Installation (3 months expected duration);
- Electrical Work (2 months expected duration);
- Substation Installation (2 months expected duration);
- Transmission Interconnection (1 month expected duration).

These activities will occur sequentially for discrete groupings of solar arrays, with the potential for overlap. In addition to the solar panels, construction activities will also occur for supporting infrastructure. Sound generated by Project construction is expected to vary depending on the construction phase. Table 6 lists the typical sound levels associated with common construction equipment and Table 7 shows the composite level per phase at all NSAs. The highest sound level experienced during construction will be 81 dBA at NSA-1.

Table 6. Summary of Construction Equipment by Phase

Construction Phase	Construction Equipment	Quantity	Usage Factor %	Maximum L_{eq} Equipment Noise Level at 50 ft dBA
Site Preparation and Grading	Tractors/Loaders/Backhoes	6	40	80
	Graders	8	40	85
	Trucks	20	40	55
	Rollers	8	20	85
	Rubber Tired Dozers	6	40	85
	Rubber Tired Loaders	8	40	80
	Skid Steer Loaders	12	40	80
	Trenchers	8	50	82
Solar Arrays and Inverters Installation	Bore/Drill Rigs	10	20	84
	Forklifts	10	40	80
	Skid Steer Loaders	2	40	80
	Trenchers	2	50	82
	Welders	6	40	73
	Trucks	5	40	55
Electrical Work	Aerial Lifts	8	20	85
	Bore/Drill Rigs	2	20	84
	Cranes	4	16	85
	Skid Steer Loaders	2	40	80
	Tractors/Loaders/Backhoes	4	40	80
	Trenchers	2	50	82
Substation Installation	Air Compressors	4	40	80
	Cranes	2	16	85
	Excavators	4	40	85
	Generator Sets	4	50	82
	Forklifts	2	40	80
	Plate Compactors	2	20	80
	Rollers	2	20	85
	Tractors/Loaders/Backhoes	6	40	80
Transmission Interconnection	Air Compressors	2	40	80
	Cranes	2	16	85
	Forklifts	4	40	80
	Generator Sets	2	50	82
	Pumps	2	50	77
	Welders	2	40	73
	Tractors/Loaders/Backhoes	2	40	80

Table 7. Summary of Construction Noise Levels by Phase

NSA	Distance to Construction	Composite L_{eq} Equipment Noise Level per Phase, dBA				
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
NSA-1	275 feet	81	76	76	77	73
NSA-2	400 feet	78	73	73	74	70
NSA-3	650 feet	74	69	69	70	66
NSA-4	750 feet	73	67	67	68	65
NSA-5	850 feet	72	66	66	67	64

NSA	Distance to Construction	Composite L_{eq} Equipment Noise Level per Phase, dBA				
		Phase 1	Phase 2	Phase 3	Phase 4	Phase 5
NSA-6	950 feet	70	65	65	66	63
NSA-7	1,050 feet	70	64	64	66	62
NSA-8	1,150 feet	69	64	64	65	61

In addition to the equipment described in Table 6, employees would also be commuting to and from the Project site. The greatest potential number of employees (300) would be commuting during Phase 2; solar arrays and inverters installation. Assuming 300 individual vehicles during a single hour, the resulting sound level would be approximately 62 dBA at 50 feet.

The highest received noise level from construction activities will be 81 dBA at NSA-1 during phase 1 construction. This is 1 dB higher than the 80 dBA FTA guidance level. In order to be in compliance with this guidance level, temporary moveable barriers will be used during construction to block the direct path from construction activities to NSA-1. Project construction would occur between 7:00 a.m. and 6:00 p.m., Monday through Friday, which is in compliance with Fresno County Code. Furthermore, all reasonable efforts would be made to minimize the impact of noise resulting from construction activities including the implementation of the following mitigation measures:

- Maintain all construction tools and equipment in good operating order according to manufacturers' specifications;
- Limit construction activities to between 7:00 a.m. and 6:00 p.m., Monday through Friday;
- Equip any internal combustion engine used for any purpose on the job or related to the job with a properly operating muffler that is free from rust, holes, and leaks;
- For construction devices that utilize internal combustion engines, ensure the engine's housing doors are kept closed, and install noise-insulating material mounted on the engine housing consistent with manufacturers' guidelines, if possible;
- Utilize a Complaint Resolution Procedure to address any noise complaints received from residents; and
- Use temporary moveable barriers to block the direct path of construction noise to NSA-1.

Given the infrequent nature of loud construction activities at the site, the limited hours of construction, and the mitigation measures listed above, the temporary increase in noise due to construction is considered to have a less than significant impact.

4.3 Vibration Calculation Methodology

Vibration levels for activities associated with Project construction were based on the average of source levels in PPV published with the FTA (2018) Noise and Vibration Manual, which documents several types of construction equipment measured under a wide variety of construction activities. Using the documented vibration levels as input into a basic propagation model, construction vibration levels were calculated at NSA-1.

4.4 Projected Vibration Levels During Construction

As discussed in Section 4.2, Project construction would be completed in five work stages. This vibration level evaluated the worst-case vibration source, which would be the vibratory roller. Table 8 summarizes the predicted vibration levels at the Project site boundary and NSAs based on the highest vibration generating equipment. These levels are based on the worst-case vibration producing equipment and it is expected that other vibration generating equipment proposed for the Project construction would result in lower vibration levels. As shown in Table 8, the Project construction would demonstrate vibration levels below the human perception threshold of approximately 65 VdB and will be a less than significant impact.

Table 8. Projected Construction Vibration Levels

Construction Operation	Vibration Level Metric	FTA Construction Vibration Level (25 feet)	NSA-1 (275 feet)
Vibratory Roller	PPV in/sec	0.21	0.00576
	VdB	94	63

5.0 OPERATIONAL NOISE

This section describes the model utilized for the assessment; input assumptions used to calculate noise levels due to the Project's normal operation, and the results of the noise impact analysis relative to the applicable noise requirements and guidelines.

5.1 Noise Prediction Model

The Cadna-A® computer noise model was used to calculate sound pressure levels from the operation of the Project. An industry standard, Cadna-A® was developed by DataKustik GmbH to provide an estimate of sound levels at distances from sources of known emission. It is used by acousticians and acoustic engineers due to the capability to accurately describe noise emission and propagation from complex facilities consisting of various equipment types like the Project, and in most cases, yields conservative results of operational noise levels in the surrounding community.

The current ISO standard for outdoor sound propagation, ISO 9613 Part 2, "Attenuation of Sound during Propagation Outdoors," was used within Cadna-A (ISO 1996). The method described in this standard calculates sound attenuation under weather conditions that are favorable for sound propagation, such as for downwind propagation or atmospheric inversion, conditions that are typically considered worst case. The calculation of sound propagation from source to receiver locations consists of full octave band sound frequency algorithms, which incorporate the following physical effects:

- Geometric spreading wave divergence;
- Reflection from surfaces;
- Atmospheric absorption at 10 degrees Celsius and 70 percent relative humidity;
- Screening by topography and obstacles;
- The effects of terrain features including relative elevations of noise sources;

- Sound power levels from stationary and mobile sources;
- The locations of noise-sensitive land use types;
- Intervening objects including buildings and barrier walls to the extent included in the design;
- Ground effects due to areas of pavement and unpaved ground;
- Sound power at multiple frequencies;
- Source directivity factors;
- Multiple noise sources and source type (point, area, and/or line); and
- Averaging predicted sound levels over a given time.

Cadna-A allows for three basic types of sound sources to be introduced into the model: point, line, and area sources. Each noise-radiating element was modeled based on its noise emission pattern. Larger dimensional sources such as the transformers and inverters were modeled as area sources. Off-site topography was obtained using the publicly available U.S. Geological Survey digital elevation data. A default ground attenuation factor of 0.5 was assumed for off-site sound propagation over acoustically “mixed” ground. A ground attenuation factor of 0.0 for a reflective surface was assumed for on-site areas.

5.2 Input to Noise Prediction Model

The Project’s general arrangement was reviewed and directly imported into the acoustic model so that on-site equipment could be easily identified; buildings and structures could be added; and sound emission data could be assigned to sources as appropriate. Figure 2 shows the Project layout.

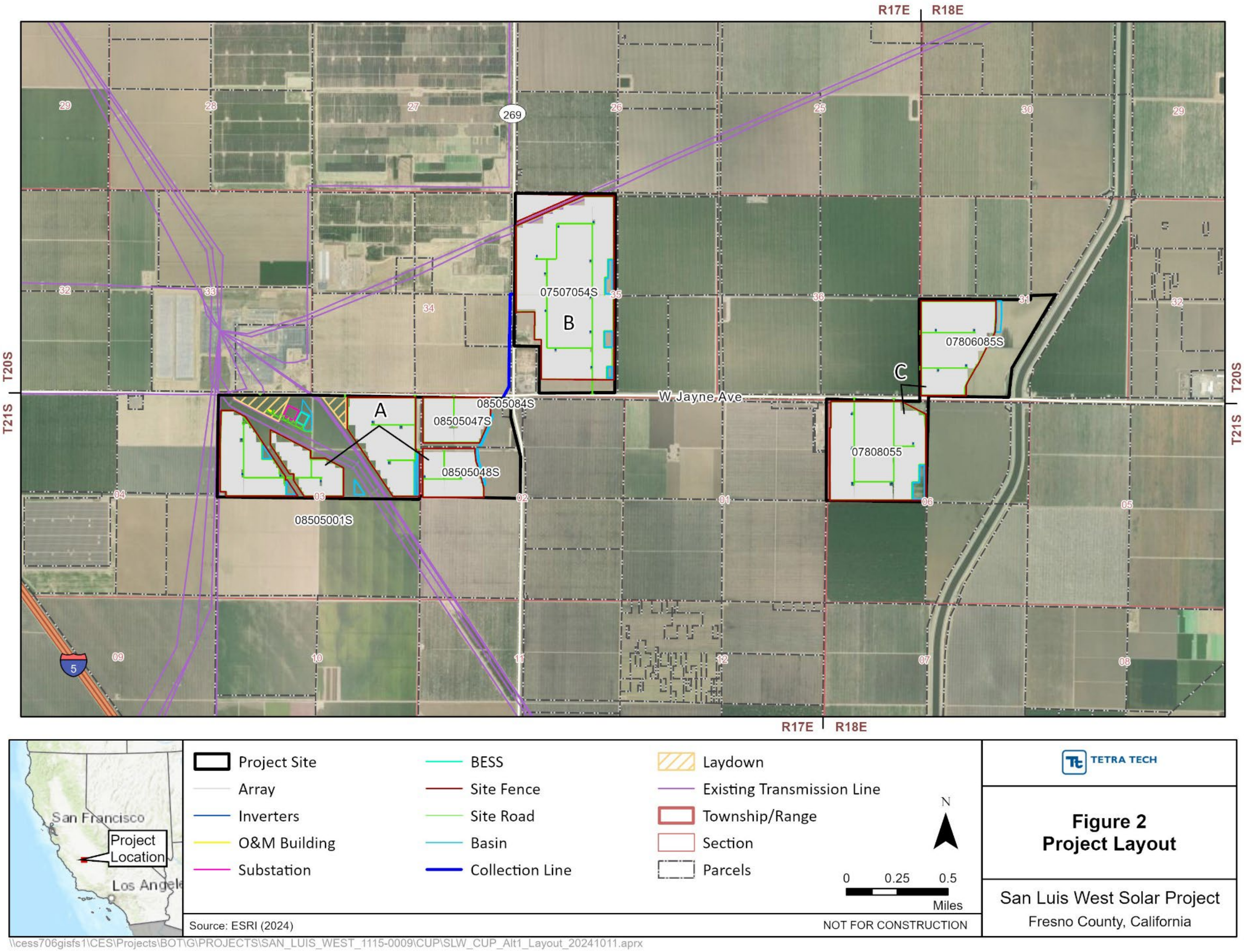

Figure 2
Project Layout

The primary noise sources during operations are the inverters, substation transformer, battery storage heating, ventilation, and air conditioning (HVAC) units, and battery storage inverters. The substation transformer will be 230 kV rated at 40 megavolt amperes (MVA). It is expected that all equipment would operate during the daytime period and nighttime period. Reference sound power levels input to Cadna-A were provided by equipment manufacturers based on information contained in reference documents or developed using empirical methods. The source levels used in the predictive modeling are based on estimated sound power levels that are generally deemed to be conservative. The projected operational noise levels are based on Applicant-supplied sound power level data for the major sources of equipment. Table 9 summarizes the equipment sound power level data used as inputs to the acoustic modeling analysis.

Table 9. Modeled Octave Band Sound Power Level for Major Pieces of Project Equipment

Sound Source	Sound Power Level by Octave Band Frequency (Hz) dBA									Broadband Level
	31.5	63	125	250	500	1k	2k	4k	8k	dBA
Inverter	46	62	74	95	89	86	85	80	65	97
Substation Transformer	49	68	80	83	88	86	82	77	67	92
Battery Storage HVAC Unit	—	64	63	71	78	82	79	73	66	86

5.3 Noise Prediction Model Results

Broadband (dBA) sound pressure levels were calculated for expected normal Project operation assuming that all components identified previously are operating continuously and concurrently at the representative manufacturer-rated sound. The sound energy was then summed to determine the equivalent continuous A-weighted downwind sound pressure level at a point of reception. The received sound levels for full Project operations at the NSAs are shown in Table 10.

Table 10. Summary of Operational Noise Levels

NSA	Distance to Project	Fresno County Noise Control Ordinance Nighttime Limit, dBA	Operational Noise Level, dBA L_{eq}	Nighttime Ambient Level, dBA L_{eq}	Increase to Nighttime Ambient Level, dBA L_{eq}
NSA-1	275 feet	45	37	50	0
NSA-2	400 feet	45	37	50	0
NSA-3	650 feet	45	36	50	0
NSA-4	750 feet	45	36	50	0
NSA-5	850 feet	45	35	50	0
NSA-6	950 feet	45	35	50	0
NSA-7	1,050 feet	45	35	50	0
NSA-8	1,150 feet	45	34	50	0

Sound contour plots displaying broadband (dBA) sound levels presented as color-coded isopleths are provided in Figure 3. The noise contours are graphical representations of the cumulative noise associated with full operation of the equipment and show how operational noise would be distributed over the surrounding area of the Project site. The contour lines shown are analogous to elevation contours on a topographic map, i.e., the noise contours are continuous lines of equal noise level around some source, or sources, of noise. This operational noise level would comply with the Fresno County Noise Control Ordinance and the Noise Element and would not result in a significant impact.

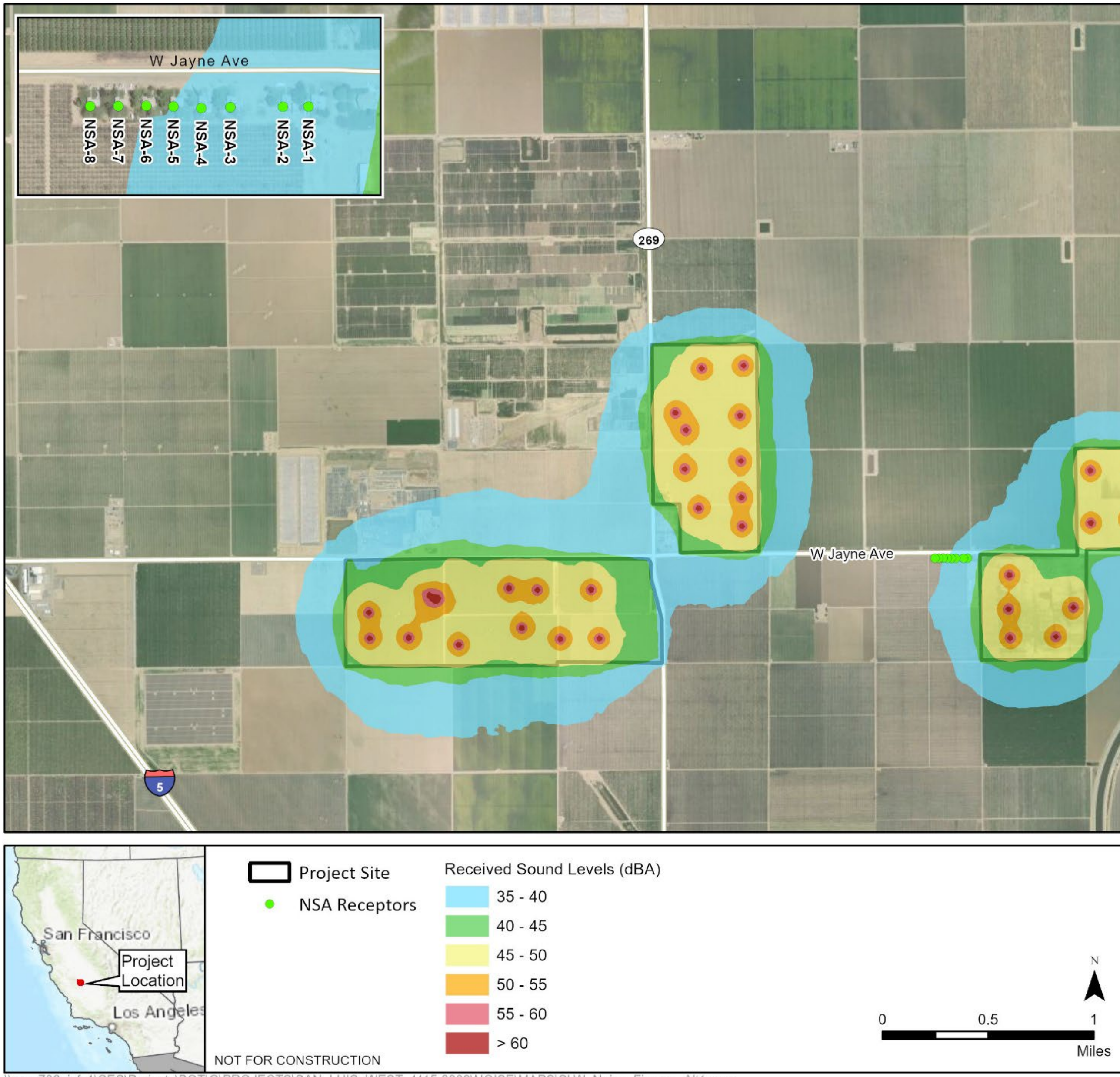

Figure 3
Received Sound Levels

San Luis West Solar Project
Fresno County, California

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6.0 CONCLUSION

The construction of the Project has been organized into five work stages. Based on sound propagation calculations, the highest construction sound level is predicted to be from 81 dBA at NSA-1. Periodically, sound levels may be higher or lower than those presented in Table 7. Reasonable efforts would be made to minimize the impact of noise resulting from construction activities at proximate noise sensitive areas through the use of mitigation measures described in Section 4.2. Because of the temporary nature of the construction noise and incorporation of mitigation measures, no adverse or long-term effects are expected.

As discussed, the Project is not located near an airstrip or airport, with the closest airport being the New Coalinga Municipal Airport, located approximately 5 miles to the west. As such, the Project would not expose people residing or working in the Project area to excessive noise levels.

During Project construction, the worst-case vibration source would be a vibratory roller. Based on vibration propagation calculations, construction vibration levels are predicted to be 0.00576 PPV inches/second (63 VdB) at NSA-1. This level is based on the worst-case vibration-producing equipment, and it is expected that other vibration generating equipment proposed for the Project construction would result in lower vibration levels. Project construction would demonstrate vibration levels below the human perception threshold of approximately 65 VdB.

Noise modeling of full Project operations shows the highest total sound level would be 37 dBA at NSA-1 and NSA-2. This level shows compliance with the Fresno County Noise Control Ordinance of 50 dBA during the daytime and 45 dBA during the nighttime, as well as the CEC increase to ambient criteria.

7.0 REFERENCES

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